ECONOMIC SIGNIFICANCE OF WORK EXPERIENCE: EVIDENCE FROM THAILAND

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ABSTRACT

Title of Dissertation	ECONOMIC SIGNIFICANCE OF WORK EXPERIENCE: EVIDENCE FROM THAILAND
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The decline in labor force due to a rapid transition of population structure to an aging society in Thailand has raised concerns over economic potential of the country and demanded urgent policies to tackle the labor reduction problem. Promoting elderly employment is a possible way of addressing the reduction in labor force, as current and future seniors tend to be healthy and highly educated. They can maintain human capital and remain productive even after retirement. Elders are highly experienced and this human capital enables them to work efficiently. Clearly, talented elders who decide to stay out of the labor market should be targeted by policymakers to tap their valuable human capital pool as a remedy for reduced labor force. This research aims to examine the size of potential elderly labor with an emphasis on their work experience as their outstanding human capital.

Population aged 50–69 year who are in good health and capable of working but remain outside the labor market are defined as potential elderly labor. The descriptive statistics show that of all potential elderly labor, 8 out of 10 are relatively young (50-59 years old) and predominantly males. These retirees have high work potential as they are highly educated and experienced.

To investigate the economic significance of work experience in various types of job, this research broke down the International Standard Classification of Occupations (ISCO-08) into three groups (high-skilled, semi-skilled, and low-skilled occupations) and used years in labor market after completing school as a proxy for actual work experience. Multinomial logistic regression was applied to correct bias in estimation process.

Empirical results show that work experience has a positive effect on wages, especially in high-skilled occupations, as it is clear from the fact that work experience yields the highest marginal return. An additional year of work experience for new highly-skilled workers is 2.66% and diminishes very small (0.08% every ten years). On the other

hand, those for new semi-skilled and low-skilled workers are 1.97% and 1.56%, respectively. However, the former diminishes 0.6% every ten years, while it is 0.18% every ten years for the latter. Evidently, work experience is empirically valuable for working especially high-skilled jobs that involve complex technical and practical tasks as well as complicated problem–solving skills. In addition, the small diminishing marginal return of work experience indicates that work experience, i.e., human capital of elder labor is slow to deteriorate.

This research concludes with the policy implications for mitigation of the reduction of labor force due to aging population. Policymakers need to design policies to encourage potential elderly labor with high work experience to remain active in the labor market, especially highly educated retirees and previously employed in high-skilled jobs. Policymakers should provide the training for potential elderly female labor who have engaged in household work and those retirees from semi-skilled and low-skilled occupations to increase their productivity and employment opportunities.

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Kritsada Wattanasaovaluk

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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

Out of concern for economic impact of labor force reduction in an aging and aged society due to a rapid decline in fertility and mortality rate, promoting elderly employment (60 years old and over who are willing and able to work) to offset labor force reduction is one possible solution. Since the current and future generations of the elderly tend to have a better health because of the advancement of medical and nutrition technologies as well as higher educational attainment and work experience, they can retain their human capital longer than the previous generation. The fact is that work capacity and human capital of the elderly do not disappear or drop immediately after they reach retirement age. Therefore, a capable elderly who retires or decides to stay out of the labor force tends to underutilized economic resources compared with their potentials.

Most aging and aged countries around the world have introduced policies to promote the elderly employment in order to maintain the economic growth, fiscal sustainablity, reduce labor shortage problem as well as promote physical and mental health of the elderly. For example, Japan has implemented both a policy supply and demand policies for the labor market. On the supply side, Japan implemened the Pension Reform Act in 2001 to raises the eligibility age from 60 to 65, which encourages private sector workers to continue working until the age of 65. On the demand side, Japan has revised the Elderly Employment Stability Law (EESL) in 2006, in which employers are legally ordered to offer employee to continue working until they reach the pension eligible age (Kondo & Shigeoka, 2017). For the United States, the government has implemented the Age Discrimination in Employment Act (ADEA) to protect employees age 40 and older from discrimination from the basis of age on the

employment opportunity, wages, promotions, termination and layoffs (Neumark, 2009). The Aged Employment Promotion Act in Korea (Hong & Lee, 2012) as well as the Active Aging policy in European Union countries (Walker & Maltby, 2012) also implemented to promote the elderly employment.

Like others countries, Thailand has become an aging society (the proportion of population aged 65 years and over exceeds 7%) since 2000 and is expected to take only 25 years before becoming a full-fledged aged society (proportion of population aged 65 years and over exceeds 14%). This is one of the most rapid demographic transition in Southeast Asia. Thai labor force is expected to decrease by at least 10% between 2010 and 2040 (World Bank, 2016). Evidently, Thailand needs an urgent policy to promote the employment of elderly people who are still capable of work to cope with the possibility of rapid labor reduction. One straightforward solution to the problem is to promote the employment of the elderly who are still able to work.

In term of quantity, Thai elder workers[1] growing steadily and becoming a significant portion of labor market in the era of an aging society[2]. Amount of elder workers increased by 57.40% from 2.77 million in 2007 to 4.36 million in 2018. Thai government and policymaker are trying to support and promote employment in the elderly, especially in the formal sector. For example, a 100% corporate tax deduction for the cost of hiring the elderly. However, it is quite ineffecitve, as seen by most seniors workers are overwhelmingly working in the informal sector, which is not legally protected. Share of the elderly workers working in the informal sector is 88% - 92%, which is significantly higher than the case of working-age workers. For instance, in 2018 about 88.2% of elder workers work in the informal sector, compared with 51% of working age (15-59 years) (National Statistical Office, 2018).

Elderly work will be more important because income from work tends to be their main source of income instead of income from their children. According to a survey report on the older person in Thailand conducted by the National Statistical Office (NSO), the main source of income for the elderly is children's income. In 2011, 40.10% of total elderly population relies on income from their chlidren. However, it continually

[1] "elder workers" is defined here as individuals age 60 and over who are willing to work, and search for jobs as well as able to work.

[2] The definition of elderly varies across countries. Some countries define as individual age 65 and over. Thailand define the elderly as individual age 60 and over.

dropped to 36.70% and 34.70% in 2014 and 2017 respectively. The same trend is also found in the case of those who report that their largest source of income is the income from working. In 2011, 35.10% of total elderly population reported that the largest income was the income from working. This proportion reduced to 33.90% and 31.00% in the case of 2014 and 2017 respectively. Other sources of income (pension, interest, spouse, and others) are relatively stable and small during the same period, except for a significant increase in old age allowances from 11.40% in 2011 to 20.00% in 2017. Given the continuously degreasing birth rate which lead to the decrease of labor force, the role of income from children and old age allowance (which depends on tax payment of the declining labor force) is the main source of income tends to diminish. Therefore, the work of elderly tend to be the most important source of income if the policy that support working and employment of the elderly is existing.

However, in term of proportion of older workers, it has decreased from 39.18% of total elderly population in 2007 to 36.95% in 2018. If employment is a match between labor demand and labor supply, the reduction in the proportion of elderly workers probably imply that the labor demand and/or labor supply of elderly workers are decrease.

For the labor supply, given the current labor market condition, low labor supply may be the result of low wages. According to the 2018 elderly people' employment survey by National Statistical Office (NSO) indicated that 950,000 of 4,361,300 elder workers (21.78% of total elder workers) reported that they had problems with their work, in this amount 60.3% of them reported that they received insufficient wages. Low wages make some elderly who are able to work and remain productive decide to stay outside the labor market because wages are lower than their reservation wage[3]. The opportunity cost of insufficient wage lead to inefficient resource allocation is in the form of social welfare loss. The opportunity cost is even higher if considering the fact that the work ability of the new generation elders is higher than the previous generation, but their employment is considered relatively low compared to their health capacity to work (Wise, 2017).

[3] Reservation wage represent the cost of working (leisure forgone) of particular individual. The individual is willing to accept and decide to work only if the wage is at least equal or higher than his or her reservation wage.

Table 1.1 Elderly Thais and Employment 2007 – 2018

Year	Senior Thais (60 years old and older) (million)	Senior workers (million)	Percentage of senior workers	Percentage of senior work in informal sector	Percentage of age 15–59 work in informal sector
2007	7.07	2.77	39.18%	90.72%	60.46%
2008	7.42	2.80	37.74%	90.99%	61.53%
2009	7.71	3.08	39.95%	91.04%	60.97%
2010	8.03	3.05	37.98%	91.80%	59.92%
2011	8.31	3.24	38.99%	90.31%	60.04%
2012	8.63	3.40	39.40%	88.24%	60.10%
2013	9.00	3.45	38.33%	89.85%	61.72%
2014	10.05	3.84	38.21%	90.10%	53.96%
2015	10.42	3.78	36.28%	92.06%	52.10%
2016	10.91	4.02	36.85%	88.55%	51.84%
2017	11.35	4.06	35.77%	88.42%	51.18%
2018	11.80	4.36	36.95%	88.20%	51.11%

Source: National Statistical Office (NSO)

Table 1.2 Main Income Source of Thai Elderly (% of Total Elderly Population)

Source of income	2011	2014	2017
Working	35.10%	33.90%	31.00%
Pension	6.0%	4.90%	5.90%
Old age allowance	11.40%	14.80%	20.00%
Inerest/Saving	2.60%	3.90%	2.30%
Spouse	3.10%	4.30%	4.60%
Children	40.10%	36.70%	34.70%
Others	1.70%	1.50%	1.50%

Source: Report on the survey of the older person in Thailand in 2011, 2014, and 2017, The National Statistical Office (NSO)

For the demand side, low wages for elderly worker may come from a common perception that as they age, their productivity is low because of wear and tear on the body. The underestimation of the marginal product of labor (MPL) of elderly workers results in reduced the labor demand and equilibrium wage. As a result, after retirement, the elders who are able and willing to work are less likely to land a job. While some accept low wages for getting a job. The opportunity cost of the underestimation of the marginal product of labor of elder workers can be seen by considering the labor demand and labor supply diagram.

In the efficient labor market for the elder worker, the demand curve is D_0 which is the marginal product of labor, MPL, multiplied by marginal revenue, MR_0. The labor supply curve is S_0. The competitive equilibrium is E_0, elder workers L_0 are hired at an optimal wage W_0. At equilibrium E_0, the producer surplus is AE_0W_0 and worker surplus is BE_0W_0. The total surplus for workers and producers are maximized, so resource allocation is efficient. In the case of undervalued elder workers, the employer expects that the marginal product of labor is MPL_e ($MPL_e < MPL$). Labor demand drops from D_0 to D_1. New equilibrium is E_1 with lower employment of elder workers, L_1, and lower wages, W_1.

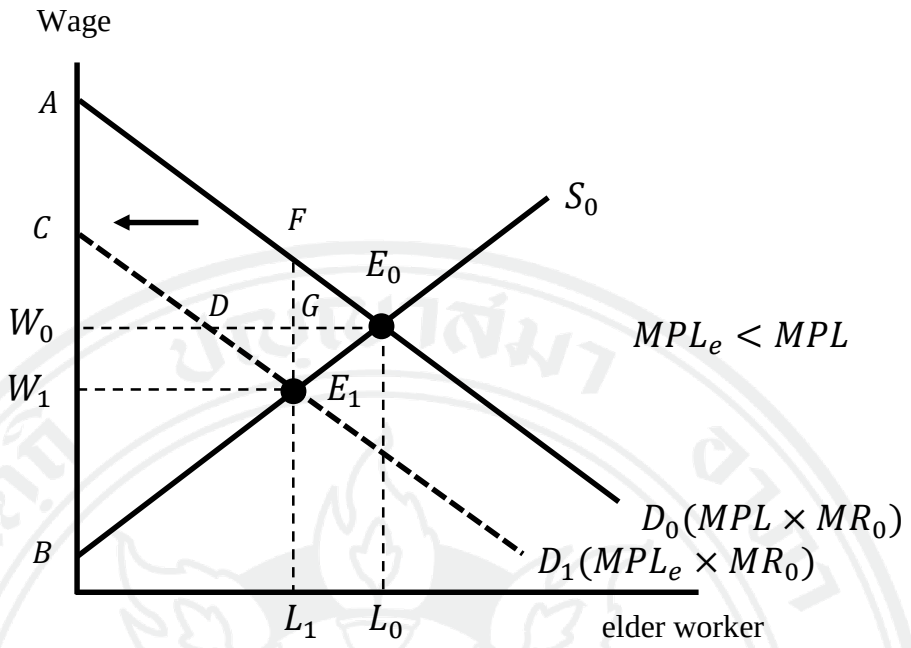

Figure 1.1 Welfare Loss in the Elders Labor Market

Worker surplus at the new equilibrium is reduced by the amount of $W_0E_0E_1W_1$; while, producer surplus gain for an amount $W_0GE_1W_1$ (the surplus transferred from workers to producers) but lost the amount FE_0G. So, the new equilibrium total surplus is smaller than the initial equilibrium E_0 by FE_0E_1, which is the social welfare loss from inefficient resource allocation. Wage W_1 is below the reservation wage for elder workers $L_0 - L_1$, so they decide not to participate in the labor market. As the market wages increases from W_1 approaching the true equilibrium W_0, labor supply and the employment increase result in social welfare loss approaches to zero.

Above diagram indicates that the market wage of elder workers is related to the perception of the physical condition and productivity of the elderly. In fact, in addition to physical conditions, there are many other personal factors that affect labor productivity, such as mental ability[4], education, and job experience.

[4] Mental ability or cognitive ability is the intellectual function of individuals. It includes reasoning, spatial orientation, numerical abilities, verbal abilities, and problem solving (Skirbekk, 2004).

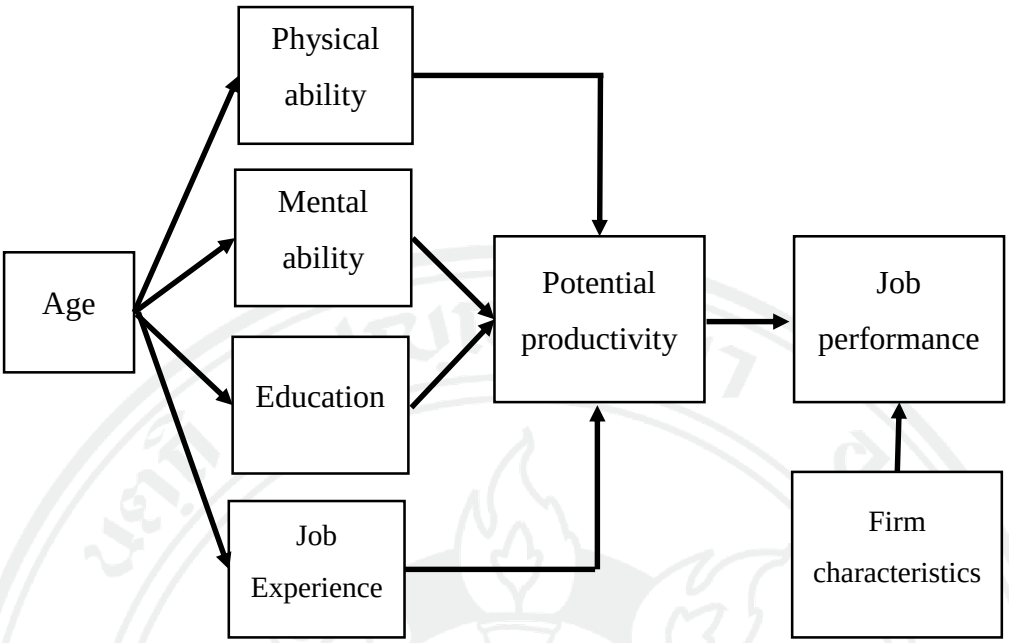

Figure 1.2 Relationship Between Age and Individual Productivity
Source: Skirbekk (2004, p. 35)

Naturally, physical ability or strength decreases with increasing age. The labor productivity tends to decline with age, especially in jobs that require physical ability. However, new generations, on average, are healthier and stronger than previous generation due to advances in medical technology and better nutrition. So, the health capacity to work of the elderly in the current generation elders in many countries has been improved than previous generations (Wise, 2017).

For mental ability or cognitive ability, it begins to decline at some point while working, except for the crystallize abilities[5] which remains high as workers are older. (Skirbekk, 2004). So, the productivity of older workers may not decline for jobs that require crystallization capability.

For education or learning ability, the elderly are good learners for what they have expertise, but their learning speed is expected slower than younger workers (Skirbekk, 2004). However, the new generation of elders are more educated and thrive with

[5] Ability that develop with growing knowledge and experience or ability to use skills, experience, and knowledge.

technological advances, so learning new or unfamiliar things is more comfortable, and their learning ability tends to be better compared with previous generation.

For the work experience, the accumulate work task tends to increase with age. Therefore, work experience is likely to increase with age. Keep other factors are constant, experience is an asset that elders have more than younger workers.

In sum, all except job experience and crystallization abilities decrease with age. Therefore, elder worker is ideal with jobs that require job experience. Workers with more work experience have more skills/knowledge which has positive effect on work performance (Mincer, 1958). Also, work experience can reduce or avoid serious errors in operations (Börsch-Supan & Weiss, 2008). Work experience is part of human capital. It represents post-school training or post-school learning process that provide human capital through work. An individual can accumulate work experience through learning by doing (Arrow, 1971; Rosen, 1972) as well as formal and informal on-the-job training (Becker, 1962; Mincer, 1958). Mothers who quit their jobs to raise children and return to work tend to earn less than women who do not have children and work regularly because their human capital accumulated during working is lower. Mothers returning to work that are different from their previous jobs may experience the loss of firm-specific human capital (Anderson, Binder, & Krause, 2003).

Therefore, the expectaion that Thailand will encounter the labor shortage problem in an aging society may not always be as worse as expected because the elderly have work experience, skill, and knowledge related to work which are the most important human capital for the elder. It can mitigate, maintains or even increases labor productivity. Work experience helps elderly work more efficiently and contribute to the firm. As discussed earlier, a capable elderly who retires or decides to stay out of the labor force is the underutilized economic resources. Therefore, the interesting question is 1) how many of the capable elderly (potential labor force) who stay outside the labor market? and 2) among potential labor force, who is require support in promoting employment because their work experience may not have much of an effect on their wage? This study attempts to answer these question by using Thailand Labor Force Survey (LFS) data conducted by National Statistical Office (NSO) of Thailand to quantifies the potential contribution of Thai elderly with an emphasize on their work experience. Note that this study does not implicate that potential elderly labor force

must or should be active in the labor market instead of staying outside the labor market. On the contrary, the potential labor is an approximation of underutilized productive resource that policymakers could introduce a policy to encourage them to participate in the labor market. The expected contributions of this study are 1) policymakers can use this study as a guideline to identify the potential elderly workers to encourage them to participate in the labor market; 2) policymakers can use this study as information to design policy to support the potential elderly worker.

CHAPTER 2

LITERATURE REVIEWS

As discussed in chapter one, work experience is an important human capital. Work experience is accumulated when working and older workers work longer than younger workers. Therefore, older workers likely possess more work experience than younger workers. More experienced workers have more practical skills/knowledge, so their productivity tends to increase with work experience and error in work tend to reduce with work experience. However, employment in elder, especially after retirement, often underestimates the significance of work experience by offering too low wages/salaries. It means that there is a distortion in the labor market for the elderly and social welfare in the labor market is not maximize. This chapter presents an empirical study of the economic significance of the elderly's work experience.

This chapter begins with a brief discussion of the definition of work experience and presents an explicit definition of the work experience of this study (section 2.1). Section 2.2 discusses about on-the-job training (OJT), which is a source of work experience that can be divided into 1) formal and informal on-the-job training, 2) general and specific on-the-job training. The cost of work experience is representing in section 2.3. Section 2.4 discusses the value of work experience. This chapter ends with section 2.5, which reviews and discusses the sources and work experience measurements.

2.1 Work Experience Defined

Since Mincer (1958) has pioneer the economic significance of work experience, the work experience has become an important variable in human capital earnings function along with the education in most of the subsequent research. However, most of them do not discuss the meaning and the occurrence of work experience explicitly. (e.g., Börsch-Supan & Weiss, 2008; Coulombe, Grenier, & Nadeau, 2014; Lagakos,

Moll, Porzio, Qian, & Schoellman, 2012; Maranto & Rodgers, 1984). These researches use amount of time in the labor market (or time in a particular job) as a proxy of work experience and do not discuss it in more detail. This section represents the investigation of the meaning and exploration of the process of work experience.

First of all, it is necessary to review the relationship between learning and skill/knowledge formation because the work experience has a close relation with learning and skill/knowledge. Generally, learning is the process of skill/knowledge acquisition. Individual learn in particular things because he/she wants the relevant skill/knowledge. The human capital theory has confirmed that skill/knowledge is an essential part of human capital and the learning (learning from school and learning on-the-job) is the method to accumulate the skill/knowledge (Becker, 1964). Typically, learning often occurs at school in the form of formal education. However, once an individual graduate from school and working in the labor market, learning continues in the form of work experience or on-the-job training (OJT). Indeed, work experience or OJT is one of the important sources of learning (Mincer, 1958, p. 287) because most of time of individual life is in working life, so the individual has opportunity to learning on-the-job longer than learning from school.

As discussed earlier, it clear that work experience has close relations to learning. Work experience is on-the-job learning which is the process of creating new skill/knowledge and accumulate the old skill/knowledge. By learning and accumulating skill/knowledge, the worker becomes more productive and making a fewer mistake. Therefore, labor productivity tends to increase with work experience.

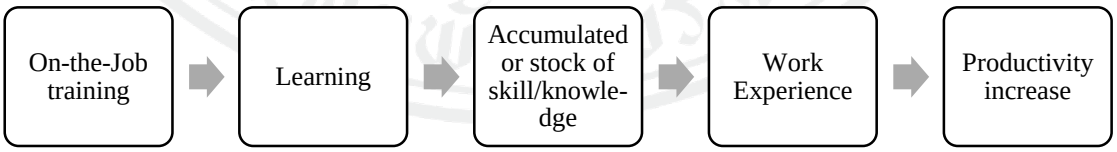

Figure 2.1 Relationship of Learning, Skill/Knowledge, and Experience

The process of work experience occurrence begins with on-the-job training, which is an activity or situation in which a worker can learn how to work and improve work efficiency. If learning occurs, it creates new skills/knowledge, or the old skills/knowledge will be stronger, then the stock of skills/knowledge and productivity

increases. Since skills/knowledge are a form of human capital, the cost of acquiring skills/knowledge through on-the-job work experience is an investment in human capital.

2.2 Source of Work Experience

As discussed in section 2.1, the occurrence of work experience begins with activities that occur during working. Such activity creates an opportunity for workers to learning new skill/knowledge or perfecting the old ones. This activity like training because the worker who participates will be more productive. Therefore, this activity is called on-the-job training (OJT). Typically, OJT is broad conceptually and includes various activities. It can both arise during and off regular work hours (Arrow, 1971; Becker, 1962; Rosen, 1972). OJT can be divided into formal and informal training (Mincer, 1962). OJT also divided into general and specific training (Becker, 1962).

2.2.1 Formal On-the-Job Training and Informal On-the-Job Training

The formal on-the-job training or formal OJT is the explicit training program that the characteristics of the training program such as the start, the end, amount of time spent, and the cost is clearly identified (e.g., apprenticeships, e-learning, seminar). The informal on-the-job training or informal OJT is the implicit training which the start, the end, amount of time spent, and the cost does not identify. Informal training occurs simultaneously with the worker's output. Informal OJT imply that workers can learn by watching their colleagues work, learning the technique of work during regular working time or during the break, learning from feedback of their colleagues and supervisor, and learning from their own work experience or learning by doing (Arrow, 1971; Brown, 1990; Mincer, 1962). In other words, formal OJT is structured training and informal OJT is unstructured training (Lynch & Black, 1995).

The direct method to investigate the OJT can conduct by a survey. Many studies analyze OJT data from the survey and found that most workers never participate in a formal OJT. Haber (1991) found that 23% of workers in the non-agriculture firms in the United States participate in a formal OJT. The similar result can be found in the study of Lillard and Tan (1986), which indicate that the share of workers that participate

the OJT in current job is 37%. The participation rate to formal OJT from an employee is contrasted to the employer point of view, most employer state that they provide formal OJT to their employees. Lynch and Black (1995) found that 81% of firms offer some type of formal OJT. The conflict between the low proportion of workers participate in formal OJT and the high proportion of firm that provide formal OJT indicate that most of the firm provide at least some of formal OJT but it not for every worker.

The literature found the complementarity between human capital formation in school and post-school. A worker with a high level of human capital from schooling is more likely to obtain the formal OJT compare with worker with low level of human capital. Munasinghe, Reif, and Henriques (2008) analyze panel data of the National Longitudinal Survey of Youth (NLSY) from 1979 to 1994 and found that 33.9% - 42.8% of workers with high level of schooling (higher than high-school) participate in the formal OJT compare with 18.2% - 20.5% of worker with low level of schooling (high-school or lower than high-school). The difference in the participation rate between high education workers and low education workers is even increased if compare the participation rate between large firms and small firms. Haber (1991) found that, for the small firms, the participation rate in training of workers with at least 16 years of education is 16.9% compared with 12.8% for a worker with less than 12 years of education. The participation rate in training is 25.1% and 14.9% respectively for the large firms. Almeida and Faria (2014) also found that the higher educated workers are more likely to receive OJT.

A similar picture is found in Thailand, about half of workers never attended formal training. The high-rank occupation (e.g., executive or managers) likely participates in the formal OJT more than the low-rank occupation (e.g., operations). Patmasiriwat, Hengpatna, and Punthunane (2012) found that 45% - 52% of workers never participate in the formal OJT. The participation rate of the high-rank employee is 77% compared with 40% for the low-rank employee.

The above survey indicates that several factors affect the probability of providing formal OJT of the firm. One of the most influential factors is the size of firms. The large firms (more than 100 employees) more likely to provide formal OJT than small firms (Haber, 1991; Lynch & Black, 1995). The probability of providing formal training also

increases with the capital/labor ratio, average education level of workers, the skill demand, the percentage of women workers, the proportion of production workers, technical workers, and clerical/sales workers. While, the probability decrease with the firm that employs less than 100 workers, the percentage of minority workers, and turnover rate (Lynch & Black, 1995).

As stated earlier, informal training includes learning by watching others, learning the technique during regular working time or during the break, learning from the feedback of their colleagues and supervisor, and learning from their own work experience or learning by doing. Informal training covers most of the activity in working life. Therefore, the low participation rate in the formal OJT implies that most of the OJT of workers are the informal OJT. This accord with the studies of Loewenstein and Spletzer (2000), Brown (1990), and Mincer (1962) which states that most of OJT are informal OJT.

The measurement of informal OJT is more complicated than measurement of formal OJT because informal OJT includes various activity that cannot observed or measured directly. However, several surveys that try to gauge the informal training such as Employment Opportunity Pilot Project (EOPP) and Small Business Administration (SBA). The EOPP is the survey by the United States department of labor which interviews 5,700 employers in 1980 – 1982. EOPP include the question about the amount of time using in the informal training by question on the total number of hours that the supervisors and co-workers spent away from their regular work to give informal training. EOPP also include a question about the total hours that average new workers spend in watching other people work rather than work regularly. The Small Business Administration survey (SBA) survey sampling 3,600 business unit in 1992 to study the training of the firms. SBA has a question about training like EOPP. The average of total time in training and the incidence rates (participation rate) of SBA in 1992 and EOPP in 1982 present in table 2.1

Table 2.1 Survey of On-The-Job Training of SBA and EOPP

Types of Training	1992 SBA	1982 EOPP
Hours of on-site formal training	13.6	11.9
(incidence rate)	(0.205)	(0.151)
Hours of informal management training	59.4	49.3
(incidence rate)	(0.906)	(0.872)
Hours of informal co-worker training	32.8	26.3
(incidence rate)	(0.605)	(0.628)
Hours of watching others	40.7	54.5
(incidence rate)	(0.645)	(0.803)
observation	**1,123**	**1,916**

Source: Barron, Berger, and Black (1997, p. 35)

2.2.2 General On-the-Job Training and Specific On-the-job Training

Besides the formal OJT and informal OJT, the OJT can divide into general OJT and specific OJT. The category of OJT depends on the characteristic of skill/knowledge obtained from training. General OJT provides skill or knowledge that useful not only for the firms that supply it but also useful for other firms. In contrast, specific training provides skill or knowledge that useful only for the firm that provides it (Becker, 1962). Conceptually speaking, how much the firm and workers will bear the cost depends the training is the general or specific training.

General training is the training that provides the general skill/knowledge for working which can improve productivity not only for the firm that provides general training but also useful for other firms if trained workers resign and joint with other firms. It risks for the firm that bears the cost to provide the general training to get nothings. Because the productivity of the trainee increases after training and the other firms can possess the benefit, although they do not pay for the cost of training, so the firms will provide general training only if worker pay the cost of general training by receiving a lower wage than elsewhere.

Specific training is the training that increases productivity to the firms providing it more than other firms (Becker, 1964) because the knowledge/skill getting from specific training is unique and specific for the firms (e.g., a specific computer program). The large firm is more likely to provide specific training than the small firms. Haber (1991), found that 25% of workers in large firms participate in specific OJT compare with 20% for the small firms.

2.3 Cost of Work Experience

For the formal OJT, the cost consists of the firm's direct expenditure of explicit costs, such as payment for equipment, material, and instructors. This kind of expenditure is called outlay. Cost of formal training also covers opportunity cost or implicit cost in the form of earning foregone of the trainee because the trainee cannot work during the training period or OJT may take the attention away from regular task, so the productivity and wage during the training period is lower than in case of they did not train. For the informal OJT, because the characteristic of training (the start, the end, time, equipment) does not identify, so the cost of informal OJT is only implicit cost. Since workers cannot full capacity working during informal learning, the foregone earnings or capacity of a worker who involves the informal OJT is the cost of the informal OJT.

There is much research that investigates the cost of OJT. Although the data about the direct expenditure of formal OJT is scant and unreliable, the estimation the cost of OJT is possible because the firm often pushes some of the direct cost of formal OJT into workers in the form of relative lower wage (compare with the wage of other firms) (Becker, 1962). Therefore, earning data is considered sufficient to estimate the cost of OJT. Mincer (1962) estimates the total cost of OJT for the United States workers in 1939, 1949, and 1959 by applying the theoretical analysis of Becker (1962). Mincer found that the total cost (formal and informal) of investment in OJT is the large proportion of total investment in human capital and consider equal to the investment in education. This estimation method is indirect estimation which bases on the assumption that the training makes workers more productive and the wage of trained workers is higher than untrained workers. So, the cost of OJT can obtain by comparing the average

earnings of workers in different age and education level. The different earnings represent the cost of OJT.

OJT is an investment in human capital because OJT represents the trade-off between current cost of training and future benefit; namely, there is sacrifice some current output in the form of a divert current production resource to be a training resource and expect to get more output from a more productive worker (trainee) after training. In other words, OJT is a process of capital formation in human (Mincer, 1962, p. 51)

2.4 Return of Work Experience

Primarily, the value of work experience can be seen through the age-earnings profile (the average earnings of the worker from the start working until retire). If learning and skill/knowledge has only acquired from schooling (i.e., no work experience and on-the-job training), then if other factors are constant, such workers may work with the same method and the performance may not increase. As the worker aging, the depreciation of skill/knowledge (obsolete, knowledge forgotten) and physical body will pull the labor productivity down[6]. Therefore, if the labor market and goods and service market is a competitive market, then the wage of the worker should be constant over the working life and begin to decrease if depreciation of skill/knowledge is significance. Empirically, the studies on age-earning profile show that it is not constant. It increases with age and declines later working life (Becker, 1964; Mincer, 1958, 1962).

Work experience has a positive effect on labor productivity and wage. Work experience in different occupation has a different amount of positive effect on wage. The positive effect of work experience is more in a job that requires more training. The slope of the age-earning profile is steeper in high training requirement job. In other words, as employee's age increase growth rate of earning is higher in high training requirement job (Mincer, 1958).

[6] The labor productivity in some industry, such as assembly line workers in car manufacturing, does not decline at the old age (Börsch-Supan & Weiss, 2008)

It can illustrate in figure 2.2, workers into two occupation categories: low training requirement job, and high training requirement job. Assume there is no depreciation of work performance, so the age-earning profile is a positive linear relationship with age. Age-earning profile of workers in low training requirement job is ABU, which is relatively flat age-earning profile. Age-earning profile of worker in high training requirement job is CBT. HBL line is the age-earning profile of workers in non-training requirement job. Along the life span, income difference between high training jobs is greater than low training jobs, for example, $(TS - T'S') > (US - U'S')$. As age increase, the income difference between higher training jobs and low training jobs is increasing, for example, $(TS - US) > (T'S' - U'S')$.

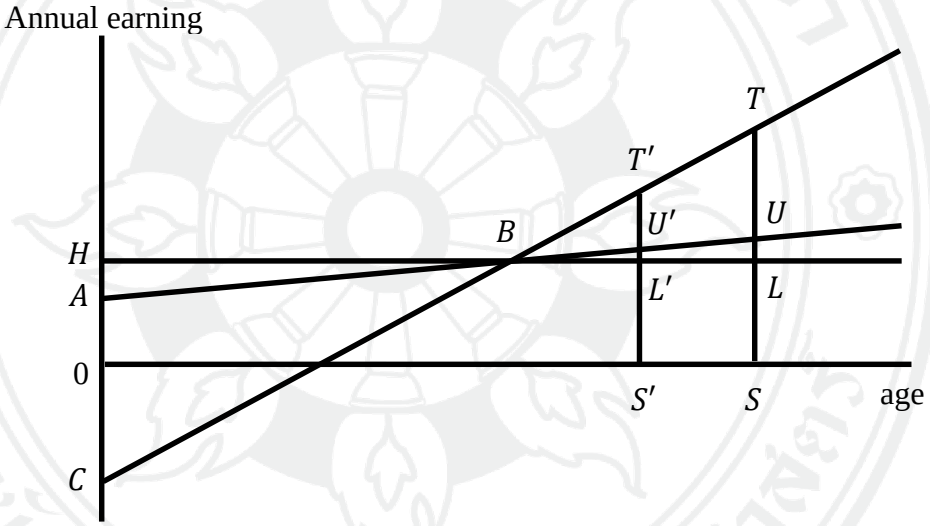

Figure 2.2 Life-Span Earning Between High Training Jobs and Low Training Jobs
Source: Mincer (1958, p. 289)

If other factors are constant, productivity can increase with knowledge and skill. The worker can learn new skill and improve old skill while on the job (Becker, 1962, p. 11). Workers with longer experience on the job tend to more learning and acquire more knowledge and skill. Therefore, work experience has a positive effect on labor productivity. Work experience has a positive impact on productivity, especially in the job that requires more training than the job that requires less training. Therefore, the

growth rate of earning of higher training job is greater than the lower training job (Mincer, 1958, pp. 287-288).

The human capital earning function of Mincer (1974) has been use to study the return of work experience (and other human capital) on earnings. Altonji and Shakotko (1987) found the effect of work experience of high school graduate on earnings is 31.7% and 48.2% for first 10 years and first 30 years of experience, respectively. After correct the heterogeneity bias from the estimation by using instrumental variables (IV), the effect of experience increase to 53.7% and 86.6%, respectively. Altonji and Shakotko (1987) indicated that the effect of work experience (general experience) on earning is larger than the effect of tenue (specific experience).

2.5 Measurement of Work Experience

The measurement of work experience can be divided into four methods: (1) accumulated product, (2) amount of time in the labor market or potential work experience, (3) amount of time in particular jobs or tenue, and (4) expected work experience.

2.5.1 Accumulated Product

An accumulated product being a proxy of work experience is often used in the study of the significance of work experience at both labor and firm levels. This measurement bases on learning-by-doing or learning from experience under the assumption that a worker learns and accumulates the stock of knowledge via daily works routine to improve productivity.

For the firm level, the most common method to study the effect of experience is the estimation of the progress function (Dutton & Thomas, 1984):

$$y = ax^{-b} \quad (2.1)$$

where

y = input cost for the x^{th} unit

x = cumulative number of products (a proxy of experience)

a = input cost for the first unit ($x = 1$)

b = the progress rate

As the progress rate (b) is positive, the production cost for x^{th} unit (y) decreases. The higher value of progress rate, the lower production cost of x^{th} unit because it allows getting more product with the same production cost. The progress rate estimated from 108 empirical studies takes numerous value from 0.55 – 0.56 to 1.07 – 1.08. The most commons of estimated rate is 0.81 - 0.82 (Dutton & Thomas, 1984, p. 238).

The progress rate depends on the learning of labor (or the Horndal effect) which is the increase of output per worker if the cumulative production of labor increases although there is no new investment in physical capital (Lundberg, 1961). The cumulative product is good in the case of the Horndal effect. However, Arrow (1971, p. 5) argued that the cumulative output does not always work as a proxy of work experience. If the amount of output produced is constant, and the firm does not invest in physical capital, then learning occurs at a low rate. In this case, the cumulative output will overestimate the work experience. Arrow proposed that investment in physical capital can change the production environment, which is the main contribution to the progress rate because it encourages workers to learn. So, cumulative gross investment is suggested as a proxy of work experience. The empirical study also confirms this suggestion (Sheshinski, 1967). The shortcoming of the cumulative product (or cumulative investment) being a proxy of work experience is data limitation. It requires records and surveys at the micro-level which is in short supply.

2.5.2 Amount of Time in Labor Market or Potential Work Experience

Second, the amount of working time being a proxy of work experience. The commons unit of time in a large number of empirical works is years. Work experience in this manner is sometimes called potential work experience being age of worker minus years of schooling and six:

$$Ex_i = Age_i - School_i - 6 \tag{2.2}$$

where

Ex_i is potential work experience of worker i
Age_i is age of worker i
$School_i$ is years of schooling of worker i

The potential work experience equals to the amount of time after completing the highest level of education. It bases on three assumptions: (1) schooling begins at the age of six, (2) all workers start their job immediately, and (3) the quality of education does not different at all. The second assumption posts a problem if the individual does not starts working immediately after completing. Some individuals spend their time searching for jobs, especially during the economic recession when it so difficult to get jobs once completing their education. Another limit or caution of using potential work experience arises out of the third assumption. It is obvious that the quality of education in the country or across countries are varied. The difference in quality of education leads to relative underestimating of actual work experience in high-quality education and relative overestimating in low-quality education. Moreover, the potential work experience implies that individuals of the same age and the education level have the same level of work experience although the actual work experience may differ.

Another possible drawback comes from women who are in and out of the labor market because of child-rearing and household responsibilities because the potential work experience does not capture such break (Anderson et al., 2003; Miller, 1993; Munasinghe et al., 2008; Zveglich, Rodgers, & Laviña, 2019), so the potential work experience tends to overestimate actual work experience for those women. Anderson et

al. (2003) founded that the gap between potential work experience and actual work experience is three years for mothers (who quite a job to raise their children and return to job again), compare with 1.5 months for non-mothers. Zveglich et al. (2019) have confirmed that the potential work experience not only overestimates the actual work experience for women but also overestimate actual work experience for men as well.

The advantage of potential work experience is the availability of the data. Most countries collect data that allows the calculation of potential work experience. Researchers can compare work experience both inside and across countries.

Potential work experience has been used by many studies (Caselli, 2005; Chiswick, 1978; Coulombe et al., 2014; Hanushek & Kimko, 2000; Lagakos et al., 2012; Michelacci & Quadrini, 2009; Mincer, 1974; Robinson, 2003) as one of independent variables in standard earnings function pioneered by Mincer (1974).

$$lnE_t = lnE_s + \beta_1 t - \beta_2 t^2 \quad (2.3)$$

where

E_t = earnings in period year t

E_s = earnings after completion of schooling

t = potential work experience

Similar concept is tenure which is the duration years of workers holding a particular position. It represents the degree of learning on the job (Shaw & Lazear, 2008, p. 3). It also represents specific skill/knowledge and specific experience of particular work. Several literatures use both tenure as a proxy of specific work experience along with potential work experience (proxy of general work experience) on earning function to estimate their effect on wages (Altonji & Shakotko, 1987; Altonji & Williams, 2005; Munasinghe et al., 2008; Topel, 1991). Börsch-Supan and Weiss (2008) investigate age and cohort effects on the production error by adding the tenure and age of worker in the production error function (Börsch-Supan & Weiss, 2008). On the other hand, Shaw and Lazear (2008) investigate the effect of tenure on the output.

The advantage of tenure as a proxy of specific work experience along with other variables such as potential work experience and age is that it can separate between the effects of specific and general experiences on the wage.

2.5.3 Expected Work Experience

Expected work experience is the sum of the probability that a particular person has worked in each period (Zveglich et al., 2019, p. 4) :

$$\Lambda_{iT} = \sum_{t=0}^{T} Exp[\rho_{it}|\Theta_{tT}] \quad (2.4)$$

where

Λ_{iT} = expected work experience of individual i at time T (today)

ρ_{it} = the probability that individual i is working during period t

Θ_{tT} = the person's actual work experience

Practically speaking, the age-gender labor force participation rate can serve as a proxy of the probability that individual i is working during period t (ρ_{it}). The expected work experience with J years old can be calculated as follows:

$$\Lambda_{JT} = \sum_{j=15}^{J} \lambda^{f}_{jT-J+j} \quad (2.5)$$

where

Λ_{iT} = the expected work experience of individual i with age J at time T

λ_{jT} = the labor force participation rate of individual i with age j at time T

The expected work experience is preferred to potential work experience (discussed in section 2.2.2) because the intermittency of worker in from of marriage or child-rearing as well as social changes such as smaller size of family, how easy to access to the childcare, changes in age structure, and change in education level have influent

to the labor force participation rate of particular age and gender (Miller, 1993). In contrast, the potential work experience captures only the age structure of the workforce and education level of the workers.

CHAPTER 3

THEORETICAL FRAMEWORK

As discussed in Chapter one, work experience is an important part of human capital. Highly experienced workers possess high skills/knowledge lead to reduced job errors and precision in decision making and predictions. Given other factors, highly experienced workers are more productive than workers with less experience. So this chapter discuss the theoretical framework related to human capital theory and the return of work experience.

3.1 Human Capital Theory

The capital is the factor of production which has been studied intensively in economics. Becker (1994, p. 15) argued that capital is an asset that yields income and other useful output over a long period. Capital in early capital theory, it is limited to only "physical capital" (e.g., building, computers, machines, vehicles, and warehouse). The expenditure for acquiring physical capital is called the investment in physical capital, which is the trade-off between current and future consumption. Physical capital has a vital role in economic development and critical to the difference in living standard across countries. (see Domar, 1946; Harrod, 1939; Solow, 1956).

Physical capital is a tangible asset. One can separate physical capital from the owner and can transfer it to the others. However, another capital raises human capabilities, future real income, and other useful output over a long period, but it has a few different characteristics which are not found in the physical capital. Becker (1994) described that this kind of capital is intangible and embeds in human beings, so it cannot be separated from the owner. So it is called human capital. The opportunity cost for achieving human capital is called the investment in human capital. There are various ways of investment in human capital, for example, schooling, on-the-job training, medical care, and vitamin consumption (Becker, 1962, p. 9).

The human capital theory has become well-known in the 1960s after the major contribution in explaining the personal income distribution (Mincer, 1958), the economic development (Schultz, 1961), and the effect of education on earnings (Becker, 1964)[7].

Mincer (1958, p. 284) and Mincer (1974, p. 9) has examined the discrepancy between the normal distribution of abilities and skewed distribution of income[8] by proposing the simple model of income distribution. The model serves as the foundation of subsequent human capital theory. The model is:

$$V_s = Y_s \sum_{t=s+1}^{n} \left(\frac{1}{1+r}\right)^t \tag{3.1}$$

where

V_s is the present value of lifetime earnings at the start of schooling

Y_s is the annual earnings of individuals with s years of schooling

n is the length of working life plus length of schooling

t is time in years, $t = 0, 1, 2, \ldots, n$

n is the amount of years of schooling

r is discount rate

d is the difference in the amount of schooling (years)

The annual earnings of individuals (Y) is depend on the amount of schooling. Assume that additional year of schooling will postpone another year of earnings and reduce additional year of earning. The total cost of schooling consists of direct expenditure and earnings foregone. High schooling individual requires high earnings to compensate for the total cost of schooling. Therefore, the amount of schooling has a positive relation with earnings.

For convenience in the analysis, transform the equation (3.1) into the continuous model.

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[7] Becker (1964) give a credit to Theodore Schultz, Jacob Mincer, Milton Friedman, Sherwin Rosen, and several associated with University of Chicago in pioneering the human capital theory.

[8] See Staehle (1943) and Mincer (1958, pp. 281-284) for a comprehensive review of this issue.

$$V_s = Y_s \int_s^n e^{-rt}\, dt = \frac{Y_s}{r}(e^{-rs} - e^{-rn}) \tag{3.2}$$

The present value of life earning of the person with $s - d$ years of schooling is

$$V_{s-d} = \frac{Y_{s-d}}{r}(e^{-r(s-d)} - e^{-rn}) \tag{3.3}$$

Jacob Mincer assumes that all individuals have identical abilities and opportunity to the occupation. Each occupation requires a different amount of training. Cost of training is the individual's earnings foregone while going through training. The present value of a person with s years of training (V_s) is equal to the present value of a person with $s - d$ years of training (V_{s-d}).

Let $k_{s,\ s-d}$ be the ratio of individual earning with s years of schooling to the earning of a person with $s - d$ years of schooling.

$$\begin{aligned}
k_{s,\ s-d} &= \frac{V_s}{V_{s-d}} = 1 \\
k_{s,\ s-d} &= V_s = V_{s-d} \\
k_{s,\ s-d} &= \frac{Y_s}{r}(e^{-rs} - e^{-rn}) = \frac{Y_{n-d}}{r}(e^{-r(s-d)} - e^{-rn}) \\
k_{s,\ s-d} &= \frac{Y_s}{Y_{s-d}} = \frac{(e^{-r(s-d)} - e^{-rn})}{(e^{-rs} - e^{-rn})} \\
k_{s,\ s-d} &= \frac{Y_s}{Y_{s-d}} = \frac{e^{r(n+d-s)} - 1}{e^{r(n-s)} - 1} > 1
\end{aligned} \tag{3.4}$$

The term $k_{s,\ s-d}$ exceed one can be interpreted as the person with more schooling has higher annual earning. This is the fundamental of the human capital theory that high schooling people are more productive as they acquire more knowledge and skill and resulting in higher income.

Differentiate equation (3.4) with respect to year of schooling (s)

$$\frac{\partial k_{s,\ s-d}}{\partial s} = \frac{\partial \left\{\frac{e^{r(n+d-s)}-1}{e^{r(n-s)}-1}\right\}}{\partial s} > 0 \qquad (3.5)$$

Equation (3.5) implies that the difference between a person with s and $s-d$ years of schooling is increasing with the amount of schooling. Given the difference in schooling time (d), The occupation that requires higher schooling tends to have higher income inequality. Therefore, given value of d, $k_{s,\ s-d}$ is a positive function of the amount of schooling (s). For example, for $d=4$, the difference in earnings of individuals with 16 years and 12 years of schooling is larger than between individuals 6 years and 2 years of schooling.

Differentiate equation (3.4) with respect to discount rate (r)

$$\frac{\partial k_{n,\ n-d}}{\partial r} = \frac{\partial \left\{\frac{e^{r(l+d-n)}-1}{e^{r(l-n)}-1}\right\}}{\partial r} > 0 \qquad (3.6)$$

For high discount rate individual, earning forgone is relative higher than low discount rate individual because the present value of life-time earning is lower than the individual with lower discount rate. Therefore, high discount rate individual attends addition education only if he or she can get higher earing to compensate the cost of education.

Differentiate equation (3.4) with respect to length of working life (n)

$$\frac{\partial k_{s,\ s-d}}{\partial n} = \frac{\partial \left\{\frac{e^{r(n+d-s)}-1}{e^{r(n-s)}-1}\right\}}{\partial n} < 0 \qquad (3.7)$$

High schooling individual will require higher earnings to compensate the cost of schooling if the length of working life is shorter.

The ratio of earning annual earning of individual who difference in d year of education is at least:

$$k_{d,0} = \frac{e^{rl} - 1}{e^{r(l-d)} - 1} \tag{3.8}$$

Although equation (3.5) and (3.7) indicate that $k_{s,\ s-d}$ is positive and negative relation with year of schooling (s) and length of working life (n) respectively, in the case of n is large enough, change in year of schooling (s) and the length of working life (n) dose not affect $k_{s,\ s-d}$.

$$\frac{\partial k_{s,\ s-d}}{\partial s} = \frac{\partial \left\{\frac{e^{r(n+d-s)} - 1}{e^{r(n-s)} - 1}\right\}}{\partial s} > 0;\ \frac{\partial k_{s,\ s-d}}{\partial s} \to 0, \text{when } n \to \infty \tag{3.8}$$

$$\frac{\partial k_{s,\ s-d}}{\partial n} = \frac{\partial \left\{\frac{e^{r(n+d-s)} - 1}{e^{r(n-s)} - 1}\right\}}{\partial n} < 0;\ \frac{\partial k_{s,\ s-d}}{\partial n} \to 0, \text{when } n \to \infty \tag{3.9}$$

Therefore, for practical purpose, $k_{n,\ n-d}$ has treated as a constant. When span of working life (n) are assume to be fixed, then

$$V_s = Y_s \int_s^{n+s} e^{-rt}\, dt = \frac{Y_s}{r} e^{-rs}(1 - e^{-rn}) \tag{3.10}$$

$$V_{s-d} = Y_s \int_s^{n+s-d} e^{-rt}\, dt = \frac{Y_{s-d}}{r} e^{-r(s-d)}(1 - e^{-rn}) \tag{3.11}$$

By definition $k_{s,\ s-d}$ is the ratio of earning of a person with s years of schooling to the earning of a person with $s - d$ years of schooling, then

$$k_{s,\ s-d} = \frac{V_s}{V_{s-d}} = \frac{\frac{Y_s}{r} e^{-rs}(1 - e^{-rn})}{\frac{Y_{s-d}}{r} e^{-r(s-d)}(1 - e^{-rn})}$$

$$k_{s,\ s-d} = e^{rd} \tag{3.12}$$

The earnings ratio ($k_{s,\ s-d}$) does not depend on amount of schooling (s) and the length of working life (n). Define $k_{s,0} = \frac{Y_s}{Y_0} = k_s$. By equation (3.12), then $k_s = e^{rs}$. Take natural logarithms for both side of equation

$$lnY_s = lnY_0 + rs \tag{3.13}$$

It indicates that the percentage of earnings is function with absolute difference of time of schooling. Note that Y_s is the earnings of individual who study s years in formal schooling and do not invest in human capital after completion from schooling. Y_s cannot directly observed because individual often continue to develop their knowledge and skill after schooling.

3.2 Post-Schooling Human Capital: Work Experience

Mincer (1974) extend the scope of human capital beyond formal education by include the informal training from work experience to his model because the experience on the job is the important part of learning process. Suppose individual enter the labor market in year j, the individual will invest C_j to extend his or her knowledge and skill. The cost C_j consist of direct expenditure or outlay and opportunity cost (value of time sacrifice). Net earning Y_j obtained in year j equal gross earinings (earnings capacity) E_j minus by the cost of investment in year j (C_j). The net earnings in earnings in year j are:

$$Y_j = Y_s + \sum_{t=0}^{j-1} r_t C_t - C_j = E_j - C_j \quad (3.14)$$

where

Y_j is net earnings in year j

Y_s is initial earning after completion s years of schooling

r_t is rate of return from investment in human capital in year t

E_j is gross earnings in year j

C_j is total cost (outlay and opportunity cost) of investment in training in year j

Y_s or the initial earning after completion s years of schooling is the earnings in the first year of working ($j = 0$), then $Y_0 = Y_s - C_0$. By equation (3.14), replace Y_s with Y_0 and with $C_t = E_t$, then

$$E_s = Y_0 + r \sum_{t=1}^{s} E_{t-1} = Y_0(1+r)^s \quad (3.15)$$

By equation (3.14) the variation of Y_j or ΔY_j is :

$$\Delta Y_j = Y_{j+1} - Y_j = \left\{ Y_s + \sum_{t=0}^{j} r_t C_t - C_{j+1} \right\} - \left\{ Y_s + \sum_{t=0}^{j-1} r_t C_t - C_j \right\}$$

$$\Delta Y_j = Y_{j+1} - Y_j = r_j C_j - (C_{j+1} - C_j) \quad (3.16)$$

ΔY_j is positive (earning is growth) if $(C_{j+1} - C_j)$ is negative (cost of investment is decline). Earning also growing if the growth rate of investment is lower than the rate of return:

$$\begin{aligned} \Delta Y_j &> 0 \\ r_j C_j - (C_{j+1} - C_j) &> 0 \\ r_j &> \frac{C_{j+1} - C_j}{C_j} \end{aligned} \tag{3.17}$$

It indicate that net earnings (Y_j) decrease if rate of return less than the growth of investment cost. However, as long as investment is existing, the gross earning (E_j) is increase.

$$\begin{aligned} E_j &= Y_j - C_j \\ E_j &= \left\{ Y_s + \sum_{t=0}^{j-1} r_t C_t \right\} \\ \Delta E_j = E_{j+1} - E_j &= \left\{ Y_s + \sum_{t=0}^{j} r_t C_t \right\} - \left\{ Y_s + \sum_{t=0}^{j-1} r_t C_t \right\} \\ \Delta E_j &= r_j C_j \end{aligned} \tag{3.18}$$

Gross earnings increase if there is investment in human capital. Firm product additional human capital (Q) to their human capital stock (H), Time (T) and other resources (R).

$$Q = f(H, T, R) \tag{3.19}$$

As the human capital production increase, the marginal return is diminishing. Therefore, the marginal cost curve of human capital production has positive slope. The marginal revenue is discounted value of future increase in earnings (assume marginal revenue is constant for additional human capital produced). If the investment occurs in later of working life, the return period is short. Therefore, the marginal revenue curve is downward sloping with age. Marginal revenue of investing in additional human capital is lower for elders worker than younger worker (MR_2 compare with MR_1 in figure 3.1). Therefore, elder worker tend to investing in additional human capital less than younger workers (Q_1 compare with Q_2).

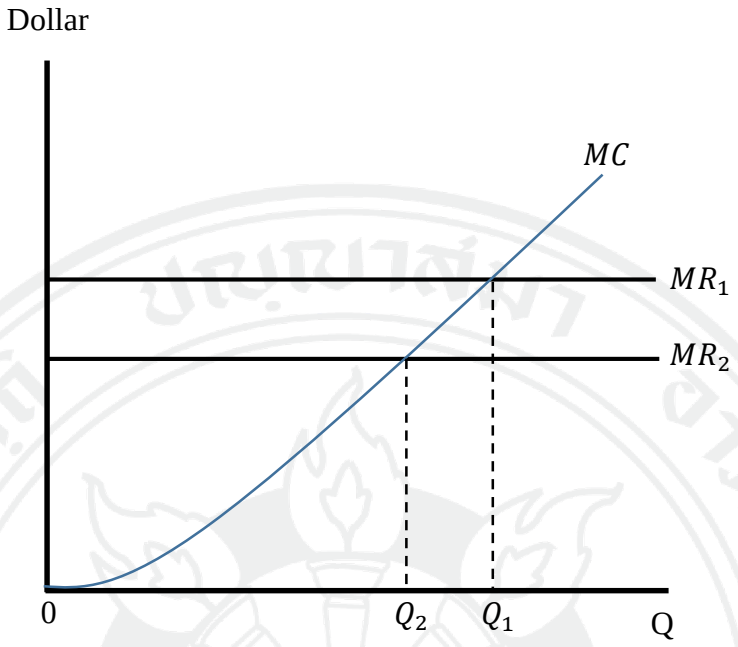

Figure 3.1 Production of Human Capital

Source: Mincer (1974, p. 15)

Jacob Mincer also predicted the characteristic of age-earning profiles. The skill and work experience are accumulating with a time as well as earnings. In the later years of working life (aging), the performance is deteriorating and earnings decline. Therefore, shape of age-earnings profile is an invert U-shape.

Becker (1962) emphasize the learning on-the-job (on-the-job training: OJT) as an important source of human capital investment. At the equilibrium, if absence of OJT, profit-maximizing firm will hire the labor until marginal product of labor equal to wage

$$MP_t = W_t \tag{3.20}$$

where

MP_t is marginal product of labor in period t

W_t is wage in period t

Marginal product of labor (MP) is relative equal to marginal receipt of the firm and wage (W) is relative equal to marginal expenditure of the firm. OJT change the condition in equation (3.20) by reduce current receipt (because on-the-job training incurs the cost) and rise current expenditure. If other factors are constant, the firm will be loss. Thus, the firm will provide training if future receipt equal or more than future expenditure. It implies that, for each period, the receipt need not equal to expenditure but the present value of sum of receipt for all period should equal to the present value of sum of expenditure for all period. The profit-maximizing condition for firm that providing OJT is

$$\sum_{t=0}^{n-1} \frac{R_t}{(1+i)^{t+1}} = \sum_{t=0}^{n-1} \frac{E_t}{(1+i)^{t+1}} \tag{3.21}$$

Where n is the number of periods, R_t is a receipt in period t, E_t is expenditure in period t, market discount rate is i. Equation (3.21) is the present value of receipt equal to the present value of expenditure. Assume training has provided in an initial period (period zero). Expenditure in training period would equal wage plus cost of training ($W_0 + k$). The maximizing profit condition become

$$MP_0 + \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} = W_0 + k + \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t}$$

$$MP_0 + \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} - \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t} = W_0 + k$$

$$MP_0 + G = W_0 + k \tag{3.22}$$

Where $G = \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} - \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t}$ or present value of profit of all period except initial period (period zero) or the return from provide the training and k is money cost of training.

Let C is true opportunities cost of training (money cost plus other opportunities cost) or $C = k + d$, where d is opportunities cost of training which equal to the difference between MP_0 and MP_0' (where MP_0' is marginal product of the initial period in case of not providing a training)

$$\begin{aligned} MP_0' - MP_0 &= d \\ MP_0' &= MP_0 + d \end{aligned} \tag{3.23}$$

Substitute $k = C - d$ into profit maximizing condition in equation (3.22) and.

$$\begin{aligned} MP_0 + G &= W_0 + C - d \\ MP_0 + d + G &= W_0 + C \\ MP_0' + G &= W_0 + C \end{aligned} \tag{3.24}$$

If the return from training (G) equal the opportunities cost of training (C), then the initial period marginal product if no training , MP_0' equal initial period wage, (W_0). If the return of training more than opportunities cost $(G > C)$, then $MP_0' < w_0$ or worker received wage more than their true productivity. If the return of training less than opportunities cost $(G < C)$, then $MP_0' > w_0$ or worker received wage less than their true productivity.

Becker separate OJT into two types: general training and specific training. General training is the training that give the general skill/knowledge for working which can improve productivity only for the firm that provide general training but also useful for other firms if trained workers resign and joint with other firms. In contrast, specific training provides skill or knowledge that useful only for the firm that provide it.

For the general training, because productivity of the trainee probably increases after training and because the other firms does not pay for the cost of the general training, so the other firms can attract the trainee by offer higher wage. Therefore, it

risks for the firm that pay the cost to provide the general training and may get nothings for this investment, so the firms will provide general training only if the worker pay the outlay (explicit cost) of training. It is rational for worker to pay the outlay for general training because their productivity and earning probably increase after training.

By assumption of perfect competition for labor market, after general training, wage and marginal product are increase in the same amount or

$$G = \sum_{t=1}^{n-1} \frac{MP_t - W_t}{(1+i)^t} = 0 \tag{3.25}$$

Substitute equation (3.25) into equation (3.24):

$$\begin{aligned} MP_0' &= W_0 + C \\ W_0 &= MP_0' - C \end{aligned} \tag{3.26}$$

Substitute equation (3.25) into equation (3.22):

$$\begin{aligned} MP_0 &= W_0 + k \\ W_0 &= MP_0 - k \end{aligned} \tag{3.27}$$

It means that the wage of trainee worker equal marginal product minus by money cost of training. For general training, trainee pay for their training by received wage below their productivity during training period.

Although OJT has divided into two general training and specific training but, in reality, most of training are in between general training and specific training depend on how much the increasing productivity from training can utilized by other firms. If the increasing productivity can utilize in the firm that provide it more than in other firms, the training is consider to be a specific training. If the productivity can utilize in other firm at least as much as in the firm that provide the training, the training is consider to be a general training.

For the case of complete specific training which the increasing in productivity from training completely cannot utilize in other firms. So the trainee is unwilling to pay the training cost because it risks for the trainee to pay training cost and get nothing if the firm lay off after training. Thus, to encourage the worker to attend the complete specific training, the firm would pay the training cost instead of worker. It is reasonable for the firm pay the training cost because the firm can collect the return from higher labor productivity after training period. Conceptually, it rational for the firm to invest in complete specific training if return from training more than the training cost or $\sum_{t=1}^{n-1} \frac{MP_t - W_t}{(1+i)^t} > C$ and the firm continue invest until the return diminish to the cost or $\sum_{t=1}^{n-1} \frac{MP_t - W_t}{(1+i)^t} = C$ or $G = C$. Therefore, the long run equilibrium the return of complete specific training equal to the cost of complete specific training. The condition of maximizing profit in equation (3.24) become

$$MP_0' = W_0 \tag{3.28}$$

It implies that, during complete specific training, the trainee received a wage (W_0) equal to opportunity (true) marginal product (MP_0'). Remember that the opportunity marginal productivity (MP_0') is more than actual marginal productivity (MP_0) because some of the time, effort and other relevant production resource are sacrifice to the training session. If $W_0 > MP_0'$ or during the training, the firm pay a wage more than the opportunity marginal productivity, labors are overwhelming to the firm and firm will lose in the long run equilibrium because the return from specific training equal to the cost of training in long run equilibrium ($G = C$). If $W_0 < MP_0'$ or during the training, the firm pay the wage less than the opportunity marginal productivity, the firm will shortage of labor because labor can received a wage equal their true marginal product ($W_0 = MP_0'$) by working with other firms. Therefore, the long run equilibrium is wage (W_0) equal to opportunity (true) marginal product (MP_0').

If the firm pay for all the cost of specific training and the trainee quit and working with other firm, the training cost will be waste. In contrast, if worker pay for their specific training and then he or she has dismissing after training, the cost of training will be loss because the skill or knowledge from specific training cannot use in other

firm. If labor turnover has occurred, it will be waste no matter the firm or worker pay the specific training cost. The willingness to pay for the cost of specific training depends on the probability of labor turnover. After specific training complete, worker has no incentive to quit and firm also has no incentive to dismiss the worker. Therefore, the amount of specific training is negative related with the turnover rate. Furthermore, in case of the firm pay the cost of specific training, the firm can reduce the probability of loss from turnover by offer higher wage after training than other firms.

The specific training also has external effect to reduce the turnover rate even the demand for output has decrease. If before the decreasing in output demand, the marginal product of specific trained worker is more than their wage. Then, the decline in output demand which cause to reduce in marginal product to lower level. However, as long as the marginal product remain equal to their wage, it irrational for the firm to lay off the worker. Even the marginal product has reduced to below the wage, it still rational for the firm to not lay off worker if the reduce in demand for output is temporary. The layoff will suffer the firm because the firm pay the cost of training but cannot get the fully return form investment in specific training. In contrast, in case of the firm not layoff the worker, the firm can get the return from specific training in the future if the demand of output is recover.

If training were not completely specific or some part of training has characteristic of general training. Some part of skill or knowledge can increase productivity and wage in other firms. The proportion of cost incidence of the firm is positively related to proportion of specific training characteristics and negatively related to proportion of general training characteristics. In contrast, the proportion of cost that paid by employee is negatively related to specific training and positively related to general training.

For profit maximizing condition in equation (3.12):

$$MP_0' + G \quad = W_0 + C \tag{3.12}$$

Let G' is the return that collected by worker, G'' is total return from training which equal to sum of the return that collected by firms (G) and worker (G').

$$G'' = G + G' \tag{3.29}$$

In the long run equilibrium, total return from training is equal to cost of training or $G'' = C$. Let a is proportion of total return that collected by the firm or $G = aG''$. The proportion of total return that collected by worker is $(1 - a)$ or $G' = (1 - a)G''$. The profit maximizing condition become:

$$\begin{aligned} MP_0' + aG'' &= W_0 + C \\ MP_0' + aC &= W_0 + C \\ W_0 &= MP_0' - (1 - a)C \end{aligned} \tag{3.30}$$

It implies that worker pay for the cost of training equal proportion $(1 - a)$ of total cost which is the same as proportion of total return from training that they collected.

By equation (3.30), if the training is completely general training or $a = 0$, then

$$W_0 = MP_0' - C \tag{3.31}$$

Equation (3.31) is similar to wage equation for worker in general training or equation (3.26). Therefore, equation (3.30) is a general form cost incidence of workers.

In contrast, if the training is completely specific training or $a = 1$, then equation (3.30) become:

$$W_0 = MP_0' \tag{3.32}$$

Equation (3.32) is similar to wage equation for worker in specific training or equation (3.28).

Becker (1962) use model of OJT as a basis for extend the human capital theory to the schooling or formal education. The school is the institute that specializing in provide training. School and firm are substitute source of skill or knowledge.

Let net earnings is the difference between actual earning and direct cost of schooling:

$$W = MP - k \tag{3.33}$$

Where MP is actual marginal product which assume equal to earning, k is direct cost of school. Let MP_0' is opportunity marginal product (the marginal product of individual if he or she does not attending to the school), so the difference between actual and opportunity marginal product $(MP_0 - MP)$ is the opportunity cost from schooling. The total cost of schooling (C) is opportunity cost plus direct cost

$$C = MP_0' - MP + k \tag{3.34}$$

By net earnings in equation (3.33), plus and subtract by MP_0' to the right hand side of equation:

$$\begin{aligned} W &= MP_0' - (MP_0' - MP + k) \\ W &= MP_0' - C \end{aligned} \tag{3.35}$$

It is the same as in case of general training in equation (3.31).

CHAPTER 4

DATA AND STATICSTICAL FRAMEWORK

This chapter describes the data and models using in this study. The first section is a brief concept and calculation of work experience. Section two presents data and definitions of variables and models to analyze the economic significance of work experience in Thai labor market.

4.1 Concept and Calculation of Work Experience

Since the data about the actual experience is limited, the concept of potential work experience in the same fashion as Mincer (1974) was chosen to be a proxy of actual work experience. Potential work experience represents the maximum amount of time (year) that the individuals can spend in working after graduation. The amount of time in working has positive relationships with formal and informal on-the-job training. Moreover, it also positively related to an opportunity to learning-by-doing or learning from experience. Therefore, it is reasonable to use potential work experience as a proxy of the actual work experience.

Although potential work experience may have several drawbacks as discussed in chapter 2, it is often used to describe wage determination in the labor market (Agiomirgianakis, Lianos, & Tsounis, 2019; Anderson et al., 2003; Caselli, 2005; Coulombe et al., 2014; Lagakos et al., 2012; Robinson, 2003). Another reason supporting the potential work experience is the availability of data. The variables that are necessary to calculate the potential work experience are (1) age, and (2) years of schooling. These variables are often found in various surveys. However, it is important to notice about the drawback and assumption of the potential work experience and carefully interpret the effect of potential work experience.

This study uses the assumption that the full-time work begins at the age of 15 years. Therefore, the calculation of potential work experience is divided into 2 cases:

$$exp_i = \begin{cases} age_i - 15; \ if \ edu_i < 9 \\ age_i - edu_i - 6; \ if \ edu_i \geq 9 \end{cases} \quad (4.1)$$

where

exp_i is the potential work experience of individual i

age_i is the age of individual i

edu_i is years of schooling individual i

Equation (4.1) means that workers who study less than 9 years (less than junior high-school) start full time working at the age of 15 years. Workers studying at least 9 years start full time working in different age ranges depending on the amount of time of their studies. The table below illustrates the assumption about the age that starting full-time work.

Table 4.1 Age When Starting Full-Time Work

Education Attainment	Years of Schooling	Age Starting Full-Time Work
No formal education	0	15
Primary school	6	15
Junior high-school	9	15
High-school	12	18
Post high-school	14	20
Bachelor	16	22
Master	18	24
Ph.D.	23	29

4.2 Data and Model

This study uses cross-sectional data sets from the Thailand Labor Force Survey (LFS) between 3rd quarter of 2016 and 4th quarter of 2018, conducted by Thailand National Statistical Office (NSO). The survey uses stratified two-stage sampling. Every province of Thailand constitutes 77 strata which each stratum divided into municipal and non-municipal areas. The survey gathers data about socioeconomic status of individual, education, employment status, occupation, as well as earning. The purpose of this study was to study the contribution of work experience of working age people (age 15-59) in the labor market by apply the human capital earnings function of Mincer (1974). The model is:

$$\begin{aligned} ln(wage_i) = \beta_1 + \beta_2 exp_i + \beta_3 exp_i^2 + \beta_4 edu_i + \beta_5 female_i \\ + \beta_6 mar_i + \beta_7 area_i + \beta_8 C_i + \beta_9 N_i + \beta_{10} NE_i \\ + \beta_{11} S_i + u_i \end{aligned} \tag{4.2}$$

where

$ln(wage_i)$ = natural log of monthly earnings of individual i

exp_i = years of work experience of individual i

exp_i^2 = the squared of work experience of individual i

edu_i = years of schooling of individual i

$female_i$ = dummy variable, 1 = female, 0 otherwise

mar_i = dummy variable, 1 = married, 0 otherwise

$area_i$ = dummy variable, 1 = in municipal area, 0 otherwise

C_i, N_i, NE_i, S_i = dummy variable, 1= Central region, North region, Northeast region, South region, 0 otherwise (Bangkok)

u_i = the error term

Most studies estimate coefficients in equation (4.2) using Ordinary Least Squares (OLS) method and the sample includes only those who are hired and paid for their work, while those who inactive in labor market are excluded from the sample. The problem is that the sample used in the OLS model is non-random variables because

those who are offered low wage (less than their reservation wage) are unlikely to work. Therefore, wage and coefficient of OLS model is likely to bias. In other words, the Ordinary Least Squares (OLS) coefficients of equation (4.2) may be selectivity biased because OLS estimation only contains data from paid employees but not individuals who are out of the labor force. If there are some unobserved variables that significant related to the probability of being the sample (wage employed or decide to work), the sample is not selected at random. Especially, if this unobserved variable is significant related with the wage, the coefficient estimated from OLS will suffer from the selectivity bias.

Several literatures tend to take into account the selectivity bias in estimated casual effect estimating, especially estimate the returns from human capital investment (Almeida & Faria, 2014; Briggs, 2004). To illustrate the source of selectivity bias, consider the following model:

$$y_i = \boldsymbol{X_i}\beta + u_i \tag{4.3}$$

$$w_i = \begin{cases} 1, \text{if } \boldsymbol{Z_i}\gamma + \delta_i > 0 \\ 0, \text{if } \boldsymbol{Z_i}\gamma + \delta_i \leq 0 \end{cases} \tag{4.4}$$

Equation (4.3) is the regression equation, it is the reduced form of the human capital earnings function in equation (4.2) with $\boldsymbol{X}$ being the vector of independent variables, β is the vector of coefficient, and u is the error term. Equation (4.4) is the reduced form of the probit model, which describes the probability of employment. $\boldsymbol{Z}$ is a vector of variables related to the probability, γ is vector of coefficients, and δ is the error term. In order to estimate coefficients (β) of regression equation, the following assumptions must be used:

1) u and δ are independent and identically distributed random variables (iid) with a standard normal distribution

2) for equation (4.3) independent variables ($\boldsymbol{X}$) is independent with error term (u)

3) for equation (4.4) independent variables ($\boldsymbol{Z}$) is independent with error term (δ)

4) $E(u|\delta) = \rho\delta$, two error terms are linearly related which can be captured by the parameter ρ.

Source of bias coefficients (β) in equation (4.3) come from the relationship between u and δ, which can be estimated by parameter ρ (value between -1 and 1). If there is a significant relationship between u and δ ($\rho \neq 0$), $\boldsymbol{X}$ may be endogenous and β will be suffer from selection bias. In contrast, if u and δ are not correlated ($\rho = 0$), there is no selection bias in the OLS regression equation.

The selection bias will be the case ($\rho \neq 0$) if an unobserved factors that affect the probability of being active in labor market are correlated with and unobserved factors that affect the wage level. For example, the individual who are very diligent (diligent included in δ) are more likely to active in labor market. At the same time, workers with high endurance (endurance included in u) tend to receive high wage. If diligence and endurance are significantly related, the coefficients in equation (4.3) are bias.

Technically, suppose the sample appears in equation (4.3) only if they are employee or w in equation (4.4) equal to one ($\boldsymbol{Z}\gamma + \delta > 0$):

$$\begin{aligned} P(w_i = 1|\boldsymbol{Z_i}) &= P(\boldsymbol{Z_i}\gamma + \delta_i > 0|\boldsymbol{Z_i}) \\ &= P(-\delta_i < \boldsymbol{Z}_i\gamma|\boldsymbol{Z}_i) \\ &= \Phi(\boldsymbol{Z_i}\gamma) \end{aligned} \tag{4.5}$$

where Φ is the cumulative density function. The conditional mean of δ given value of Z and $w = 1$ is:

$$\begin{aligned} E(\delta|\boldsymbol{Z}, w = 1) &= E(\delta|\delta > -\boldsymbol{Z}\gamma) \\ &= \frac{\phi(-\boldsymbol{Z}\gamma)}{1 - \Phi(-\boldsymbol{Z}\gamma)} \\ &= \frac{\phi(\boldsymbol{Z}\gamma)}{\Phi(\boldsymbol{Z}\gamma)} \\ &= \lambda(\boldsymbol{Z}\gamma) \end{aligned} \tag{4.6}$$

where λ is the inverse Mills' ratio, ϕ is the probability density function, Φ is the cumulative density function. If error term of equation (4.3) and (4.4) are linearly related or $E(u|\delta) = \rho\delta$, the conditional mean of y given $\boldsymbol{Z}$ and $w = 1$ is:

$$
\begin{aligned}
E(y|\boldsymbol{Z}, w = 1) &= \boldsymbol{X}\beta + E(u|\boldsymbol{Z}, w = 1) \\
&= \boldsymbol{X}\beta + E(u|\boldsymbol{Z}\gamma + \delta > 0) \\
&= \boldsymbol{X}\beta + \rho E(\delta|\delta > -\boldsymbol{Z}\gamma) \\
&= \boldsymbol{X}\beta + \rho\left[\frac{\phi(-\boldsymbol{Z}\gamma)}{1 - \Phi(-\boldsymbol{Z}\gamma)}\right] \\
&= \boldsymbol{X}\beta + \rho\left[\frac{\phi(\boldsymbol{Z}\gamma)}{\Phi(\boldsymbol{Z}\gamma)}\right] \\
&= \boldsymbol{X}\beta + \rho\lambda(\boldsymbol{Z}\lambda) \qquad (4.7)
\end{aligned}
$$

Equation (4.7) implies that in the case of non-randomly sample and error term u and δ are linearly related, if the OLS model ignores the inverse Mills ratio (λ) and coefficient ρ is statistically different from zero, the coefficients β in equation (4.3) are biased.

This thesis solves selectivity bias that may occur in equation (4.2) by using the two-steps procedure suggested by Heckman (1979). Step one, estimate inverse Mills ratio $\left(\widehat{\lambda_\iota} = \frac{\phi(\boldsymbol{Z}\widehat{\gamma})}{\Phi(\boldsymbol{Z}\widehat{\gamma})}\right)$ from probit model from all N individuals in the population. The probit model used in this study is:

$$
\begin{aligned}
P(w_i = 1|\boldsymbol{Z_i}) &= P(\alpha + \boldsymbol{Z_i}\gamma + \delta_i > 0|\boldsymbol{Z_i}) \\
&= P(-\delta_i < \alpha + \boldsymbol{Z_i}\gamma|\boldsymbol{Z_i}) \\
&= \Phi(\alpha + \boldsymbol{Z_i}\gamma) \qquad (4.8)
\end{aligned}
$$

where P is probability of $w_i = 1$ which $w_i = 1$ if individual i work and receives a wage and 0 otherwise, $\boldsymbol{Z}_i$ is the vector of covariates that affects the probability of getting employed which consists of: age of individual i (age_i), age of individual i squared (age_i^2), year of schooling of individual i (edu_i), gender (dummy variable $female_i$ = 1 if female and 0 otherwise), marital status (dummy variable mar_i = 1 if married and 0 otherwise), administrative area (dummy variable $area_i$ = 1 if individual i live in municipality and 0 otherwise), Region (4 dummy variables: central, north, northeast, and south), and head of household ($dhead_i$ = 1 if individual i is the head of household and 0 otherwise).

Step two, include the estimation of the inverse Mills ratio ($\hat{\lambda}_i$) as another independent variable of the OLS model. The coefficients estimated from the Heckman procedure will converge to the true coefficient asymptotically.

$$\begin{aligned} ln(wage_i) = \beta_1 + \beta_2 exp_i + \beta_3 exp_i^2 + \beta_4 edu + \beta_5 female_i \\ +\beta_6 mar_i + \beta_7 area_i + \beta_8 C_i + \beta_9 N_i + \beta_{10} NE_i \\ +\beta_{11} S_i + \rho\hat{\lambda}_\iota + u_i \end{aligned} \quad (4.9)$$

If coefficient ρ is statistically different from zero, coefficients β in equation (4.2) are biased and coefficients of equation $(4.XX)$ are true coefficient.

The effect of work experience on wages may be vary depending on job positions. Some jobs require experience, skills and expertise, but some jobs require no experience but require physical strength. The purpose of this study was to study the impact of work experience on various types of work by using the International Standard Classification of Occupation (ISCO) data (International Labour Office, 2012) to classify the occupation into three occupation groups: (1) high-skill occupation includes manager, professionals, and technicians and associate professionals, (2) semi-skill occupation including clerical support workers, services and sale workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, and plant and machine operators and assemblers, (3) low-skill occupation include elementary occupations (e.g., cleaning staff, agricultural laborers, transport and storage laborers) and estimate each occupation groups with OLS method.

$$\begin{aligned} ln(wage_{ij}) = \beta_1 + \beta_2 exp_{ij} + \beta_3 exp_{ij}^2 + \beta_4 edu_{ij} + \beta_5 female_{ij} \\ +\beta_6 mar_{ij} + \beta_7 area_{ij} + \beta_8 C_{ij} + \beta_9 N_{ij} \\ +\beta_{10} NE_{ij} + \beta_{11} S_{ij} + u_{ij} \end{aligned} \quad (4.10)$$

where

$ln(wage_{ij})$ = natural log of monthly earnings of individual i who are working in occupation group j

exp_{ij} = years of work experience of individual i who are working in occupation group j

exp_{ij}^2 = the squared of work experience of individual i who are working in occupation group j

edu_{ij} = years of schooling of individual i who are working in occupation group j

$female_{ij}$ = dummy variable, 1 = female, 0 otherwise, for occupation group j

mar_i = dummy variable, 1 = married, 0 otherwise, for occupation group j

$area_i$ = dummy variable, 1 = in municipal area, 0 otherwise, for occupation group j

$C_{ij}, N_{ij}, NE_{ij}, S_{ij}$ = dummy variable, 1= Central region, North region, Northeast region, South region, 0 otherwise (Bangkok), for occupation group j

u_{ij} = the error term

j = 1, 2, and 3 are high-skill, semi-skill, and low-skill occupation, respectively

The coefficient from OLS estimation in equation (4.10) are unbiased if the samples in each occupational group are randomly selected. If it is not the case, OLS regressions may be biased. In this case, the two-step Heckman correction cannot overcome the selectivity bias in each occupational group. The limitation is that the probit model can apply only in the case of binary dependent variables (e.g., equal 1 if wage employed and 0 otherwise). However, if the dependent variable is multiple choices: (1) high-skill occupation, (2) semi-skill occupation, (3) low-skill occupation, and (4) stay outside the labor market, different approaches to solving the selectivity bias are needed.

In this case, Lee (1983) generalized the Heckman's procedure for solving the selectivity bias. For the purposes of illustration, consider the following example:

$$y_j = \boldsymbol{X_j}\beta_j + \sigma_j u_j \quad (4.11)$$

$$y_j^* = \boldsymbol{Z_j}\gamma_j + \eta_j \quad (4.12)$$

where j is categorical variable that describes the choice of individual among M occupational group, $j = 1, \dots, M$. Equation (4.11) is OLS model which y_j is dependent variable (wage of individual working in occupational group j), X_j is vector of independent, β_j is vector of coefficients, σ_j is the coefficient of relationship between the error term of OLS model, u_j and the error term of multinomial logit model, (η_j). Equation (4.12) is multinomial logit model which y_j^* is dependent variable, $\boldsymbol{Z_j}$ is vector of independent variables, γ_j is vector of coefficient, and η_j is error term. The assumption is that the conditional mean of error term are zero or $E(u_j : \boldsymbol{X_j}, \boldsymbol{Z_j}) = 0$ and $E(\eta_j | \boldsymbol{X_j}, \boldsymbol{Z_j}) = 0$.

The dependent variable y_j is observed if and only if the occupational group j is selected. Occupational group j is selected if and only if:

$$y_j^* > \max_{s \neq j} y_s^* \quad (4.13)$$

Let I is variable with value 1 to M and $I = j$ if occupational group j is chosen.

$$I = j \text{ if and only if } \boldsymbol{Z_j}\gamma_j > \epsilon_j \quad (4.14)$$

where

$$\epsilon_j \equiv \max_{s \neq j} y_s^* - \eta_j \quad (4.15)$$

For each pair of (u_j, ϵ_j), suppose the marginal distribution of u_j is $G_j(u)$ and marginal distribution of ϵ_j is $F_j(\epsilon)$. Let $g_j(\cdot)$ is the density function of $G_j(\cdot)$ and define dummy variables D_j where $j = 1, \dots, M$ such that

$$D_j = 1 \text{ if and only if } I = j \quad (4.16)$$

Lee (1983) shows that the log likelihood for the M model with random sample of size N is

$$ln\,L = \sum_{i=1}^{N}\sum_{j=1}^{M} D_{ji} ln g_j\left(\frac{y_{ji} - \boldsymbol{X_{ji}}\beta_j}{\sigma_j}\right) - D_{ji} ln\sigma_j$$

$$+D_{ji} ln\Phi\left(\frac{J_{1j}(\boldsymbol{Z_{ji}}\gamma_j) - \rho_j J_{2j}(y_{ji} - \boldsymbol{X_{ji}}\beta_j)}{(1-\rho_s^2)^{\frac{1}{2}}}\right) \quad (4.17)$$

where $J_{1j} = \Phi_0^{-1}F_j$ and $J_{2j} = \Phi_0^{-1}G_j$. From the multinomial logit model in equation (4.12), assume $\gamma_1 = \gamma_2 = \cdots = \gamma_M$, the model become:

$$y_j^* = \boldsymbol{Z_j}\gamma + \eta_j \quad (4.18)$$

The stochastic part of the function is

$$F_j(\epsilon) \equiv Prob[\epsilon_j < \epsilon] = Prob\left[\left(\max_{s\neq j} y_s^* - \eta_j\right) < \epsilon\right]$$

$$= \frac{\exp(\epsilon)}{\exp(\epsilon) + \sum_{s=1, s\neq j}^{m}\exp(Z_s\gamma)} \quad (4.19)$$

Lee (1983) shows that if the marginal distribution of u_j are normal distributed, the unbiased estimation equation of (4.1) is

$$y_j = \boldsymbol{X_j}\beta_j - \sigma_j\rho_j\frac{\phi\left(J_{1s}(Z_j\gamma)\right)}{F_j(Z_j\gamma)} + \eta_j \quad (4.20)$$

If coefficient σ is statistical significant, the coefficient in equation (4.11) is biased. This study applies the generalization of Heckman's procedure proposed by Lee (1983) to testing and correct the selectivity bias of wage equation of each occupational groups.

CHAPTER 5

EMPIRICAL RESULTS

This chapter aims to present and discuss the empirical analysis of the economic significance of work experience, especially the impact of work experience on wages. This chapter begins with a summary of the data used in the study, followed by an analysis of experience - earnings profile across education level and occupations. The last part is an analysis of the economic significance of work experience in each occupational groups by resolving the selectivity bias by generalization of Heckman's procedure proposed by Lee (1983).

5.1 Sample Profile

This study uses cross-sectional data set from the Thailand Labor Force Survey (LFS) made available by Thailand National Statistical Office (NSO). The LFS collects data on the supply side of Thai labor market on individual level. The survey uses stratified two-stage sampling. All provinces of Thailand constitute 77 strata which each stratum divides into municipal and non-municipal areas. The survey gathers data about the socioeconomic status, education, employment status, occupation, as well as earnings. This study uses LFS data between the third quarter of 2016 to the fourth quarter of 2018. The total sample is 2,174,949, it has been reduced to 1,756,316 individuals after excluding those under age 15.

The remaining samples are female more than male. Approximately 30% of them live in the central region, more than half are live in municipality area. 54% of sample graduated in primary education or lower, while only 11% of sample graduated with bachelor's degree. Most sample (64%) are married.

Table 5.1 Sample Profile (Percentage)

Variables	2016 (Q3–Q4)	2017	2018	Total
Gender				
- Male	46.39	46.52	46.62	46.54
- Female	53.61	53.48	53.38	53.46
Region				
- Bangkok	5.26	5.40	5.41	5.37
- Central	30.25	30.15	29.89	30.07
- North	21.35	21.37	21.49	21.41
- North East	26.29	26.14	26.13	26.16
- South	16.85	16.95	17.08	16.98
Administrative area				
- In the municipality	55.42	55.68	55.62	55.60
- Outside the municipality	44.58	44.32	44.38	44.40
Education				
- No formal education	34.35	34.07	33.67	33.97
- Primary	19.85	19.66	19.88	19.79
- Lower-secondary	15.88	15.84	15.79	15.83
- Upper-secondary	14.30	14.37	14.41	14.37
- Post-secondary	3.87	3.91	4.00	3.94
- Bachelor	10.22	10.56	10.67	10.54
- Master	1.48	1.52	1.52	1.51
- Ph.D.	0.05	0.06	0.07	0.06
Marital				
- Single	21.22	21.68	21.54	21.53
- Married	64.73	63.77	63.58	63.89
- others	14.05	14.55	14.88	14.58
Total Observation	**359,233**	**703,768**	**693,315**	**1,756,316**

The sample is divided into those inside and outside the labor force. The former group is the labor who are participate in labor market, which consists of employed, unemployed, and seasonally inactive labor force. Although Thai people are able to

work-full time at age of 15, the labor force participation rate of teenagers is only 17% - 18% as they are disproportionately in school. The labor participation rate increases with age and reaches its peak (88% - 89%) at the age of 35–44, then continues to decline with age, especially after the formal retirement age (60 years) which dropped to 58% and 43% for 60–64 and 65–69 age groups, respectively.

Table 5.2 Labor Market Status, 2016

(unit: persons, percent in parenthesis)

Age	Labor Force			Labor Force Participation (4) = [(1)+(2)+(3)]	Non-Participation (5)	Total Sample (6) = (4)+(5)
	Employed (1)	Unemployed (2)	Seasonal Inactive (3)			
15-19	4,530	230	20	4,780	21,809	26,589
	(17.04)	(0.87)	(0.08)	(17.98)	(82.02)	(100.00)
20-24	12,856	639	40	13,535	7,384	20,919
	(61.45)	(3.05)	(0.19)	(64.70)	(35.30)	(100.00)
25-29	19,748	344	35	20,127	7,384	23,498
	(84.04)	(1.46)	(0.15)	(85.65)	(31.42)	(100.00)
30-34	23,245	197	40	23,482	3,222	26,704
	(87.04)	(0.74)	(0.15)	(87.93)	(12.06)	(100.00)
35–39	27,319	117	45	27,481	3,482	30,963
	(88.23)	(0.38)	(0.15)	(88.75)	(11.25)	(100.00)
40–44	29,745	92	47	29,884	3,644	33,528
	(88.72)	(2.74)	(0.14)	(89.13)	(10.87)	(100.00)
45-49	32,414	69	64	32,547	4,781	37,328
	(86.84)	(0.18)	(0.17)	(87.19)	(12.80)	(100.00)
50-54	30,905	58	91	31,054	5,994	37,048
	(83.41)	(0.16)	(0.25)	(83.82)	(16.18)	(100.00)
55-59	26,310	42	97	26,449	7,409	33,858
	(77.71)	(0.12)	(0.29)	(78.12)	(21.88)	(100.00)
60-64	17,251	25	81	17,357	12,479	29,836
	(57.82)	(0.08)	(0.27)	(58.17)	(41.83)	(100.00)
65-69	9,221	9	44	9,274	12,118	21,392
	(43.10)	(0.04)	(0.21)	(43.35)	(56.65)	(100.00)
70+	5,728	3	27	5,758	31,812	37,570
	(15.25)	(0.00)	(0.07)	(15.33)	(84.67)	(100.00)
Total	239,272	1,825	631	241,728	117,505	359,233
	(66.61)	(0.51)	(0.18)	(67.29)	(32.71)	(100.00)

Table 5.3 Labor Market Status, 2017

(unit: persons, percent in parenthesis)

Age	Labor Force			Labor Force Participation (4) = [(1)+(2)+(3)]	Non-Participation (5)	Total Sample (6) = (4)+(5)
	Employed (1)	Unemployed (2)	Seasonal Inactive (3)			
15-19	8,112	571	78	8,761	41,977	50,738
	(15.99)	(1.13)	(0.15)	(17.27)	(82.73)	(100.00)
20-24	24,389	1,410	125	25,924	14,627	40,551
	(60.14)	(3.48)	(0.31)	(63.93)	(36.07)	(100.00)
25-29	37,941	799	83	38,823	6,835	45,658
	(83.10)	(1.75)	(0.18)	(85.03)	(14.97)	(100.00)
30-34	43,955	442	125	44,522	6,443	50,965
	(86.25)	(0.87)	(0.25)	(87.36)	(12.64)	(100.00)
35–39	50,462	263	147	50,872	6,588	57,460
	(87.82)	(0.46)	(0.26)	(88.53)	(11.47)	(100.00)
40–44	57,597	195	204	57,996	7,691	65,687
	(87.68)	(0.30)	(0.31)	(88.29)	(11.71)	(100.00)
45-49	62,055	173	330	62,558	9,401	71,959
	(86.24)	(0.24)	(0.46)	(86.94)	(13.06)	(100.00)
50-54	60,860	140	355	61,355	12,434	73,789
	(82.48)	(0.19)	(0.48)	(83.15)	(16.85)	(100.00)
55-59	51,808	102	393	52,303	14,931	67,234
	(77.05)	(0.15)	(0.58)	(77.79)	(22.21)	(100.00)
60-64	34,402	48	349	34,799	25,517	60,316
	(57.04)	(0.08)	(0.58)	(57.69)	(42.31)	(100.00)
65-69	18,241	15	180	18,436	24,786	43,222
	(42.20)	(0.03)	(0.42)	(42.65)	(57.35)	(100.00)
70+	11,624	13	98	11,735	64,454	76,189
	(15.25)	(0.02)	(0.13)	(15.40)	(84.60)	(100.00)
Total	461,446	4,171	2,467	468,084	235,684	703,768
	(65.57)	(0.59)	(0.35)	(66.51)	(33.49)	(100.00)

Table 5.4 Labor Market Status, 2018

(unit: persons, percent in parenthesis)

Age	Labor Force			Labor Force Participation (4) = [(1)+(2)+(3)]	Non-Participation (5)	Total Sample (6) = (4)+(5)
	Employed (1)	Unemployed (2)	Seasonal Inactive (3)			
15-19	7,659	460	82	8,201	39,428	47,629
	(16.08)	(0.97)	(0.17)	(17.22)	(82.78)	(100.00)
20-24	23,431	1,278	88	24,797	13,932	38,729
	(60.50)	(3.30)	(0.23)	(64.30)	(35.97)	(100.00)
25-29	36,870	756	84	37,710	6,293	44,003
	(83.79)	(1.72)	(0.19)	(85.70)	(14.30)	(100.00)
30-34	42,033	359	106	42,498	6,071	48,569
	(86.54)	(0.74)	(0.22)	(87.50)	(12.50)	(100.00)
35–39	49,356	249	107	49,712	6,362	56,074
	(88.02)	(0.44)	(0.19)	(88.65)	(11.35)	(100.00)
40-44	55,677	190	165	56,032	7,110	63,142
	(88.17)	(0.30)	(0.26)	(88.74)	(11.26)	(100.00)
45-49	60,966	157	230	61,353	9,033	70,386
	(86.62)	(0.22)	(0.33)	(87.17)	(12.83)	(100.00)
50-54	61,477	121	284	61,882	12,240	74,122
	(82.94)	(0.16)	(0.38)	(83.49)	(16.51)	(100.00)
55-59	52,818	94	330	53,242	14,548	67,790
	(77.91)	(0.14)	(0.49)	(78.54)	(21.46)	(100.00)
60-64	35,014	43	303	35,360	25,690	61,050
	(57.35)	(0.07)	(0.50)	(57.92)	(42.08)	(100.00)
65-69	19,407	10	189	19,606	25,233	44,839
	(43.28)	(0.02)	(0.42)	(43.73)	(56.27)	(100.00)
70+	11,951	7	88	12,046	64,936	76,982
	(15.52)	(0.00)	(0.11)	(15.65)	(84.35)	(100.00)
Total	456,659	3,724	2,056	462,439	230,876	693,315
	(65.87)	(0.54)	(0.30)	(66.70)	(33.30)	(100.00)

Similarly, labor force participation rates of males and females increase with age and decrease with age reaching the peak at the age of 40–44. Although female labor force participation rate is less than that of males as a whole due to household responsibilities,

Thai women are considerably active in the labor market compare with other countries (Loper, 2018).

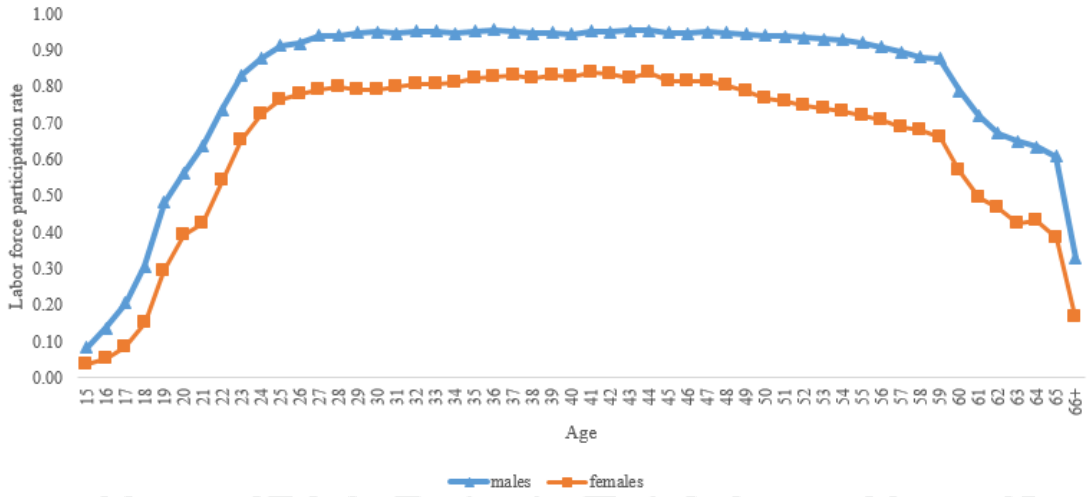

Figure 5.1 Labor Force Participation Rate by Gender, 2018

The labor force participation rate decreased markedly at age 50 for female and age 55 for male. It is interesting why they leave the labor market. Whether they are capable of working?

5.2 Potential Elderly Labor Force in Thailand

This thesis investigates the potential elderly labor in Thailand between the ages of 50–69 years who are healthy and capable of working, but they exclude themselves out of the labor force. This study does not implicate that all of potential labor should be active in the labor market but the potential labor is an approximation of underutilized productive resources that policymakers can introduce a policy to encourage them to participate in the labor market.

According to the Thailand Labor Force Survey (LFS), the elderly will stay outside the labor market if they are (1) engage in household work, (2) too young or too old to work, (3) ill or disability, (4) voluntarily idle, and (5) retired. Share of those who are out of labor market increases dramatically after reaching retirement age (age 60) (i.e., from 21.84% at age 55-59 to 42.12% at age 60-64). The main reason to leave the labor market for them after retirement is too old to work.

Table 5.5 Workers Outside the Labor Force, 2016–2018

(unit: percent)

Age	Out of Labor Market	Incapable of Working			Capable of Working			
		Too Old to Work	Ill and Disabilities	Other Reasons	Household Work	Voluntarily Idle	Retired	Total
50-54	16.58	0.00	2.95	0.31	12.16	1.10	0.00	13.32
55–59	21.84	0.00	3.91	0.36	14.82	1.68	1.07	17.57
60–64	42.12	13.43	4.28	0.24	15.07	1.12	7.97	24.16
65-69	56.77	30.42	4.72	0.16	13.58	0.80	7.09	21.47
70+	84.51	69.37	4.73	0.08	5.71	0.28	4.35	10.33

It has been argued that health is the main factor determining the work capacity (Cutler, Meara, & Richards-Shubik, 2011; Wise, 2017), this study uses health condition to consider whether those elders who stay outside the labor force are capable of working. Unfortunately, the dataset does not contain the health condition of the sample hence this study uses the reason for staying outside the labor force as the proxy of the health status. Those who are too old to work and in poor health (due to either illnesses or disabilities) are treated as those who have health problems and unable to work. The remaining sample (engaged in household work, voluntarily idle, and retired) is assumed to be the potential labor force as they are healthy and have capacity to perform a job. Note that the person outside the labor force for other reason are assumed that they are unable or inconvenient to work.

Table 5.6 Potential Labor Force Ratio

Age	Potential labor force ratio		
	Total	Male	Female
50–54	0.8032	0.4109	0.8897
55–59	0.8043	0.5306	0.8806
60–64	0.5736	0.4477	0.6341
65–69	0.3781	0.2689	0.4379
70+	0.1222	0.1050	0.1327

Thailand has quite a lot of potential labor force because most of people outside the labor market are capable of working. The potential labor force ratio (number of potential labor force divided by number of the outside labor market) shows that, for age 50–59 years, 80% of the outside labor market probably have capacity to perform a job because most of them are engaged in household work. Potential labor force is still considered high, even if it is the case of those older than formal retirement age (age 60). 57.36% and 37.81% of sample outside labor market are the potential labor force for age 60–64 and 65–69 respectively. By comparison between men and women, the main source of potential labor force is women. Over 88% of women age 55-59 who are outside the labor market has capable to perform a job. Although older than 60 years, the potential labor force of women is still up to 63% for ages 60–64 and 44% for ages 65–69.

Table 5.7 Male Outside the Labor Force, 2016–2018

(unit: percent)

Age	Out of Labor Market	Incapable of Working			Capable of Working			
		Too Old to Work	Ill and Disabilities	Other Reasons	Household Work	Voluntarily Idle	Retired	Total
50-54	6.58	0.00	3.61	0.26	1.19	1.51	0.00	2.70
55–59	10.47	0.00	4.60	0.31	1.59	2.44	1.52	5.56
60–64	30.33	11.61	5.03	0.11	1.52	1.62	10.44	13.58
65-69	44.46	26.62	5.78	0.10	1.28	1.10	9.58	11.96
70+	77.39	63.58	5.61	0.07	0.77	0.35	7.00	8.13

Table 5.8 Females Outside the Labor Force, 2016 – 2018

(unit: percent)

Age	Out of Labor Market	Incapable of Working			Capable of Working			
		Too Old to Work	Ill and Disabilities	Other Reasons	Household Work	Voluntarily Idle	Retired	Total
50-54	24.97	0.00	2.40	0.34	21.55	0.67	0.00	22.22
55–59	31.32	0.00	3.34	0.40	25.85	1.04	0.69	27.58
60–64	51.80	14.94	3.66	0.35	26.20	0.71	5.94	32.85
65-69	66.90	33.55	3.85	0.21	23.70	0.55	5.04	29.29
70+	89.50	73.42	4.12	0.08	9.16	0.23	2.49	11.87

The composition of the potential labor force shows that the biggest source of potential labor force is those who are engaged in household work which most of them

have no formal education. For example, 56.29% of potential labor force in age 55-59 have no formal education. Their productivity in labor market probably low (although labor productivity in household work may not be low), resulting in limited employment opportunities. Therefore, providing the necessary skills sets and knowledge by training is important policy to increase productivity and employment opportunities for this group.

However, there are a moderate proportion of the potential labor force who are educated at the tertiary level. Most of them stay outside the labor market because due to retirement. This group account for 22.27% of potential labor force for age 60 – 64 and 20.11% for 65 – 69. Although they are retired, their human capital (knowledge and work experience) are not disappear or drop markedly. In contrast, the human capital remain valuable in labor market. Therefore, providing the incentive to work and appropriate matching between labor demand and labor supply as well as between a job and their knowledge, experience and physical condition are necessary policies.

Table 5.9 Education of Potential Elderly Labor Age 55-59, 2016–2018

(unit: percent)

Educational Attainment	**50–54 years**			**55–59 years**		
	Household Work	**Voluntarily Idle**	**Retired**	**Household Work**	**Voluntarily Idle**	**Retired**
No schooling	43.63	2.81	0.00	56.29	5.16	0.26
Primary	23.17	1.68	0.00	10.90	1.22	0.11
Lower secondary	7.10	0.74	0.00	5.24	0.74	0.64
Upper secondary	9.91	1.17	0.00	6.43	1.17	1.43
Diploma in vocational	3.01	0.33	0.00	2.12	0.37	0.59
Bachelor’s degree	4.98	1.02	0.00	3.21	076	2.67
Master degree	0.28	0.16	0.00	0.19	0.12	0.36
Ph.D.	0.01	0.01	0.00	0.01	0.01	0.02

Table 5.10 Education of Potential Elderly Labor age 60-69, 2016–2018

(unit: percent)

Educational Attainment	60–64 years			65–69 years		
	Household Work	Voluntarily Idle	Retired	Household Work	Voluntarily Idle	Retired
No schooling	48.63	2.97	1.13	52.68	2.62	1.30
Primary	5.75	0.49	0.58	4.81	0.27	0.66
Lower secondary	2.63	0.34	2.64	2.31	0.27	3.23
Upper secondary	2.74	0.44	4.41	1.82	0.23	5.26
Diploma in vocational	0.70	0.09	1.95	0.49	0.07	2.47
Bachelor's degree	1.79	0.27	18.75	1.04	0.20	17.00
Master degree	0.15	0.03	3.36	0.09	0.06	2.95
Ph.D.	0.01	0.00	0.16	0.01	0.01	0.16

Providing knowledge, skills and reskills through training is a way to motivate the potential labor force to participate in the labor market, especially those who are not educated. Suitable jobs for the elderly is jobs that do not rely on physical strength but rely on knowledge, skills, and experience such as high-skill and semi-skill occupation because the physical condition gradually deteriorates with age. According to the International Standard Classification of Occupation (ISCO), the jobs can classify into three groups base on skill level: (1) high-skill occupation includes manager, professionals, and technicians and associate professionals, (2) semi-skill occupation includes clerical support workers, services and sale workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, and plant and machine operators and assemblers, (3) low-skill occupation include elementary occupations (e.g., office cleaners, agricultural laborers, transport and storage laborers). Dataset from Thailand Labor Force Survey (LFS) shows that those with primary or lower education are more likely to work in low-skill occupation and semi-skill occupation. Almost 88% of semi -skill workers graduate at secondary or lower. In contrast, 76.46% of high-skill occupation workers graduate at tertiary level. It confirms that training is necessary for the potential labor force to perform in semi -skill and high-skill jobs.

Table 5.11 Share of Occupational Group Across Education Level

Education	Low-Skill Occupation	Semi-Skill Occupation	High-Skill Occupation
Primary	66.61%	54.73%	7.52%
Secondary	29.84	32.44%	16.02%
Tertiary	3.55	12.83%	76.46%
Total	100.00%	100.00%	100.00%

5.3 The Economic Significant of Work Experience

This thesis studies the influence of work experience on wages by analyzing data of working age sample (age 15-59). After initial data cleaning by deleting the samples older than 59 years as well as the missing data, the sample has been reduced to 1,304,920. In this amount, 24.05% are private employees, 24.17% are own-account workers (self-employed), 14.03% are unpaid family workers, and 22.76% are the person outside the labor force. This proportion of 2016, 2017 and 2018 is nearly similar to the total sample.

Unfortunately, wage data is not available for employers, own-account workers, and unpaid family workers. Therefore, this study examines the economic significance of work experience by analyzing the wages of government employees, state enterprise employee, and private employees only. After deleting the sample that wage data is not available, the sample has been reduced to 467,072.

Table 5.12 Share of Working Status

Status	2016 (Q3–Q4)	2017	2018	Total
Employers	2.01%	2.02%	1.98%	2.00%
Own-account workers	24.58%	23.77%	24.36%	24.17%
Unpaid family workers	14.81%	13.70%	13.94%	14.03%
Government employees	8.71%	8.92%	8.91%	8.87%
State enterprise employee	0.79%	0.85%	0.78%	0.81%
Private employees	23.73%	24.27%	24.00%	24.05%
Others	1.93%	2.27%	2.49%	2.28%
Outside the labor force	22.59%	23.08%	22.53%	22.76%
unemployment	0.66%	0.78%	0.72%	0.73%
Observation	**270,435**	**524,041**	**510,444**	**1,304,920**

5.3.1 Work Experience–Earning Profiles

The first step in analyzing the economic significant of work experience is to compare the average monthly wage of an inexperience worker with an experienced worker (for example 10 years) across years of education. This study estimates the amount of time spent studying (years) of sample according to their education attainment (Table 5.13). Table 5.14 shows the average monthly earning across education level. The average monthly earnings increase with education level from 7,367 baht for uneducated worker to 46,737 baht for those with a doctorate degree. The average earnings of zero and ten years of experience across education level indicate that the earnings of ten years of work experience more than zero work experience between 26.75% – 71.00% depend on education level.

Table 5.13 Years of Schooling

Education Attainment	Years of Schooling
No education	0
Primary school	6
Junior high-school	9
High-school	12
Post high-school	14
Bachelor	16
Master	18
Ph.D.	23

The earnings dispersion has increase with experience and education. The standard deviation of earnings of ten-year experience workers is higher than inexperience workers for all education groups except primary and uneducated group and the difference in standard deviations has increases with level of education.

Moreover, the relation between work experience and average monthly wage across education level can also be analyze from the experience-earnings profile. Figure 5.2 shows the experience-earnings profile for 0, 6, and 9 years of schooling groups and Figure 5.3 show the case of 12, 14, 16, and at least 18 years. For workers with 0, 6, and 9 years of education, the earning at zero experience is between 5,000 – 5,350 baht/month. The earnings in the first two-year experience are approximately indifferent. Their earnings gradually divert after 6 years of work experience. Their income is growing rapidly during the first 6 years of work. But after that, average monthly income of 9 and 6 years of schooling has slowly growing and the earnings of uneducated workers gradually decline until they are retired.

Table 5.14 Earnings at Different Education Level and Work Experience

Years of Schooling	Average Monthly Earnings			
	Age 15 – 59 (S.D.)	**Zero experience (S.D.)**	**10th year of experience (S.D.)**	**Different Earnings (%)**
0	7,367	4,992	7,915	+58.55%
	(3,308)	(2,522)	(2,055)	
6	8,016	5,089	7,653	+50.38%
	(3,588)	(2,528)	(2,501)	
9	9,261	5,345	8,645	+61.74%
	(4,463)	(2,686)	(3,009)	
12	11,335	7,717	9,781	+26.75%
	(6,609)	(2,495)	(3,736)	
14	14,599	9,680	12,298	+27.05%
	(10,152)	(2,777)	(5,263)	
16	23,104	12,891	17,075	+32.46%
	(14,386)	(4,522)	(7,514)	
18	35,683	18,020	26,474	+46.91%
	(20297)	(7,055)	(10,885)	
23	46,737	25,090*	42,904	+71.00%
	(26,738)	(5,787)	(18,091)	

Note: 1) * is one-year work experience.

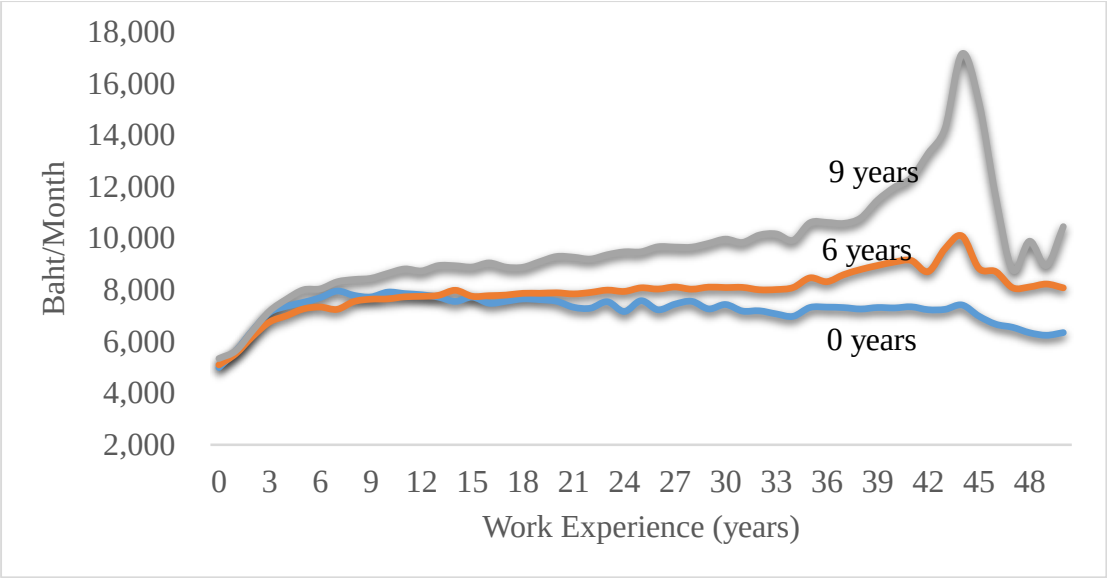

Figure 5.2 Experience-Earnings Profile of 0, 6, and 9 Years of Education

The experience-earnings profile of 12 to at least 18 year of education is higher and more growing with experience than 0-9 years of education because the most of them are working in semi and high-skill occupation compare with the worker with 0–9 years of education which the most of them are working in low-skill and semi-skill occupation (Table 5.15). Since knowledge/skill from work experience is relatively more important for the performance of high-skill occupation than simple and routine task of low-skill and semi-skill occupation, and high-skill occupation are paid more than those in semi and low skill-occupation, so the earnings of 12 to at least 18 year of education workers are both higher and growing more than earnings of 0-9 year of education workers.

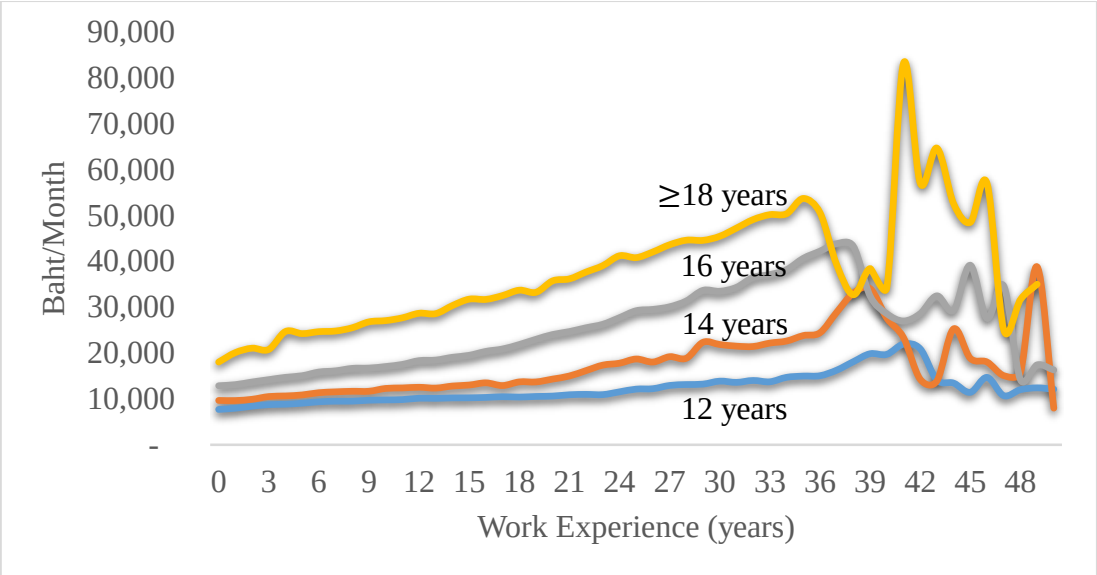

Figure 5.3 Experience-Earnings Profile of 12, 14, 16 and 18 Years of Education

Table 5.15 Share of Occupational Groups across Education Level

Years of Schooling	Low-Skill Occupation	Semi-Skill Occupation	High-Skill Occupation	Total
0	46.53%	51.09%	2.38%	100.00%
6	36.54%	60.47%	2.99%	100.00%
9	24.94%	69.85%	5.23%	100.00%
12	13.45%	72.10%	14.45%	100.00%
14	4.72%	66.51%	22.77%	100.00%
16	1.08%	30.88%	68.04%	100.00%
18	0.42%	7.61%	91.97%	100.00%
23	0.26%	0.91%	98.83%	100.00%

As discussed above, jobs have divided into 3 groups (low-skill, semi-skill and high-skill occupation). Work experience has small effect on earnings in low and semi-skill occupation group except for the clerical support worker that slightly increases with experience. Therefore, their experience-earnings profile is relatively flat.

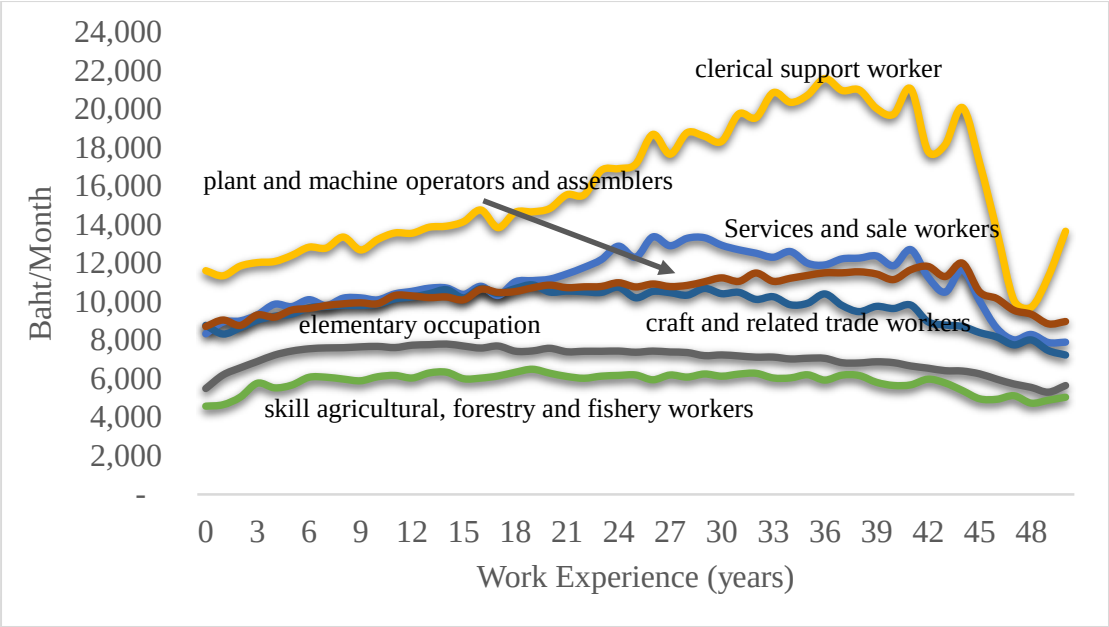

Figure 5.4 Experience-Earnings Profile of Semi and Low Skill Occupation

For the high-skill occupation, the work experience has high effect on the earnings. It is obvious that the average monthly wage has strongly increasing with work experience, especially in professional jobs. It means that experience is important for the performance in the jobs that require high level of knowledge, skill and expertise.

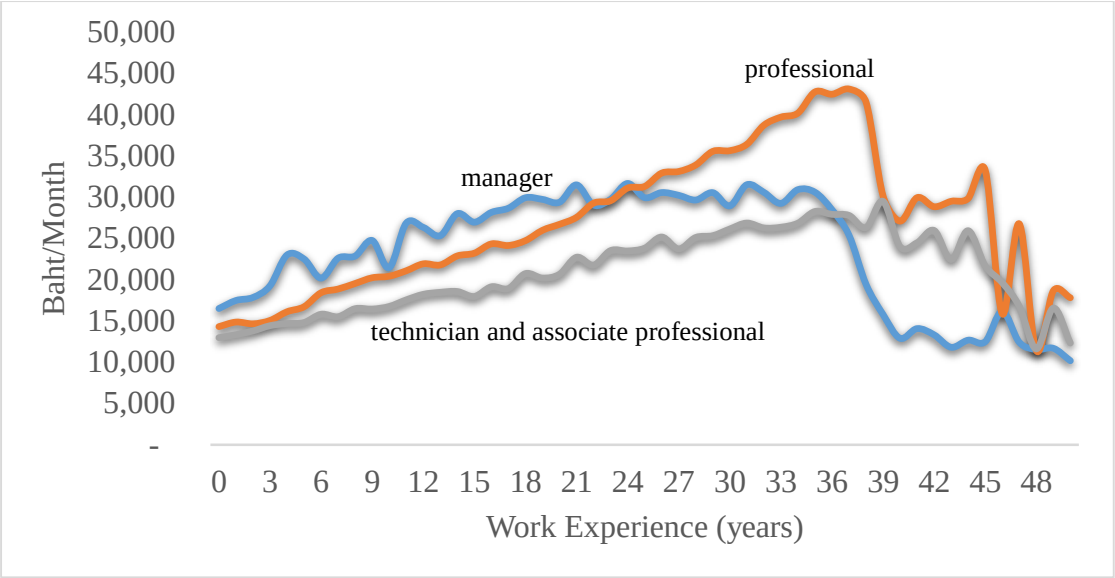

Figure 5.5 Experience-Earnings Profile of High-Skill Occupation

5.3.2 Estimate the Economic Significance of Work Experience

This study apply the concept of human capital earnings function of Mincer (1974) to investigation the economic significance of work experience of working age person (age 15-59) on the labor market outcome. The model in equation (4.2) has estimated with Ordinary Least Squared method (OLS) and estimation is present in table 5.16.

Table 5.16 OLS Estimation of Human Capital Learning Function

Independent Variables	Coefficients		
	2016 (Q3 – Q4)	**2017**	**2018**
$constant$	8.2522	8.2495	8.2609
edu	0.0864***	0.0874***	0.0870***
exp	0.0178***	0.0175***	0.0192***
exp^2	-0.00004***	-0.00004***	-0.0001***
$female$	-0.0838***	-0.0885***	-0.0849***
$marriage$	0.0541***	0.0505***	0.0550***
$area$	0.1257***	0.1259***	0.1313***
$Central$	-0.1932***	-0.1842***	-0.1804***
$North$	-0.3525***	-0.3461***	-0.3584***
$Northeast$	-0.3577***	-0.3573***	-0.3758***
$South$	-0.3455***	-0.3281***	-0.3469***
R-squared	0.4835	0.4825	0.4820
Observation	94,469	188,977	183,626

Note: 1) OLS estimation is heteroskedastic-robust

2)*** represent the significance at 1%, ** represent the significance at 5%, and * represent the significance at 10%

Although there are 3 models (2016, 2017, and 2018), coefficients are quite similar and all are statistical significant. Accord with the human capital theory, the positive sign and statistical significant of coefficients of year of schooling (edu) and work experience (exp) mean that the additional year of schooling and work experience lead to an increase in average monthly income. However, the negative sign of the coefficient of squared work experience (exp^2) imply that the positive effect of work experience is diminishing as work experience increase. The return to additional years of schooling or the marginal private return of education is 8.64% – 8.74%, while the average return to additional years of experience or the marginal return of work experience is

approximately 1.8% - 1.9% and slightly decrease with additional year of work experience. (Table 5.17).

Table 5.17 Marginal Return of Work Experience

Years of Work Experience	2016	2017	2018
0	1.78%	1.75%	1.92%
10	1.70%	1.67%	1.72%
20	1.62%	1.59%	1.50%
30	1.54%	1.51%	1.32%

Several interesting results in Table 5.16 will briefly discuss here. On average, female earns less than male 8% - 9% which decrease from 16% - 17% in 2007 – 2010 (Tangtipongkul, 2015). Married workers earn more than other relationship status (single, divorce, separate, widow, and others) about 5.05% - 5.50%. Table 5.16 indicates the strong positive influence of municipal area on monthly earnings. Workers who live in the municipality gain 13% higher wages than those outside the municipality.

5.3.3 Corrected the Selectivity Bias

As discussed in section 4.2, estimating the human capital earnings function with OLS method that the sample include only workers and excluded those who inactive in labor market may lead to the selectivity bias. If there are some unobserved variables that significant relate to the probability of being the sample (wage employed or decide to work), the sample is not selected at random and the coefficient estimated from OLS will suffer from the selectivity bias.

To correct the possibility of selectivity bias, this study adopt the two-steps procedure suggested by Heckman (1979). Step one, estimate the inverse Mills ratio from probit model that describes the probability of being wage employment the factor that affect the probability of from all individual of the population. The estimation of pool data of 2016 – 2018 shows in Table 5.18.

Table 5.18 Probit Model Estimation

Variables	Coefficients	Marginal effects
Constant	-1.6083	-
age	0.1524***	0.0429***
age^2	-0.0021***	-0.0005***
edu	0.0418***	0.0118***
$dfemale$	-1.0282***	-0.2727***
$dmarriage$	-0.1358***	-0.0375***
$darea$	0.0085**	0.0024***
$dcentral$	0.0640***	0.0179***
$dnorth$	-0.0309***	-0.0088***
$dnortheast$	-0.2621***	-0.0787***
$dsouth$	-0.0729***	-0.0209***
$dhead$	0.3652***	0.0985***
observations	622,459	622,459
Prob > Chi12	0.0000	0.0000

Note: 1) *** represent the significance at 1%, ** represent the significance at 5%, and * represent the significance at 10%

The estimation in Table 5.18 shows that the likelihood of selected into sample (working and get wage) is increases with at a diminishing rate with age. Specifically, additional age raises the probability of being in sample is (percentage points):

$$\frac{\partial(P=1)}{\partial(age)} = [0.0429 - \{(2 \times 0.0005) \cdot age\} \times 100] \qquad (5.1)$$

Extra years of education increases the probability of being in sample approximately 1.18 percentage point. Female has less likelihood of being in sample than male by 27.27 percentage points. Married individual has less probability of being in sample by 3.75 percentage points. Geographic factors also significant affect the probability of being in the sample. Individual who lives in municipality has higher likelihood of being in

sample than living outside municipality by 0.24 percentage points. Individual who live in North, Northeast, and South regions has less probability of being in sample than those who live in Bangkok by 0.88, 7.87, and 2.09 percentage points, respectively. However, the individual who lives in Central region has likelihood to get in sample higher than those who live in Bangkok by 1.79 percentage points.

Step two, use information of Table 5.18 to calculate the inverse Mill ratio and put it as another independent variable in the human capital earnings function. The estimation shows in Table 5.19

Table 5.19 Two-Step Heckman's Procedure Estimation

Independent variables	**Heckman' two step procedures**	**Ordinary Least Squared (OLS)**
Constant	8.1595	8.2542
edu	0.0902***	0.0870***
exp	0.0239***	0.01825***
exp^2	-0.0002***	-0.00006***
$dfemale$	-0.1647***	-0.0862***
$dmarriage$	0.0400***	0.0528***
$darea$	0.1288***	0.1279***
$dcentral$	-0.1795***	-0.1847***
$dnorth$	-0.3540***	-0.3523***
$dnortheast$	-0.3839***	-0.3648***
$dsouth$	-0.3427***	-0.3390***
Inverse Mill's ratio (λ)	0.1934***	-
observations	622,459	467,072

Note: 1) OLS estimation is heteroskedastic-robust

2)*** represent the significance at 1%, ** represent the significance at 5%, and * represent the significance at 10%

Table 5.19 shows that the inverse Mill's ratio is positively statistical significant. It is mean that the error terms in the probit model and OLS model are positively related. In

other words, the unobserved variables that make individuals participate in the labor market is likely to be correlated with higher wages. In Heckman's procedures the coefficients of experience (exp) is larger than OLS method proximately 25% (0.0239 > 0.01825). In contrast, the coefficients of squared of work experience (exp^2) is more negative in Heckman's procedure than the OLS model (-0.0002 < -0.00006). The marginal return of work experience shows in Table 5.20 and Figure 5.6.

Table 5.20 Marginal Return of Work Experience

Years of Work Experience	Marginal return of work experience
0	2.39%
10	1.99%
20	1.59%
30	1.19%

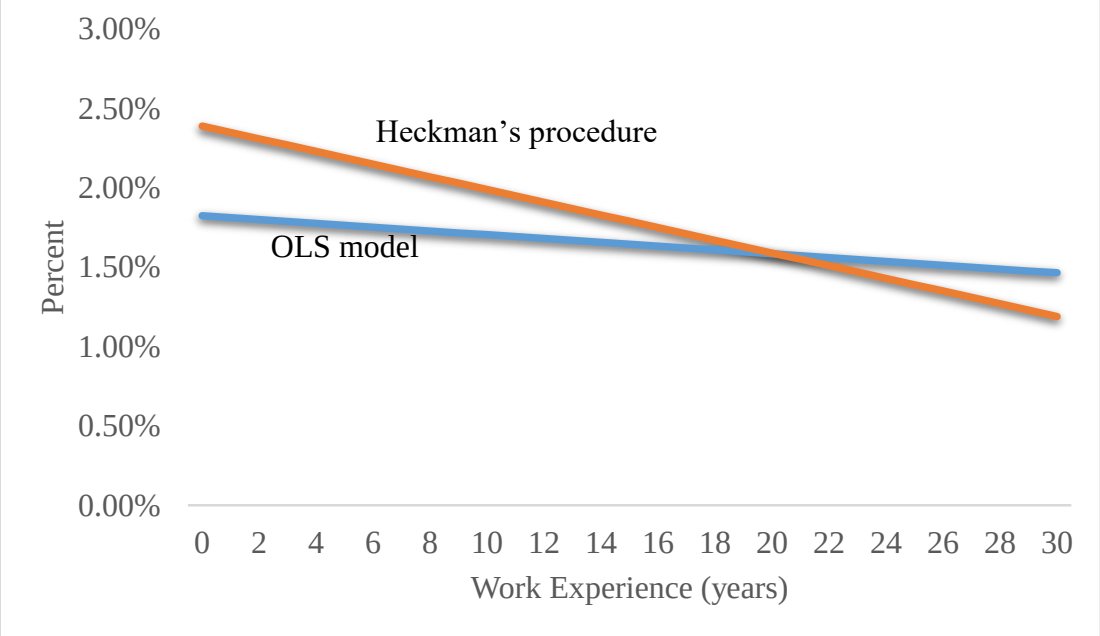

Figure 5.6 Marginal Return of Work Experience

Figure 5.6 illustrates OLS model is downward biased in coefficient of work experience and the marginal returns of work experience. The unbiased marginal return of work experience is higher than the case of OLS method and they are converged as the work experience increases.

5.4 Significant of Work Experience across Occupations

The effect of work experience on earnings as discussed above is the average effect of all occupations. However, each occupation has different job characteristics and skill or knowledge that are essential for work task. It implies that the informal on-the-job training as well as on-the-job training varies across occupations. Therefore, the effect of work experience on earning may be different across occupation. This study investigate the impact of work experience on various types of work by using the International Standard Classification of Occupation (ISCO) data (International Labour Office, 2012) to classify the occupation into three groups into three occupation groups: (1) high-skill occupation includes manager, professionals, and technicians and associate professionals, (2) semi-skill occupation includes clerical support workers, services and sale workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, and plant and machine operators and assemblers, (3) low-skill occupation include elementary occupations (e.g., office cleaners, agricultural laborers, transport and storage laborers) and estimate the human capital earnings function by OLS method. The estimation shows in Table 5.21.

Table 5.21 OLS Estimation across Occupational Groups

Variables	Coefficients		
	high-skill occupation	**semi-skill occupation**	**low-skill occupation**
Constant	7.5613	8.6477	8.9237
edu	0.1325***	0.0563***	0.0166***
exp	0.0275***	0.0099***	0.0107***
exp^2	-0.00004***	-0.00002***	-0.0002***
$dfemale$	-0.0578***	-0.1413***	-0.0543***
$dmarriage$	0.0363***	0.0443***	0.0563***
$darea$	0.1172***	0.1030***	0.0792**
$dcentral$	-0.1725***	-0.1400***	-0.2915***
$dnorth$	-0.2892***	-0.2998***	-0.5322***
$dnortheast$	-0.3362***	-0.3388***	-0.4807***
$dsouth$	-0.2816***	-0.3672***	-0.3276***
observations	116,491	255,758	94,823
R-squared	0.4871	0.3125	0.1498

Note: 1) OLS estimation is heteroskedastic-robust

2)*** represent the significance at 1%, ** represent the significance at 5%, and * represent the significance at 10%

Work experience is positively related to monthly wage with small diminishing effect and it is statistical significant at 1% level for all occupation groups. The return to work experience varies based on occupation groups. Additional year of work experience for novice workers in high-skill, semi-skill, and low-skill occupation are 2.75%, 0.99%, and 1.07%, respectively. The marginal return of work experience shows in Table 5.22 and Figure 5.7.

Table 5.22 Marginal Return of Work Experience across Occupational Groups

Years of Work Experience	high-skill occupation	semi-skill occupation	low-skill occupation
0	2.75%	0.99%	1.07%
10	2.67%	0.95%	0.67%
20	2.59%	0.91%	0.27%
30	2.51%	0.87%	-0.13%

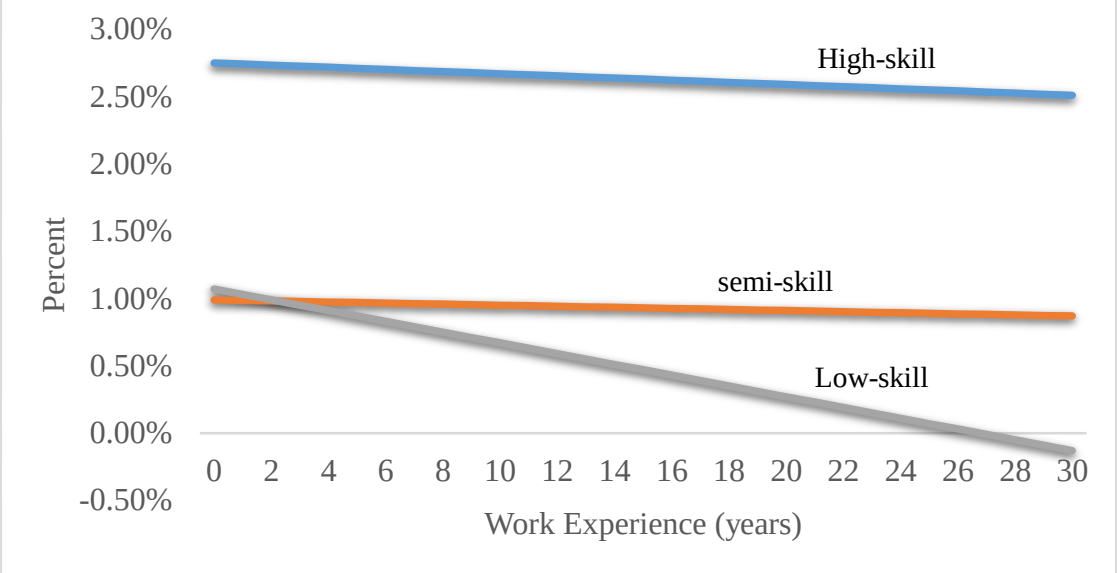

Figure 5.7 Marginal Return of Work Experience across Occupational Groups

As discussed earlier, the OLS estimation may suffer from selectivity bias if there are any unobservable variables that relate to both of the probability to working on the particular occupation and their earnings level. This study applies the generalization of Heckman's procedure proposed by Lee (1983) to correct the selectivity bias. Similar to the Heckman's procedure, it has two-step process, the first step is to set up the multinomial logit model to estimate the probability of observing the sample in each occupational groups. The second step, for each occupational group, calculate the

correcting term and includes it into the OLS regression model. The result shows in Table 5.23.

Table 5.23 Human Capital Earnings Function with Corrected Selectivity Bias

Variables	high-skill occupation	semi-skill occupation	low-skill occupation
Constant	7.7240	8.3190	8.7379
edu	0.1247***	0.0533***	0.0006
exp	0.0266***	0.0197***	0.0156***
exp^2	-0.00004***	-0.0003***	-0.0004***
$dfemale$	-0.0548***	-0.3497***	-0.0099***
$dmarriage$	0.0376***	0.0435***	0.0254***
$darea$	0.1179***	0.1160***	0.0612***
$dCentral$	-0.1698***	-0.1076***	-0.2754***
$dNorth$	-0.2869***	-0.3420***	-0.4866***
$dNortheast$	-0.3384***	-0.4093***	-0.4677***
$dSouthest$	-0.2787***	-0.3543***	-0.3334***
Correcting term	0.0405***	-0.4874***	-0.2216***

Note: (1) *, **, and *** is statistical significant at 10%, 5% and 1% respectively

The correcting term of all occupation groups are statistical significance. It implies that the unobserved factor that relates with earnings level is significantly correlated with the unobserved factor that determines the probability of selections into each occupational group. In other words, the coefficients in Table 5.21 are bias.

After fixing the selectivity bias by applying the procedure proposed by Lee (1983), the coefficient of work experience (exp) is slightly changed. It reduced from 0.0275 to 0.0266 for high-skill occupation. In contrast, for the case of semi-skill, it increases from 0.0099 to 0.0197 and from 0.0107 to 0.0156 for low-skill occupation.

The marginal return of work experience also slightly different from previous estimation. For high-skill occupation, an additional year of work experience of novice workers raise earnings by 2.66% and diminish 0.08 percentage point every ten years.

For semi-skill occupation, the marginal return of work experience in the initial year of work experience is 1.97% and decrease 0.6 percentage points every ten years. For low-skill occupation, the marginal return in the first year of work experience is 1.56% and diminishes 0.18 percentage point every ten years.

Table 5.24 Marginal Return of Work Experience with Corrected Selectivity Bias

Years of Work Experience	**high-skill occupation**	**semi-skill occupation**	**low-skill occupation**
0	2.66%	1.97%	1.56%
10	2.58%	1.37%	1.48%
20	2.50%	0.77%	1.40%
30	2.42%	0.17%	1.32%

CHAPTER 6

CONCLUSION AND POLICY IMPLICATION

6.1 Conclusion

The rapid demographic change to aging and aged population in Thailand leads to a decrease in labor force and concerns about the economic potential of country. Therefore, the study of the elderly who are able to work and analyze their economic significance fo work experience is important to public policy. This study treats the population age 50 – 69 year who are healthy and capable of working and stay outside the labor market as the potential elderly labor. The analysis of data from Thailand Labor Force Survey (LFS) show that Thailand has a lot of potential elderly labor because most of people outside the labor market are capable of working. Approximately 80% of people age 50 – 59 who stay outside labor market have capacity to perform a job because most of them are healthy and engaged in household work. The potential elderly labor of age 60 – 64 and age 65 – 69 is 57.36% and 37.81% respectively.

Most of potential elderly labor is female, approximately 81.00% of potential elderly labor is female. Among source of potential elderly labor (engaged in household work, voluntarily idle, and retired) those who are engaged in household work are highest (74.67%). Unfortunately, most of them have no formal education. However, approximately 20% of total potential elderly labor in age 60 – 69 had graduated at tertiary level.

This study also found that the experience - earnings profile of low education (0 – 9 years) is growing rapidly and approximately indifferent during first six years of work experience. But after that, average monthly income of 9 and 6 years of schooling has slowly growing and the earnings of uneducated workers slightly decline until they are retired. The clearly picture of positive effects of work experience on productivity can be found in the experience-earnings profile of the sample studied at least 12 years,

whose average monthly are growing steadily until they retired. This indicates that effects of experience on labor productivity has increases with education. This study divided occupations in to three groups base on the skill (high-skill, semi-skill, and low-skill occupation). For low-skill and middle-skill occupations, the experience – earnings profile is relatively flat. It means that work experience has a small effect on the earnings of this type of job except for the clerical support worker that slightly increases with experience. For the case of high-skill occupation, the experience-earnings profile is increases markedly with age. This indicates that the experience is very important for increasing productivity in jobs that require the skills and knowledge.

To study the impact of work experience on various types of job in more detail, this study estimates the human capital earnings function for each occupational groups by applies the generalization of two-steps Heckman's procedures to correct possibility of selectivity bias. The study found that work experience has highest positive impact on productivity in high-skill occupation. The marginal return of work experience of high-skill occupation for inexperienced workers is 2.66% and diminishes only 0.08 percentage points every ten years. For workers with 30 years of work experience, the additional year of work experience will gain 2.42% increase in wages. It confirms that work experience is very important for performance in high-skill occupations. The interesting is that the marginal return of experience of inexperience workers in semi-skill occupation is 1.97%, which is higher than 1.56% for the case of low-skill occupation. But the former has diminished 0.6 percentage point every ten years, which is more than the latter (decreased 0.18 percentage point every ten years). As a result, after 8 years of work experience, the marginal return of work experience of semi-skill occupation is lower than low-skill occupation and the marginal return of 30 years of experience workers is almost zero.

6.2 Discussion and Policy Implications

Since the potential elderly labor possess high level of human capital (work experience), they are in good position for the policymaker to introduce policies to encourage them to work for solving the problem of reduction in working age population in aging society. Although the potential elderly labor may require the adjustment of working schedules to supporting some deterioration of physical strength, they are still productive and contribute to economy. Phijaisanit (2015) calculate that if at least 50% of potential elderly labor to participate in the labor market, gross domestic product (GDP) will be higher than base case (no employment in potential elderly labor) around 4.74% - 9.35%.

Although Thailand has a lot of potential elderly labor, most of them have no formal education. This is may be an obstacle in promoting the work of the potential elderly labor because education is the important factor influencing the productivity of elderly (Teerawichitchainan, Prachuabmoh, & Knodel, 2019). However, the experience of the elderly also is the important factors affecting the productivity. This thesis found that the complementary between human capital from schooling and work experience. The experience-earnings profile shows that the work experience has clearly positive effect on the productivity (wages) of high educated person and high-skill occupation. These occupations do not require the physical strength but require skills/knowledge to solve the problem and make a decision. The employers can sustain productivity and avoiding severe mistake by putting the elder workers in a team of above occupations (Börsch-Supan & Weiss, 2008).

The policy suggestion base on this study is to develop the database of the elderly so that the policymakers and employers can use it in planning to providing work incentives and appropriate matching between labor demand and labor supply as well as appropriate matching between a job and their knowledge, experience and physical condition. Suitable jobs for the elderly is jobs that do not rely on physical strength but rely on knowledge, skills, and experience such as high-skill and semi-skill occupation. Providing the necessary skills sets and knowledge by training is another important policy to increase productivity and employment opportunities, especially for low educated person and working in the semi-skill and low-skill occupation.

6.3 Limitations of the Study

This study quantifies the potential contribution of Thai elderly with an emphasize on their health status and work experience. This study has some limitations which should be discussed as follows:

6.3.1 Work Experience Measurements

In this study, because of the data limitation, work experience refers to the potential work experience which is calculate by age of worker minus years of schooling and six. The potential work experience base on three assumptions: (1) schooling begins at the age of six, (2) all workers start their job immediately, and (3) the quality of education does not different. The adoption of different measurement of work experience such as tenure, the expected work experience could improve the result of study.

6.3.2 Scope of Data

This study use pool data between 3rd quarter of 2016 to 4th quarter of 2018. Therefore, the findings of this study is specific to this particular period. The short period of data probably leads to lack of dynamic and evolution of the impact of work experience. The adoption of longer period of data or longitudinal data could improve the findings of this study.

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