Labor Productivity, Education, and Their Linkage: Evidence from Thailand*

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Abstract

This study aims to examine labor productivity growth and educational attainment, as measured by mean years of schooling, of employed persons in Thailand during 2001-2010. In addition, it investigates the influence of educational attainment on labor productivity growth in Thailand by employing multiple regression analysis. The findings reveal that employed persons in Thailand, on average, had only 6.88 years of schooling in 2010, implying that most of them completed only primary school. Fortunately, the mean years of schooling of employed persons in Thailand clearly exhibited an upward trend during the study period. In terms of labor productivity, I found that Thailand's labor productivity constantly increased over the study period but exhibited high volatility in its growth rate. The industrial sector exhibited the highest labor productivity growth, followed by the agricultural and service sectors. Additionally, educational attainment was a vital determinant of labor productivity growth in Thailand because the findings reveal that employed persons will be more productive as they receive more education. However, we found that Thailand's educational system has failed to create human resources that are suitable for every sector.

Keywords: *Labor Productivity, Education, Years of Schooling, Thailand*

ผลิตภาพแรงงาน การศึกษา และความเชื่อมโยง
ระหว่างปัจจัยทั้งสอง: หลักฐานจากประเทศไทย*

ศุภเจตน์ จันทร์สาส์น**

บทคัดย่อ

งานวิจัยเรื่องนี้มีวัตถุประสงค์เพื่อศึกษาการเจริญเติบโตของผลิตภาพแรงงานและ
ระดับการศึกษาซึ่งวัดโดยจำนวนปีเฉลี่ยที่ได้รับการศึกษาของแรงงานในประเทศไทย ระหว่าง
ปี พ.ศ. 2544-2553 นอกจากนี้ ยังมีวัตถุประสงค์เพื่อศึกษาอิทธิพลของระดับการศึกษาที่มีต่อ
การเจริญเติบโตของผลิตภาพแรงงานในประเทศไทยโดยอาศัยการวิเคราะห์การถดถอย
พหุคูณอีกด้วย จากการศึกษา พบว่า ในปี พ.ศ. 2553 แรงงานในประเทศไทยมีจำนวนปีเฉลี่ย
ที่ได้รับการศึกษาเพียง 6.88 ปี นั่นคือ มีการศึกษาเพียงระดับประถมศึกษาเท่านั้น อย่างไร
ก็ตาม พบว่า จำนวนปีเฉลี่ยที่ได้รับการศึกษาของแรงงานในประเทศไทยมีแนวโน้มสูงขึ้น
อย่างต่อเนื่องตลอดระยะเวลาที่ทำการศึกษา เมื่อพิจารณาผลิตภาพแรงงาน พบว่า ผลิตภาพ
แรงงานของประเทศไทยเพิ่มสูงขึ้นอย่างต่อเนื่องตลอดระยะเวลาที่ทำการศึกษา อย่างไรก็ตาม
พบว่า อัตราการเจริญเติบโตของผลิตภาพแรงงานมีความผันผวนเป็นอย่างมาก โดย
ภาคอุตสาหกรรมมีการเจริญเติบโตของผลิตภาพแรงงานสูงที่สุด ตามด้วยภาคเกษตรกรรม
และภาคบริการ ตามลำดับ นอกจากนี้ ยังพบว่า ระดับการศึกษาเป็นปัจจัยสำคัญที่กำหนด
การเจริญเติบโตของผลิตภาพแรงงานของประเทศไทย สะท้อนให้เห็นว่าระบบการศึกษาไทย
มีคุณภาพสูงเนื่องจากแรงงานมีแนวโน้มที่จะมีผลิตภาพสูงขึ้นเมื่อได้รับการศึกษาสูงขึ้น
อย่างไรก็ตาม พบว่า ระบบการศึกษาไทยยังไม่สามารถสร้างทรัพยากรมนุษย์ที่เหมาะสมกับ
ทุกภาคการผลิตได้

คำสำคัญ: *ผลิตภาพแรงงาน การศึกษา จำนวนปีเฉลี่ยที่ได้รับการศึกษา ประเทศไทย*

Introduction

In 1970, the first national population policy was announced in Thailand (WHO, 2003), with the primary objective to slow down the population growth rate, which was higher than three percent per annum (United Nations, 2010). The policy was impressively successful, leading to a decreasing fertility rate and a declining proportion of young population aged 0 to 14 years old, which is regarded as a dependent population. Meanwhile, the policy led to an increasing proportion of working-age people (15-59 years old), from 50.2 percent of the total population in 1970 to 67.0 percent in 2010, giving Thailand an economic benefit from the greater labor force relative to the population dependent on it. Based on the statistics from World Bank (2010), Thailand's average growth rate of real gross domestic product from 1970 to 2009 equaled 5.65 percent per annum, and this was attributable to the increasing proportion of working-age population. This fact was supported by Chansarn (2010a), who found a positive influence of the proportion of working-age population on the economic growth of Thailand.

Nevertheless, the size of Thailand's working-age population reached a peak at 67.0 percent of the total population in 2010 (United Nations, 2010), and thereafter it will constantly decline. That is, it will decrease to 65.6 and 63.6 percent of the total population in 2015 and 2020, respectively (United Nations, 2010). In contrast, the proportion of old-age the population (60 years old and over), which is the other dependent population, is expected to constantly increase from 11.5 percent of the total population to 13.7 and 16.4 percent in 2015 and 2020, respectively (United Nations, 2010). Such a demographic change implies that the economic benefit from the growing working-age population is fading away. On the other hand, Thailand can no long rely on the quantity of labor to create its economic growth and, of course, it is necessary for Thailand to find a way to increase its labor productivity in order to compensate for the shrinking working-age population so as to maintain its economic growth in the long run.

Education is regarded as one of the most important determinants of labor productivity. It has been found to have a positive influence on labor productivity in many studies all over the world. It is also the primary component of human capital,

which enables the same amount of labor force to produce more output, thus enhancing Thailand's competiveness and leading to a nation's economic prosperity. With the realization of the importance of education for labor productivity and economic growth, Thailand extended the nation's compulsory education to 12 years in 2002 (from grade one to grade twelve) (OBEC, 2002) and extended it further to 15 years in 2009 (from kindergarten one to kindergarten three and from grade one to grade twelve) (MOE, 2011). Consequently, this study aims to investigate the influence of education on labor productivity in Thailand during 2001 and 2010 with the primary objective to evaluate the quality of Thailand's educational system and to examine whether it can become the source of labor productivity growth of Thailand in the long run.

Literature Review

According to the literature reviews, several studies have focused on labor productivity in various aspects. Some of them were found to focus on the measurement of the level of labor productivity and the growth rate of labor productivity by employing various methods, such as those of Scheryer (2005), Diewert et al. (2009), BLS (2010), whereas others focused on the influence of labor productivity on economic growth as measured by the growth rate of real GDP (Economic Policy Institute, 2000) and improving the standard of living of people in the countries, as measured by the growth rate of real GDP per capita (Fisher and Hostland, 2002; Chansarn, 2010b) and as measured by the growth rate of gross national income (GNI) per capita (Chansarn, 2009). In addition, all of these studies found a positive influence of labor productivity on economic growth and on improving standard of living.

Furthermore, several studies focused on the determinants of labor productivity. Firstly, Duryea and Pages (2002), Razzak and Timmins (2007), and Chansarn (2010c) found a positive influence of education on labor productivity. Knapp (2007) and Chadha (2008) found a positive influence of health and longevity on labor productivity. Additionally, Choudhry, (2009), Jajri and Ismail (2009), and Chansarn (2010c) found the positive influence of technological progress, as measured by total factor productivity and ICT investment, on labor productivity

growth. In addition, another issue regarding labor productivity which has been currently in focus is the impact of population ageing on labor productivity (Prskawetz et al., 2008) and also the contribution of labor productivity growth to offset the impact of population ageing so that a particular country could experience constant economic growth, implying a better standard of living (Chansarn, 2010b).

There have also been several studies on labor productivity in Thailand. Ramstetter (2004), for example, investigated the influence of firm ownership on labor productivity in the manufacturing sectors in Thailand. Chansarn (2009) measured the growth rate of labor productivity in Thailand and examined the relationship between the growth rate of labor productivity and improving the standard of living of Thai people. Moreover, Chansarn (2010b) measured the growth rate of labor productivity in Thailand and investigated the contribution of labor productivity growth to offset the declining proportion of the working-age population so that Thailand could experience constant economic growth. However, study of the determinants of labor productivity, especially education, was not found. As a result, the study of the determinant of labor productivity in Thailand is still an interesting issue, and that is why this study has focused on the influence of education on labor productivity in Thailand.

Research Methodology

The research methodology for this study is divided into two sections. The first section presents the analytical method, whereas the second section identifies the data and sources of the data.

Analytical Method

The analytical method for this study is divided into three sections. The first section aims to calculate the mean years of schooling of employed persons in the agricultural, industrial, and service sectors in Thailand during 2001-2010 in order to present the situation of education in Thailand. In the calculation, employed persons in Thailand were categorized into six groups according to their levels of education as follows.

1. Employed persons that did not complete primary school (grade six) are assumed to have no education, having zero years of schooling.

2. Employed persons that completed primary school (grade six) have 6 years of schooling.

3. Employed persons that completed lower secondary school (grade nine) have 9 years of schooling.

4. Employed persons that completed upper secondary school (grade twelve), with a certificate of vocational education or a certificate of teacher training, are assumed to have 12 years of schooling.

5. Employed persons that completed a certificate of higher vocational education or a certificate of higher teacher training are assumed to have 14 years of schooling.

6. Employed persons that completed a bachelor degree or over are assumed to have 16 years of schooling.

The mean years of schooling of employed persons in each sector and each year will be calculated by utilizing the simple average method.

The next section focuses on labor productivity in Thailand by measuring the level of labor productivity and the growth rate of labor productivity in each sector based on the calculation method used by the U.S. Bureau of Labor Statistics (BLS, 2009). First, the level of labor productivity as measured by the labor productivity index was calculated using the following formula.

$$\text{Labor productivity index (LPI}_{t,0}) = \left[\frac{Q_t/Q_0}{L_t/L_0} \right] \times 100 \tag{1}$$

, where $LPI_{t,0}$ = labor productivity index in the current year compared to the base year, which is 2000, Q_t = real GDP in the current year, Q_0 = real GDP in the base year, L_t = number of employed persons[1] in the current year and L_0 = number of employed persons in the base year.

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[1] Immigrant workers were not included in employed persons in this study since we assumed that immigrant workers in Thailand are mostly unskilled laborers and have very low productivity so that the quantity of output produced by them is negligible.

Thereafter the growth rates of labor productivity were calculated using the following formula.

$$\text{Growth rate of labor productivity} = \ln\left[\frac{LPI_{t,0}}{LPI_{t-1,0}}\right] \times 100 \qquad (2)$$

The final section for the analytical method focuses on the influence of education as measured by mean years of schooling on labor productivity in Thailand by employing multiple regression analysis. The regression model to be estimated is as follows.

$$\ln(lp) = \beta_0 + \beta_1 mys + \beta_2 ind + \beta_3 ser + \beta_4(mys \times ind) + \beta_5(mys \times ser) + \mu \qquad (3)$$

, where lpi = labor productivity as measured by labor productivity index, mys = education as measured by mean years of schooling, ind = 1 for industrial sector and 0 otherwise, ser = 1 for service sector and 0 otherwise β_i = regression coefficients and μ = residual term.

The regression analysis will shed more light on the influence of education on labor productivity, the differences of labor productivity among the agricultural, industrial, and service sectors, and the differences of the influence of education on labor productivity among these three sectors, enabling us to evaluate the quality of Thailand's educational system, which is very important for enhancing labor productivity in the nation.

Data and Sources

This study relies on secondary time-series data in an annual format during 2001-2010 obtained from two sources. The data to be analyzed in this study include (1) number of employed persons categorized by their levels of education and sectors obtained from the National Statistical Office (NSO, 2011), and (2) real gross domestic product (GDP) categorized by sectors obtained from the National Economic and Social Development Board (NESDB, 2011).

Findings

The mean years of schooling of employed persons in Thailand in the agricultural, industrial, and service sectors during 2001-2010 are presented in Table 1. The findings reveal that employed persons in Thailand, on average, still have low education. That is, their mean years of schooling equaled 6.88 years in 2010, implying that, on average, they completed only primary school. However, there is a good sign. That is, the mean years of schooling of employed persons in Thailand obviously exhibited an upward trend, increasing from 5.41 years in 2001 to 6.88 years in 2010.

Now let us look at the mean years of schooling of employed persons in each sector. According to Table 1, employed persons in the service sector had the highest education among the three sectors, having, on average, 9.24 years of schooling in 2010. This figure implies that, on average, employed person in this sector completed lower secondary school. Moreover, we found that employed persons in the industrial sector, on average, had 7.53 years of schooling in 2010, indicating that, on average, they completed only primary school.

Employed persons in the agricultural sector were found to have the lowest education among the three sectors. That is, they had, on average, only 4.36 years of schooling, implying that, on average, they did not complete even primary school. However, the good sign is that the mean years of schooling of employed persons in every sector exhibited an upward trend. That is, the mean years of schooling of employed persons in the agricultural, industrial and service sectors increased from 3.17, 6.37 and 7.82 years in 2001 to 4.36, 7.53 and 9.24 years in 2010, respectively.

Table 1: Mean Years of Schooling (Years) of Employed Persons in Thailand

Year	Agricultural Sector	Industrial Sector	Service Sector	Overall
2001	3.17	6.37	7.82	**5.41**
2002	3.29	6.48	7.86	**5.53**
2003	3.37	6.65	8.06	**5.75**
2004	3.58	6.84	8.30	**6.00**
2005	3.51	6.99	8.37	**6.01**
2006	3.63	7.11	8.50	**6.14**
2007	3.82	7.28	8.71	**6.36**
2008	4.08	7.26	8.91	**6.53**
2009	4.27	7.24	9.05	**6.75**
2010	4.36	7.53	9.24	**6.88**

Source: Author's calculation based on data obtained from NSO (2011).

Remarks: The agricultural sector includes the (1) agriculture, hunting, and forestry and (2) fishing sectors. The industrial sector includes the (1) mining and quarrying, (2) manufacturing, (3) electricity, gas and water supply, and (4) construction sectors. The service sector includes (1) wholesale and retail trade, repair of vehicles and personal and household goods, (2) hotels and restaurants, (3) transport, storage, and communication, (4) financial intermediation, (5) real estate, renting, and business activities, (6) public administration and defense and compulsory social security, (7) education, (8) health and social work, and (9) other community, social, and personal service activities.

Table 2 presents the levels of labor productivity as measured by labor productivity indices and the growth rates of labor productivity in the agricultural, industrial and service sectors in Thailand during 2001-2010. According to Table 2, Thailand's labor productivity index equaled 125.48 in 2010, implying that in 2010 its labor productivity increased by 25.48 percent compared to the base year, 2000. Moreover, it is obvious that Thailand's labor productivity had constantly increased during 2001-2008 since the labor productivity index increased from 99.54 in 2001 to 122.46 in 2008; thereafter it decreased to 117.42 in 2009 before it increased to 125.48 in 2010. In terms of labor productivity growth, it was found that the growth rates of labor productivity in Thailand during the study period ranged from the lowest rate of -4.20 percent per year in 2009 to the highest rate

of 6.64 percent per year in 2010, with the average growth rate of 2.27 percent per year and a standard deviation of 3.05 percent per year.

The industrial sector had the highest level of labor productivity and average growth rate of labor productivity during 2001-2010. According to Table 2, the labor productivity index in the industrial sector in 2010 was 134.04, indicating that labor productivity in this sector increased by 34.04 percent compared to 2000. Moreover, the movement of labor productivity in the industrial sector had the same pattern as the overall labor productivity in Thailand. That is, it constantly increased during 2001-2008, and then it decreased in 2009 and increased again in 2010. In terms of growth rate, the average growth rate of labor productivity in the industrial sector was the highest among the three sectors, equaling 2.93 percent per year with a standard deviation of 5.05 percent per year, indicating high volatility.

Table 2: Labor Productivity Index and Growth Rate of Labor Productivity in Thailand

Year	Agricultural Sector		Industrial Sector		Service Sector		Overall	
	Index	Growth	Index	Growth	Index	Growth	Index	Growth
2001	104.91	4.79	94.79	-5.35	97.24	-2.80	99.54	-0.46
2002	102.38	-2.44	97.89	3.21	99.18	1.97	101.72	2.16
2003	116.71	13.10	102.18	4.29	97.91	-1.29	106.54	4.63
2004	116.00	-0.61	104.71	2.44	98.62	0.72	110.38	3.54
2005	114.00	-1.74	107.90	3.01	101.05	2.43	113.78	3.04
2006	115.07	0.93	114.89	6.27	106.11	4.89	118.13	3.75
2007	115.34	0.23	119.82	4.20	108.93	2.62	122.16	3.36
2008	116.94	1.38	125.29	4.47	106.40	-2.35	122.46	0.24
2009	118.55	1.37	119.08	-5.08	101.31	-4.90	117.42	-4.20
2010	117.05	-1.28	134.04	11.83	102.83	1.49	125.48	6.64
Mean	-	1.57	-	2.93	-	0.28	-	2.27
SD	-	4.54	-	5.05	-	3.01	-	3.05

Source: Author calculation based on data obtained from NESDB (2011) and NSO (2011).
Remark: The base year of labor productivity index is 2000.

In addition, labor productivity in the agricultural sector in 2010 increased by 17.05 percent compared to 2000 since its labor productivity index was 117.05 in 2010. The labor productivity in this sector gradually changed during 2001-2002

before it soared in 2003, having a labor productivity index of 116.71. Thereafter labor productivity in the agricultural sector was volatile during 2004-2010, increasing during 2006-2009 and decreasing during 2004-2005 and 2010. The average growth rate of labor productivity in the agricultural sector during 2001-2010 equaled 1.57 percent per year with a standard deviation of 4.54 percent per annum, indicating high volatility in labor productivity growth, as mentioned before.

The service sector had the lowest level of labor productivity and average growth rate of labor productivity among the three sectors. The labor productivity index in 2010 was only 102.83, implying that the labor productivity in this sector in 2010 increased by 2.83 percent compared to 2000. The level of labor productivity in this sector reached a peak in 2007 with a labor productivity index of 108.93, and thereafter it constantly declined during 2008-2009 before it slightly increased in 2010. According to Table 2, the average growth rate of labor productivity in the agricultural sector was very low, equal to 0.28 percent per year; however, the standard deviation was very high, at 3.01 percent per year, indicating high volatility in labor productivity growth in this sector.

According to Table 3, which presents the results from the regression analysis, the estimated equation was significant at a 5 percent level with an F-stat of 38.265. This equation could explain the total variation in labor productivity by 88.9 percent thanks to the R-Squared of 0.889. In terms of statistical violation, no evidence of an autocorrelation problem was found in the regression analysis because the Durbin-Watson statistic equaled 1.498, whereas the lower bound for the Durbin-Watson critical value for the 30 observations and 5 percent significance level equaled 1.071 (Stanford University, 2011). Moreover, the findings revealed that education, as measured by mean years of schooling (mys), the dummy variable for the industrial sector (ind), and the interaction between mean years of schooling and the dummy variable for the industrial sector (mys x ind), were statistically significant at a 5 percent level, indicating the significant influences on labor productivity as measured by the labor productivity index. Therefore, the estimated equations for the agricultural, industrial, and service sectors could be identified as the following.

Agricultural and service sector : $\quad \ln(lp) = 4.421 + 0.084 mys$

Industrial sector $\qquad\qquad$: $\quad \ln(lp) = 2.695 + 0.289 mys$

Accordingly, education was seen to be the vital determinant of labor productivity in all agricultural, industrial, and service sectors in Thailand. The mean years of schooling was found to have a positive influence, yet with a different magnitude, on the labor productivity index in these three sectors. That is, labor productivity in the agricultural and service sectors was expected to increase by 8.4 percent if the employed persons in these two sectors had one more year of schooling, but that in the industrial sector as expected to increase by 28.9 percent if the employed persons in this sector had one more year of schooling.

Table 3: Results from the Regression Analysis

Variable	Coefficients	Std. Error	t-Statistics	P-Value
constant	4.421*	0.096	46.225	0.000
mys	0.084*	0.026	3.276	0.003
ind	-1.726*	0.216	-7.978	0.000
ser	-0.223	0.206	-1.082	0.290
mys x ind	0.205*	0.038	5.430	0.000
mys x ser	-0.034	0.033	-1.010	0.323

Observation = 30, F-Stat for Overall Significance = 38.265*, P-Value for Overall Significance = 0.000,

R-Square = 0.889, Std. Error of the Estimate = 0.032, Durbin-Watson Stat = 1.498

Source: Author's calculation

Remark: (1) Dependent variable is labor productivity index in natural logarithm

$\qquad$ (2) * indicates statistical significance at 5 percent level

Discussion

This study has shed more light on the situation of education in Thailand. According to the United Nations, the mean years of schooling of Thai people in 2009 equaled 6.6 years (UNDP, 2010). This figure is very close to the findings in this study, which shows that the mean years of schooling of Thai people in 2009 equaled 6.75 years. However, this study presented not only the mean years of

schooling of employed persons in Thailand but also those of employed persons in the agricultural, industrial and service sectors in the nation. The findings clearly point out a problem regarding education in the agricultural sector, where the employed persons in this sector had only 4.36 years of schooling in 2010. The employed persons in the industrial and service sectors had a higher education than the average; however, the employed persons in these 2 sectors were still regarded as unskilled laborers.

Additionally, the findings regarding labor productivity showed that the level of labor productivity in Thailand constantly increased during the study period, implying a good signal for Thailand's economic prospects. However, some findings raised concern over labor productivity in Thailand. First of all, the growth rates of labor productivity in Thailand were very volatile, especially during the period after the global economic crisis, stemming from sub-prime mortgage, implying that the labor market structure in Thailand is not flexible. In other words, Thailand was unable to fully utilize its labor force in production during the economic downturn since most of Thailand's laborers are unskilled labors and have low competitiveness. This problem might be solved by creating skilled and professional laborers so as to enhance Thailand's competitiveness in the global market. By doing so, the impact of global crisis on its production and labor force utilization will be reduced.

The findings also revealed that the industrial sector had the highest labor productivity, followed by the agricultural and service sectors, even though the employed persons in service sector had the highest education, followed by the industrial and agricultural sectors. These findings raise concern over Thailand's educational system. That is, Thailand's educational system has failed to create human resources that are suitable for every sector. In other words, the knowledge and skills obtained from education in Thailand seem to fit with the industrial sector more than the others. This statement can be supported by the finding that one more year of schooling will lead to roughly a 29 percent increase in labor productivity in the industrial sector but only a 8.4 percent in the other sectors.

Conclusion and Recommendations

This study demonstrated that education is very crucial for Thailand's economic prospects since it is proved to be the significant source of labor productivity growth in Thailand, finally leading to the improved standard of living of its people. Moreover, Thailand's educational system seems to have impressive quality because employed person will be more productive when they receive more education. However, the appropriateness of the educational system still needs improvement so that it can create human resources that are more suitable for every sector, especially the service sector. The service sector is very important for Thailand's economic prosperity in an ageing society and with a shrinking labor force since it is knowledge-intensive, which creates higher added value and is less affected by the global crisis and the ageing population. Nevertheless, enhancing education and improving the educational system take a long time to achieve. In the short run, enhancing labor skills will be a vital tool for enhancing the competency and competitiveness of Thailand's labor force so that it can be efficiently utilized all the time, lessening the volatility of labor productivity growth. Success depends heavily on the effort and seriousness of the government and the authorities.

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