THE RETURNS TO EDUCATION IN BHUTAN: EMPLOYING A PSEUDO - PANEL APPROACH

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ABSTRACT

Title of Thesis	THE RETURNS TO EDUCATION IN BHUTAN: EMPLOYING A PSEUDO - PANEL APPROACH
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In view of education as a doorway to the economic well-being of individuals and nation, the Government of Bhutan confers top priority to the development of education sector by allocating the highest share of annual budget for the last several years. However, despite government bestowing apex precedence to education sector, there are no explicit empirical studies carried out to ascertain private returns to education in Bhutan. Thus, this study aims to investigate the determinants of earnings and estimate returns to education for Bhutanese workers by employing pooled regression models and a pseudo-panel approach respectively. A pseudo-panel dataset was constructed from six repeated cross-sectional labor force surveys from 2010 – 2015 for workers born in 1955 – 2000. The returns to education were estimated for two-year and three-year birth cohorts. Additionally, the OLS regression using data on individuals was employed in this study for the comparative purpose. The study shows that the earnings of males exceed that of females, earnings of rural workers exceed that of urban workers, and the earnings of divorced workers exceed that of married ones whereas the single workers earn fairly lower than their married counterparts. Furthermore, this study affirms work experience of individuals as an important determinant of earnings in Bhutan. This study also shows that the OLS estimated returns to education is approximately 9% whereas the returns from pseudo-panel estimations are 21% for both two-year and three-year birth cohorts suggesting a downward bias in the OLS estimation.

Keywords: returns to education, pseudo-panel approach, Bhutan, labor force surveys

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

CHAPTER 1

INTRODUCTION

1.1 Background and significance of the study

Bhutan is a small country featured with rugged mountainous topography landlocked between the extensive borders of the two most populated nations, China in the north and India in the south. Until the 1950s, Bhutan's education was chiefly monastic, and the literacy was narrowed to the monasteries. Bhutan opened its first worldly schools, with both curriculums and the medium of instruction lent from India in the 1950s during the reign of second king. Indeed, it was in the 1960s, that Bhutan began to develop its education system in grave under the ascendance of third king, His Majesty Jigme Dorji Wangchuck. After comprehending a small, isolated and developing country such as Bhutan needs to be able to communicate with rest of the countries around the world, His Majesty the king, has introduced English as medium of instruction, which in fact laid foundation for the associations of primary, secondary and tertiary institutions spread out across the country at present.

The education system in Bhutan essentially consists of three central categories viz, Formal education, Non-formal education and Monastic education. The Formal education is provided freely by government to those children of school-going age until class ten and additionally the free higher education is made equally accessible to all based on merit. The Non-formal education is funded and basically provided to those people that have missed the opportunity of formal schooling. Although the monastic education is aged form of education that exist the time immemorial in Bhutan, yet the formal education inflates radically, and it stands as largest form of education at present. In 2016, the Annual Education Statistics of Bhutan shows total of 522 schools in Bhutan, out of which 486 consist of public schools (including 51 central schools), and 36 private schools offering primary to higher secondary education with total of 169,560 students and 9,081 teachers within the country

(Ministry of Education, 2016). In Bhutan, the academic year begins in the month of February and ends in December, and the official entrance age for primary school is 6. The education system in Bhutan was structured in a manner that the Primary schooling encompasses 6 years, lower secondary schooling 4 years, upper secondary schooling 2 years and bachelors' degree of 3 years.

In the era of world fueled by a remarkable unification of globalization, knowledge-based economies, human rights-based development and demographic drifts, the discovery of dynamic roles of education is increasingly growing and the education has become an essential device for development for all the countries around the world.

1.2 Statement of problem

The Government of Bhutan has a goal to enhance access and provide quality education to all the citizens of the country. In view of this government confers top priority to the development of Education sector by allotting the highest share of the annual budget for the last several years. In addition to investing in customary educational agenda, government allocates considerable amount of budget for various scholarship programs within and outside the country and provide interest-free education loans to economically disadvantaged students. However, despite Government bestows apex precedence to education by investing substantial amount of resources, there are no explicit studies carried out empirically about the returns to education in Bhutan. Thus, it has become an essential to carry out empirical studies to determine the rate of returns to education for Bhutan.

The majority of Bhutanese prefers to work and discontinue pursuing higher studies after they complete higher secondary schooling or bachelor's degree, unless they are supported by the government. The individual's willingness to pay for higher levels of education in Bhutan possibly would be low even though there are no empirical findings to support the view. In fact, one possible rationale for such widespread observation of low private investment in higher levels of education in Bhutan could be due to lack of information about the returns to education in Bhutan. Thus, determining returns to education empirically for Bhutan has become an urgent

task, which consequently would ensure better educational policy planning and may persuade people to pursue higher levels of education by making more private investment in education in the future.

The Government of Bhutan has dedicated to reducing gender inequality through equitable distribution of opportunities and benefits of development among all individuals in the country. In this regard government constantly highlights on importance of mainstreaming gender into policies, plans and programs. The government agencies were also directed to implement gender related policies in their agendas and activities (Planning Commission & Royal Government of Bhutan, 1999). Bhutan's initiative for reducing gender inequality has made good progression in recent decades and formally there is no overt gender discrimination in terms of access to education in Bhutan. The social institutions and gender index shows that the Bhutan's score was just 0.1142, placing Bhutan among the countries with a low level of discrimination in social institutions (Wikigender, 2014). However, on the contrary to the much of government efforts in eliminating gender discrimination, there are still influential and deep-rooted gender stereotype and norms that are largely invisible and greatly underrated in Bhutan. Perhaps, one potential explanation for the gender discrimination in Bhutan can be examined through finding the differences in earnings between male and female workers.

The government of Bhutan has made tremendous effort to reduce rural to urban migration by providing essential services in rural areas. However, despite government's continual efforts, the rural to urban migration trends in Bhutan keep on increasing at the alarming rate causing the biggest shift of labor force from rural to the urban centers. The shift of labor force from rural to urban not only causes the labor shortage in the villages but it would also give rise to various urban problems such as unemployment, crime, violence, etc. as the towns in Bhutan are not wholly equipped and well settled to deal with such rapid influxes of new migrants. Conceivably, one of the possible reasons for people migrating from rural to urban area in Bhutan could be due to difference in earnings between rural and urban workers. Thus, it has become an essential to carry out empirical studies to investigate the earnings differences between rural and urban workers in Bhutan.

The returns to education have been extensively studied around the world since the 1950s and it has universally observed that education and earnings as positively linked. Several research papers show proof of positive influence of education on earnings i.e., the returns to education increases with years of education accomplished by individuals in most of the developing economy. The existing studies also suggest that investing in education helps in augmenting an individual's income and consequently it will be helpful in boosting economic development. One of the conventional methods employed to estimate returns to education is Mincer's earnings function which was developed by Jacob Mincer (1974). Indeed, this paper will also use the Mincer's earnings function as a groundwork to estimate the rate of returns to education for workers in Bhutan.

1.3 Research Questions

1.3.1 What are the determinants of earnings?

1.3.2 What is an average rate of returns to education for Bhutanese workers?

1.4 Research Objectives

1.4.1 To investigate the determinants of earnings.

1.4.2 To estimate the overall rates of returns to education for Bhutanese workers.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature review

The act of estimating returns to education is one of the insightful economic analyses since late 1950s. The work of Jacob Mincer (1974) is universally asserting to be the base for estimating the rate of returns to education and basically his rudimentary model comprises a semi-log linear function regressing log of earnings on years of education and experience. The years of education accomplished are considered as a measure of levels of human capital obtains through education by individuals and years of experience as measure of the levels of human capital gained through work by individuals. The coefficient on years of education is referred to as additional rates of returns and it essentially illustrates approximate percentage change in earnings with extra years of schooling accomplished by individuals. By virtue of education being very important and used as essential device to mitigate most of the challenges faced in the world, many scholars have attempted to estimate returns to education in the past and most of the studies have used Mincerian earnings function as a groundwork.

In Psacharopoulos (1985, 1989, 1994a, 1994b); Psacharopoulos & Patrinos (2004); and Peet, Fink, & Fawzi (2015), the researchers principally focused on estimating returns to education for developing countries. To be specific, Peet, Fink, & Fawzi (2015) have carried out a study to estimate returns to education for 25 developing countries using 61 nationally representative living standard measurement study household survey data from 1985 to 2012. Their OLS estimated results do not show any systematic excess returns to education for developing countries over developed countries and no evidence of systematic variations in returns to education for last two decades. Another specific finding from their study is that, at individual's level, the returns to education appear to be higher for females than males.

Additionally, the results indicated greater average returns to tertiary education with 8.2% compared to 7.3% and 6.5% from primary and secondary education respectively. In terms of cross-country differences, the returns to education vary from country to country.

Himaz & Aturupane (2012) have carried out a study with the aim to estimate returns to education for Sri Lankan workers using pseudo panel data constructing from nine recurring cross-sectional labor force surveys. Due to very low female labor force participation rate, the study thus focused on male workers. Both OLS and pseudo-panel techniques were employed. Their OLS estimated results were higher than those from pseudo-panel estimation due to uncontrolled unobservable individual fixed effects. Additionally, it was also found that those males with higher ability tend to accomplish higher levels of education.

Warunsiri & McNown (2010) have also carried out a study to estimate the returns to education for Thailand. The main objective of their study was to estimate returns to education for Thailand by controlling unobserved individual specific effects (i.e., problem related to endogeneity of variables) which may otherwise lead to biased estimation. The Thailand's LFS data from 1986 to 2005 were utilized. Pseudo-panel and instrumental variable approaches were employed to estimate the returns to education. Their finding shows overall return between 14% and 16% for Thailand with greater returns for females than for males. Additionally, it has also found that the returns to unmarried workers are higher than married workers and higher returns for those workers who work in urban areas than their counterparts in the rural areas.

Some researchers have focused on estimating returns to education among different regions rather than focusing on entire country. For example, Polat (2017) focused on estimating regional returns to education after Turkey had adopted the policy of expansion of higher education. The main objectives of his study were to find out whether nearness to college determines local residence's access to college or not and to examine whether change in education policy had affected local returns to college degrees. He has employed households labor force survey data from year 2004 to 2013 and used Mincerian wage regression approached to estimate returns to education. The result of his paper shows that expansion of higher education policy has substantial positive impact on earnings for low educated households in some regions

and had increasing returns in terms of wages for local level although the country is experiencing rapid increase in numbers of graduates with such expansion policy.

The Mincerian framework is commonly used around the world to estimate the returns to education. However, the drawback associated with Mincerian framework is that it does not reflect endogeneity biasedness which may arise due to correlation of workers' years of schooling with unobserved abilities (i.e., those omitted factors in error term). With existence of the problem of endogeneity, researchers may not be able to develop an apparent causal relationship between dependent and independent variables thus, consequently would give unlikely estimated rate of returns to education. Perhaps, knowing the fact that endogeneity bias deters researchers from determining the reliable rate of returns to education, most of the researchers have used instrumental variables as a technique to address such problems. For example, Kane & Rouse (1993) have used the instrumental variable approach in their study on labor market returns to two-and four-year colleges. They have essentially carried out a study with aim to find the comparative earnings differences of two-and four-year colleges with high school graduates. They have used data from the National Longitudinal Study of the High School Class of 1972. After they got the data then they have estimated returns using ordinary least square method. Additionally, they have employed IV method, where they have used distance from individual's house to the two-year and four-year colleges as an instrument. Their result shows that the average two-years and four-years college students earned approximately 5% more than those high school graduates for every year of credits completed.

Furthermore, Kerr & Quinn (2010) has also used the instrumental variable approach in their study. They have used education reforms implemented in Tanzania in the 1960s as a source of exogenous variation in education to estimate the returns to education. They have employed integrated labor force survey data for year 2001 and 2006. Alike most of the other papers, they followed the Mincer's earnings framework. Firstly, they have used OLS to estimate the returns to education and then they have used IV approach. Additionally, they have also used control function approach to estimate returns to education. By using OLS approach their result shows returns to education of 8% (in 2006) and 13% (in 2001) with an extra year of education and by

using control function to control for endogeneity of education, they have found that the returns are concave with higher returns for lower levels of education.

The use of techniques of the instrumental variable in estimating the rate of returns to education has been widespread among many scholars and they suppose as more suitable technique of estimation with endogenous nature of variables. However, on the contrary to their perceptions, there are some scholars who have found estimating returns to education using IV approach as less accurate than OLS estimates (Bound, Jaeger, & Baker, 1995)**.** They have carried out a study to examine the problems associated with using of instrumental variable estimation when the correlation between the instruments and the endogenous explanatory variable is weak. They have used OLS as well as IV approaches and examined for inconsistency of IV relative to OLS approach using some equations. Further, they have reexamined others paper and test for finite sample bias. Their finding shows that if the instruments are weakly correlated with the endogenous explanatory variable, then even a weak correlation between the instruments and the error in original equation will lead to large inconsistency in IV estimates. Further, it has been observed that the IV estimates suffer from finite sample bias even when the sample size is large.

In some studies, researchers have focused on estimating returns to education for different employment status. For example, Kavuma (2014) have carried out a study to estimate private returns to education for wage employees and self-employed in Uganda. His main objective was to estimate marginal private returns to education for two different types of laborers viz, wage employees and self-employed. He has used two waves of panel data i.e., from 2005/2006 Uganda National Household Survey (UNHS) and 2009/2010 Uganda National Panel Survey (UNPS) which was collected by Uganda Bureau of Statistics. He has analyzed returns to education using Mincerian earnings function as groundwork. He has used OLS method along with two-stage least squares (2SLS) method and then used quintile regression to test for heterogeneity along the earnings profile. His study shows that for both wage employees and self-employed, an extra year of schooling is associated with an increase in earnings of 15%. There were concave age-earnings relationships among wage-employees but not for the self-employed. The time trend in his model shows greater increase in earnings over life time for self-employed than wage-employment.

The rural–urban wage gap has been also wider for the self-employed than wage employees. Additionally, it has found that the gap between the returns to education for two types of laborers is large at the bottom than at the top of the education profile which indeed signifies that the individuals with lower education are much better off in wage sector compared to the self-employed sector.

CHAPTER 3

METHODOLOGY AND DATA

3.1 Theoretical background of the analysis

The basic theory of human capital

Generally, human capital is referring to a stock of knowledge or characteristics that the workers possess, either inborn or assimilated that contributes to his or her productivity. It is regarded as a resource or asset of an individual and it encompasses the notion that they are investments in people. Human capital is one of the Becker's (1964) distinctive study of how investing in individuals' education and training alike to business investment in its equipment. Becker (1964) supposes that human capital will augment worker's productivity in all areas, tasks, and situations. Becker (1964) also affirmed that expenses on education, medical care, training, etc. were considered as investment in human capital for the reason that human could not be separated from their knowledge, health, skills, values, etc. in a way that we could not separate ourselves from our monetary and physical asset.

The theory of human capital has been used extensively to study earnings variances amongst individuals with different educational attainment. As per the maxim of this theory, it states that the wage differences among individuals can be explained by the differences in human capital e.g. the levels of education attained, or experience gained in the workplace. One widespread application for estimating returns to investing in human capital, within the context of this theory is Mincer's (1974) earnings function. Indeed, this study will espouse standard Mincerian earnings framework for estimating rates of returns to education for Bhutan.

Fundamentally, Mincerian earnings function states relationship between earnings and schooling, and experience as follows;

$$\ln w = \beta_0 + \beta_1 E + \beta_2 X + \beta_3 X^2 + u$$

Where; ln$w$ is natural logarithm of earnings (i.e., hourly wage), E the years of education, X the years of work experience, and X^2 the experience squared.

3.2 Empirical Methodology

Using the Mincer's earnings function as a groundwork, this study will estimate returns to education using two methods; pooled OLS regression and pseudo panel estimation with the help of Bhutan's labor force survey data which were collected by Ministry of Labor and Human Resources between year 2010 and 2015.

3.2.1 Application of Ordinary Least Square (OLS) Method.

The rate of returns to education will be first estimated by pooled data. Under this approach, we can simply pool all the samples which are collected randomly at different time periods. For example, we can take individuals A and B's earnings data for year 2010 and then we can pool with individual X and Y's earnings data for other year. Here, we can pool all the samples required from all years without taking into consideration of time periods. Following the Mincer's earnings function, the log of hourly real wages will be used as a dependent variable and the years of schooling, potential experience, and potential experience squared as explanatory variables. Other potential determinants of earnings such as gender, area, marital status, workers' skill level, nature of employment, and industry of employment will also be included in this model.

The Mincer's earnings framework incorporating with this approach can be written as follows;

$$\ln w_i = \beta_0 + \beta_1 Edu_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \beta_4 male_i + \beta_5 rural_i + \beta_6 divorce\_2i + \beta_7 single\_3_i + \beta_8 skill\_1_i + \beta_9 skill\_3_i + \beta_{10} skill\_4_i + \beta_{11} reg\_1_i + \beta_{12} fam\_wrk3_i + \beta_{13} own\_act4_i + \beta_{14} emplyr5_i + \beta_{15} agri\_1_i + \beta_{16} inds\_2_i + \varepsilon_i \quad (1)$$

Where;

- i – represent different individuals
- lnw_i – natural log of hourly real wages of individual i
- Edu_i – completed years of education by individual i
- Exp_i – potential experience of individual i (See Appendix A.1)
- Exp_i^2 – potential experience squared (See Appendix A.2)
- $male_i$ – dummy for male gender (with female as a reference group)
- $rural_i$ – dummy for rural area (with urban as a reference group)
- *divorce_2i* – dummy for divorce marital status
- $single\_3_i$ – dummy for single marital status
  (with married as a reference group for marital status)
- $skill\_1_i$ – dummy for skill level-1
- $skill\_3_i$ – dummy for skill level-3
- *skill_*4i – dummy for skill level-4 (See Appendix A.3)
  (with skill level-2 as a reference group for skill levels)
- reg_1_i – dummy for regular paid employees
- fam_wrk3_i – dummy for family workers
- own_act4_i – dummy for own account workers
- $emplyr5_i$ – dummy for employers
  (with non-regular paid employees as a reference group for nature of employment)
- $agri\_1_i$ – dummy for agriculture (major industry)
- $inds\_2_i$ – dummy for industries (major industry) (See Appendix A.4)
  (with service as a reference group for major industry).
- ε_i – measures individual-specific errors.
- βj – parameters that need to be estimated.

The details of variables employed in equation (1) are given in Table 3.1 below.

Table 3.1 Model Specification

Variables	Explanations
Dependent variable	
lnw (Hourly wages)	- A natural log value of hourly wage. It is computed through dividing individual's monthly salary from primary occupation by total number of hours work in their primary occupation in a month.
Independent variables	
Edu (Years of education)	- It is referring to the number of years of education attended by individuals. It takes into consideration of only the completed years of education. For example, if individual has drop the school in the mid of academic year then his/her years of education will be only the number of years of schooling he/she has completed (See Appendix A.5).
Exp (Potential experience)	- The potential experience of an individual is obtained through subtracting years of education attended by individual and six years (age before getting into school) from age of respective individuals (i.e., Experience = Age of individual – Years of education – 6 years).
Exp^2 (Potential experience squared)	- The potential experience squared which indicates an individual's experience over the lifetime.
Male (Gender)	- This variable is used to find out if there is any difference in earnings between male and female workers. It is used as a dummy variable where male = 1 and female = 0.

Variables		Explanations
Rural (Area)	-	The data gathered in this study include samples (individuals) from both rural and urban areas. It is used as a dummy variable where rural = 1 and urban = 0.
Divorce (Marital status) (See Appendix A.6)	-	Divorce/separated/widowed = 1, Otherwise = 0.
Single (Marital status)	-	Single/never married = 1, Otherwise = 0.
Skill level-1 (Primary occupation) (See Appendix A.7)	-	Dummy for skill level-1. The occupations at skill level-1 typically involve the performance of simple and routine physical or manual tasks such as elementary occupations, craft and related works, agriculture works, etc.
Skill level-2 (Primary occupation)	-	Skill level-2 is used as a reference group. The occupations at this skill level involve the performance of tasks such as operating machinery and electronic equipment. For example, plant and machine operators and assemblers.
Skill level-3 (Primary occupation)	-	Dummy for skill level-3. The occupations at skill level-3 involve the performance of complex technical and practical tasks that require an extensive body of factual, technical and procedural knowledge in a specialized field. It includes occupations such as technicians, associate professions, etc.
Skill level-4 (Primary occupation)	-	Dummy for skill level-4. The occupations at skill level-4 involve the performance of tasks that require complex problem-solving, decision-making and creativity based on an extensive body

Variables	Explanations
	of theoretical and factual knowledge in a specialized field such as professionals, legislators, senior officials, managers, etc.
Regular paid employees (Nature of Employment) (See Appendix A.8)	- Regular paid employees = 1, Otherwise = 0.
Non-regular paid employees (Nature of Employment)	- Non-regular paid employees include casual and contract paid employees. It is used as a reference group.
Own-account workers (Nature of Employment)	- Own-account workers include both agricultural and non-agricultural own-account workers. Own-account workers = 1, Otherwise = 0.
Family workers (Nature of Employment)	- Family worker (Agriculture/Non-Agriculture) = 1, Otherwise = 0.
Employers (Nature of Employment)	- Employers = 1, Otherwise = 0.
Agriculture (Major industry) (See Appendix A.9)	- Dummy for being employed in agricultural sector, forestry, mining and quarrying.
Industry (Major industry)	- Dummy for being employed in industrial sector such as manufacturing, construction, electricity, etc.
Service (Major industry)	- Services sector includes transport, public administration, financial, health, education, tourism, etc. It is used as a reference group.

Some researchers have argued qualification of individuals as more influential in determining returns to education compared to the number of years of education attained. For example, they claim that the additional returns of one year from grade 4 to 5, is different from grade 5 to 6 because if individuals complete grade 6 then they will have a primary qualification. Indeed, such argument clearly indicates the existence of wage premium for completing final year of each levels of education such as primary, lower secondary, higher secondary and bachelor's degree and above. Thus, to test for such non-linearity of returns to education along the education profile, the returns to levels of educational attainment will be estimated. The levels of education in Bhutan can be categorized into four categories viz, 1. Primary education, 2. Lower and middle secondary, 3. Higher secondary and 4. Bachelor's degree and above. Hence, the returns to levels of education can be estimated as follows;

$$\ln w_i = \beta_0 + \beta_1 Pry_i + \beta_2 Low\_mid_i + \beta_3 deg_i + \beta_4 Exp_i + \beta_5 Exp_i^2 + \beta_6 male_i + \beta_7 rural_i + \beta_8 divorce\_2i + \beta_9 single\_3_i + \beta_{10} skill\_1_i + \beta_{11} skill\_3_i + \beta_{12} skill\_4_i + \beta_{13} reg\_1_i + \beta_{14} fam\_wrk3_i + \beta_{15} own\_act4_i + \beta_{16} emplyr5_i + \beta_{17} agri\_1_i + \beta_{18} inds\_2_i + \varepsilon_i \quad (2)$$

Where Pry_i refers to primary level education attained by individual *i*, Low_mid_i – lower and middle secondary level of education attained by individual *i*, and deg_i – degree and above level of education attained by individual *i*. The higher secondary level of education attained by individual *i* is used as a reference group.

3.2.2 Application of a Pseudo-Panel Approach

When we estimate returns to education using Mincer's earnings model, the literatures have normally considered individuals' years of education as an exogenous variable. However, the years of schooling accomplished by individuals may also depend upon individual's optimal choice. Therefore, schooling variable can be an endogenous variable. The use of least square technique in estimating returns to education with endogeneity nature of variables will probably give biased estimation so, the endogeneity effect must be rectified in order generate a reliable estimation.

One profound method used for controlling the unobserved heterogeneity across individuals is using a panel estimation. However, a developing country such as Bhutan is lacking genuine panel data, so this study will employ pseudo panel data as a substitute approach for estimating returns to education for Bhutan.

The prime objective of this paper is to find the rate of returns to education for Bhutan for last six years using repeated cross-sectional analysis. One common empirical problem of using cross-sectional data reflected in the past studies is the problem of unobserved individual heterogeneity. It has been one main weakness of cross-sectional analysis which deters researchers from determining the true rate of returns to education. In addition to the problem of unobserved individual heterogeneity, some researchers such as Glenn (2005) had pointed out another drawback of using cross-sectional data. The people of different age cohorts have been molded by different determinative experiences and influence. Each age cohort would be exposed to different opportunities, attitudes, behaviors, etc. which possibly determine the quality and years of education attained. Thus, the returns to education may vary across cohorts over different years. It is therefore of importance to control for cohort-specific effects when a pseudo-panel approach is employed.

This approach begins with elementary Mincerian earnings framework (Mincer, 1974) which was specified as follows;

$$\ln w = \beta_0 + \beta_1 Edu + \beta_2 Exp + \beta_3 Exp^2 + \varepsilon \quad (3)$$

Where *lnw* is natural log of hourly real wage, *Edu* – completed years of education by individuals, *Exp* – years of potential labor market experience of individuals, Exp^2 – potential experience squared which indicates an individual's experience over the lifetime, ε – individuals-specific errors and βj – parameters that need to be estimated.

The coefficient associated with years of schooling can be regarded as the rate of returns to education and the coefficient on potential experience and potential experience square as change in earnings with additional years of potential experience.

To represent above equation with respect to time, year and individual specific;

$$\ln w_{it} = \beta_0 + \beta_1 Edu_{it} + \beta_2 Exp_{it} + \beta_3 Exp^2_{it} + \alpha_{it} + \varepsilon_{it} \quad (4)$$

Where;

- i – represent different individuals
- t – represent different periods
- lnw_{it} – natural log of hourly real wage of individual i at time t,
- Edu_{it} – completed years of education by individual i at time t,
- Exp_{it} – potential experience of individual i at time t,
- Exp_{it}^2 – potential experience squared
- ε_{it} – individual-specific errors at time t
- βj – parameters that need to be estimated.

The term α_{it} in equation (4) captures the unobserved individual specific effects which could be different abilities or different motivations among different individuals. If α_{it} is not correlated with explanatory variables i.e., Edu_{it} and Exp_{it}, then equation (4) above can be directly estimated using ordinary least squares method by treating α_{it} and ε_{it} as merged error term. However, there is possibility and it is highly probable that α_{it} can correlate with both the explanatory variables. If the ability or motivations are easily observed, then we can directly include them into equation (4) and estimate for respective coefficients. But in practice, it is very difficult to include ability or motivation variable directly into equation (4) or it is not easy to use individuals' fixed effects to control for unobserved individual heterogeneity while estimating equation (4) with obtained individual survey data. Thus, in the absence of such information, the unobservable term denoted by α_{it} in equation (4) will cause OLS estimation to be biased and inconsistent.

As it has already been mentioned above, one method used to deal with the problem of bias which was triggered by unobserved heterogeneity across different individuals is through using of panel estimation with individual fixed effects. If panel data are available, then the individual fixed effects can easily take into consideration

by including individual history in the model or by obtaining deviations from individual means. However, a developing country such as Bhutan is facing this data limitation, and it will not be able to have reliable estimation due to the nature of the data. Nevertheless, to solve for such problems, Deaton (1985) recommended for constructing cohorts from the given data and then to use cohorts to estimate the fixed effects. Deaton (1985) defined a set of cohorts (C) based on year of birth of individuals and then by tracking birth year cohorts, he averages up the cohort members and hence derived a model which is expressed in terms of cohort means, which in fact becomes the units of observation for pseudo-panel approach.

By averaging of equation (4) above over cohort members, it will eliminate heterogeneity across individuals such as different abilities and motivations. Possibly, if observations in respective cohorts are combined, the consequential equation can be written as follows;

$$\overline{\ln w}_{ct} = \beta_1 \overline{Edu}_{ct} + \beta_2 \overline{Exp}_{ct} + \beta_3 \overline{Exp^2}_{ct} + \overline{\alpha}_{ct} + \overline{\varepsilon}_{ct} \qquad (5)$$

Where the cohorts (c) i.e., c =1, 2, …, C and the time periods (t) i.e., t =1, 2, …, T. $\overline{\ln w}_{ct}$ is the mean of ln$w$ for observations in the cohort (c) at time t or simply it is an average of all hourly real earnings for those individuals in the cohort (c) at time t. $\overline{\alpha}_{ct}$ is defined as an average of all individuals fixed effects in cohort (c) at time period t. In fact, $\overline{\alpha}_{ct}$ in equation (5) cannot be constant over time as $\overline{\alpha}_{ct}$ depends on t, which indicates that data are collected individually at different time periods. Moreover, due to $\overline{\alpha}_{ct}$ relying on t, it is probable for $\overline{\alpha}_{ct}$ to correlate with $\overline{Edu}_{ct}$ by means of α_{it} being likely to correlate with Edu_{it} in equation (4) above. Alike before we still cannot include $\overline{\alpha}_{ct}$ directly in the estimation due to unobservable nature. However, Verbeek & Nijman (1992) found that the cohort sizes greater than hundred observations per cell is nearly adequate to remove the bias. So conceivably, $\overline{\alpha}_{ct}$ can be considered as fixed unknown parameter where $\overline{\alpha}_{ct} = \alpha_c$ over time if samples in each cohort are adequately large. Thus, α_c can be treated as unobserved cohort fixed effects or true cohort effects.

Now in this case, the equation can be written as;

$$\overline{\ln w}_{ct} = \beta_0 + \beta_1 \overline{Edu}_{ct} + \beta_2 \overline{Exp}_{ct} + \beta_3 \overline{Exp^2}_{ct} + \alpha_c + \overline{\varepsilon}_{ct} \quad (6)$$

Now the equation (6) above is based on cohort means for respective time periods for which the data is collected. Warunsiri & McNown (2010) have stated that all the error elements that are correlated to explanatory variables in equation (4) have been eliminated from error term in equation (6). Hence, the fixed effects estimation of individuals in equation (6) which is modeled in terms of cohort means has become consistent (See Appendix A.10).

If size of cohort is fixed for data collected in different periods then the error term (ε_{ct}) in equation (6) will be independent, normal, and homoskedastic. On other hand, if cohort sizes are different for different time periods then the error term in (6) will be heteroskedastic which conversely would lead to biased standard errors. To solve the problems of heteroskedasticity, Dargay (2007) have recommended to use weighted least square estimations by weighting each observations with square root of cohort sizes. Indeed, as the number of observations in each cell or the cohort size in data would be possibly differing from one survey to another, so the weighted least square estimation will be using to correct for the problem of heteroskedasticity in this paper.

3.3 Constructing cohorts

As cohorts are the unit of observations in the pseudo-panel estimation, the construction of a pseudo-panel dataset begins by defining cohorts using six repeated cross-sectional data extending from the year 2010 to 2015. Guillerm (2017) has stated that the construction of cohorts must be based on a selection criterion that corresponds to a stable characteristic of the individuals, and it must be observable for all individuals so that the individual can be classified exactly into one cohort. Indeed, one obvious example of such selection criterion that is observable and stable characteristic of all individuals is the year of birth. The age of individuals was given in each labor force survey data, so the year of birth was generated by using the year of survey and

the age of individuals i.e., year of birth = year of survey – age of individuals and accordingly the birth cohorts are constructed for those born between 1955 to 2000 using data from surveys for 2010 through 2015, which makes 15 years of age as the youngest workers in the sample. Once the birth cohorts are defined using individuals' year of birth from the cross-sectional dimension of data, the individual observations on variables of interest are averaged over each birth cohort and hence, the cohort means are derived. Basically, the construction of pseudo panel dataset assumes that the individual of age X years in year t will be of age X+1 years in the year t+1 and so on.

The core principle of a pseudo-panel is to construct cohorts i.e., profiles, that group all individuals together by common stable characteristic. This principle will be more plausible and credible if the profiles are defined more precisely. However, defining profiles precisely comes with cost due to bias-variance tradeoff. If the size of cohorts is small, then there will be larger extent of errors while measuring empirical means i.e., $\overline{\ln w_{ct}}$ and $\overline{\text{Edu}}_{ct}$, $\overline{\text{Exp}}_{ct}$, $\overline{\text{Exp}^2}_{ct}$ and there will be greater temporal variability of the means of individual specific effects $\overline{\alpha}_{ct,}$ which possibly would lead to bias and imprecision of the standard estimators. Nevertheless, the problem of bias and imprecision of estimators are reduced by increasing the number of observations in each cohort. As per the empirical study of Verbeek & Nijman (1992), they found cohort size greater than 100 observations as agreeably enough to remove the sampling errors. On the other hand, if we increase the size of cohorts by enlarging the year of birth (e.g. by two-years or three-years year of birth brackets) then the total number of cohorts will decline and consequently, the total observations (i.e., cohort as the unit of observations) in a pseudo-panel model will be reduced. Thus, with a smaller number of observations, the estimation will be less precise.

Preserving the concept of the bias-variance tradeoff as guidelines, the pseudo-panels are constructed from 55,692 individual observations available in six survey data covering the year 2010 to 2015. The number of year of birth used for creating cohorts was adjusted based on the availability of observations in each year of birth to ensure that the cohorts have a minimum required size to rid of the sampling errors. Indeed, the number of observations in a single year of birth is fairly low for all survey years so the cohorts are built using a two-years year of birth bracket. For example, in

the survey year 2010, the initial year of birth used was 1955 and it extends up to the year 1995, where 21 two-years year of birth cohorts were built. In 2011, the initial year of birth used was 1955 and spreads up to the year 1996 and so on. The first dataset pools data from all six survey years and generated 132 two-years year of birth cohorts-observations in total. In every case cohort size exceed 100, and the vast majority contains over 300 individuals (See Appendix A.11).

The second dataset was constructed by using the three-years year of birth brackets by pooling all six surveys from the year 2010 to 2015. For example, in the survey year 2010, the initial year of birth used was 1955 and it extends up to 1995, where 14 three-years year of birth cohorts were constructed. The total of 89 three-years year of birth cohorts-observations were created for the second dataset and all 89 three-year birth cohort contains over 100 individual observations.

3.4 Key variables of Pseudo-panel approach

The most important variables used in this study are an hourly real wage, completed years of education and work experience. The hourly wages used are from primary or main occupation. The monthly wages from primary occupation were given in nominal term, so it was deflated using Bhutan's consumer price index given for respective survey years (2010 = 100 as base year). Once monthly real wages are obtained, an hourly real wage was computed through dividing monthly real wages from primary occupation by the total number of hours worked in primary occupation in a month as recorded in the survey data. Following Mincer's wage equation (1974), the log of hourly real wage is used as a response variable in this study.

The years of education attained by individuals were given in terms of years of schooling completed i.e., only completed years of education was taken into consideration. For instance, if an individual left school in the mid of academic year then only his/her completed years of schooling was counted and recorded in the surveys. The years of education reported in Bhutan's LFS data ranges from 0 to 17 with 0 referring for no education or illiterate, 1-6 years for primary education, 7-10 years reflecting lower and middle secondary schooling, 11-12 years representing higher secondary schooling, 13-15 years reflecting bachelor's degree and 17 years

reflecting master's degree and above. The number of individuals who have attained master's degree and Ph.D. was comparatively low during those survey years in Bhutan so the years of education attained by those individuals who have master's degree and Ph.Ds. were grouped together under one category of completed years of education. Indeed, the completed years of education is used as one important predictor variable in this study.

The age of individuals was given in the LFS data for all six surveys, so the potential experience of individuals was derived using their respective age and completed years of education i.e., potential experience = age of individual – years of education – 6 years (age before getting into school). The potential experience squared was also used in this model to capture any non-linearities in earnings with respect to lifetime experience of individuals. In fact, one very important thing to note about this sample design is that it disregards the individual's earnings from secondary occupation due to very low proportion of labor force taking up secondary occupations in Bhutan (See Appendix A.12).

3.5 Data

This study uses six periodic cross-sectional labor force survey data (i.e., from 2010 to 2015) which were collected by Ministry of Labor and Human Resources of Bhutan. The labor force survey (LFS) in Bhutan is carried out with aims to deliver a quantitative framework for the preparation of national plans, programs and the formulation of policies that affect Bhutan's labor market. The labor force survey represents a nationwide statistics of labor force in Bhutan. In most of the countries around the world, the labor force survey is carried out on quarterly basis but in case of Bhutan it is carried out on yearly basis. Bhutan's labor force survey covers the samples from both rural and urban areas for all twenty districts with all classes of demographic and economic characteristics. For data collection, the dzongkhags were divided into numerous enumeration blocks such as rural, urban and chiwogs (sub-district) and then categorize as Primary sampling units and Secondary sampling units. The questionnaires were pre-tested and reviewed several times before making direct interview to ensure its precision. Essentially, Bhutan's labor force survey

questionnaire consists of two main components viz, demographic characteristics and economic characteristics. The data are collected by several enumerators involved in the field under the supervision of various supervisors through direct interview method. Indeed, the labor force survey in Bhutan was conducted as per the International Labor Organization (ILO) guidelines and standards.

The different wave of Bhutan's labor force survey comprises different numbers of variables. For instance, the labor force survey (LFS) 2011 have collected data for 70 variables whereas the labor force survey 2010 have collected data only for 54 variables. Similarly, LFS 2012, 2013, 2014 and 2015 have collected data for 61, 64, 79 and 76 variables respectively. Conceivably, each wave of Bhutan's labor force survey consists a good number of variables pertaining to demographic and economic characteristics. However, this study will be using only those variables which are relevant and essential for determining the returns to education. Some of the basic descriptive statistics of important variables are given in Table 3.2 and Table 3.3 below.

Table 3.2 Basic descriptive statistics of important variables (2010 – 2012).

	2010		**2011**		**2012**	
Variables	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**
yrs_edu	32,744	5.248	31,411	5.3912	32,611	5.6730
real_earnpry	10,666	9881	9,993	10062	14,717	10660
real_hrswage	10,336	45.510	9,889	51.547	14,431	50.210
male	32,755	.47782	31,411	.47900	32,611	.47888
rural	32,755	.76000	31,411	.75152	32,611	.74159
married1	32,755	.45456	31,411	.46028	32,611	.45098
divorce2	32,755	.03175	31,411	.03021	32,611	.03495
single3	32,755	.51369	31,411	.50950	32,611	.51405
reg1	13,930	.49059	13,152	.44829	13,612	.43733
non_reg2	13,930	.07516	13,152	.05786	13,612	.06641
fam_wkr3	13,930	.19971	13,152	.16248	13,612	.26704
own_act4	13,930	.23251	13,152	.32778	13,612	.22810

emplyr5	13,930	.00201	13,152	.00357	13,612	.00110
skill1	13,936	.40628	13,152	.43833	13,612	.48927
skill2	13,936	.30180	13,152	.32306	13,612	.30642
skill3	13,936	.11194	13,152	.08508	13,612	.06589
skill4	13,936	.17996	13,152	.15351	13,612	.13840
agri1	13,933	.26864	13,151	.29800	13,612	.35167
inds2	13,933	.12545	13,151	.13960	13,612	.13311
serv3	13,933	.60589	13,151	.56239	13,612	.51520
exp	32,755	16.400	31,411	16.392	32,611	16.229

Table 3.3 Basic descriptive statistics of important variables (2013 – 2015).

	2013		**2014**		**2015**	
Variables	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**
yrs_edu	15,783	6.1080	15,021	6.5735	14,465	6.4253
real_earnpry	7,862	11026	7,039	11720	7,269	11915
real_hrswage	7,773	51.635	6,904	58.817	7,163	60.495
male	15,783	.48007	15,502	.48277	15,156	.47077
rural	15,783	.73420	15,502	.74332	15,156	.73363
married1	15,783	.45682	11,146	.64731	10,850	.65216
divorce2	15,783	.04124	11,146	.06253	10,850	.06543
single3	15,783	.50193	11,146	.29014	10,850	.28239
reg1	6,501	.46131	6,126	.46147	6,246	.43788
non_reg2	6,501	.05999	6,126	.05550	6,246	.05251
fam_wkr3	6,501	.16551	6,126	.20649	6,246	.19004
own_act4	6,501	.31318	6,126	.27652	6,246	.31956
skill1	6,501	.39963	6,126	.39813	6,246	.41178
skill2	6,501	.30856	6,126	.33480	6,246	.32516
skill3	6,501	.07075	6,126	.06382	6,246	.06564
skill4	6,501	.22104	6,126	.20323	6,246	.19740
agri1	6,501	.26688	6,126	.27473	6,246	.27393

inds2	6,501	.16243	6,126	.13075	6,246	.14777
serv3	6,501	.57068	6,126	.59451	6,246	.57829
exp	15,783	16.525	15,502	17.948	15,156	18.693

The descriptive statistics given in Table 3.2 and Table 3.3 above show that the average real earnings (real_earnpry) increase fairly for Bhutan for last six years starting from year 2010 up until year 2015. The highest increase in real earnings was for the year 2013 to 2014 with Nu.694 and second highest for year 2011 to 2012 with Nu.598. Indeed, it is also very inspiring to observe that the average years of education (yrs_edu) accomplished by individuals goes on increasing with each newest year for last five years (i.e., from year 2010 to 2014) in Bhutan. However, there is a slight decrease in average years of education attained by individuals in Bhutan from year 2014 to 2015 with mean value of 6.574 to 6.425 respectively. When we focus on the hourly real wage (real_hrswage), there is a slight drop in year 2012 i.e., from Nu.51.547 in year 2011 to Nu.50.210 in year 2012 and then again, a sharp increase in hourly real wage from year 2013 up until year 2015. In all six years, rural workers account for 73-76% of the labor which is considerably higher than that of urban workers.

Regarding the nature of employment, in all six survey years, regular paid workers (reg1) account for 43-49% of the labor whereas non-regular paid workers (non_reg2) account 5-8% of the labor. Furthermore, the own-account workers (own_act4) account for 23-33% of the labor whereas family workers (fam_wkr3) account only 16-26% of the labors in Bhutan. In all six survey years, the workers of skill level-1 comprises highest with 39-49% of the labor followed by workers of skill level-2 with 30-33% of the labor. Unexpectedly, the workers of skill level-4 comprises higher than workers of skill level-3 i.e., with 13-22% and 6-11% of the labor for skill level-4 and skill level-3 respectively for all six survey years.

For sector of employment, in all six years, workers in service sector (serv3) account for 51-60% of the labor which is considerably higher than workers in industry sector (inds2) which account for 12-16% of the labor in Bhutan. Regarding work experience (exp), the average year of work experience is in the range of 16-19 years for all six surveys.

Table 3.4 Consumer Price Index (2010 – 2015) (See Appendix A.13)

	Year					
Consumer price index	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
	100	111.34	120.74	129.19	139.80	146.12

(*Source: World Bank*) *https://fred.stlouisfed.org/series/DDOE02BTA086NWDB*

Table 3.5 Average monthly real earnings from primary occupation by education attainment.

Education	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
No education	7227.09	6453.98	7783.22	7464.98	9203.25	9352.98
Primary	7474.28	7833.61	9157.59	9364.28	9771.72	9867.38
Lower and middle secondary	9196.88	9670.12	11026.2	12055.5	10880.4	11359.4
Higher secondary	11462.2	11804.7	12687.9	12549.6	13107.8	13733.3
Bachelor's degree and above	18132.3	18789.6	18595.7	18846.6	18637.6	18534.4
Ratios of bachelor and above and No education	2.5	2.9	2.4	2.5	2.0	1.9

When computing for average monthly real earnings from primary occupation by education level, it shows that the average monthly real earnings goes on increasing with higher levels of education for each year i.e., highest earnings from bachelor's degree and above followed by higher secondary, lower and middle secondary, and lowest from primary education. For all six survey years, the average monthly real earnings from no education is lower than average monthly real earnings from primary education. We can also have comparative study about average monthly real earnings for same educational level for different years (i.e., from year 2010-2015). Bhutan has experienced increasing trends of earnings from primary education during those six studied periods. For lower and middle secondary education, the average earnings goes on increasing until 2013 and thereafter it decreases slightly. For higher secondary

education level, the earnings increase for first three years and then drops slightly in 2013 and again rises in year 2014 and 2015. In fact, the earnings difference from bachelors and above is much higher for all years (2010-2015) compared to other education levels.

The earnings from bachelor and above is approximately 2.5 times larger than earnings from no education in year 2010. The earnings difference between bachelor and above and no education increases sharply in 2011 and dropped in the year 2012. Again, the earnings differences between bachelor and above and no education increases in the year 2013 and from year 2014 onwards, the earnings differences dropped with 2.0 and 1.9 times for the year 2014 and 2015 respectively. As the earnings from bachelors and above is more than twice for most of the study period (except 2015 with 1.9 times), so it indicates the existence of inequality between these two groups (i.e., Bachelor and above and no education group).

Table 3.6 Average monthly real earnings from primary occupation by age group.

Age group	2010	2011	2012	2013	2014	2015
15 – 24	6409.32	7533.44	7848.95	7537.84	7792.49	8560.41
25 – 34	9580.72	9632.71	10829.1	10667.6	11216.9	11861.5
35 – 44	10783.7	11176.8	11341.7	12175.6	12405.9	12122.6
45 – 54	12720.2	11703.3	11119.6	12448.1	13254.4	12345.1
55 +	11596.4	11084.6	11321.1	10799.4	12072.6	14097.8

We can also observe average monthly real earnings from primary occupation by age group. As this study uses workers of age between 15-60 so the age group has been created with minimum of age 15 years and maximums of age 60 years. The statistics in Table 3.6 above shows an increasing trend of average monthly real earnings with the higher age group up until age group 45-54 for five survey years (except 2012). For year 2012 there is slight decrease in earnings for age group 45-54 but however, it increases again for age group 55 and above. One exciting observation for Bhutan's labor market is that, in four of six surveys the average monthly real

earnings decreases for age group 55 and above whereas for other two surveys (i.e., year 2012 and 2015), earnings continues to increase even for age group 55 and above.

In the year 2010, the average monthly real earnings for age group 55+ dropped approximately by 1.09 times and then around 1.06 times in 2011. Furthermore, for year 2013 and 2014 the average monthly real earnings for age group 55 and above dropped by around 1.15 times and 1.09 times respectively.

Table 3.7 Average monthly real earnings from primary occupation by district.

Dzongkhags	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Bumthang	9135.47	9328.66	11252.3	8284.50	7907.15	7504.51
Chukha	9307.01	9038.31	10884.4	10584.2	12107.4	12589.5
Dagana	8645.01	13524.7	13500.5	7914.71	11619.0	8706.84
Gasa	11334.0	10076.4	5549.80	9386.99	8232.65	9900.53
Haa	8944.67	10036.9	11578.0	11732.9	11347.0	11140.9
Lhuntse	8398.40	9145.87	9528.30	8119.39	9113.49	10960.7
Mongar	9125.19	8964.02	10003.0	10192.2	8540.53	11103.9
Paro	8258.12	10963.9	11399.6	10943.6	12388.4	14567.7
Pema Gatshel	8848.95	10071.6	6848.05	6943.58	9962.75	12454.2
Punakha	12110.7	10341.2	10982.9	12831.2	11158.8	13132.5
Samdrup Jongkhar	7841.38	9070.13	6903.24	7041.65	10694.4	8141.24
Samtse	9071.78	7144.32	7376.86	7302.95	7559.30	8650.21
Sarpang	9334.03	8548.41	10933.9	9247.64	11180.3	13995.8
Thimphu	11011.2	11745.0	12573.3	13636.4	13275.1	12777.4
Trashigang	9142.38	8565.22	9792.24	11302.8	9905.94	11874.3
Trashi Yangtse	9661.81	8829.04	7183.54	6088.45	8644.68	11622.8
Trongsa	10992.6	8602.0	13602.6	10821.1	11032.8	12272.3
Tsirang	7458.54	8007.28	9128.03	8341.86	9607.79	9394.73
Wangdue	10228.7	10621.2	10877.3	10193.3	14824.8	12190.5
Zhemgang	11444.4	8468.18	10912.1	7191.22	11226.1	8009.61

Bhutan have twenty districts (dzongkhags) with varying extent and population. In the year 2010, Punakha district stood at top with average monthly real earnings of Nu. 12110.7 and Tsirang district at the bottom with Nu. 7458.54. The ratio of highest

earnings district and lowest earnings district is approximately 1.6 times for year 2010. In the year 2011, the top three districts with highest earnings are Dagana, Thimphu and Paro whereas the districts with lowest earnings are Samtse, Tsirang and Zhemgang. Trongsa district has highest average monthly real earnings of Nu. 13602.6 and Gasa district as lowest with Nu. 5549.80 in the year 2012. Thimphu, the capital city of Bhutan has highest average monthly real earnings with Nu. 13636.4 and Trashi Yangtse district as lowest with Nu. 6088.45 in year 2013. The ratio of highest earnings district (Thimphu) and lowest earnings district (Trashi Yangtse) is approximately 2.2 times in the year 2013. This is not surprising because workers in the lowest earnings district are mainly in agriculture whereas their counterparts in highest earnings district are working as government employee, working in manufacturing sector, service sectors, etc.

In 2014, Wangdue, Thimphu and Paro districts were highest average monthly real earnings districts and Samtse, Bumthang and Gasa districts as bottom three average monthly real earnings districts. The ratio of top three highest earnings districts and bottom three earnings districts is approximately 1.7 times in the year 2014. In 2015, Paro district stood at the top with average monthly real earnings of Nu. 14567.7 and Bumthang at lowest with Nu. 7504.51 with ratio of approximately 1.9 times. Again, individuals in highest earnings district are mostly working as government employees, service sector, business, etc. whereas individuals in lowest earnings districts are mostly involved in agriculture. Although the highest Average monthly real earnings from primary occupation by district goes on changing from one year to another, yet the average monthly real earnings for capital district (i.e., Thimphu) remains mostly within top five highest earnings for all past six years of the study period.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Determinants of wages: OLS

(a) Estimates for individual survey year

The discussion of empirical results of this study begins by presenting estimates obtained for years of education for each survey year i.e., the results from OLS regressions on individual data for all six survey years separately. The details of returns are shown in Table 4.1 below. The estimation (for all six survey years) also includes thirteen dummy variables essentially to investigate the differences in earnings between males and females, rural and urban workers, among workers of different marital status, skill level, nature of employment and by the industry of employment. The basic finding of returns estimated by using OLS analysis for all six survey years independently is in the range of 7 – 8%, with highest in the survey year 2011 (8%) and around 7% for all other remaining five survey years. One of the most important findings of this study is that the returns to education for all six survey years are positive and statistically significant at 1% level, suggesting an additional year of education as an important cause for higher earnings in Bhutan.

The OLS analysis also shows an experience as one of the important contributors to earnings in all six survey years. The returns from every additional year of work experience is in the 3 – 6% range, with highest returns in the survey year 2010. On the other hand, the returns to a lifetime experience of individuals (proxied by experience squared) appear to be negative for all six survey years suggesting the diminishing returns of experience as the years of experiences get bigger. The result in Table 4.1 also shows higher earnings for male workers than female workers in most of the surveys except in the year 2010, the earnings is higher for female workers. The differences in earnings for male and female clearly indicate the existence of gender discrimination in terms of earnings in Bhutan. Surprisingly, the earnings of rural workers exceed that of urban workers in five survey years. However, this result is

similar to what Peet, Fink, & Fawzi (2015) have found for seven out of thirteen Asian developing countries in their study. Conceivably, the reasons for higher earnings for rural workers than urban workers could be due to the existence of different allowance and benefit schemes in Bhutan. For example, if an individual is willing to work in unsuitable rural areas then government provides different forms of allowances and benefits such as; high altitude allowance, difficulty area allowance, scarcity allowance, radiation allowance, etc. to compensate for forgoing conducive working environments.

The result in Table 4.1 shows that in four of six surveys, the earnings of divorced workers exceed that of married workers but in the remaining two surveys the earnings of divorced workers do not seem to be different from that of the married workers. The analysis also shows that the single workers' earnings are not different from the married ones. Regarding skill levels, it is quite surprising that the skill levels do not seem to play any significant roles in explaining earnings variation among Bhutanese workers. Additionally, the nature of employment and type of industry in which the workers are employed do not appear to have any influence on the wages in Bhutan either.

Table 4.1 Determinants of wages (for each survey year)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
VARIABLES	lnhr_realw	lnhr_realw	lnhr_realw	lnhr_realw	lnhr_realw	lnhr_realw
yrs_edu	0.0702***	0.0819***	0.0705***	0.0753***	0.0734***	0.0776***
	(0.00195)	(0.00214)	(0.00213)	(0.00272)	(0.00273)	(0.00277)
Exp	0.0581***	0.0395***	0.0301***	0.0369***	0.0415***	0.0383***
	(0.00499)	(0.00471)	(0.00464)	(0.00593)	(0.00545)	(0.00581)
Exp_sq	-0.0009***	-0.0005***	-0.0004***	-0.0005***	-0.0005***	-0.0005***
	(0.000125)	(0.000108)	(0.000105)	(0.000138)	(0.000122)	(0.000130)
male	-0.120***	0.127***	0.142***	0.0967***	0.0210	0.107***
	(0.0219)	(0.0244)	(0.0239)	(0.0310)	(0.0307)	(0.0292)
rural	0.0148	0.193***	0.755***	0.660***	0.373***	0.496***
	(0.0570)	(0.0399)	(0.0363)	(0.0451)	(0.0442)	(0.0467)
divorce2	0.119**	0.103*	0.154***	0.0777	-0.0582	0.0990*
	(0.0506)	(0.0548)	(0.0543)	(0.0632)	(0.0600)	(0.0556)
single3	-0.0306	-0.0453	-0.0293	-0.0438	-0.0178	-0.0221
	(0.0275)	(0.0286)	(0.0295)	(0.0414)	(0.0405)	(0.0476)
skill1	0.0177	0.110***	0.00858	-0.0754	-0.0121	0.00878
	(0.0316)	(0.0323)	(0.0360)	(0.0505)	(0.0455)	(0.0462)
skill3	0.00520	0.0753**	4.21e-07	-0.00260	0.0151	-0.0340
	(0.0350)	(0.0373)	(0.0446)	(0.0558)	(0.0549)	(0.0558)

skill4	-0.0165	0.0381	0.0256	-0.0489	0.0375	-0.0168
	(0.0278)	(0.0299)	(0.0322)	(0.0372)	(0.0359)	(0.0377)
reg1	-0.00184	0.0822**	-0.0513	-0.000294	-0.0493	-0.0407
	(0.0378)	(0.0411)	(0.0415)	(0.0610)	(0.0509)	(0.0630)
fam_wkr3	0.0231	0.151***	-0.00149	0.000492	-0.104	-0.189**
	(0.0517)	(0.0511)	(0.0525)	(0.0738)	(0.0632)	(0.0750)
own_act4	0.00167	0.0973**	-0.0418	0.00109	-0.0221	-0.0940
	(0.0436)	(0.0439)	(0.0462)	(0.0637)	(0.0557)	(0.0656)
emplyr5	-0.0465	0.00448	-0.653***	-	-	-
	(0.138)	(0.141)	(0.237)			
agri1	-0.0282	-0.122***	-0.0835*	0.0314	-0.0459	0.0547
	(0.0407)	(0.0383)	(0.0453)	(0.0617)	(0.0534)	(0.0589)
inds2	-0.0225	-0.0206	-0.0228	-0.0401	-0.0793*	-0.000643
	(0.0335)	(0.0305)	(0.0371)	(0.0472)	(0.0425)	(0.0459)
Constant	2.444***	2.184***	2.034***	1.993***	2.417***	2.266***
	(0.0851)	(0.0747)	(0.0697)	(0.0945)	(0.0846)	(0.107)
Observations	4,432	3,989	6,168	3,250	2,723	2,848
R-squared	0.227	0.313	0.314	0.321	0.281	0.316

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

(b) Pooled estimates for years of education

The details of returns to education for the pooled full sample is reported in Table 4.2 below. The OLS estimated returns to education show that an extra year of education increases an hourly real wage by around 8% and it is statistically significant at 1% level. This result is similar to what Himaz & Aturupane (2012) had found for Sri Lanka. The estimates also show an experience as one of the important contributors to earnings, with every year of work experience adding approximately 4% in earnings for Bhutanese workers. This result is realistic and consistent with what is normally observed in Bhutan i.e., the workers with same years of education employed in the same job but with different years of work experience have different levels of earnings. The returns to a lifetime experience of individuals (proxied by experience squared) appear to be negative suggesting the diminishing returns of experience as the years of experience increase.

Regarding the differences in earnings by gender, the earnings of male workers exceed that of female workers by around 7%. The differences in earnings between male and female workers clearly reflects the still-existence of traditional female low paying culture in Bhutan. Unexpectedly, the earnings of rural workers are considerably higher than urban workers and the difference is statistically significant at

1% level. This result irrefutably defends earnings differences as not the cause of rural to urban migration taking place in Bhutan.

Besides, the earnings of divorced workers are around 10% higher than that of the married ones whereas the single workers earn 3% less than their married counterparts. The nature of employment and the levels of skills do not seem to play any significant roles in explaining the earnings variations in Bhutan. Furthermore, results show that the earnings of workers in industry and agriculture sector are lower than earnings of workers in service sector by around 3% and 5% respectively.

Table 4.2 Determinants of wages (Pooled)

VARIABLES	Pooled regression lnhr_realw
yrs_edu	0.0758***
	(0.000971)
Exp	0.0396***
	(0.00217)
Exp_sq	-0.000521***
	(5.02e-05)
male	0.0661***
	(0.0111)
rural	0.506***
	(0.0188)
divorce2	0.0982***
	(0.0238)
single3	-0.0343**
	(0.0142)
skill1	0.00792
	(0.0161)
skill3	-0.00159
	(0.0187)
skill4	0.00893
	(0.0138)
reg1	0.00258
	(0.0197)
fam_wkr3	0.0126
	(0.0249)
own_act4	0.0125
	(0.0214)
agri1	-0.0473**
	(0.0200)
inds2	-0.0278*

	(0.0162)
Constant	2.094***
	(0.0343)
Observations	23,410
R-squared	0.284

Note: Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Returns to education estimates for levels of education: OLS

(a) Estimates for individual survey year

In the literature, some researchers have argued qualification of individuals as more influential in determining returns to education compared to the years of education attained by them. Hence, to test for such non-linearity of returns to education along the education profile, the returns to different levels of educational attainment have estimated and reported in Table 4.3 below. An interesting finding of this study is that the earnings goes on increasing with higher levels of educational attainment for all six survey years and it is statistically significant at 1% level. The earnings, which is measured in terms of hourly real wage, is roughly in the range of 40% to 45% higher for bachelor's degree and above in comparison with the higher secondary level of education. The highest difference in earnings between workers with bachelor's degree and above and workers with no education is in the survey year 2011 with the approximate difference of 50.3% (See Appendix A.14) and the lowest difference is in the survey year 2010 with difference of around 35.6% (See Appendix A.15). The differences in earnings for different levels of education clearly indicate the existence of wage premium along the education profile in Bhutan and more importantly, this finding persuades people of Bhutan to invest and pursue higher levels of education, as accomplishing higher levels of education is closely linked with higher earnings.

However, when we emphasis on returns to different levels of education, the returns to Bhutanese workers appear to increase rather exponentially as they accomplish higher levels of education for five survey years. For instance, in the survey year 2011, the difference in earnings between primary school graduates and

non-educated workers is 11.2%, a year at primary schooling provides 1.9% increase in earnings (See Appendix A.16). At the lower secondary level, a year of schooling yields 10.6% (See Appendix A.17) whereas an extra year at higher secondary level and bachelor's degree improves earnings by 20% (See Appendix A.18) and 14.5% (See Appendix A.19) respectively. Similarly, in the survey year 2012, a year at primary, lower secondary, higher secondary, and bachelor's degree and above provides 1.7% (See Appendix A.20), 8.7% (See Appendix A.21), 17.6% (See Appendix A.22), and 14.7% (See Appendix A.23) increase in earnings respectively.

The returns to education also goes on increasing with higher levels of educational attainment for survey year 2013 and 2014 i.e., contributing approximately 3.2%, 8.1%, 17.2%, and 13.2% increase in earnings in the year 2013 and approximately 1.6%, 7.8%, 21.5%, and 13.9% increase in earnings in the year 2014. The returns to levels of education for year 2015 also increases rather exponentially with a year of schooling at primary, lower secondary, higher secondary, and bachelor's degree and above improving earnings by around 2.4%, 8.5%, 17.5%, and 14.9% respectively (See Appendix A.24). In the survey year 2010, unlike for other surveys, the earnings of non-educated workers appear to be higher than workers with primary education so, a year at primary schooling decreases earnings by around -0.7%. However, a year of schooling at lower secondary, higher secondary and bachelor's degree and above increases earnings by around 9.1%, 23.9% and 14.8% respectively (See Appendix A.25).

The results of our empirical analysis for past six survey years clearly indicate that although Bhutanese workers with bachelor's degrees and above earn more than other groups, the returns to education at the higher secondary level seem to be highest for all six survey years, confirming the non-linearity of returns to education at different education level for all past six survey years in Bhutan.

The rest of the results regarding experience, experience squared, gender, area of residence, marital status, workers' skill levels, nature of employment, and industry of employment are consistent with the results in Table 4.1 above.

Table 4.3 Returns to education estimates for levels of education (each survey year)

VARIABLES	**2010** lnhr_realw	**2011** lnhr_realw	**2012** lnhr_realw	**2013** lnhr_realw	**2014** lnhr_realw	**2015** lnhr_realw
no_edu1	-0.801***	-0.937***	-0.801***	-0.856***	-0.832***	-0.835***
	(0.0302)	(0.0339)	(0.0329)	(0.0439)	(0.0412)	(0.0434)
pry_edu2	-0.842***	-0.825***	-0.699***	-0.666***	-0.739***	-0.689***
	(0.0407)	(0.0437)	(0.0430)	(0.0550)	(0.0532)	(0.0547)
low_edu3	-0.479***	-0.400***	-0.352***	-0.344***	-0.429***	-0.348***
	(0.0284)	(0.0305)	(0.0297)	(0.0392)	(0.0368)	(0.0399)
bac_abv5	0.445***	0.434***	0.440***	0.395***	0.418***	0.446***
	(0.0316)	(0.0336)	(0.0312)	(0.0370)	(0.0337)	(0.0390)
Exp	0.0704***	0.0503***	0.0388***	0.0428***	0.0539***	0.0462***
	(0.00488)	(0.00490)	(0.00475)	(0.00599)	(0.00549)	(0.00587)
Exp_sq	-0.0012***	-0.0008***	-0.0006***	-0.0006***	-0.0007***	-0.0007***
	(0.000122)	(0.000111)	(0.000108)	(0.000138)	(0.000123)	(0.000131)
male	-0.109***	0.114***	0.149***	0.106***	0.0188	0.109***
	(0.0214)	(0.0246)	(0.0239)	(0.0308)	(0.0302)	(0.0292)
rural	0.0282	0.205***	0.780***	0.688***	0.418***	0.516***
	(0.0554)	(0.0407)	(0.0364)	(0.0457)	(0.0449)	(0.0470)
divorce2	0.117**	0.0869	0.140***	0.0818	-0.0706	0.0883
	(0.0494)	(0.0553)	(0.0543)	(0.0637)	(0.0601)	(0.0553)
single3	-0.0227	-0.0508*	-0.0285	-0.0429	-0.0252	-0.0162
	(0.0268)	(0.0281)	(0.0294)	(0.0409)	(0.0396)	(0.0470)
skill1	0.00246	0.0999***	0.00220	-0.0640	-0.0159	0.00237
	(0.0307)	(0.0316)	(0.0356)	(0.0506)	(0.0445)	(0.0460)
skill3	0.0142	0.0657*	-0.00956	-0.00614	-9.36e-05	-0.0379
	(0.0341)	(0.0366)	(0.0441)	(0.0551)	(0.0540)	(0.0550)
skill4	-0.0166	0.0343	0.0176	-0.0482	0.0347	-0.0258
	(0.0265)	(0.0295)	(0.0319)	(0.0371)	(0.0350)	(0.0374)
reg1	-0.0191	0.0723*	-0.0514	-0.00247	-0.0531	-0.0429
	(0.0364)	(0.0406)	(0.0415)	(0.0604)	(0.0502)	(0.0634)
fam_wkr3	0.0227	0.140***	-0.00589	-0.00798	-0.105*	-0.177**
	(0.0501)	(0.0508)	(0.0525)	(0.0731)	(0.0623)	(0.0751)
own_act4	-0.0224	0.0855**	-0.0499	-0.00336	-0.0175	-0.0854
	(0.0420)	(0.0436)	(0.0462)	(0.0630)	(0.0548)	(0.0661)
emplyr5	-0.0393	-0.00564	-0.677***	-	-	-
	(0.145)	(0.139)	(0.235)			
agri1	-0.0114	-0.0952**	-0.0762*	0.0309	-0.0402	0.0433
	(0.0396)	(0.0378)	(0.0449)	(0.0620)	(0.0522)	(0.0583)
inds2	-0.0214	-0.0190	-0.0178	-0.0436	-0.0745*	-0.00990
	(0.0323)	(0.0299)	(0.0367)	(0.0473)	(0.0418)	(0.0453)
Constant	3.248***	3.113***	2.796***	2.823***	3.167***	3.085***
	(0.0778)	(0.0687)	(0.0675)	(0.0900)	(0.0801)	(0.101)
Observations	4,432	3,989	6,168	3,250	2,723	2,848
R-squared	0.276	0.330	0.325	0.325	0.303	0.329

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

(c) Pooled estimates for levels of education

The estimated earnings for different levels of education are reported in Table 4.4 below. As expected, the results show that the earnings from primary education is 76% less than higher secondary education and it is statistically significant at 1%. The earnings from lower secondary education tend to be less than higher secondary education by around 41%. Furthermore, the earnings from bachelor's degree and above shows considerably higher than higher secondary education with the difference of approximately 44%.

It is worth pointing out that the returns to education for Bhutanese workers increases rather exponentially as they climb on to the higher ladder along the education profile. For instance, the difference in returns between primary school graduates and non-educated workers is 10.3%, i.e., a year at primary schooling provides 1.7% increase in earnings (See Appendix A.26). At the lower secondary level, a year of schooling yields 8.8% (See Appendix A.27) whereas an extra year at higher secondary level and bachelor's degree improves earnings by 20.4% (See Appendix A.28) and 14.5% (See Appendix A.29) respectively.

Our empirical findings indicate that although those with the bachelor's or more advanced degrees earn more than other groups, the returns to education at the higher secondary level seems to be highest at 20.4% per a schooling year, confirming the non-linearity of returns to education at different education level.

The rest of the results regarding experience, experience squared, gender, area of residence, marital status, workers' skill level, nature of employment, and industry of employment are consistent with the results in Table 4.2 above.

Table 4.4 Returns to education estimates for levels of education (Pooled)

VARIABLES	Pooled regression lnhr_realw
no_edu1	-0.863***
	(0.0152)
pry_edu2	-0.760***
	(0.0198)
low_edu3	-0.408***
	(0.0137)

bac_abv5	0.435***
	(0.0141)
Exp	0.0495***
	(0.00220)
Exp_sq	-0.000722***
	(5.08e-05)
male	0.0713***
	(0.0110)
rural	0.539***
	(0.0189)
divorce2	0.0870***
	(0.0238)
single3	-0.0338**
	(0.0140)
skill1	0.00356
	(0.0159)
skill3	-0.00470
	(0.0184)
skill4	0.00392
	(0.0135)
reg1	-0.00289
	(0.0195)
fam_wkr3	0.00686
	(0.0247)
own_act4	0.00477
	(0.0212)
agri1	-0.0390**
	(0.0198)
inds2	-0.0282*
	(0.0159)
Constant	2.919***
	(0.0325)
Observations	23,410
R-squared	0.301

Note: Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3 Cohort estimates: Pseudo-panel

(a) Returns to education estimates for two-year cohort means and three-year cohort means.

The analysis under this approach was conducted using two different groupings of the data i.e., two-year birth cohorts and three-year birth cohorts, essentially to ensure

that the results are robust. Table 4.5 below shows the estimates obtained from pseudo-panel method. Columns (i) and (ii) show the returns to education estimate based on two-year cohort means and columns (iii) and (iv) estimates based on three-year cohort means. Interestingly, the returns to education estimates obtained using two-year cohort means and three-year cohort means are same even though the number of observations in each cell for two-years cohorts and three-years cohort dataset are different. Conceivably, obtaining same results from two different sets of estimations evidently signifies that there are no apparent biases with smaller size of cohorts. Indeed, this result is consistent with the study of Verbeek & Nijman (1992), where they have concluded that a cell containing minimum of a hundred observations is sufficient enough to get rid of the biasness (See Appendix A.30).

The results in Table 4.5 show that the returns to education estimate obtained without controlling for cohort-fixed effects (columns (i) and (iii)) are slightly lower than estimates obtained after controlling for cohort-fixed effects (columns (ii) and (iv)). The difference in returns to education estimates between with and without controlling for cohort fixed effects for two different datasets clearly demonstrates the importance of controlling for cohort fixed effects in order to generate robust estimates. Indeed, these differences in returns strongly validate the Deaton's (1985) affirmation that the cohort fixed effect must be included in the pseudo-panel regressions to excerpt the degree of dependence between the regressor and the error term.

The returns estimated using pseudo-panel method show that an additional year of educational attainment increases the earnings of Bhutanese workers by around 20.7% – 21% for two-year cohort dataset and by around 20.5% – 21% for three-year cohort dataset. The magnitude of bias is slightly higher with around 0.5% (See Appendix A.31) for three-year cohort dataset compared to two-year cohort dataset which is around 0.3% (See Appendix A.32). Based on estimates, the overall true rate of returns to education estimated for Bhutan is around 21% (See Appendix A.33). The estimates also show an experience as one important contributor to earnings, with every year of work experience adding in the range of 7% – 8% increase in earnings for Bhutanese workers (See Appendix A.34). Additionally, the returns to a lifetime experience of individuals (proxied by experience squared) appear to be negative for both two-year

and three-year cohort analyses suggesting the diminishing returns of experience as the years of experience increase (See Appendix A.35).

Table 4.5 Returns to education estimates for two-year cohort means and three-year cohort means.

VARIABLES	Pseudo-panel (Two-year cohort means) WLS (i)	Pseudo-panel (Two-year cohort means) WLS (ii)	Pseudo-panel (Three-year cohort means) WLS (iii)	Pseudo-panel (Three-year cohort means) WLS (iv)
Years of education	0.207***	0.210***	0.205***	0.210***
	(0.0136)	(0.0226)	(0.0164)	(0.0255)
Experience	0.146***	0.0824***	0.143***	0.0768***
	(0.00529)	(0.0191)	(0.00624)	(0.0222)
Experience squared	-0.00214***	-0.00128***	-0.00210***	-0.00119***
	(9.71e-05)	(0.000386)	(0.000116)	(0.000455)
Cohort dummies	No	Yes	No	Yes
Constant	0.633***	1.921***	0.679***	1.992***
	(0.135)	(0.232)	(0.160)	(0.264)
Cohort-year observations	132	132	89	89
Individual observations per cohort:				
- Max	2406	2406	3614	3614
- Min	119	119	316	316
Number of yr_birth	23	23	16	16

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

(b) Comparison of returns to education from individual data, two-year cohort means, and three-year cohort means.

For comparative purpose, the results obtained from both pooled cross-sectional regression and pseudo-panel approach are presented in Table 4.6 below. The essential findings presented in Table 4.6 suggest that the returns to education estimate from pseudo-panels (columns (ii) and (iii)) are comparatively higher than returns from regression with individual data (column (i)). The returns to education estimated by

OLS analysis (See Appendix A.36) using individual data show that an additional year of education is associated with an increase in hourly real wages by around 9% whereas the returns estimated by pseudo-panels are around 21% for both two-year and three-year cohort analyses.

Overall, the returns to education estimated by using pseudo-panel analysis are considerably larger than returns estimated by using OLS analysis suggesting a downward bias in the OLS estimation. The magnitude of bias is substantial, with returns to education underestimated by as much as 57% from a comparison of OLS analysis with pseudo-panel analyses. This downward bias in the estimates of returns to education based on individual data is explained by schooling optimization argument. This argument advocate that the individuals with higher ability or motivation may have higher potential wage options in the labor market so that they leave formal schooling at an early age and enter the labor market. In fact, it clearly indicates that the opportunity cost of continuing education is high for higher ability or motivation workers. The higher ability or motivation individuals leaving school at the early age would lead to two important consequences; 1. The negative correlation between ability/motivation and years of education and 2. The positive correlation between ability/motivation and hourly real wages. Thus, due to this omitted factor in the OLS analysis, the regression on individual data would show a negative endogeneity bias. Indeed, this result is in sharp contrast to what Himaz & Aturupane (2012) had found for Sri Lanka, where the returns estimated using OLS estimation are relatively higher than returns estimated using pseudo-panel analysis suggesting that the higher ability workers in Sri Lanka tend to accomplish higher years of education compared to lower ability workers.

The both OLS and pseudo-panel analyses show experience as one important contributor to earnings, with every additional year of work experience contributing around 5% increase in earnings from OLS analysis and in the range of 7% - 8% increase in earnings from pseudo-panel analysis. The returns to experience obtained for Bhutanese workers from OLS analysis appear similar to the returns to experience estimated for workers of Jakarta, Indonesia (i.e., around 4%) using OLS analysis (Magdalyn, 2013). The returns to a lifetime experience of individuals (proxied by experience squared) appear to be negative for both OLS and pseudo-panel analysis

suggesting the diminishing returns of experience as the years of experience get bigger (See Appendix A.37).

Table 4.6 Comparison of returns to education from individual data, two-year cohort means, and three-year cohort means.

VARIABLES	Individual data (Cross-sectional regression) OLS (i)	Pseudo-panel (Two-year cohort means) WLS (ii)	Pseudo-panel (Three-year cohort means) WLS (iii)
Years of education	0.0851***	0.210***	0.210***
	(0.000649)	(0.0226)	(0.0255)
Experience	0.0515***	0.0824***	0.0768***
	(0.00142)	(0.0191)	(0.0222)
Experience squared	-0.000808***	-0.00128***	-0.00119***
	(3.37e-05)	(0.000386)	(0.000455)
Cohort dummies	-	Yes	Yes
Constant	2.409***	1.921***	1.992***
	(0.0156)	(0.232)	(0.264)
Individual observations	55,692	55,692	55,692
Cohort-year observations	-	132	89
Individual observations per cohort:			
- Max	-	2406	3614
- Min	-	119	316
R-squared	0.243	-	-
Number of yr_birth	-	23	16

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

(c) The effects of experience on wages (OLS).

The Figure.1 below shows the effects of experience on wages under OLS analysis. The coefficient for both experience and experience squared given in Table 4.6 above are statistically significant at 1% level. The coefficient for experience is positive whereas the coefficient for experience squared is negative. The positive coefficient for

experience and negative for experience squared could indicate a monotonic increasing function of wage by experience until a turning point (around 31.9 years of experience) (See Appendix A.38) is reached, after which point the function starts to decrease. The Figure.1 below clearly shows that the log of hourly real wages goes on increasing with increase in experience until certain points and then gradually decreases after that point (See Appendix A.39).

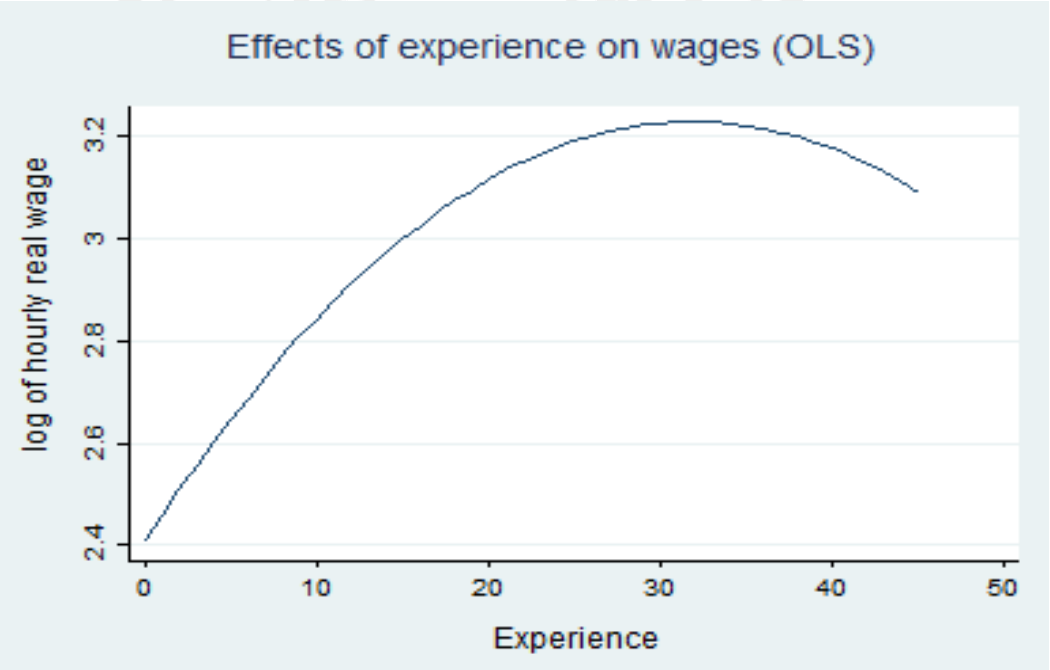

Figure.1 The effects of experience on wages (OLS)

(d) The effects of experience on wages (two-year birth cohorts).

The Figure.2 below shows the effects of experience on wages under two-year birth cohorts analysis. The coefficient for both experience and experience squared is statistically significant but however the coefficient for experience squared is negative unlike positive for experience. The negative coefficient on experience squared suggest diminishing returns of experience as the years of experience increase. The Figure.2 below clearly shows this relationship i.e., the log of hourly real wages goes on increasing with increase in experience until certain points (around 32.2 years of

experience) (See Appendix A.40) and then gradually decreases when experience further increases (See Appendix A.41).

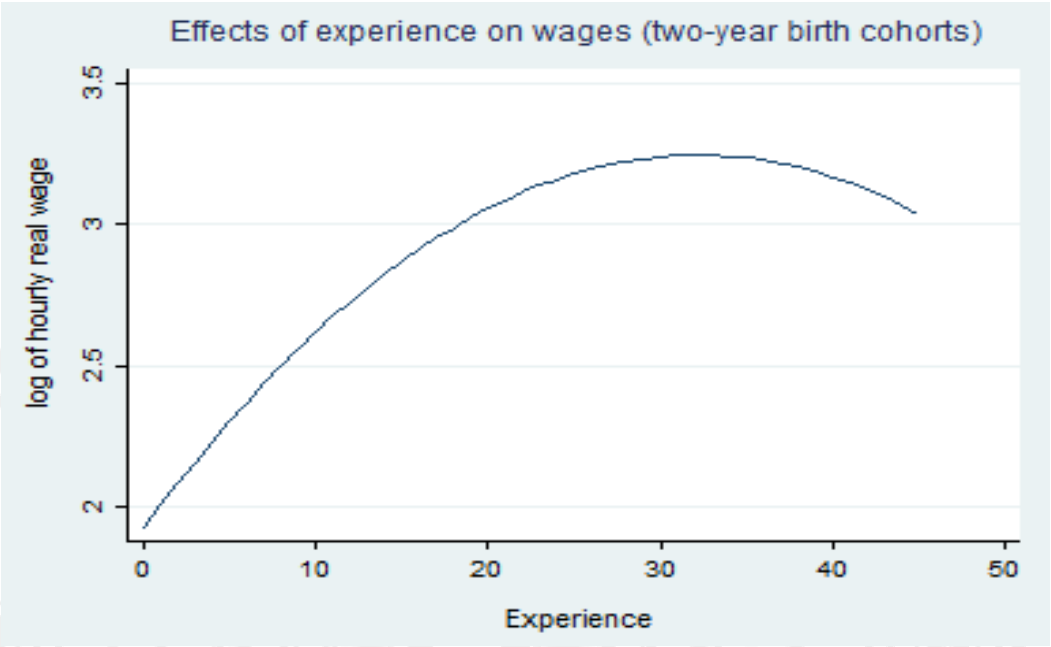

Figure.2 The effects of experience on wages (two-year birth cohorts)

(e) The effects of experience on wages (three-year birth cohorts).

The Figure.3 below shows the effects of experience on wages under three-year birth cohorts analysis. Under this approach, the coefficient for both experience and experience squared are statistically significant at 1% level. The coefficient for experience is positive whereas the coefficient for experience squared is negative. The negative coefficient on experience squared suggest diminishing returns of experience as the years of experience get bigger. The Figure.3 below clearly shows that the log of hourly real wages goes on increasing with increase in experience until certain points (around 32.3 years of experience) (See Appendix A.42) and then gradually decreases when experience gets bigger (See Appendix A.43).

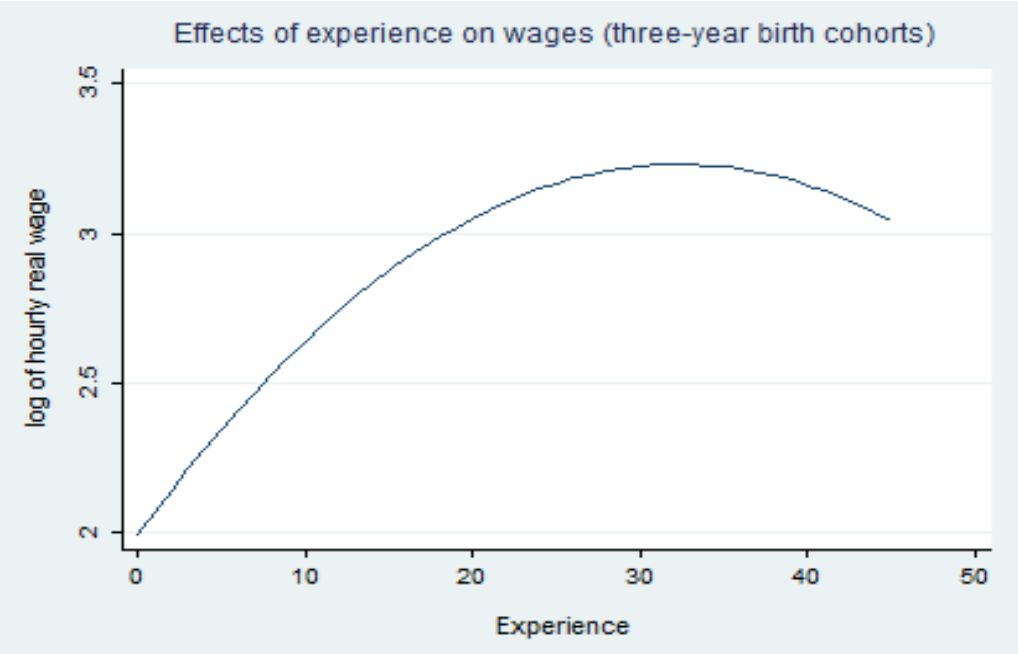

Figure.3 The effects of experience on wages (three-year birth cohorts)

CHAPTER 5

CONCLUSION

This study was mainly carried out with two important objectives. The first is to investigate the determinants of earnings for workers in Bhutan, and the second is to estimate the overall rate of returns to education for Bhutan, using six waves of Bhutan's labor force surveys conducted between the year 2010 and 2015.

The determinants of earnings for Bhutanese workers have examined by using the Mincerian framework with pooled regression models. The pooled OLS regression shows educational attainment and work experience as important determinants of wages for workers in Bhutan. The study also shows that the earnings of males exceed that of females, earnings of rural workers exceed that of urban workers, and the earnings of divorced workers exceed that of the married ones whereas the single workers earn fairly lower than their married counterparts. The nature of employment and the levels of skills do not seem to play any significant roles in explaining the earnings variation in Bhutan. Furthermore, this study shows higher earnings for workers in service sector compared to workers in industry and agriculture sectors.

This study also attempts to estimate the rate of returns to education for those Bhutanese workers born in 1955 to 2000 using Bhutan's labor force survey data from the year 2010 to 2015. Due to the unavailability of genuine panel data, a pseudo-panel approach was employed in this study as an alternative approach to panel estimation, essentially to control unobserved individual heterogeneity across individuals that may otherwise bias the estimates of returns to education. Undoubtedly, this study is first to utilize Bhutan's labor force survey data to construct pseudo-panel dataset and first to estimate returns to education in Bhutan empirically. The OLS analysis (See Appendix A.44) on individual data was also conducted in order to compare with pseudo-panel analysis. Fundamentally, both OLS and pseudo-panel analysis in this study were carried out within the framework of conventional Mincerian earnings equation.

The returns to education obtained from OLS analysis is considerably lower than returns obtained from a pseudo-panel analysis. The OLS estimated returns to education is around 9% whereas the returns from pseudo-panel estimations are 21% for both two-year and three-year birth cohorts. There is around 12% difference in returns and this differences clearly indicate that the unobservable such as different ability or motivation among individuals have caused a downward bias in the OLS estimation. In fact, the magnitude of this bias is substantial, with returns to education underestimated by as much as 57% from a comparison of OLS analysis with pseudo-panel analyses. The downward bias in the OLS estimation was explained by schooling optimization argument i.e., the higher ability/motivation individuals face higher opportunity cost of continuing their education due to higher potential wage options in the labor market. This schooling optimizing behavior can give rise to a negative correlation between ability/motivation and years of schooling, and a positive correlation between ability/motivation and earnings thus account for the downward bias in the OLS estimation. Overall, the rate of returns to education obtained for Bhutan by employing a pseudo-panel approach is 21%, which is relatively higher than countries such as Sir Lanka, Tanzania, Thailand and Indonesia. Additionally, this study also affirms work experience of individuals as an important determinant of earnings, with every year of work experience adding in the range of 7% – 8% increase in earnings for Bhutanese workers.

The results obtained in this study provide numerous policy implications and recommendations. The results showing positive returns to education from both OLS and pseudo-panel analyses clearly indicate educational attainment as one important factor that explain earnings differences among workers in Bhutan. This finding strongly persuades people of Bhutan to pursue additional years of education as the additional years of education is closely associated with higher earnings. Furthermore, it also suggests that the parents must increase investing in their children's education as the earnings of their children in the future will be largely determined by the years of education attained by them.

The results showing highest returns from higher secondary level of education (i.e., around 20.4% per year) (See Appendix A.45) in Bhutan calls for the higher education reforms i.e., to increase the provision of free education from tenth standard

to until twelfth standard. This higher education reform would be greatly beneficial to those children who do not qualify from tenth standard, and who normally choose to discontinue their education due to their parents' unaffordability in private schools.

This study also suggests that the government must support and promote continuing education (CE) and distance education (DE) program as it can extend opportunity for working individuals to accomplish additional levels of education. Furthermore, introducing weekends class education system (i.e., on Saturdays and Sundays) would greatly enhance the opportunity for working individuals (especially government employees and corporate employees who have break on Saturdays and Sundays) to upgrade their education. With more individuals accomplishing higher levels of education, the earnings of individuals will be increased and consequently the living standards of individuals would improve as higher earnings are positively correlated with better living standards.

The results showing positive returns to education for Bhutan clearly indicate the important roles played by the Ministry of Education. Strengthening the capacity of the Ministry of Education in terms of the teachers' quality and quantity will bring about much benefit. Furthermore, the government's support for education would lead to greater equality in education and hence in earnings. The increased equality in earnings would be greatly beneficial in improving unity among individuals in the country (Fuente & Ciccone, 2003).

As discussed in many studies, such as World Bank (1995), McMahon (1999), and Warunsiri and McNown (2010), the social returns to education was much larger than private returns. However, this study has focused only on private returns to education due to data limitation so a future research on gains to society is recommended to justify large government education subsidies in Bhutan.

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APPENDIX

Appendix A

1. If the data for actual experience is not available then Mincer suggested using potential experience of individuals which can be derived as; potential experience = age of individual – years of schooling – 6 years (i.e., age before getting into school).
2. Potential experience squared is used as an indicator for an individual's experience over the lifetime.
3. Main occupation consists of 10 categories viz; 1. Legislators/Senior officials/Managers 2. Professionals 3. Technicians and Associate Professionals 4. Clerks 5. Service Workers and Shop and Market Sale Workers 6. Skilled Agricultural Workers 7. Craft and Related Workers 8. Plant and Machine Operators 9. Elementary Occupations and 10. Armed Forces. All categories of occupation were classified into four levels of skills based on International Standard Classification of Occupation (ISCO, vol-08).
4. All categories of industry are classified into three major industries based on International Standard Industrial Classification (ISIC, revision-4).
5. This study disregards monastic education (i.e., monastic education attains by lamas, monks, nuns and lay monks) because from the economic perspective it is believed that monastic education is not backed by earnings motives and more importantly the data onto earnings made by religious practitioner are not available.
6. Marital status consists of three categories viz; 1. Married/Living together, 2. Divorced/separated/ Widowed, 3. Single/Never married.
7. Main occupation (the job at which individual has worked greater number of hours).
8. Employment status consists of 5 categories viz; 1. Regular paid employee, 2. Non regular paid employee, 3. Own-account worker (Agriculture/Non-Agriculture) 4. Family worker (Agriculture/Non-Agriculture). 5. Employer.
9. It is major industry in which individual have worked during the reference period. It consists of three categories viz; 1. Agriculture 2. Industry and 3. Service.
10. Random effects models also include individual specific effects like fixed effects models. However, unlike fixed effects models, the random effects models assume that the individual specific effects are not correlated with the explanatory variables.
11. The construction of single year of birth cohort using Bhutan's labor forces survey data is not possible due to less observation in each year of birth. The empirical studies have generally considered 100 individuals per cohort as enough to ignore sampling errors.
12. The number of people taking up secondary occupations in Bhutan is very less because individuals that were employed as civil servants have some obligations on having an additional job besides their primary occupation.
13. The data for individuals' monthly earnings from primary employment was given in nominal term (i.e., the current-ngultrum amount of a person's income) so to convert into real income (i.e., Nominal income adjusted for price changes) the consumer price index given for respective years has been used (2010=100 as base year). Hence, the monthly real income is calculated as follows; Real income = (Nominal income / CPI for each year) x 100.
14. No_edu1 – high_sec = - 0.937, bac_abv5 – high_sec = 0.434. The difference between no_edu1 and bac_abv5 = 0.503 or 50.3%.

15. No_edu1 – high_sec = - 0.801, bac_abv5 – high_sec = 0.445. The difference between no_edu1 and bac_abv5 = 0.356 or 35.6%.
16. No_edu1 – high_sec = - 0.937, Pry_edu2 – high_sec = - 0.825. The difference between Pry_edu2 and no_edu1 = 0.112 or 11.2%. Primary education lasts 6 years so the yearly returns is 1.9%.
17. Pry_edu2 – high_sec = - 0.825, low_edu3 – high_sec = -0.400. The difference between Pry_edu2 and low_edu3 = 0.425 or 42.5%. Lower secondary school takes 4 additional years hence the returns is 10.6% per year.
18. low_edu3 – high_sec = - 0.400. The difference between low_edu3 and high_sec = 0.400 or 40%. Higher secondary school takes 2 additional years hence the returns is 20% per year.
19. bac_abv5 – high_sec = 0.434. The difference between bac_abv5 and high_sec = 0.434 or 43.4%. Bachelor's degree takes 3 additional years hence the returns is 14.5% per year.
20. No_edu1 – high_sec = - 0.801, Pry_edu2 – high_sec = - 0.699. The difference between Pry_edu2 and no_edu1 = 0.102 or 10.2%. Primary education lasts 6 years so the yearly returns is 1.7%.
21. Pry_edu2 – high_sec = - 0.699, low_edu3 – high_sec = -0.352. The difference between Pry_edu2 and low_edu3 = 0.347 or 34.7%. Lower secondary school takes 4 additional years hence the returns is 8.7% per year.
22. low_edu3 – high_sec = - 0.352. The difference between low_edu3 and high_sec = 0.352 or 35.2%. Higher secondary school takes 2 additional years hence the returns is 17.6% per year.
23. bac_abv5 – high_sec = 0.440. The difference between bac_abv5 and high_sec = 0.440 or 44%. Bachelor's degree takes 3 additional years hence the returns is 14.7% per year.
24. The returns to levels of education for survey year 2013, 2014, and 2015 was calculated in same way as like calculated for the year 2011 and 2012.
25. The returns to levels of education for survey year 2010 was calculated in same way as like calculated for survey year 2011 and 2012.
26. No_edu1 – higher_sec = - 0.863, Pry_edu2 – higher_sec = - 0.760. The difference between Pry_edu2 and no_edu1 = 0.103 or 10.3%. Primary education lasts 6 years so the yearly returns is 1.7%.
27. Pry_edu2 – higher_sec = - 0.760, low_edu3 – high_sec = -0.408. The difference between Pry_edu2 and low_edu3 = 0.352 or 35.2%. Lower secondary school takes 4 additional years hence the returns is 8.8% per year.
28. low_edu3 – high_sec = -0.408. The difference between low_edu3 and high_sec = 0.408 or 40.8%. Higher secondary takes 2 additional years hence the returns is 20.4% per year.
29. bac_abv5 – high_sec = 0.435. The difference between bac_abv5 and high_sec = 0.435 or 43.5%. Bachelor's degree takes 3 additional years hence the returns is 14.5% per year.
30. All the cohorts in this study contains more than hundred individual observations. The minimum individual observations per cohort for two-years birth cohorts and three-years birth cohort are 119 and 316 respectively.
31. Returns to education estimates for three-year birth cohorts: without cohort fixed effects (21%) – with cohort fixed effects (20.5%) = 0.5%.
32. Returns to education estimates for two-year birth cohorts: without cohort fixed effects (21%) – with cohort fixed effects (20.7%) = 0.3%.
33. The returns to education estimates which is obtained after controlling for cohort fixed effects for two-year cohort dataset and for three-year cohort dataset.

34. The returns to experience is in the range of 8-15% for two-year cohort analysis and in the range of 7-14% for three-year cohort analysis. However, the overall returns to experience was concluded based on estimates which are obtained after controlling for cohort fixed effects for two different datasets.
35. The returns to experience squared is in the range of -0.13% to -0.21% for two-year cohort analysis and in -0.12% to -0.21% range for three-year cohort analysis. The overall returns to experience squared was concluded based on estimates which are obtained after controlling for cohort fixed effects for two different datasets.
36. The model specification here is different from the pooled data in the previous section. In this model only three key explanatory variables (i.e., years of education, potential experience and potential experience squared) are included in the regression.
37. The returns to experience squared for two-year and three-year cohort analyses are -0.128% and -0.119% whereas the returns to experience squared for OLS analysis is -0.081%.
38. The turning point is calculated as; $y = ax^2 + bx + c$. where, y = log of hourly real wages, x = experience, and x^2 = experience squared.
39. The best way to examine the effects of experience on wages is to plot predicted wage by experience. This can be done using Stata as follows; generate predicted wage = 2.409 + 0.0515*experience + (-0.000808) *experience squared. Let predicted wage = pwage, experience = exp, and experience squared = exp^2. Then define line graph to predicted wage by experience as; twoway (line pwage exp, sort).
40. The turning point is calculated as; $y = ax^2 + bx + c$. where, y = log of hourly real wages, x = experience, and x^2 = experience squared.
41. The effects of experience on wages can be examined by plotting predicted wage by experience as follows; generate predicted wage = 1.921 + 0.0824*experience + (-0.00128) *experience squared. Let predicted wage = pwage, experience = exp, and experience squared = exp^2. Then define line graph to predicted wage by experience as; twoway (line pwage exp, sort).
42. The turning point is calculated as; $y = ax^2 + bx + c$. where, y = log of hourly real wages, x = experience, and x^2 = experience squared.
43. The effects of experience on wages can be examined by plotting predicted wage by experience. This can be done using Stata as follows; generate predicted wage = 1.992 + 0.0768*experience + (-0.00119) * experience squared. Let predicted wage = pwage, experience = exp, and experience squared = exp^2. Then define line graph to predicted wage by experience as; twoway (line pwage exp, sort).
44. This model includes only three key explanatory variables i.e., years of education, potential experience, and potential experience squared.
45. low_edu3 – high_sec = -0.408. The difference between low_edu3 and high_sec = 0.408 or 40.8%. Higher secondary takes 2 additional years hence the returns is 20.4% per year.

Appendix B

Cohorts' size

Table 1: Two-year generations

Year of birth	Year of Survey					
	2010	**2011**	**2012**	**2013**	**2014**	**2015**
1955-1956	690	642	542	199	219	302
1957-1958	622	540	578	256	239	271
1959-1960	940	646	555	283	320	304
1961-1962	903	979	839	293	322	282
1963-1964	734	829	819	476	452	271
1965-1966	1122	1019	780	410	482	467
1967-1968	971	796	1056	432	387	462
1969-1970	1366	1010	969	351	546	483
1971-1972	1351	1464	1347	465	523	395
1973-1974	1497	1385	1314	798	671	532
1975-1976	1602	1701	1382	714	662	714
1977-1978	1609	1314	1612	834	770	770
1979-1980	2144	1734	1691	799	845	888
1981-1982	2057	2328	2197	823	875	674
1983-1984	2040	2139	2182	1210	972	810
1985-1986	2371	2280	2343	1183	1073	1122
1987-1988	2047	1974	2310	1142	1030	939
1989-1990	2216	1807	1963	1087	1038	1029
1991-1992	2406	2157	2100	860	803	866
1993-1994	2030	2090	2222	874	835	695
1995-1996	1068	1981	1970	966	961	801
1997-1998	-	-	1127	969	784	906
1999-2000	-	-	-	-	444	909

Cohorts' size

Table 2: Three-year generations

Year of birth	Year of Survey					
	2010	**2011**	**2012**	**2013**	**2014**	**2015**
1955-1957	985	916	883	317	316	443
1958-1960	1267	912	792	421	462	434
1961-1963	1252	1425	1190	597	440	447
1964-1966	1507	1402	1248	582	816	573
1967-1969	1443	1370	1442	599	750	635
1970-1972	2245	1900	1930	649	706	705
1973-1975	2435	2127	1949	1165	950	957
1976-1978	2273	2273	2359	1181	1153	1059
1979-1981	3117	3187	2456	1279	1213	1226
1982-1984	3124	3014	3614	1553	1479	1146
1985-1987	3382	3308	3623	1723	1583	1605
1988-1990	3252	2753	2993	1689	1558	1485
1991-1993	3471	3386	3074	1317	1198	1206
1994-1996	2033	2842	3218	1383	1401	1156
1997-1999	-	-	1127	969	1228	1311
2000	-	-	-	-	-	504

BIOGRAPHY

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ACADEMIC BACKGROUND	Sherubtse College, Kanglung, Bhutan B.A Economics with Environmental science (2007 – 2010) Samtse College of Education, Samtse, Bhutan Post Graduate Diploma in Education (PGDE) (2011) Graduate School of Development Economics National Institute of Development Administration (NIDA), Thailand. Master of Economics (2016 – 2018)
EXPERIENCES	Working under Ministry of Education (MOE), Bhutan.