

Rates of Return to Schooling in Thailand

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Using 2007–2010 data from Thailand's National Labor Force Survey, this paper examines the rates of return to schooling. The Mincer-type rate of return to investment in schooling was estimated. The rates of return to schooling for work experience are significantly positive, but at a decreasing rate. Region of residence and variation in gross provincial product per capita are significant factors in determining the private rate of return. The rates of return to schooling by type of industry reveal higher earnings in mining, utilities, construction, manufacturing, and services than in agriculture. The private and social returns on vocational secondary education attainment are greater than on general secondary education. Finally, the private returns on university attainment for women exceed men by about 1.5 percentage points.

Keywords: education, education policy, social rates of return to schooling, Thailand

JEL codes: I20, I21, I28

I. Introduction

This paper addresses the rate of return to formal education in Thailand. Human capital investment is essential to turn technical change and physical capital investment into productivity gains (Schultz 1975, Rosenzweig 1995, McMahon 1999). Progress in the Thai economy has shifted from agriculture to manufacturing and services (Krongkaew 1995; Krongkaew, Chamnivickorn, and Nitithanprapas 2006). In 1960, 82.3% of the Thai population was engaged in agriculture, while only 17.7% were engaged in nonagriculture activities in the manufacturing and services sector. In contrast, more than 50% of the labor force has been employed outside agriculture since 2000 (Table 1, Figure 1). Economic growth and restructuring have fundamentally changed the Thai labor force. The increasing demand for labor in the manufacturing and services sectors will require workers to gain more human capital. Workers need to apply knowledge and specific skills to perform tasks in nonagriculture sectors. Several studies have been done on the returns to education in Thailand. Amornthum and Chalamwong (2001) find that every additional year of education after the upper primary level leads to an increase in earnings, with males

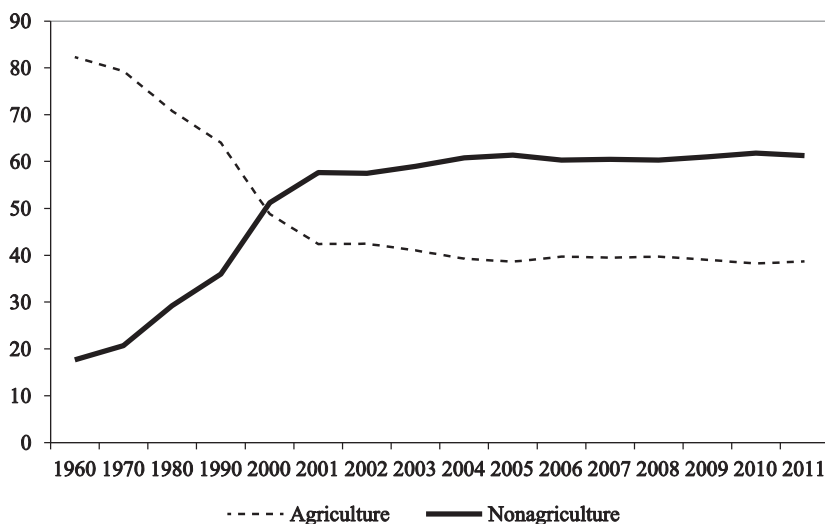
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Table 1. Sectoral Shares of Employment (%)

	1960	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Agriculture	82.3	79.3	70.8	64	48.8	42.40	42.47	41.02	39.26	38.6	39.7	39.5	39.7	39.0	38.2	38.7
Nonagriculture	17.7	20.7	29.2	36	51.2	57.60	57.53	58.98	60.74	61.4	60.3	60.5	60.3	61.0	61.8	61.3

Sources: Adapted from Krongkaew, M. and N. Kakwani, 2003. The Growth–Equity Trade-Off in Modern Economic Development: The Case of Thailand. *Journal of Asian Economics*, 14 (5), pp. 735–57; Tinakorn, P. 2002. Income Inequalities during Four Decades of National Development: 1961–2001. *Thammasat Economic Journal*, 20 (2/3), pp. 141–208; Figures for 2001–2011 are from the Government of Thailand, National Statistical Office. <http://web.nso.go.th/>

Figure 1. Sectoral Shares of Employment



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usually receiving higher returns than females. Hawley (2004) finds that completing an additional year of schooling provides an additional 11%–12% of monthly log earnings for both men and women. The impact of an additional year of schooling for urban residents is higher than for rural residents (Warunsiri and McNown 2010, Hawley 2004). Hawley (2003) and Moenjak and Worswick (2003) find that vocational secondary education provides higher earnings returns than general secondary education. Mehta et al. (2013) reveal that high-skilled services helped to lift college returns moderately in Thailand. Furthermore, Mehta et al. (2011) find little evidence of overeducation in unskilled jobs in Thailand. There is still limited evidence to answer the following questions: If students decide not to continue to higher education, which option between vocational education or general education will give higher private and social returns? And, if students decide to continue higher education, what are the private and social returns on a university degree?

This study's objective is to investigate the rates of return to schooling in Thailand based on a Mincerian earnings function. The empirical results suggest that schooling has a positive and significant impact on private and social returns to schooling. Secondary vocational education gives much higher private and social returns to schooling than secondary general education. However, after secondary education, evidence shows that completing higher education (e.g., bachelor's degree) gives private returns of 37.2% and social returns of 21.3%. These findings call into question the belief that aggregate demand for the college-educated increases rapidly.

Table 2. Level of Education—Description and Goal

Level of Education	Description
Pre-elementary	<ul style="list-style-type: none"> • A 2- or 3-year course in public or private pre-elementary school • Aims to nurture and prepare physical, mental, intellectual, and emotional skills of students for their elementary education
Elementary	<ul style="list-style-type: none"> • Grades 1–6 • Emphasizes basic literacy, numerical skills, and the cultivation of desirable behavior
Lower secondary	<ul style="list-style-type: none"> • Grades 7–9 • Allows students to explore their needs, areas of interests, and aptitudes; enables them to meet the demands of appropriate careers
Upper secondary	<ul style="list-style-type: none"> • Grades 10–12 • Aims to prepare students to meet labor market needs and promote their entrepreneurial skills through <ul style="list-style-type: none"> ➤ vocational and technical colleges for students with such skills, or ➤ academic colleges offering a general education
Diploma	<ul style="list-style-type: none"> • 1–4 years of study for students who have completed upper-secondary education • Aims to develop learners' knowledge and vocational skills at the semiskilled level, and enable them to initiate entrepreneurial activities
Undergraduate	<ul style="list-style-type: none"> • A 4-year course with some exceptions (e.g., architecture and medical science require 5–6 years of study; students who have received a diploma and passed an entrance examination can take a 2-year course to pursue at higher technological and educational institutions) • Aims to develop students' abilities to apply theories toward the country's development and capacity to meet international challenges
Graduate	<ul style="list-style-type: none"> • 1–3 years of study at the graduate diploma, master's degree, or doctoral degree levels • stimulates specialization and bringing theories into practice; focuses on the learners' perspective in looking at the world and improving the country's international competitiveness

Source: Government of Thailand, Ministry of Education. <http://www.moe.go.th/moe.html>

The paper is organized as follows. Section II discusses Thailand's educational system, policies, and planning. Section III gives an overview of the data. Section IV describes the empirical strategy. Section V discusses empirical results. Section VI highlights the policy implications and concludes.

II. Background on Thailand's Education System, Policies, and Planning

A. Thailand's Education System

Formal education in Thailand—which is based on the National Education Act, 1999 (revised 2002) and the Compulsory Education Act, 2002—is divided into two levels: basic and higher education. Basic education includes pre-elementary, elementary, and secondary levels. Higher education, or postsecondary education, includes diploma and degree levels. Table 2 presents goals and a description for each level of education. The pre-elementary level is a 2- or 3-year course that aims

Table 3. Number of Students Enrolled by Level of Education

Level of Education	Number of Students		
	2007	2008	2009
Pre-elementary	1,754,371	1,772,439	1,771,351
Elementary	5,561,937	5,342,794	5,166,379
Lower secondary	2,790,837	2,786,819	2,786,067
Upper secondary general	1,176,484	1,204,321	1,256,572
Secondary vocational	772,305	766,925	750,646
Higher vocational certificate	346,880	360,774	364,679
Diploma	23,569	23,509	22,836
Undergraduate degree	1,802,672	1,827,044	1,831,141
Graduate diploma	18,036	20,168	20,168
Master's degree	181,634	178,309	178,471
Higher graduate diploma	764	2,364	2,364
Doctorate degree	16,202	16,247	16,247
Total	14,447,698	14,303,721	14,168,930

Note: Data as of 10 June each year.

Source: Government of Thailand, Ministry of Education. <http://www.moe.go.th/moe.html>

to develop physical, mental, intellectual, and emotional skills among students. The elementary level is a 6-year course emphasizing basic literacy and numerical skills, and cultivating desirable behavior. The lower-secondary level is a 3-year course allowing students to explore their needs and areas of interest, and enabling them to meet the demands of appropriate careers. The upper-secondary level is a 3-year course, comprising either vocational or general education, aiming to prepare students for the labor market. Mandatory schooling includes the pre-elementary level to the upper-secondary level. Higher education includes diploma, undergraduate, and graduate programs. A diploma program is 1–4 years of study aiming to develop knowledge and vocational skills (semiskilled level), and enable students to initiate entrepreneurial activities. An undergraduate degree offers 4–6 years of study aiming to develop students' abilities by encouraging them to apply theories in practice toward the country's development. A graduate degree offers 1–3 years of study focusing on learners' broader perspectives of the world in order to improve the country's international competitiveness.

Table 3 shows the number of students enrolling in each level of education in 2007–2009. The number of students enrolling increases at the upper-secondary general level, mainly resulting from the government's 15-Year Free Education with Quality Policy launched in 2009. The number of students enrolling in higher education, including undergraduate degrees and higher vocational certificate programs, also increases due to the availability of student loan program and access to private universities.

B. Thailand's Education Policies and Planning

Thailand's education reform started in 1999. The National Education Act, 1999 was implemented during the first phase of education reform, which mandated

children aged 7 years old to enroll in primary and secondary education until they turn 16 years old or complete Grade 9. In 2009, implementation of the 15-Year Free Education with Quality Policy was initiated to lessen the financial burden of parents as well as to stimulate the economy. Students are provided with education from kindergarten through Grade 12, including general and vocational education. The policy covers tuition fees and expenses for books, utensils, uniforms, school equipment, and extracurricular activities. The second phase of education reform was implemented between 2010 and 2012. The investment plans under the second stimulus package of education included 11 projects: (i) teacher quality improvement, (ii) education support, (iii) modernized vocational education, (iv) transformation of Thailand into an education hub in Southeast Asia, (v) investment in education and general sciences and mathematics, (vi) school improvement, (vii) boosting moral and “Thai-ness” for the sustainable development of Thai children, (viii) school quality standardization, (ix) promotion of university research and national research universities, (x) education reform, and (xi) capacity building of internal sectors of the Ministry of Education.

III. Data and Sample

This study is based on 2007–2010 data from Thailand’s National Labor Force Survey conducted by the National Statistical Office. The sample is drawn randomly from different households throughout the country. Each year of the survey consists of four quarterly sets of data: (i) January–March (dry or nonagricultural season), (ii) April–June (the period in which a large group of new workers enter the labor force after graduation), (iii) July–September (rainy and agricultural season), and (iv) October–December. The measure of education collected in the data relates to the level of education the respondent has completed. Because of the focus on private returns to education in this paper, only individuals who studied in the general or vocational education system and reported their monthly salary are included in the analysis. Those who are in religious schools are excluded. The analysis is limited to individuals aged 16–60 years at the time of the survey. The sample is further restricted to individuals who work as employees in either the government, a state enterprise, or a private sector business; individuals classified as employers or self-employed, or those whose work is restricted to household work were excluded. The data includes information gathered from (i) 209,999 individuals in 2007, (ii) 210,810 individuals in 2008, (iii) 209,260 individuals in 2009, and (iv) 191,593 individuals in 2010.

Variable names, means, and standard deviations are summarized in Table 4. The dependent variable for the estimation is the log of monthly earnings. Monthly earnings are the summation of monthly salary, average monthly bonus, and additional earnings each month. The explanatory variables include geographic region,

Table 4. Descriptive Statistics of Dependent and Explanatory Variables

Variable	Description	2007 Mean (Standard Deviation)	2008 Mean (Standard Deviation)	2009 Mean (Standard Deviation)	2010 Mean (Standard Deviation)
Sample size (N)		209,999	210,810	209,260	191,593
Dependent variables					
Log earnings	Natural logarithm of monthly earnings	8.86 (0.84)	8.92 (0.83)	8.92 (0.83)	8.97 (0.79)
Explanatory variables					
Bangkok ^ψ	Living in Bangkok (yes = 1, no = 0)	0.08 (0.28)	0.09 (0.28)	0.09 (0.28)	0.08 (0.27)
North ^ψ	Living in the northern region (yes = 1, no = 0)	0.18 (0.39)	0.18 (0.39)	0.18 (0.39)	0.18 (0.39)
Northeast ^ψ	Living in the northeast region (yes = 1, no = 0)	0.18 (0.39)	0.18 (0.38)	0.18 (0.38)	0.18 (0.39)
South ^ψ	Living in the southern region (yes = 1, no = 0)	0.16 (0.37)	0.16 (0.37)	0.16 (0.37)	0.17 (0.37)
Municipal ^ψ	Living in a municipal area (yes = 1, no = 0)	0.66 (0.47)	0.65 (0.48)	0.65 (0.48)	0.65 (0.48)
Log gross provincial product per capita	Natural logarithm of gross provincial product per capita	11.49 (0.85)	11.57 (0.85)	11.59 (0.79)	11.69 (0.77)
Divorced, Widowed, or Separated ^ψ	Marital status (divorced, widowed, or separated = 1, otherwise = 0)	0.07 (0.26)	0.08 (0.27)	0.08 (0.27)	0.08 (0.28)
Married ^ψ	Marital status (married = 1, otherwise = 0)	0.68 (0.47)	0.67 (0.47)	0.67 (0.47)	0.66 (0.47)
Male ^ψ	Gender (male = 1, otherwise = 0)	0.53 (0.50)	0.54 (0.50)	0.53 (0.50)	0.53 (0.50)
Years of schooling	Years of schooling	9.81 (4.91)	9.89 (4.93)	9.96 (4.94)	10.03 (4.93)
Primary education level ^ψ	Education level (Finished primary education level = 1, otherwise = 0)	0.19 (0.39)	0.19 (0.39)	0.18 (0.39)	0.19 (0.39)
Lower secondary education level ^ψ	Education level (Finished lower secondary education level = 1, otherwise = 0)	0.15 (0.35)	0.15 (0.35)	0.15 (0.36)	0.15 (0.36)
Upper secondary education level ^ψ	Education level (Finished upper secondary education level = 1, otherwise = 0)	0.10 (0.30)	0.10 (0.30)	0.10 (0.30)	0.11 (0.31)
Higher vocational education level ^ψ	Education level (Higher vocational certificate = 1, otherwise = 0)	0.06 (0.24)	0.06 (0.24)	0.06 (0.24)	0.06 (0.24)

Continued.

Table 4. *Continued.*

Variable	Description	2007 Mean (Standard Deviation)	2008 Mean (Standard Deviation)	2009 Mean (Standard Deviation)	2010 Mean (Standard Deviation)
Diploma ^ψ	Education level (diploma = 1, otherwise = 0)	0.003 (0.06)	0.003 (0.06)	0.003 (0.05)	0.003 (0.06)
Bachelor ^ψ	Education level (bachelor's degree = 1, otherwise = 0)	0.21 (0.41)	0.21 (0.41)	0.22 (0.41)	0.22 (0.41)
Master or higher ^ψ	Education level (Master's degree or higher = 1, otherwise = 0)	0.03 (0.16)	0.03 (0.17)	0.03 (0.18)	0.03 (0.18)
Experience	Years of working experience	21.21 (12.27)	21.39 (12.33)	21.65 (12.45)	21.64 (12.52)
Experience squared	Years of working experience squared	600.42 (587.33)	609.51 (592.39)	623.69 (603.34)	624.93 (607.90)
Public ^ψ	Working in the public sector (public sector = 1, otherwise = 0)	0.26 (0.44)	0.26 (0.44)	0.26 (0.44)	0.26 (0.44)
State enterprise ^ψ	Work in the state-enterprise sector (state enterprise = 1, otherwise = 0)	0.02 (0.16)	0.03 (0.16)	0.02 (0.16)	0.02 (0.15)
Legislator ^ψ	Occupation 1 (legislator, senior official, or manager = 1, otherwise = 0)	0.03 (0.18)	0.03 (0.18)	0.03 (0.18)	0.03 (0.18)
Professional ^ψ	Occupation 2 (professional = 1, otherwise = 0)	0.13 (0.33)	0.13 (0.33)	0.13 (0.33)	0.13 (0.33)
Technician ^ψ	Occupation 3 (technician or associated professional = 1, otherwise = 0)	0.09 (0.29)	0.09 (0.29)	0.09 (0.29)	0.09 (0.28)
Clerk ^ψ	Occupation 4 (clerk = 1, otherwise = 0)	0.09 (0.28)	0.09 (0.28)	0.09 (0.29)	0.09 (0.29)
Service workers ^ψ	Occupation 5 (service workers and shop or market sales worker = 1, otherwise = 0)	0.07 (0.25)	0.07 (0.25)	0.07 (0.26)	0.07 (0.26)
Skilled agricultural ^ψ	Occupation 6 (skilled agricultural or fishery worker = 1, otherwise = 0)	0.06 (0.23)	0.06 (0.24)	0.06 (0.24)	0.06 (0.23)
Craft ^ψ	Occupation 7 (craft and related trade worker = 1, otherwise = 0)	0.16 (0.37)	0.16 (0.37)	0.16 (0.37)	0.16 (0.37)

Continued.

Table 4. *Continued.*

Variable	Description	2007 Mean (Standard Deviation)	2008 Mean (Standard Deviation)	2009 Mean (Standard Deviation)	2010 Mean (Standard Deviation)
Machine operator ^ψ	Occupation 8 (plant and machine operator or assembler = 1, otherwise = 0)	0.13 (0.34)	0.13 (0.34)	0.13 (0.33)	0.13 (0.33)
Agriculture ^ψ	Industry 1 (agriculture, including fishing, hunting, and forestry = 1, otherwise = 0)	0.11 (0.31)	0.11 (0.32)	0.12 (0.32)	0.11 (0.31)
Mining ^ψ	Industry 2 (mining and quarrying = 1, otherwise = 0)	0.002 (0.05)	0.003 (0.05)	0.002 (0.05)	0.003 (0.05)
Utilities ^ψ	Industry 3 (utilities = 1, otherwise = 0)	0.01 (0.09)	0.01 (0.09)	0.01 (0.09)	0.01 (0.09)
Construction ^ψ	Industry 4 (construction = 1, otherwise = 0)	0.10 (0.30)	0.10 (0.29)	0.10 (0.29)	0.10 (0.30)
Low-skill manufacturing ^ψ	Industry 5 (low-skilled manufacturing = 1, otherwise = 0)	0.14 (0.35)	0.13 (0.34)	0.13 (0.34)	0.13 (0.33)
High-skill manufacturing ^ψ	Industry 6 (high-skilled manufacturing = 1, otherwise = 0)	0.09 (0.29)	0.09 (0.29)	0.09 (0.29)	0.09 (0.29)
Low-skill services ^ψ	Industry 7 (low-skilled services = 1, otherwise = 0)	0.21 (0.41)	0.21 (0.41)	0.22 (0.41)	0.22 (0.41)
High-skill services ^ψ	Industry 8 (High-skilled services = 1, otherwise = 0)	0.34 (0.47)	0.34 (0.47)	0.34 (0.47)	0.34 (0.47)
Quarter 2 ^ψ	Quarter 2 dataset	0.25 (0.43)	0.25 (0.43)	0.25 (0.43)	0.28 (0.45)
Quarter 3 ^ψ	Quarter 3 dataset	0.24 (0.43)	0.25 (0.43)	0.24 (0.43)	0.18 (0.38)
Quarter4 ^ψ	Quarter 4 dataset	0.25 (0.43)	0.25 (0.43)	0.25 (0.43)	0.27 (0.44)

Source: Author's computations.

gross provincial product (GPP) per capita, gender, marital status, education level, type of occupation, type of industry, and years of experience. Geographic region is generated as a dummy variable and classified into four groups: (i) Bangkok, (ii) north, (iii) northeast, and (iv) south. There are 76 provinces in Thailand and each province is divided into municipal and nonmunicipal areas. An area of residence

dummy variable is equal to 1 for a municipal area and 0 for a nonmunicipal area. GPP per capita is included to account for economic variation among provinces. GPP is defined as the sum of what accrues to the various factors of production present in a given economy for their part in the productive process that leads to the final market value of a good or service. A dummy variable has been introduced for the gender of the respondent and is equal to 1 for a male and equal to 0 otherwise. A marital status variable was included in anticipation that married individuals were more motivated, worked harder, and earned higher incomes (Byron and Manaloto 1990). Marital status is generated as a dummy variable and classified into two groups: (i) married; and (ii) divorced, widowed, or separated. Education level is generated as a dummy variable and classified into eight groups: (i) primary education, (ii) lower general secondary education, (iii) upper general secondary education, (iv) vocational certificate, (v) higher vocational certificate, (vi) diploma, (vii) bachelor's degree, and (viii) higher than bachelor's degree. Type of occupation is used to capture the work characteristics' effect and is generated as a dummy variable and classified into nine groups: (i) legislators, senior officials, and managers; (ii) professionals; (iii) technicians and associated professionals; (iv) clerks; (v) service workers and shops and market sales workers; (vi) skilled agricultural and fishery workers; (vii) craft and related trades workers; (viii) plant and machine operators and assemblers; and (ix) elementary occupations. Type of industry is generated as a dummy variable and classified into eight industries according to the definitions of Mehta et al. (2013) and shown in Table 5. These include (i) agriculture, (ii) mining, (iii) utilities, (iv) construction, (v) low-skill manufacturing, (vi) high-skill manufacturing, (vii) low-skill services, and (viii) high-skill services. Sector of work is generated as a dummy variable and classified into three sectors: (i) public, (ii) state enterprise, and (iii) private. Actual years of experience of current and previous jobs are not reported. The potential years of experience variable is generated as a proxy and defined as the age reported at the time of the survey minus the age at time of leaving school minus 6 years. Thus, potential years of working experience is calculated by the following equation:

$$\begin{aligned} \text{years of working experience} &= \text{age reported at the time of survey} \\ &\quad - \text{age at time of leaving school} - 6 \text{ years} \end{aligned}$$

Experience squared is included in the model to reflect that the life cycle of earnings is not a linear pattern of growth (Mincer 1974).

IV. Empirical Strategy and Methodology

The ordinary least squares method was used to describe factors associated with the returns to schooling. The following regression allows an estimate to be

Table 5. **Classification by Industry**

Sector	Description
Agriculture	(i) Agriculture (ii) Fishing (iii) Hunting (iv) Forestry
Mining	(i) Mining (ii) Quarrying
Utilities	(i) Electricity (ii) Water supply (iii) Gas
Construction	
Low-skill manufacturing	(i) Food products (ii) Tobacco (iii) Textiles (iv) Footwear (v) Apparel (vi) Nonwearing textile products (vii) Wood and cork products (viii) Furniture and fixtures (ix) Leather and fur products not for wearing (x) Rubber products (xi) Petroleum products (xii) Other nonmetallic mineral products (xiii) Metal products, excluding machines (xiv) Transport equipment (xv) Miscellaneous
High-skill manufacturing	(i) Paper and paper products, printing, publishing (ii) Chemicals and chemical products (iii) Basic metals (iv) Machinery (v) Electrical machinery (vi) Medical and scientific equipment (vii) Photographic and optical products (viii) Watches and clocks
Low-skill services	(i) Retail trade (ii) Transportation (iii) Personal and household services (iv) Hotels and restaurants (v) Wholesale trade (vi) Recreational and cultural and cultural services (vii) Warehousing (viii) Sanitary and similar activities
High-skill services	(i) Public administration and defense (ii) Education, scientific, and research (iii) Health and medical services (iv) Social work and other social and community services (v) Communications (vi) Financial intermediation (vii) Real estate (viii) Business activities, including renting (ix) Insurance

Sources: Government of Thailand, National Statistical Office 2001–2011; Mehta et al. 2013.

made of the monetary return by completed schooling level separate from the effect of postschool experience and other individual characteristics. The log earnings is a function of years of schooling, years of experience, and years of experience squared, as shown in equation (1). The regressions are based on Mincer (1974):

$$\ln W_i = \gamma_1 + \gamma_2 Yrs\ of\ schooling_i + \beta_4 E_i + \beta_4 E_i^2 + u_i \tag{1}$$

where $\ln W_i$ is the log of monthly earnings of individual i , $Yrs\ of\ schooling_i$ represents years of schooling of individuals, E_i is a potential year of working experience of individual i , E_i^2 is a potential year of working experience squared, and u_i is the random disturbance term.

An extended earnings function which replaces *Year of schooling_i* with levels of schooling and individual characteristics is shown in equation (2):

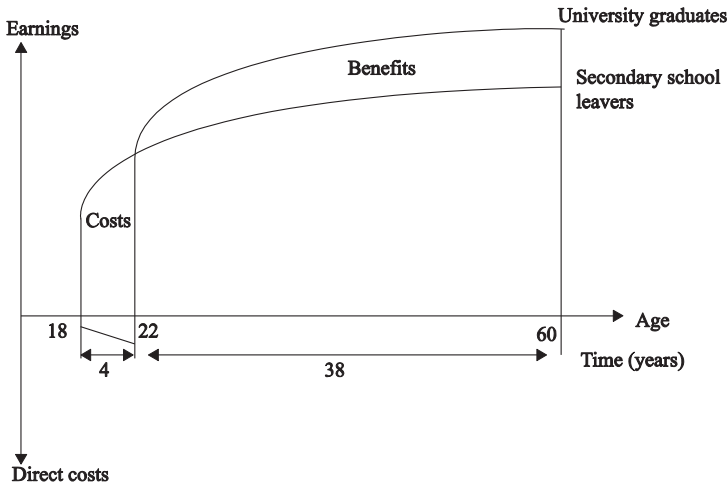
$$\ln W_i = \beta_1 + \beta_2 X_i + \beta_3 S_i + \beta_4 E_i + \beta_4 E_i^2 + u_i \tag{2}$$

where $\ln W_i$ is the log of monthly earnings of individual i , X_i represents a vector of background characteristics of individuals and control variables, S_i is a vector of completion of education attainment level of individual i , E_i is a potential year of working experience of individual i , E_i^2 is a potential year of working experience squared, and u_i is the random disturbance term. Experience is included to adjust the education coefficients for the impact of work experience in the labor market (Griliches 1977). All regression models are fitted by methods that generate White’s standard errors, which account for potential failures of the assumption of residual heteroscedasticity. Sampling weights are included in the estimation of all models.

The internal rate of return of education is estimated in terms of both private and social rate of returns. The private rate of return is used to describe the demand for education and assess the equity effects of public education expenditures (Psacharopoulos 1994, 1995). On the other hand, the social rate of return reviews the costs and benefits of the education investment from the government’s viewpoint (Psacharopoulos 1994, 1995). Psacharopoulos (1995) states that a key assumption in a social rate of return calculation is that observed wages are a good proxy for the marginal product of labor, especially in a competitive economy using data from the private sector of the economy. The first method to compute the private rate of return to an investment in a given level of education is finding the rate of discount (r) that equalizes the stream of discounted benefits to the stream of costs at a given point in time as shown in equation (3):

$$\sum_{t=1}^{38} \frac{(W_U - W_S)_t}{(1+r)^t} = \sum_{t=1}^4 (W_S - C_U)_t (1+r)^t \tag{3}$$

Figure 2. Stylized Age–Earnings Profiles



Source: Adapted from Psacharopoulos, G. 1995. The Profitability of Investment in Education: Concepts and Methods. Human Capital Development and Operations Policy Working Paper No. 15280. Washington, DC: World Bank.

where $W_U - W_s$ is the earnings differential between a university graduate (subscript U) and a secondary general school graduate (subscript s , the control group), C_U represents the direct costs of university education (e.g., tuition, fees, books), and W_s denotes the student’s foregone earnings or indirect costs (Psacharopoulos 1995). Figure 2 illustrates the stylized age–earning profiles between university graduates and secondary school leavers. Psacharopoulos (1995) stated that the main computation difference between private and social rates of return is that, for a social rate of return calculation, the costs include the government’s large spending on education such as professorial salaries and the rental of buildings.

The second method is the shortcut method to approximate the private returns to education based on Psacharopoulos (1995):

$$private\ r = \frac{\bar{W}_U - \bar{W}_s}{4(\bar{W}_s)} \tag{4}$$

where \bar{W} refers to the mean earnings of an individual with the subscripted education level, \bar{W}_U is the mean earnings of an individual with a university education, \bar{W}_s is the mean earnings of an individual with a general secondary education, and 4 years is the length of the university cycle. The social rate of return in this case is shown in equation (5):

$$social\ r = \frac{\bar{W}_U - \bar{W}_s}{4(\bar{W}_s + C_U)} \tag{5}$$

where C_U is the annual direct cost of university education.

Table 6. Mincer-Type Returns to Education

Explanatory Variable	Log Monthly Earnings			
	2007	2008	2009	2010
Constant	6.8274*** (0.0098)	6.8884*** (0.0098)	6.8628*** (0.0093)	6.9836*** (0.0098)
Years of schooling	0.1376*** (0.0005)	0.1337*** (0.0005)	0.1322*** (0.0005)	0.1263*** (0.0006)
Experience	0.0501*** (0.0007)	0.0503*** (0.0006)	0.0514*** (0.0006)	0.0506*** (0.0006)
Experience squared	-0.0006*** (0.00001)	-0.0006*** (0.00001)	-0.0006*** (0.00001)	-0.0006*** (0.00001)
Number of observations	209,999	210,810	209,260	191,593
R-squared	0.4497	0.4577	0.4601	0.4575

Notes: Robust standard errors in parentheses. *** = significant at 1% level, ** = significant at 5% level.
Source: Author's computations.

V. Empirical Results

Table 6 gives means of the regression coefficient on years of schooling in a semilog earnings function from equation (1). These figures are interpreted as private returns to the typical year of education. The private returns on average are 13.8%, 13.4%, 14.2%, and 12.6% in 2007, 2008, 2009, and 2010, respectively. The rates of return to schooling for work experience were significantly positive, but at a decreasing rate. Table 7 gives means of the regression coefficient on levels of schooling in a semilog earnings function from equation (2) without control variables. An extended earnings function method (Psacharopoulos 1995) is fitted in the data set, where the educational variable enters as a set of education dummy variables, the set of rates of return to investment in the different levels of education reported in Table 8. The rate of return to investment in primary education in 2010 is only 1.8%. The rate of return to investment in secondary vocational education is higher than secondary general education. The rate of return to investment in a bachelor's degree in 2010 remained high at 20.8%.

The full estimated earnings regression functions from equation (2) are shown in Table 9. Earnings functions are estimated by regressing the log of monthly earnings on a vector of education dummies, regional residence, area of residence, GPP per capita, gender, marital status, type of occupation, type of industry, work experience, and work experience squared. In order to capture differences in rates of pay across regions, the model included region of residence and area of residence. Individuals in Bangkok earn on average about 2% more than individuals in the central region. Residents in the northern and northeastern regions earn on average about 10% less than residents in the central region. Per capita household income generally grew faster in the capital city and much more gradually in the northern and northeastern region between the late 1980s and the early 1990s, according to Thailand's

Table 7. **Determinants of Earnings (dependent variable: log monthly earnings)**

Explanatory Variable	Log Monthly Earnings			
	2007	2008	2009	2010
Constant	8.2439*** (0.0049)	8.3047*** (0.0051)	8.3176*** (0.0049)	8.4071*** (0.0049)
Education attainment				
Primary education	0.1403*** (0.0070)	0.1319*** (0.0070)	0.1175*** (0.0066)	0.1065*** (0.0069)
Lower secondary	0.3549*** (0.0076)	0.3223*** (0.0076)	0.2881*** (0.0074)	0.2698*** (0.0072)
Upper secondary	0.5098*** (0.0088)	0.4754*** (0.0084)	0.4373*** (0.0079)	0.4071*** (0.0083)
Secondary vocational	0.8165*** (0.0117)	0.7445*** (0.0114)	0.6937*** (0.0122)	0.6442*** (0.0127)
Higher vocational	0.9015*** (0.0099)	0.8494*** (0.0103)	0.8112*** (0.0096)	0.7586*** (0.0096)
Diploma	0.9417*** (0.0508)	0.8324*** (0.0503)	0.8667*** (0.0442)	0.8014*** (0.0470)
Bachelor's	1.3888*** (0.0071)	1.3404*** (0.0071)	1.2997*** (0.0070)	1.2371*** (0.0072)
Master's or higher	2.0688*** (0.0147)	1.9743*** (0.0122)	1.9650*** (0.0119)	1.8829*** (0.0147)
Number of observations	209,999	210,810	209,260	191,593
R-squared	0.4071	0.4152	0.4145	0.4101

Notes: Robust standard errors in parentheses. *** = significant at 1% level, ** = significant at 5% level.
Source: Author's computations.

Table 8. **Returns to Education in Thailand: Extended Earnings Function Method (%)**

Education Level	2007	2008	2009	2010
Primary	2.3	2.2	1.9	1.8
Secondary (General)	6.2	5.7	5.3	5.0
Secondary (Vocational)	11.3	10.2	9.6	8.9
Bachelor's	21.9	21.6	21.6	20.8

Note: Computations are based on extended earnings function method described in Psacharopoulos, G. 1995. *The Profitability of Investment in Education: Concepts and Methods*. Human Capital Development and Operations Policy Working Papers No. 15280. Washington, DC: World Bank.

Household Socio-Economic Surveys conducted by the National Statistical Office (Krongkaew 1993, Krongkaew and Kakwani 2003). Residents in municipal areas earn about 8% more than residents living in nonmunicipal areas. GPP per capita is included to account for economic variation among provinces. GPP is defined as the sum of what accrues to the various factors of production present in a given economy for their part in the productive process that leads to the final market value of a good or service. In 2010, an increase in log GPP per capita by 10% on average would increase monthly earnings by 1.5%.

Table 9. Determinants of Earnings (dependent variable: log monthly earnings)

Explanatory Variable	Log Monthly Earnings			
	2007	2008	2009	2010
Constant	5.3086*** (0.0427)	5.4360*** (0.0391)	5.4913*** (0.0417)	5.608*** (0.0399)
Education attainment				
Primary education	0.2070*** (0.0071)	0.1834*** (0.0076)	0.1602*** (0.0071)	0.1601*** (0.0069)
Lower secondary	0.4107*** (0.0082)	0.3759*** (0.0085)	0.3367*** (0.0080)	0.3512*** (0.0079)
Upper secondary	0.5452*** (0.0091)	0.5058*** (0.0095)	0.4659*** (0.0088)	0.4730*** (0.0092)
Secondary vocational	0.6794*** (0.0109)	0.6371*** (0.0108)	0.5805*** (0.0107)	0.5981*** (0.0116)
Higher vocational	0.8562*** (0.0108)	0.8084*** (0.0110)	0.7480*** (0.0102)	0.7637*** (0.0103)
Diploma	0.8207*** (0.0420)	0.7175*** (0.0460)	0.7580*** (0.0347)	0.7209*** (0.0353)
Bachelor's	1.1560*** (0.0110)	1.1082*** (0.0108)	1.0343*** (0.0103)	1.0498*** (0.0107)
Master's or higher	1.6239*** (0.0171)	1.5312*** (0.0151)	1.4745*** (0.0144)	1.4810*** (0.0167)
Region of residence				
Bangkok	0.0020 (0.0057)	0.0194*** (0.0052)	0.0255*** (0.0049)	0.0250*** (0.0054)
North	-0.1419*** (0.0064)	-0.1469*** (0.0060)	-0.1342*** (0.0057)	-0.1173*** (0.0055)
Northeast	-0.1188*** (0.0074)	-0.1030*** (0.0071)	-0.1094*** (0.0068)	-0.1044*** (0.0067)
South	0.0057 (0.0056)	0.0163*** (0.0053)	-0.0213*** (0.0052)	-0.0179*** (0.0054)
Area of residence				
Municipal	0.0834*** (0.0032)	0.0855*** (0.0031)	0.0977*** (0.0031)	0.0854*** (0.0033)
Log gross provincial product per capita	0.1604*** (0.0034)	0.1570*** (0.0032)	0.1559*** (0.0034)	0.1505*** (0.0032)
Male	0.1631*** (0.0040)	0.1672*** (0.0039)	0.1659*** (0.0037)	0.1555*** (0.0039)
Marital status				
Married	0.0535*** (0.0049)	0.0604*** (0.0044)	0.0734*** (0.0043)	0.0777*** (0.0046)
Divorced, separated, or widowed	-0.0107 (0.0086)	-0.0067 (0.0077)	-0.0034 (0.0075)	-0.0053 (0.0076)
Work characteristics				
Experience	0.0350*** (0.0006)	0.0336*** (0.0006)	0.0330*** (0.0006)	0.0336*** (0.0006)
Experience squared	-0.0004*** (0.00001)	-0.0004*** (0.00001)	-0.0004*** (0.00001)	-0.0004*** (0.00001)
Public	0.1500*** (0.0072)	0.1354*** (0.0071)	0.1592*** (0.0067)	0.1298*** (0.0075)

Continued.

Table 9. *Continued.*

Explanatory Variable	Log Monthly Earnings			
	2007	2008	2009	2010
State enterprise	0.3921*** (0.0158)	0.3685*** (0.0140)	0.3743*** (0.0147)	0.4020*** (0.0166)
Legislator	0.3547*** (0.0151)	0.3828*** (0.0150)	0.3896*** (0.0150)	0.4115*** (0.0150)
Professional	0.4674*** (0.0102)	0.4945*** (0.0094)	0.5012*** (0.0094)	0.5018*** (0.0104)
Technician	0.3686*** (0.0087)	0.3544*** (0.0077)	0.3454*** (0.0076)	0.3461*** (0.0085)
Clerk	0.2145*** (0.0076)	0.2096*** (0.0071)	0.2125*** (0.0072)	0.2022*** (0.0074)
Service workers	0.1415*** (0.0075)	0.1444*** (0.0089)	0.1454*** (0.0071)	0.1354*** (0.0077)
Skilled agricultural	0.1138*** (0.0125)	0.1817*** (0.0112)	0.0878*** (0.0106)	0.1182*** (0.0116)
Craft	0.0594*** (0.0065)	0.0635*** (0.0063)	0.0683*** (0.0060)	0.0811*** (0.0062)
Machine operator	0.2254*** (0.0066)	0.2220*** (0.0061)	0.2115*** (0.0059)	0.2078*** (0.0063)
Mining	0.6015*** (0.0419)	0.6067*** (0.0327)	0.5466*** (0.0368)	0.5099*** (0.0368)
Utilities	0.4870*** (0.0304)	0.3958*** (0.0307)	0.4488*** (0.0266)	0.3329*** (0.0280)
Construction	0.3653*** (0.0105)	0.3454*** (0.0103)	0.3380*** (0.0099)	0.2697*** (0.0098)
Low-skill manufacturing	0.3463*** (0.0105)	0.3374*** (0.0098)	0.3061*** (0.0097)	0.2789*** (0.0094)
High-skill manufacturing	0.4645*** (0.0105)	0.4386*** (0.0098)	0.4021*** (0.0098)	0.3702*** (0.0097)
Low-skill services	0.4135*** (0.0098)	0.3888*** (0.0092)	0.3814*** (0.0091)	0.3314*** (0.0090)
High-skill services	0.3487*** (0.0103)	0.3389*** (0.0101)	0.3379*** (0.0099)	0.2765*** (0.0099)
Survey quarter				
Quarter 2	0.0136*** (0.0051)	-0.0040 (0.0049)	-0.0065 (0.0047)	0.0099** (0.0046)
Quarter 3	0.0146*** (0.0052)	0.0196*** (0.0050)	0.0243*** (0.0047)	0.0365 (0.0052)
Quarter 4	0.0271*** (0.0053)	0.0122*** (0.0049)	0.0190*** (0.0047)	0.0347 (0.0046)
Number of observations	209,999	210,810	209,260	191,593
R-squared	0.6116	0.6282	0.6332	0.6176

Notes: Robust standard errors in parentheses. *** = significant at 1% level, ** = significant at 5% level.

Source: Author's computations.

In addition, these findings show that men on average receive significantly higher monthly earnings than women. In contrast, Warunsiri and McNown (2010) find that, using the pseudo-panel approach on Thailand's National Labor Force Surveys from 1986 through 2005, females have higher returns than males. Nakavachara

(2010) shows that higher levels of education among females did not result in them earning more than males in Thailand. Married workers on average earned about 7% more than single workers in 2009 and 2010. The differences in monthly earnings for workers with divorced, widowed, or separated marital status were not statistically significant.

The rates of return to schooling for work experience were significantly positive, but at a decreasing rate. The Mincer-type earnings function shows that if students decide not to continue to higher education then vocational education attainment will return higher earnings than general education attainment. The sample is restricted to individuals who work as employees in either the government, private sector businesses, or state enterprises, excluding individuals classified as employers or self-employed, or individuals whose work is restricted to household work. The private sector is the base category for sector of occupation variables. Individuals who work as employees in the public sector on average earned 13% more than private sector employees in 2010. Individuals who worked as employees in state enterprises on average earned 40.2% more than private sector employees in 2010.

The rates of return to schooling for all types of occupations are significant. The elementary occupations are the omitted category for type of occupation variables. Examples of elementary occupations include cleaners, doormen, messengers, drivers, and laborers. Legislators, senior officers, and managers had higher earnings on average of about 41% than those in elementary occupations in 2010. Professionals had higher earnings on average of about 50% than those in elementary occupations in both 2009 and 2010. Technicians and associated professionals had higher earnings on average of about 35% than those in elementary occupations in years 2008, 2009, and 2010. Clerks had higher earnings on average of about 20% than those in elementary occupations in year 2010. Service workers and sales workers had higher earnings on average of about 14% than elementary occupations in years 2007, 2008, 2009, and 2010. Skilled agricultural and fishery workers had higher earnings on average of 12% than those in elementary occupations in year 2010. Individuals with work in crafts and related trades had higher earnings on average of about 8% than those in elementary occupations in year 2010. Plant and machine operators and assemblers had higher earnings on average of about 21% than those in elementary occupations in years 2009 and 2010. All types of occupations received higher monthly earnings when compared with elementary occupations in years 2007, 2008, 2009, and 2010.

The rates of return to schooling for all types of industry are significant. The agriculture industry is the omitted category for type of industry variables. Examples from the agriculture industry include agriculture, fishery, hunting, and forestry. Workers in the mining industry had higher earnings on average of about 50% than agriculture industry workers in 2010. Workers in the utilities industry had higher earnings on average of about 33% than agriculture industry workers in 2010. Workers in the construction industry had higher earnings on average of

Table 10. Mean Earnings and Direct Cost by Level of Education, 2010

Education Level	Mean Earnings Cycle (B/year)	Length of School (years)	Annual Direct Cost per Public School Year (B)
No education	51,302.5	n.a.	n.a.
Primary	66,449.5	6	40,970
Secondary (General)	90,258.8	6	29,600
Secondary (Vocational)	122,657.4	3	29,600
		3	40,242
University	224,654.5	4	67,885

B = baht, n.a. = not applicable.

Note: \$1 = B35.65 as of 28 August 2015.

Sources: Government of Thailand, National Statistical Office. National Labor Force Survey (Table 2: Number and Percentage of Employed Persons by Industry, 2001–2011). http://service.nso.go.th/nso/nso_center/project/search_center/23project-th.htm (accessed 30 May 2011); National Education Account of Thailand. seminar.qlf.or.th/File/DownloadFile/699

Table 11. Returns to Education—Full Discounting Method (%)

Education Level	Social Returns
Primary	3.4
Secondary (General)	5.7
Secondary (Vocational)	8.0
University	11.3

Sources: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfs_e.htm; National Education Account of Thailand. seminar.qlf.or.th/File/DownloadFile/699

about 27% than agriculture industry workers in 2010. Individuals with work in low-skill manufacturing had higher earnings on average of about 28% than agriculture industry workers in 2010. Individuals with work in high-skill manufacturing had higher earnings on average of about 37% than agriculture industry workers in 2010. Individuals with work in low-skill services had higher earnings on average of about 33% than agriculture industry workers in 2010. Individuals with work in high-skill services had higher earnings on average of about 28% than agriculture industry workers in 2010. Workers in all types of industries received higher monthly earnings when compared with those in the agriculture industry. However, the gap between average monthly earnings in these particular industries and the agriculture industry tended to narrow between 2007 and 2010.

The mean earnings and annual direct cost by level of education irrespective of age are illustrated in Table 10. The annual direct cost for public schools by level of education is taken from the National Education Account of Thailand. On the basis of information provided in Tables 10, A.1, and A.2, it is possible to estimate private and social returns to different levels of education based on equation (3) as shown in Table 11. The availability on earnings profile is only for individuals aged 16–60 years old. Due to the data limitation, the missing earnings information for individuals with

Table 12. **Shortcut Estimates of the Returns to Education (%)**

Education Level	Private Returns	Social Returns
Primary	4.9	2.7
Secondary (General)	6.0	4.1
Secondary (Vocational)	14.1	8.8
University	37.2	21.3

Sources: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfs_e.htm; National Education Account of Thailand. seminar.qlf.or.th/File/DownloadFile/699

no education and primary education aged 15 years or below will be replaced with the average earnings at 16 years old. Psacharopoulos (1994) and Psacharopoulos and Patrinos (2004) state that the difference between the private and social rates of return reflects the degree of public subsidization of education. The social returns on primary education are approximately 3.4%. The social returns on general secondary education are approximately 5.7%. The social returns on vocational secondary education are approximately 8%. Unlike the previous studies (Psacharopoulos 1994, Psacharopoulos and Patrinos 2004), both private and social returns on vocational secondary education are more than on general secondary education. This may be due to the data availability on the average annual direct cost for vocational secondary education. The average annual direct cost for vocational secondary education is the average cost from eight fields including industrial, commerce, agriculture, applied arts, home economics, textile, tourism industry, and information and communications technology. The social returns on university education are 11.3%. Among the four main levels of education, university education exhibits the highest social profitability in Thailand.

Using only the information provided in Table 10, it is possible to estimate private and social returns to different levels of education using the shortcut method of Psacharopoulos (1995) as shown in equations (4) and (5). This gives the results shown in Table 12. Psacharopoulos (1995) mentions that the weakness of the shortcut method lays in the abstraction that age-earnings profiles are concave, and that the discounting process is sensitive to the values of the early-working ages entering the calculation.

The mean earnings and direct cost by level of education and gender irrespective of age are shown in Table 13. The mean annual earnings for women are less than men at all education levels. The shortcut estimates of the returns to education are shown in Table 14. The private and social returns on secondary general education and secondary vocational education are dissimilar between women and men. Women receive lower private and social returns than men. The difference in private and social returns is not greater than 1 percentage point. However, the private returns on a university education for women exceed men by about 1.5 percentage points. Psacharopoulos (1995) suggested that the additional private returns to women may

Table 13. Mean Earnings and Direct Cost by Level of Education and Gender

Education Level	Mean Earnings (B/year)		Length of School Cycle (years)	Annual Direct Cost per Public School Year (B)
	Male	Female		
No education	56,338.8	46,840.7	n.a.	n.a.
Primary	71,254.0	59,399.4	6	40,970
Secondary (General)	97,279.9	80,897.9	6	29,600
Secondary (Vocational)	132,224.3	108,986.7	6	40,242
University	247,880.8	210,802.3	4	67,885

B = baht, n.a. = not applicable.

Note: \$1 = B35.65 as of 28 August 2015.

Sources: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfs_e.htm; National Education Account of Thailand. seminar.qlf.or.th/File/DownloadFile/

Table 14. Shortcut Estimates of the Returns to Education by Gender (%)

Education Level	Private Returns		Social Returns	
	Male	Female	Male	Female
Primary	4.41%	4.47%	2.55%	2.38%
Secondary (General)	6.09%	6.03%	4.30%	4.03%
Secondary (Vocational)	14.26%	13.91%	9.11%	8.29%
University	38.70%	40.14%	22.80%	21.83%

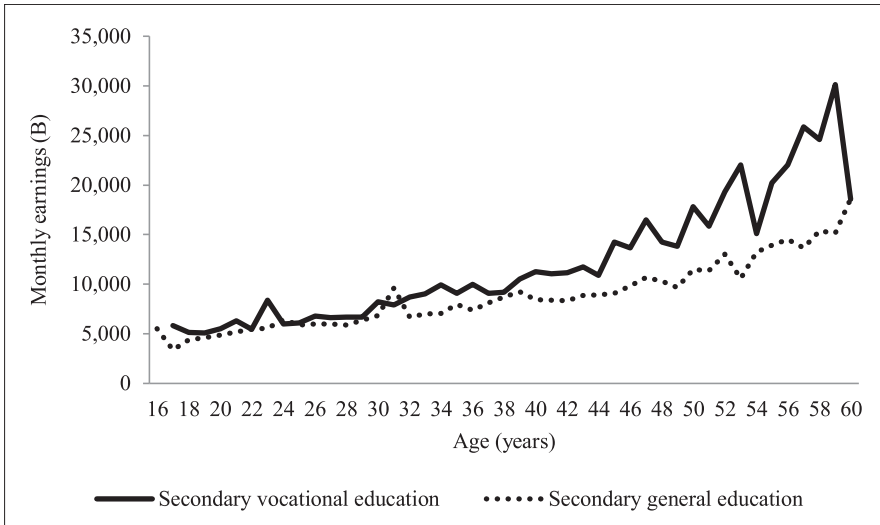
Sources: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfs_e.htm; National Education Account of Thailand. seminar.qlf.or.th/File/DownloadFile/699

be an underestimation because the rate of return to investment in women's education does not take into account the increased probability of more educated women participating in the labor force.

Figure 3 displays the average monthly earnings for secondary vocational education attainment and secondary general education attainment. Suppose an individual made the decision to end his or her education investment after the completion of a secondary education. This graph gives a comparison of the payoff between vocational–technical and general education. The sample is restricted to individuals who complete secondary education as their highest education attainment. The highest attainment of secondary general education is the omitted category for the level of education variable. The average monthly earnings for the secondary vocational education attainment are higher than the secondary general education from the age profile of 16–60 years old. The descriptive statistics confirm that secondary vocational education attainment gives a higher private rate of return than secondary general education. These findings support the research conducted by Hawley using data from earlier years of Thailand's National Labor Force Survey (Hawley 2003, 2004; Moenjok and Worswick 2003).

Figure 4 displays the average monthly earnings for attainment of a general diploma, higher vocational–technical education, bachelor's degree, and master's or

Figure 3. Average Monthly Earnings for Secondary Vocational Education Attainment and Secondary General Education Attainment



B = baht.

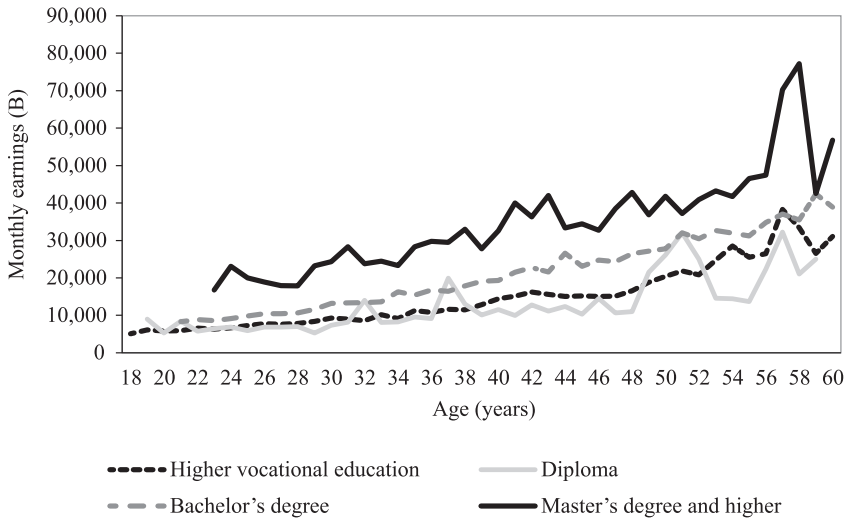
Source: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfse.htm

higher degree. Suppose that an individual made the decision to continue on to higher education after completion of the secondary education level. Figure 4 gives a comparison of the payoff between a general diploma, higher vocational–technical certificate, bachelor’s degree, and master’s or higher degree. The sample is restricted to individuals who have received either a general diploma, higher vocational–technical certificate, bachelor’s degree, or master’s or higher degree as their highest level of educational attainment. This graph shows that the average monthly earnings for bachelor’s degree attainment are higher than for vocational–technical education attainment for 18–60 year olds. Based on both regression analysis and descriptive statistics, these findings show that bachelor’s degree attainment gives a higher private rate of return than either a general diploma or higher vocational–technical education attainment. These findings call into question the belief that aggregate demand for the college-educated increases more rapidly than demand for those with higher vocational–technical education or a general diploma. In addition, the average monthly earnings for master’s degree and higher are the highest compared with other degrees.

VI. Policy Implications and Conclusions

Human capital investment is an essential tool to promote labor productivity amid the transformation of the Thai economy from agriculture to manufacturing and

Figure 4. Average Monthly Earnings for Higher Vocational Education Attainment, Bachelor's Degree Attainment, and Master's Degree or Higher Attainment



B = baht.

Source: Government of Thailand, National Statistical Office. Labor Force Survey, 2010. http://web.nso.go.th/eng/stat/lfs_e/lfse.htm

services. The government launched its 15-Year Free Education with Quality Policy in 2009, aiming to lessen the financial burden of parents and stimulate the economy. Students covered by the program range from kindergarten to Grade 12 and include both general and vocational education students. This policy promotes accessibility to basic education for everyone.

The empirical results of this study suggest that years of schooling has a positive and significant impact on returns to schooling. Comparing between vocational secondary education and general secondary education, the Mincer-type earnings function shows that if students decide not to continue to higher education then vocational education attainment will give higher earnings than general education attainment. These results are comparable to those of Hawley (2003) and Moenjak and Worswick (2003) who used data from earlier years of the National Labor Force Survey. With regard to the private and social returns to different levels of education, using the shortcut method of Psacharopoulos (1995) shows that secondary vocational education attainment is about 8.1 percentage points higher on private returns and 4.7 percentage points higher on social returns than secondary general education. The rates of return to schooling outcomes and the high demand for semiskilled labor in Thailand provide strong incentives to the Ministry of Education and Ministry of Labor to develop medium- to long-term strategic plans.

Regarding the private and social returns to different levels of higher education, using the full discounting method of Psacharopoulos (1995) show that private and social returns on a bachelor's degree are 46.2% and 11.3%, respectively. A bachelor's

degree gives the highest private and social returns among all education levels. The results are somewhat different than for developing economies in the 1990s when primary education gave the highest private and social returns (Psacharopoulos 1994, Psacharopoulos and Patrinos 2004). Growth in private higher education is expected to change the rates of return because the annual direct cost per private school is generally higher. The private and social rates of return for higher education are expected to decline.

The mean annual earnings for women are less than for men at all education levels. The private and social returns on primary, secondary general education, and secondary vocational education are dissimilar between women and men. Women receive lower private and social returns than men. However, the private returns on university for women exceed those for men. Psacharopoulos (1995) suggested that the additional private returns for women may be an underestimation because the rate of return to investment in women's education does not take into account the increased probability of more educated women participating in the labor force.

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*ADB recognizes "China" as the People's Republic of China.

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Appendix

Table A.1. Age–Earnings Profiles and Direct Costs by Level of Education, 2010 (B/year)

Age	No Education	Primary	Secondary (General)	Secondary (Vocational)	Bachelor
16	3,736.7	4,177.7	0.0	0.0	0.0
17	4,200.6	4,015.3	0.0	0.0	0.0
18	3,885.0	4,226.3	4,395.9	5,123.4	0.0
19	4,523.5	4,558.8	4,582.6	5,048.7	0.0
20	4,684.7	4,469.0	4,840.9	5,508.8	0.0
21	4,987.6	4,719.2	5,194.8	6,314.9	0.0
22	4,189.0	4,698.0	5,426.8	5,474.0	8,825.8
23	4,463.9	4,895.6	5,571.7	8,395.3	8,585.0
24	4,493.4	4,671.8	6,420.1	5,995.4	9,121.1
25	4,528.0	4,907.3	5,897.3	6,104.6	9,821.5
26	4,809.0	5,038.8	5,986.3	6,795.2	10,445.1

Continued.

Table A.1. *Continued.*

Age	No Education	Primary	Secondary (General)	Secondary (Vocational)	Bachelor
27	4,891.1	4,865.0	5,984.9	6,645.8	10,412.7
28	4,635.8	5,112.3	5,881.1	6,690.8	10,640.9
29	4,377.9	4,977.6	6,357.8	6,675.1	11,627.6
30	4,485.7	5,425.6	6,856.8	8,200.9	13,172.4
31	4,629.5	5,523.9	9,606.8	7,876.2	13,312.6
32	4,763.3	5,420.3	6,682.7	8,722.8	13,381.8
33	4,259.2	5,283.2	6,987.3	9,025.6	13,583.6
34	6,269.9	5,456.7	7,071.6	9,935.3	16,313.3
35	5,192.4	5,459.8	7,932.0	9,051.6	15,387.8
36	4,787.0	5,694.9	7,380.6	9,987.4	16,768.1
37	4,095.7	5,443.7	8,100.4	9,051.2	16,447.7
38	4,338.0	5,590.5	8,691.0	9,160.1	17,887.7
39	3,828.6	5,470.1	9,252.7	10,533.8	19,092.4
40	4,257.7	6,167.2	8,457.7	11,274.4	19,283.4
41	4,331.7	5,664.6	8,387.6	11,030.2	21,495.8
42	4,398.3	5,800.1	8,333.7	11,149.1	22,727.9
43	3,789.9	5,889.9	8,860.3	11,744.9	21,613.1
44	4,314.5	5,665.9	8,917.0	10,880.0	26,611.5
45	4,170.5	6,032.1	9,065.7	14,261.0	23,061.3
46	3,487.5	6,592.6	9,801.0	13,658.3	24,759.9
47	4,425.2	6,844.5	10,687.3	16,505.7	24,361.5
48	3,874.4	6,462.3	10,298.6	14,264.3	26,483.3
49	4,111.6	6,426.8	9,678.5	13,798.5	27,180.2
50	4,110.3	6,519.9	11,499.3	17,840.3	27,790.9
51	3,979.9	8,105.5	11,345.5	15,847.3	32,009.8
52	4,301.5	7,811.2	13,045.1	19,323.8	30,417.6
53	3,677.5	7,528.2	10,550.1	22,022.8	32,651.9
54	3,836.6	6,880.0	13,214.6	15,099.0	31,982.1
55	3,520.5	7,974.0	13,903.9	20,223.4	31,210.7
56	4,288.8	9,226.9	14,490.4	22,024.8	34,781.4
57	4,211.5	7,585.1	13,673.0	25,887.4	37,045.6
58	3,616.6	9,341.8	15,357.4	24,580.0	35,456.2
59	3,570.6	9,594.4	15,154.6	30,155.9	42,383.2
60	3,698.1	7,063.5	18,645.5	18,540.7	38,882.5

B = baht.

Source: Author's computations.

Table A.2. **Age–Earnings Profiles and Direct Costs by Level of Education—Input to Social Rate of Return Calculation, 2010 (B/year)**

Age	No Education	Primary	Secondary (General)	Secondary (Vocational)	Bachelor
6	Not available	-40,970	0	0	0
7	Not available	-40,970	0	0	0
8	Not available	-40,970	0	0	0
9	Not available	-40,970	0	0	0
10	Not available	-40,970	0	0	0
11	Not available	-40,970	0	0	0
12	Not available	Not available	-29,600	-29,600	0

Continued.

Table A.2. *Continued.*

Age	No Education	Primary	Secondary (General)	Secondary (Vocational)	Bachelor
13	Not available	Not available	-29,600	-29,600	0
14	Not available	Not available	-29,600	-29,600	0
15	Not available	Not available	-29,600	-40,242	0
16	3,736.7	4,177.7	-29,600	-40,242	0
17	4,200.6	4,015.3	-29,600	-40,242	0
18	3,885.0	4,226.3	4,395.9	5,123.4	-67,885
19	4,523.5	4,558.8	4,582.6	5,048.7	-67,885
20	4,684.7	4,469.0	4,840.9	5,508.8	-67,885
21	4,987.6	4,719.2	5,194.8	6,314.9	-67,885
22	4,189.0	4,698.0	5,426.8	5,474.0	8,825.8
23	4,463.9	4,895.6	5,571.7	8,395.3	8,585.0
24	4,493.4	4,671.8	6,420.1	5,995.4	9,121.1
25	4,528.0	4,907.3	5,897.3	6,104.6	9,821.5
26	4,809.0	5,038.8	5,986.3	6,795.2	10,445.1
27	4,891.1	4,865.0	5,984.9	6,645.8	10,412.7
28	4,635.8	5,112.3	5,881.1	6,690.8	10,640.9
29	4,377.9	4,977.6	6,357.8	6,675.1	11,627.6
30	4,485.7	5,425.6	6,856.8	8,200.9	13,172.4
31	4,629.5	5,523.9	9,606.8	7,876.2	13,312.6
32	4,763.3	5,420.3	6,682.7	8,722.8	13,381.8
33	4,259.2	5,283.2	6,987.3	9,025.6	13,583.6
34	6,269.9	5,456.7	7,071.6	9,935.3	16,313.3
35	5,192.4	5,459.8	7,932.0	9,051.6	15,387.8
36	4,787.0	5,694.9	7,380.6	9,987.4	16,768.1
37	4,095.7	5,443.7	8,100.4	9,051.2	16,447.7
38	4,338.0	5,590.5	8,691.0	9,160.1	17,887.7
39	3,828.6	5,470.1	9,252.7	10,533.8	19,092.4
40	4,257.7	6,167.2	8,457.7	11,274.4	19,283.4
41	4,331.7	5,664.6	8,387.6	11,030.2	21,495.8
42	4,398.3	5,800.1	8,333.7	11,149.1	22,727.9
43	3,789.9	5,889.9	8,860.3	11,744.9	21,613.1
44	4,314.5	5,665.9	8,917.0	10,880.0	26,611.5
45	4,170.5	6,032.1	9,065.7	14,261.0	23,061.3
46	3,487.5	6,592.6	9,801.0	13,658.3	24,759.9
47	4,425.2	6,844.5	10,687.3	16,505.7	24,361.5
48	3,874.4	6,462.3	10,298.6	14,264.3	26,483.3
49	4,111.6	6,426.8	9,678.5	13,798.5	27,180.2
50	4,110.3	6,519.9	11,499.3	17,840.3	27,790.9
51	3,979.9	8,105.5	11,345.5	15,847.3	32,009.8
52	4,301.5	7,811.2	13,045.1	19,323.8	30,417.6
53	3,677.5	7,528.2	10,550.1	22,022.8	32,651.9
54	3,836.6	6,880.0	13,214.6	15,099.0	31,982.1
55	3,520.5	7,974.0	13,903.9	20,223.4	31,210.7
56	4,288.8	9,226.9	14,490.4	22,024.8	34,781.4
57	4,211.5	7,585.1	13,673.0	25,887.4	37,045.6
58	3,616.6	9,341.8	15,357.4	24,580.0	35,456.2
59	3,570.6	9,594.4	15,154.6	30,155.9	42,383.2
60	3,698.1	7,063.5	18,645.5	18,540.7	38,882.5

B = baht.

Source: Author's computations.