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Returns to Education in Different Industries of Thailand

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Abstract

In this study, an analysis of returns on education across industry levels and sub-industries was conducted. The main objective of this study is to find and analyze the different impacts on monthly wages as a result of different types of education across different industries and sub-industries. This could give a better understanding of the current situation of the Thai labor market. The main focus types of education in this study are high school, upper vocational, higher vocational, and bachelor's degree. The chosen five industries include agricultural, manufacturing, retail/wholesale, hospitality, and entertainment. The chosen sub-industries are farming, fishing, automobile, electronic, textile, food manufacturing, petrochemical, hotel, and hospitality-related services. Labor Force Survey data from the years 2012 to 2022 was used with the extended Mincerian method to find a more current and insightful analysis of the return on education. The extended Mincerian equation is the primary method labor economists use when performing the return to education analysis. The data was restricted to those who work full-time and those who work in the public and private sectors only. The cleansed dataset also does not include those who have master's or doctorate degrees.

The results proved that there are not many differences when analyzing the industry and sub-industry levels, which means that the type of industry employed does not affect your returns on education ranking. However, the amount does vary between different industries so the labor force could understand that even though the ranking is the same, the income level is different for the same type of education in different industries. At the overall, industry, and sub-industry levels, it is proven that a bachelor's degree earns the highest followed by higher vocational, upper vocational, and high school. Those employed in the public sector will have an increase in monthly wages compared to the private sector. Being female will reduce the monthly wage. Bangkok will give the highest returns compared to other provinces. The type of occupation also affects the amount of income, and it varies when looking at industry and sub-industry levels.

Keywords: *Return to education; Extended Mincerian equation; Human capital; Labor economics*

1. Introduction

Returning to education is one of the most debated topics around the world as the world has been progressing at a rapid pace. This brought a question to many countries including Thailand, whether a bachelor's degree will always give the highest return compared to vocational degrees. The goal of the research is to find the differences in return in education between various education types in Thailand across chosen industries and sub-industries. The focus type of education is high school, upper vocational, higher vocational, and university (bachelor).

According to Hawley (2004), a university degree could give lower returns compared to vocational degrees. However, the data used from 1985 and 1995 might not be relevant today. Similarly, Moenjak, and Worswick (2003) used data from the years 1989 to 1995 and concluded that returns for vocational degrees are higher for high school degrees, however, still significantly lower than university level. Srinang (2014) used more updated data compared to the previous two studies by using data from 2001 and 2011. They also concluded that vocational school would give higher returns than high school, however, it will not be as high as university level. A more recent study was conducted by Tangtipongkul (2015) using data from 2007 to 2010 and they came to the same conclusion as the previous two

studies. All papers in Thailand mostly focus analysis on the overall level but this study will also conduct a sub-sample analysis based on five chosen industries which include agriculture, manufacturing, retail/wholesale, hospitality, and entertainment. Furthermore, there will be a sub-industries analysis on farming, fishing, automobile, electric, textile, food manufacturing, hotel, and hospitality-related services. Additionally, the number of studies on return to education in Thailand is very small even though it is indeed a very important concern in the Thai labor market therefore this paper should contribute to improving and updating the analysis on return to education.

On the international side, Ahmed, and Chattopadhyay (2016) conducted a study in India and also found that a vocational degree gives less returns compared to university degrees but higher than high school degrees. According to Chen, and Pastore (2021) in the case of China, higher vocational graduates suffer a wage penalty of around 20 percent compared to university graduates. Strawiński, Broniatowska, and Majchrowska (2016) explained that university graduates do earn more than vocational graduates, but the gap has been decreasing since 2010 due to the oversupply of university graduates in Poland. Fiaschi, and Gabbriellini (2013) in the case of Italy found that those on academic paths such as high school and university earn more than vocational paths. Contrary to prior study, Sakellariou (2003), in the case of Singapore found that the return on vocational education is slightly higher than the return on education at the university level. The author used data from mid-1998. According to Kahyarara, and Teal (2008), in the case of Tanzania, the return on education depends on the size of the firm the highest degree earned by vocational graduates is higher than by university graduates in larger firms than in smaller firms. All studies mentioned previously used the Mincerian equation as it is a standard method when studying returns to education.

There is a gap in previous literature as most focus on the overall level but not the industry and sub-industry level even though the results could be different from the overall level. This study will clarify whether the monthly wage in sub-sample analysis is vastly different from the overall level. Additionally, in the case of Thailand, more updated Labor Force Surveys are available therefore, this study will show the most recent view of the Thai labor market. With new jobs emerging rapidly this study also aims to update readers on the issue of whether the results found using more updated data still applies to results found more than a decade ago.

2. Objectives

1. To find and analyze the impact of education on wage/salary at different types of education in Thailand. The focus group will be as follows, high school, upper vocational, higher vocational, and bachelor's.
2. To find and analyze if the return on education at different education levels differs across industries and sub-industries in Thailand including agricultural, hospitality, manufacturing, wholesale/retail, and entertainment industries.
3. To give a better understanding of the current labor market situation as the result of the different types of education and occupation. If the average return to education differs across industries, stakeholders in each industry can be better aware of the situation.

3. Material and Methods

3.1 Data

Data are obtained from the Labor Force Survey conducted and recorded by the National Statistical Office Thailand (NSO) for the 3rd quarter between the years of 2012 to 2022. The National Labor Force Survey (LFS) is the collection of national household data. The main aim of the survey is to gather data on the labor force of the country as well as the situation regarding employment and unemployment in the country. In the case of Thailand, LFS is conducted every quarter of a year. Each quarter has a sample size of around 200,000 people. The questions on the survey consist of for example a person's highest education, type of employment, hours of work, work-seeking behaviors, level of income, overall individual expenses, and unemployment.

The LFS also uses the International Standard Classification of Occupations (ISCO) to classify people’s occupations which are divided into ten major groups and many more subgroups. This research will use the first codes of ISCO to classify occupations. The types of occupations that are present across all five chosen industries are as follows:

1. managers,
2. professional,
3. technicians and associate professionals,
4. clerical support workers,
5. service and sales workers,
6. Other type of occupation

Furthermore, sub-industries level analysis will also be conducted. This includes farming and fishing sub-industries within the agricultural industry; automobile, electronic, textile, food manufacturing, and petrochemical sub-industries within the manufacturing industry; and hotel and service sub-industries within the hospitality industry. The retail/wholesale industry does not have sub-industries inside the LFS data therefore we will not be analyzing the sub-industry level for this industry. Furthermore, the entertainment industry has a very low observation when divided into a sub-industries level which means the result might not be statistically significant.

Data is restricted to those who work 30 or more hours per week only. The method follows Hawley's (2004) method to be able to analyze those who work full-time only. Furthermore, this study does not take those who are employed in state enterprises into account since the observation for those in this sector is very low. After the data is cleansed, the total number of eligible people is 299,226. Table 1 shows the full list of variables used in regression. Please also take note that there is a difference between upper vocational and higher vocational. Higher vocational education is an advanced program for those who want to pursue higher education after they finish the upper vocational level.

Table 1 Variable Used in Regression

Variable name in the model	Variable	Definition of variable	Measurement
ln_wage	Earning	Log of total monthly income	Number
noedu	No education/less than primary school	If a person has no or less than the primary level of education (0=no 1=yes)	Dummy
primary	Primary school	If primary school is the highest degree earned (0=no 1=yes)	Dummy
middle	Middle school	If middle school is the highest degree earned (0=no 1=yes)	Dummy
high	High school	If high school is the highest degree earned (0=no 1=yes)	Dummy
upper_voc	Upper vocational	If upper vocational is the highest degree earned (0=no 1=yes)	Dummy
higher_voc	Higher vocational	If higher vocational is the highest degree earned (0=no 1=yes)	Dummy
uni	University	If a bachelor degree is the highest degree earned (0=no 1=yes) (Omitted)	
female	Female	Gender male/female (0=male 1= female)	Dummy
age	Age	Age is used as a proxy for work experience according to Mincerian	Number
	Location	4 dummies for 4 regions of Thailand: North, North-East, South, East	Dummy
nor		North (1=North, 0= other)	
nor_ea		North-East (1= North-East, 0= other)	
sou		South (1=South, 0= other)	
cen		Central (1= central, 0 = other)	
bkk			

Variable name in the model	Variable	Definition of variable	Measurement
		Bangkok is omitted (1= Bangkok, 0 = other)	
married	Marital status	Marriage :Single/married (0= single 1=married)	Dummy
public	Working Sector	Sector that the person work in: Public/Private (0=private 1=public)	Dummy
agexpublic	AgeXPublic	Interaction between age and public	Dummy
	Occupation	Occupation in major groups	Dummy
professional		Professional is omitted	
manager		Manager (0=no 1=yes)	
technician		Technicians (0=no 1=yes)	
clerical		Clerical support workers (0=no 1=yes)	
servicesale		Service workers (0=no 1=yes)	
skillagri		Skilled agricultural worker (0=no 1=yes)	

3.2 Mincerian Equation

Mincer (1974) developed a model called the Mincerian equation to study and analyze factors that affect the labor market. The model explains that more years of education results in higher productivity and therefore results in higher financial return. In addition to the number of years of education, experience also plays an important role in the model. In the equation, age captures the experience of the person and as age increases in combination with years of education, return to education also increases. However, when age reaches a certain level, returns start to increase at a diminishing rate due to deteriorating health as humans get older Most of the previous works used extended Mincerian equations as their methodology. According to Heckman, Lochner, & Todd (2006) the Mincerian equation is an extensively utilized method for labor economists when estimating the return to education and the gender wage gap impact. The Mincerian equation is the foundation for analyzing the return on education in developing countries (Heckman et al., 2006).

$$\ln w_i=\beta_0+\beta_1 \text{Educ}+ \beta_2 \text{Age}+\beta_3 \text{Age}^2+ X_i\beta_i+ \varepsilon_i$$

$\ln w_i$ is the log of wage of the person, Educ is the type or year of education, Age is the age of the person and in the Mincerian model, it captures the experience of the person. Xi is other control variables that could affect the return on education such as sex, location, marital status, employment sector et cetera.

3.3 Extended Mincerian Equation

This is the extended Mincerian equation that is employed in this study:

$$\begin{aligned}\text{In\_wage}=&\beta_0+\beta_1\text{noedu}+\beta_2\text{primary}+\beta_3\text{middle}+\beta_4\text{high}+\beta_5\text{upper\_voc}\\&+\beta_6\text{higher\_voc}+\beta_7\text{female}+\beta_8\text{age}+\beta_9\text{age\_square}+\beta_{10}\text{nor}+\beta_{11}\text{nor\_ea}+\beta_{12}\text{sou}\\&+\beta_{13}\text{cen}+\beta_{14}\text{married}+\beta_{15}\text{public}+\beta_{16}\text{year}+\beta_{17}\text{Occupations}+\varepsilon\end{aligned}$$

The main explanatory variables include completing high school, upper vocational, and higher vocational with the university being an omitted category. The coefficients β_1 to β_5 will provide the estimated return to education for each type of education. We expect the coefficient of education β_1 to β_5 to be negative. The estimation will be run based on four main samples of industries including hospitality, manufacturing, wholesale/retail, and entertainment with nine sub-industries including farming, fishing, automobile, electronic, textile, food manufacturing,

petrochemical, hotel, and services. Married is a dummy variable where 1 stands for if the person is married, otherwise it is 0. When the variable public is equal to 1 means the person works in the public sector and if the person works in the private sector, then it is 0. There will be six types of occupation which include manager, technician, clerical support worker, service worker, and skilled agricultural worker where professional is omitted. Epsilon ε is the error term.

Many of the chosen variables are based on previous literature with the most common being region, marital status, and gender. Occupation type was chosen as the occupation employed could affect earnings, not the type of education alone. The public sector system promotes their employee when they meet a certain age while performance is the main reason for promotion in the private sector thus including the interaction term between the public and age. LFS data is a survey implemented by the International Labor Organization which many countries have made use of. Most past literature also uses LFS which means it is up to the international standard. However, there will still be a limitation to the research as there could be other factors that contribute to returns to education but are not captured by the survey thus endogeneity will always be present, however, LFS and the Mincerian Equation are the best tools labor economists use at the moment.

4. Results and Discussion

Table 2 Regression Result of Overall Level and Industry Level

	Overall	**Agriculture**	**Manufacturin--g**	**Retail/ Wholes- -ale**	**Hospitality**	**Entertainment**
Variables	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**
noedu	-0.821***	-0.254***	-0.615***	-0.490***	-0.505***	-0.701***
	(0.00354)	(0.0339)	(0.00671)	(0.00756)	(0.0110)	(0.0440)
primary	-0.670***	-0.257***	-0.529***	-0.398***	-0.433***	-0.576***
	(0.00318)	(0.0336)	(0.00618)	(0.00637)	(0.0101)	(0.0347)
middle	-0.525***	-0.209***	-0.428***	-0.305***	-0.348***	-0.509***
	(0.00314)	(0.0342)	(0.00599)	(0.00600)	(0.0100)	(0.0337)
high	-0.461***	-0.209***	-0.355***	-0.240***	-0.275***	-0.385***
	(0.00305)	(0.0351)	(0.00605)	(0.00591)	(0.0102)	(0.0340)
upper_voc	-0.322***	-0.112**	-0.286***	-0.193***	-0.239***	-0.194***
	(0.00407)	(0.0447)	(0.00732)	(0.00750)	(0.0138)	(0.0476)
	Overall	**Agriculture**	**Manufacturin--g**	**Retail/ Wholes- -ale**	**Hospitality**	**Entertainment**
Variables	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**
	(0.00349)	(0.0439)	(0.00641)	(0.00657)	(0.0133)	(0.0400)
age	0.0230***	0.0175***	0.0391***	0.0271***	0.0261***	0.0292***
	(0.000411)	(0.00148)	(0.000718)	(0.000850)	(0.00111)	(0.00528)
age_sq	-0.000174***	-0.000237***	-0.000456***	-0.000297***	-0.000292***	-0.000238***
	(5.04e-06)	(1.75e-05)	(9.08e-06)	(1.11e-05)	(1.38e-05)	(6.64e-05)
female	-0.161***	-0.198***	-0.172***	-0.116***	-0.131***	-0.0832***
	(0.00156)	(0.00654)	(0.00260)	(0.00350)	(0.00498)	(0.0191)
married	0.0701***	0.0255***	0.0509***	0.0484***	0.0557***	0.0520**
	(0.00166)	(0.00749)	(0.00284)	(0.00333)	(0.00473)	(0.0203)
public	0.0412***	0.0736**	0.130***	-0.0954	0.0957***	0.157***
	(0.00218)	(0.0368)	(0.0383)	(0.0657)	(0.0280)	(0.0413)
nor	-0.382***	-0.398***	-0.393***	-0.378***	-0.440***	-0.386***
	(0.00329)	(0.0794)	(0.00613)	(0.00618)	(0.00904)	(0.0375)
nor_ea	-0.390***	-0.461***	-0.348***	-0.350***	-0.433***	-0.364***
	(0.00328)	(0.0794)	(0.00641)	(0.00610)	(0.00919)	(0.0364)
sou	-0.315***	-0.259***	-0.299***	-0.318***	-0.234***	-0.198***
	(0.00323)	(0.0791)	(0.00657)	(0.00599)	(0.00789)	(0.0329)
cen	-0.192***	-0.129	-0.152***	-0.232***	-0.241***	-0.197***
	(0.00293)	(0.0791)	(0.00491)	(0.00562)	(0.00773)	(0.0259)
manager	-0.267***	0.00103	0.282***	0.181***	0.275***	0.322***
	(0.00447)	(0.0732)	(0.0118)	(0.0147)	(0.0232)	(0.0598)
technician	-0.166***	-0.00524	-0.0978***	-0.180***	-0.0133	0.00771
	(0.00368)	(0.0646)	(0.00949)	(0.0136)	(0.0207)	(0.0319)
clerical	-0.329***	-0.403***	-0.302***	-0.315***	-0.207***	-0.202***

	Overall	Agriculture	Manufacturin--g	Retail/ Wholes- -ale	Hospitality	Entertainment
Variables	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**	**ln_wage**
	(0.00367)	(0.0739)	(0.00988)	(0.0132)	(0.0189)	(0.0415)
servicesale	-0.368***	-0.507***	-0.339***	-0.421***	-0.314***	-0.336***
	(0.00363)	(0.0702)	(0.0134)	(0.0124)	(0.0173)	(0.0371)
otheroccu	-0.454***	-0.906***	-0.435***	-0.458***	-0.380***	-0.290***
	(0.00363)	(0.0601)	(0.00908)	(0.0127)	(0.0175)	(0.0324)
year	0.0314***	0.0291***	0.0314***	0.0360***	0.0407***	0.0305***
	(0.000360)	(0.00144)	(0.000626)	(0.000759)	(0.00110)	(0.00473)
publicxage	0.0195***	0.00612**	0.0195***	0.00390	0.0110***	0.0171***
	(0.000162)	(0.00277)	(0.00332)	(0.00667)	(0.00251)	(0.00402)
Constant	9.554***	9.684***	9.274***	9.380***	9.276***	9.213***
	(0.00874)	(0.100)	(0.0163)	(0.0200)	(0.0280)	(0.102)
Observations	299,225	20,597	72,941	43,499	25,943	1,940
R-squared	0.532	0.228	0.510	0.459	0.408	0.552

Note: Standard errors in parentheses and critical values are as follows *** p<0.01, ** p<0.05, * p<0.1

Table 3 The Effect of Dummy Explanator Variable of Wage (Percentage Change in Wage)

	Overall	Agriculture	Manufacturing	Retail/Wholesale	Hospitality	Entertainment
Variables	**Percentage change relative to omitted category**					
noedu	-56.00	-22.43	-45.94	-38.74	-39.65	-50.39
primary	-48.83	-22.66	-41.08	-32.83	-35.14	-43.79
middle	-40.84	-18.86	-34.82	-26.29	-29.39	-39.89
high	-36.93	-18.86	-29.88	-21.34	-24.04	-31.95
upper_voc	-27.53	-10.60	-24.87	-17.55	-21.26	-17.63
higher_voc	-24.19	-12.89	-17.22	-13.06	-14.36	-22.74
female	-14.87	-17.96	-15.80	-10.95	-12.28	-7.98
married	7.26	2.58	5.22	4.96	5.73	5.34
public	4.21	7.64	13.88	-	10.04	17.00
nor	-31.75	-32.83	-32.50	-31.48	-35.60	-32.02
nor_ea	-32.29	-36.93	-29.39	-29.53	-35.14	-30.51
sou	-27.02	-22.82	-25.84	-27.24	-20.86	-17.96
cen	-17.47	-	-14.10	-20.71	-21.42	-17.88
manager	-23.43	-	32.58	19.84	31.65	37.99
technician	-15.30	-	-9.32	-16.47	-	-
clerical	-28.04	-33.17	-26.07	-27.02	-18.70	-18.29
servicesale	-30.79	-39.77	-28.75	-34.36	-26.95	-28.54
otheroccu	-36.49	-59.59	-35.27	-36.75	-31.61	-25.17

Note: Conversion using $\left(e^{\beta_{\text{of chosen dummy}}}-1\right)\times 100$

For example, for higher vocational from our model in section 3.2 $\left(e^{\beta_6}-1\right)\times 100$

If the number is blank this means that it is not statistically significant at 5 and 1 percent

Gujarati, N. G. & Porter, C. D. (2021). Basic econometrics

Raw regression results for overall and five chosen industries are shown in Table 2 while Table 3 converts the coefficient associated with each dummy explanatory variable to the effect of each respective dummy on the percentage change in wage to facilitate interpretation. Most main types of education show negative signs relative to the university level which is consistent with previous literature. Having no education, primary education, middle school education, high school education, upper vocational education, and higher vocational education on average leads to a decrease in monthly wages of 56, 48.83, 40.84, 36.93, 27.53, and 24.19 percent relative to those with bachelor's degrees

respectively. This shows that the return to education increased as with higher education levels. This also shows that upper vocational graduates on average earn higher than high school graduates which is consistent with the previous literature in Thailand. When the gender is female, the monthly wages will be 14.87 percent less than male. Being married will give you a 7.26 percent increase in monthly wages compared to being single. Being employed in the public sector will increase the monthly wages by 4.21 percent. The coefficient associated with regional dummy variables all show negative signs which means that working in Bangkok gives you the highest monthly wages compared to other regions, this also holds for the five chosen industries. Having a manager, technician, clerical support worker, service worker, skilled agricultural, and other types of occupation on average will lead to a reduction of monthly wage by 23.43, 15.3, 28.04, 30.79, and 36.49 percent respectively. Take note that the average age of the person in the dataset is 39 years old. To interpret the result for age and age square the following equation will be used: $\left(\beta_8+2\beta_9\text{average age}\right)\times 100$ since age is a continuous variable. If the age of the person increases by one from the average age then monthly wages will increase by 0.94 percent. The interaction term between public and age shows a positive sign which shows that as the age of public sector employees increases as along with the wages.

In the agricultural industry, people with no education, primary, middle, high, upper vocational, and higher vocational get a reduction in monthly wage by 22.43, 22.66, 18.86, 18.86, 10.6, and 12.89 percent respectively when compared to university graduates. Occupation variables show a negative percentage change for clerical workers (-33.17 %), service/sales workers (39.77%), and other occupations (59.59%) on average. When age increases by one from the average age, monthly wages decrease by 0.03 percent. This could be due to the agricultural industry being a physically demanding industry that deteriorates as age increases. However, it is a very small reduction in wages. Females experience a 17.96 percent reduction in monthly wage compared to males. Marriage is associated with an increase in monthly wages by 2.58 percent compared to being single. Public sector workers get a 7.64 percent increase in monthly wage compared to private sector workers. The wage penalty gap between different types of education is not huge compared to other industries, this could be due to the fact that the education requirement is not as significant compared to other industries. Furthermore, those with other occupations suffered the worst penalties in this industry.

The manufacturing industry shows a statistically significant result for all types of education. People with no education experience a significant reduction in monthly wages of 45.94 percent. Those who completed primary, middle, and high school also experienced a reduction in monthly wages by 41.08, 34.82, and 29.88 percent respectively compared to university graduates. Higher vocational and upper vocational give a reduction in monthly wages by 24.87 and 17.22 percent when compared to the omitted category which is the university. When age increases by one from the average age which is 39 then the wages are raised by 0.35 percent. When the gender is female, the monthly wages then decrease by 15.8 percent, and being married increases the monthly wages by 5.22 percent. The monthly wages are increased by 13.88 percent if one is employed in the public sector. Having a technician, clerical worker, service/sales worker, and others as an occupation gives a reduction in monthly wages by 9.32, 26.07, 28.75, and 35.27 percent respectively when compared to a professional. However, being a manager increases the monthly wages by 32.58 percent. It appears that the estimation results of the manufacturing industry seem to be consistent with the overall results of all industries combined except for managers.

In the retail/wholesale industry, the results for the type of education and types of occupation are very similar to that from the manufacturing industry. However, managers give a positive percentage change of 19.84 in monthly income when compared to professionals. As age increases by one from the average age, wages increase by 0.43 percent. Monthly wages are reduced by 10.95 percent when the person is female while monthly wages will increase by 4.96 percent if married. Again, the results of the retail/wholesale industry follow the overall result.

The results obtained from the hospitality industry closely follow the overall and previous industry results. It is noteworthy that females in this industry suffer from wage penalties by 12.28 percent which is in contrast with the popular belief that hospitality is a female-dominated industry. Additionally, wages are increased by 0.23 percent as age increases by one from the average age.

In the entertainment industry, people with lesser education suffered from a higher reduction in monthly wagess compared to the university level. Those with no education get a reduction of 50.39 percent in monthly income,

which is the highest amongst the chosen five industries. Those who graduated from primary, middle, high, and upper vocational school get their monthly wages decreased by 43.79, 43.79, 39.89, 31.95, and 17.63 percent respectively. However, even though higher vocational education is more advanced than upper vocational, the reduction in monthly wages is 22.74 percent which is higher than upper vocational. This shows that this particular industry requires upper vocational graduates more than higher vocational graduates. Wages increase by 0.01 percent as age increases by one from the average age.

Table 4 Regression Result of Sub-Industry Level

Variable	Farmin-g ln_wage	Fishery ln_wage	Automo--bile ln_wage	Electronic ln_wage	Textile ln_wage	Food ln_wage	Petroche-m ln_wage	Hotel ln_wage	Hospitali-ty Service ln_wage
noedu	-0.301***	-0.478***	-0.645***	-0.617***	-0.421***	-0.503***	-0.892***	-0.399***	-0.609***
	(0.0409)	(0.0662)	(0.0254)	(0.0240)	(0.0391)	(0.0123)	(0.0348)	(0.0173)	(0.0337)
primary	-0.296***	-0.400***	-0.544***	-0.519***	-0.347***	-0.454***	-0.737***	-0.343***	-0.531***
	(0.0406)	(0.0654)	(0.0202)	(0.0160)	(0.0367)	(0.0120)	(0.0297)	(0.0146)	(0.0268)
middle	-0.253***	-0.335***	-0.450***	-0.374***	-0.284***	-0.414***	-0.618***	-0.255***	-0.473***
	(0.0413)	(0.0671)	(0.0174)	(0.0120)	(0.0365)	(0.0120)	(0.0275)	(0.0137)	(0.0256)
high	-0.250***	-0.350***	-0.383***	-0.321***	-0.233***	-0.354***	-0.515***	-0.200***	-0.414***
	(0.0426)	(0.0739)	(0.0171)	(0.0116)	(0.0369)	(0.0123)	(0.0274)	(0.0130)	(0.0258)
upper_voc	-0.136***	-0.148	-0.355***	-0.280***	-0.230***	-0.264***	-0.460***	-0.165***	-0.362***
	(0.0527)	(0.104)	(0.0197)	(0.0140)	(0.0477)	(0.0155)	(0.0348)	(0.0177)	(0.0369)
higher_voc	-0.172***	-0.0311	-0.249***	-0.192***	-0.133***	-0.203***	-0.185***	-0.100***	-0.286***
	(0.0501)	(0.0951)	(0.0175)	(0.0122)	(0.0441)	(0.0136)	(0.0263)	(0.0161)	(0.0383)
age	0.0165***	0.0251***	0.0160***	0.00940***	0.0359***	0.0320***	0.0251***	0.0205***	0.0371***
	(0.00177)	(0.00419)	(0.00293)	(0.00233)	(0.00346)	(0.00123)	(0.00472)	(0.00222)	(0.00407)
age_sq	-0.000225***	-0.000260***	-5.73e-05	5.21e-05	-0.000452***	-0.000400***	-0.000149**	-0.000180***	-0.000435***
	(2.11e-05)	(5.01e-05)	(3.95e-05)	(3.26e-05)	(4.35e-05)	(1.52e-05)	(6.09e-05)	(2.80e-05)	(5.19e-05)
female	-0.131***	-0.237***	-0.120***	-0.0809***	-0.145***	-0.145***	-0.203***	-0.107***	-0.199***
	(0.00759)	(0.0279)	(0.00845)	(0.00609)	(0.0145)	(0.00491)	(0.0151)	(0.00752)	(0.0171)
married	0.0108	0.0983***	0.0404***	0.0229***	0.00718	0.0495***	0.0767***	0.0381***	0.0379**
	(0.00910)	(0.0198)	(0.00889)	(0.00616)	(0.0127)	(0.00530)	(0.0158)	(0.00794)	(0.0154)
public	0.307***		0.0291	-0.0258	0.117	0.181**	0.130	0.0925***	-0.0494
	(0.0704)		(0.104)	(0.272)	(0.273)	(0.0793)	(0.151)	(0.0305)	(0.0815)
nor	-0.391***	-0.175	-0.219***	-0.306***	-0.506***	-0.334***	-0.382***	-0.450***	-0.391***
	(0.0861)	(0.307)	(0.0313)	(0.0167)	(0.0183)	(0.0145)	(0.0418)	(0.0173)	(0.0281)
nor_ea	-0.409***	-0.297	-0.230***	-0.274***	-0.404***	-0.272***	-0.182***	-0.413***	-0.440***
	(0.0861)	(0.299)	(0.0274)	(0.0185)	(0.0178)	(0.0146)	(0.0488)	(0.0186)	(0.0287)
sou	-0.346***	-0.0842	-0.150***	-0.131*	-0.459***	-0.275***	-0.220***	-0.218***	-0.173***
	(0.0854)	(0.292)	(0.0307)	(0.0767)	(0.0278)	(0.0141)	(0.0521)	(0.0147)	(0.0217)
cen	-0.167*	-0.0788	-0.0611***	-0.134***	-0.224***	-0.173***	-0.0909***	-0.249***	-0.244***
	(0.0854)	(0.292)	(0.0164)	(0.0145)	(0.0158)	(0.0130)	(0.0226)	(0.0151)	(0.0224)
manager	0.0486	0.0843	0.299***	0.0977***	0.370***	0.258***	0.158***	0.285***	0.181**
	(0.0947)	(0.113)	(0.0345)	(0.0254)	(0.0749)	(0.0254)	(0.0421)	(0.0316)	(0.0721)
technician	-0.110	0.113	-0.131***	-0.217***	-0.0912	-0.0984***	-0.181***	-0.00841	-0.138**
	(0.0924)	(0.116)	(0.0280)	(0.0203)	(0.0607)	(0.0212)	(0.0349)	(0.0290)	(0.0540)

Variable	Farmin-g ln_wage	Fishery ln_wage	Automo--bile ln_wage	Electronic ln_wage	Textile ln_wage	Food ln_wage	Petroche-m ln_wage	Hotel ln_wage	Hospitali-ty Service ln_wage
clerical	-0.306***	-0.315**	-0.330***	-0.386***	-0.296***	-0.311***	-0.366***	-0.256***	-0.281***
	(0.0967)	(0.134)	(0.0300)	(0.0220)	(0.0613)	(0.0211)	(0.0388)	(0.0275)	(0.0505)
servicesale	-0.307***	-0.480***	-0.348***	-0.519***	-0.480***	-0.338***	-0.437***	-0.287***	-0.242***
	(0.0918)	(0.134)	(0.0468)	(0.0362)	(0.0859)	(0.0249)	(0.0503)	(0.0272)	(0.0494)
otheroccu	-0.774***	-0.608***	-0.407***	-0.516***	-0.586***	-0.440***	-0.416***	-0.366***	-0.337***
	(0.0793)	(0.113)	(0.0276)	(0.0194)	(0.0571)	(0.0204)	(0.0349)	(0.0273)	(0.0519)
year	0.0201***	0.0444***	0.0356***	0.0297***	0.0375***	0.0322***	0.0190***	0.0379***	0.0340***
	(0.00172)	(0.00412)	(0.00185)	(0.00139)	(0.00269)	(0.00118)	(0.00349)	(0.00179)	(0.00356)
publicxage	0.190	-	-0.00464	-0.00138	0.0825	0.0119*	0.0135	0.0146***	0.00959
	(0.263)		(0.00688)	(0.00599)	(0.0547)	(0.00671)	(0.0117)	(0.00280)	(0.00772)
Constant	9.652***	9.304***	9.532***	9.730***	9.338***	9.363***	9.576***	9.339***	9.317***
	(0.116)	(0.320)	(0.0578)	(0.0447)	(0.0850)	(0.0316)	(0.0953)	(0.0501)	(0.0886)
Observations	13,299	2,535	5,440	9,072	4,710	17,699	2,769	7,141	2,647
R-squared	0.160	0.349	0.549	0.561	0.426	0.466	0.608	0.484	0.445

Table 5 The Effect of Dummy Explanator Variable of Wage for Sub-Industries (Percentage Change in Wage)

Variables	Farming	Fishery	Automo-bile	Electronic	Textile	Food	Petroch-em	Hotel	Hospitality Service
	Percentage change relative to omitted category								
noedu	-25.99	-38.00	-47.53	-46.04	-34.36	-39.53	-59.02	-32.90	-25.99
primary	-25.62	-32.97	-41.96	-40.49	-29.32	-36.49	-52.15	-29.04	-25.62
middle	-22.35	-28.47	-36.24	-31.20	-24.72	-33.90	-46.10	-22.51	-22.35
high	-22.12	-29.53	-31.82	-27.46	-20.78	-29.81	-40.25	-18.13	-22.12
upper_voc	-12.72	-	-29.88	-24.42	-20.55	-23.20	-36.87	-15.21	-12.72
higher_voc	-15.80	-	-22.04	-17.47	-12.45	-18.37	-16.89	-9.52	-15.80
female	-12.28	-21.10	-11.31	-7.77	-13.50	-13.50	-18.37	-10.15	-12.28
married	-	10.33	4.12	2.32	-	5.07	7.97	3.88	1.09
public	35.93	0	-	-	-	19.84	-	9.69	-
nor	-32.36	-	-19.67	-26.36	-39.71	-28.39	-31.75	-36.24	-32.36
nor_ea	-33.57	-	-20.55	-23.97	-33.24	-23.81	-16.64	-33.83	-33.57
sou	-29.25	-	-13.93	-	-36.81	-24.04	-19.75	-19.59	-29.25
cen	-	-	-5.93	-12.54	-20.07	-15.89	-8.69	-22.04	-15.38
manager	-	-	34.85	10.26	44.77	29.43	17.12	32.98	4.98
technician	-	-	-12.28	-19.51	-	-9.37	-16.56	-	-10.42
clerical	-26.36	-27.02	-28.11	-32.02	-25.62	-26.73	-30.65	-22.59	-26.36
servicesale	-26.43	-38.12	-29.39	-40.49	-38.12	-28.68	-35.40	-24.95	-26.43
otheroccu	-53.88	-45.56	-33.44	-40.31	-44.35	-35.60	-34.03	-30.65	-53.88

Note: Conversion using $\left(e^{\beta_{\text{of chosen dummy}}}-1\right)\times 100$

For example, for higher vocational from our model in section 3.2 $\left(e^{\beta_6}-1\right)\times 100$

If the number is blank this means that it is not statistically significant at 5 and 1 percent

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Regression results at the sub-industry level are shown in Table 4 and Table 5 converts the coefficient associated with each dummy explanatory variable to the effect of each respective dummy on the percentage change in wage to facilitate interpretation like Table 3 but at the sub-industry level. In farming and fishing sub-industries, it mostly follows the result found in the overall agricultural industry. However, the result for upper vocational and higher vocational are not significant in the fishing sub-industry. It is noteworthy that there are no public companies in the fishing sub-industry. In terms of region, the farming sub-industry gives similar results to the overall agricultural level. However, regions are not statistically significant in the fishing sub-industry. This could be because fishery farming could be done anywhere on land with the right equipment while farming sub-industries required a specific type of land made for farming crops. It is also noteworthy that those who are employed in the public sector in farming sub-industries will be able to gain the highest increase in monthly wage compared to other sub-industries. Other sub-industries give similar results to the results found at the overall level except for manager where it gives a positive sign. Furthermore, results for the public sector are not statistically significant for farming, automobile, electronic, textile, petrochemical, and hospitality-related service sub-industries. Females also suffer greatly in fishing and petrochemical sub-industries which could be due to these sub-industries requiring physical strength which is more suitable for males.

5. Conclusion

The paper used an extended Mincerian method similar to prior studies with the addition of taking industries, sub-industries, and occupations into account to find and analyze the return on education in Thailand. The study used the data from the years of 2012 to 2022 to give a more updated analysis of the current Thai labor market. The overall results show that the type of education does affect the monthly wage, university earns the most followed by higher vocational, upper vocation, and high school respectively. After doing sub-sample analysis on the industry and the sub-industries level, it was concluded that the results are not so different from the overall result. Both types of vocational degrees still earn higher than a high school level, but a vocational degree will not be able to earn as much as a bachelor's degree level. The results are consistent with older studies found in Thailand in terms of education. This proved that even results from sub-sample analysis show that the return on education shows similar ranking across industries. In terms of other variables in the study such as region, Bangkok shows positive signs relative to other provinces. Marriage shows a positive sign all across industry and sub-industry levels. Women gain less monthly income compared to men even in the hospitality industry, contrary to popular belief. Surprisingly, the public sector shows positive signs relative to the private sector. By adding occupation type into account, it shows that the monthly income of different types of occupation varies between industries and sub-industries.

Lastly, the number of eligible people in the LFS data that can be used in the analysis might not be enough for the results to become statistically significant at the sub-sample analysis level, hence the restriction in the number of chosen industries and their sub-industries. Future researchers should try to counter this problem.

6. References

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