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THE IMPACT OF CHANGE IN LABOR FORCE STRUCTURE ON ECONOMIC GROWTH ---- IN CASE OF THAILAND

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Abstract

The study tries to explore the economic impact of the changing labor force structure in Thailand from several dimensions.

As labor force structure can be broken down into several categories, for example, age, agender, workforce available, education levels, so, this paper will dig into the depth about the economic impact from the perspectives on labor force, based on some main categories in Thailand so as to find the suitable policies what would be recommended to Thai Government.

The current research found that given the technology levels, Thailand has been changing from labor intensive industries to capital intensive industries, as the result, the educational level of total labor force positively affect the economic growth in Thailand, and the inverse elasticity of substitution rate between the change rate of total labor force and those labor force available but not looking for jobs can either positively or negatively affect the economic growth in Thailand significantly, also, the combination of coefficients of capital and labor implies that there is an increasing economic return to scale in Thailand, therefore, the Thai government does not only attract more foreign direct investment, but also need to transform the labor available but not looking jobs to be in labor force, extend the working life span for suitable older persons and increase the educational levels simultaneously.

Introduction

Like many countries in the world, Thailand has been falling into the aging society since 2002, and it will be an aged society around 2024, as same as that of Singapore, Thailand has taken only 22 years transiting from aging society to be aged society, which is the second fastest country slided into aged society in the world (United Nations ESCAP, Population Data Sheet, 2016).

According to the economic statistical report from Asian Development Bank, the economic growth rate of Thailand was the second lowest among ASEAN 10 countries for year 2013, 2014, and the third lowest for year 2015 to 2017, while Singapore recorded the third lowest growth rate in year 2013, 2014 and the second lowest growth rate from year 2015 to 2017.

Contrast to other developed countries, for instance, France, Sweden, it took these two countries 115years (from 1865 to 1980) and 85 years (from 1890 to 1975) respectively transformed from aging to aged society while their per capita were already 12,672.00 USD and 9,974.00 USD separately.

In ASEAN 10 cities, Singapore has same speed (in 22 years) as that of Thailand to reach the aged society in 2000, but, its per capita was 23,792.00 USD at that time. However, when Thailand will be aged society in 2024, its estimated per capita will be only 8,907.35 USD in year 2022 and could be reached 9,634.20 in 2024 if the growth rate is at 4% annually. given the low per capita of Thailand in current, it is import to research on "become richer before become older" which is not only meaningful to Thailand, but also useful for other developing countries (Bloom et. al., 2010). Phijaisanit E. (2016) used two "demo" incentives to argue that if Thai government can promote elderly employment with either more flexible employment structure or tax incentives, then, the per capita even can increase, but, there is no empirical test so far.

Based on Cobb-Douglas production function, the labor force is one important factor included into the function, so, the change of labor force affects the output on several aspects. Such conclusion can be reaffirmed on the total populations change rate, for example, the total populations change rate (increase) of Thailand has been the lowest since year 2005 and fertility rate of Thailand has been the second lowest since year 2000 too, further, the such phenomenon could be approved as well in year 2018 and 2019 (forecasted).

Therefore, in the current study, how Thailand can improve its per capita before year 2024 will be discussed in quantitative way by using the inverse elasticity of substitution rate between the change rate of available labor force (but not looking for jobs) and the change rate of total labor force, and the relative knowledgeable level of labor force as independent variables.

Literature review

According to report of United Nations Economics and Social Council 2017, the

Asia and the Pacific area has been encountered rapid aging pace for whole populations, for example, Japan has more than 30% of population aged over than 60 years in 2015, and Hong Kong, Republic of Korea, Singapore, Taiwan will join this group in 2030.

For Thailand, it has been in the group of 10% to 15% of populations aged 60 years old and over in 2010, but will enter into 25% to 30% group in 2030.

The most obvious phenomenon of this unprecedent aging society in Asia and the Pacific countries is that many countries will be aged society before the per capita reach the levels as same as that of developed countries. This is a very important issue challenged for every government of developing countries. Because the supporting rate to old age or retired person will drop about 80% from 8.4 working age people to 3.4 working age people in 2050, and every 1% increase in aged population will cause 0.5 to 0.75 percentage reduction in economic growth, these problems will be left for governments with limited choices: by increasing productivities or burden heavy fiscal and social responsibilities (Phijaisanit E. (2016)

Many research papers focus on why and how aged society affect economic growth rate. For instance, Bloom D. and Williamson G. J (1998) found that the aged population transition affected economic growth in a long-time span, at most, it may take as many as 50 years, the authors contributed such results to older people saving more during their working life stage, also, they discovered that East Asia's economic miracle could be explained by 50% through the population transition or dynamics. Started with Cobb Douglas production function, Akintunde et al. (2013) revealed that the lower fertility rate has a negative impact on economic growth rate, but, the life expectancy at birth has a positive relationship with economic growth rate in Sub-Saharan Africa, they concluded that a sustainable economic growth must be underpinned by high population growth. This conclusion was echoed by Maestas et al. (2016) and Nagarajan et al. (2016).

Maestas et al. (2016) stated that when aged population increased by 10%, the per capita will decrease by 5.5%. This problem could be explained by decrements on labor force supplement and productivities growth when people in work force were aging. The authors also argued that such negative relationship between incremental aged population and per capita could be found in every industry if the earnings were used as proxy for changes of skill factor that have effect on the labor productivity, even if there were some offsets between the aged skilled workers and younger educated workers.

Nagarajan et al. (2016) explained the ways how aged population affected the economy. They argued that the aged population may affected economic growth by consumption, saving patterns, public expenditure and return on human capital in negative ways.

Conversely, Elgin C. and Tumen S. (2012) stated that when economic growth

for a country shifted from labor intensive technology to human capital-intensive technology, then, the decreasing population or decreasing labor force can coexist with sustained economic growth.

Erdem E. and Tugcu C.T (2011) studied the relationship between higher education and economic growth base on data from Turkish. Their findings showed that the relationship between higher education and economic growth is cointegrated and causally, in other words, higher education can enhance the economic growth while higher real GDP may strengthen the more higher education system further.

Sukpaiboonwat S. et al. (2014) summarized the mechanisms how the aged population affected economic growth by either diminishing or enhancing the growth rate. They explained that on one hand when people become aged, they may change their attitude on marriage or other aspects as well as change in living standard, as results, these changes will cause low birth rate, high health expenses and lower consumption and saving, then, these ageing population will cause lower economic growth. Meanwhile, if these ageing population has more accumulated human capital so as to increase efficiency of work and increasing life satisfaction, then, these changes could increase economic growth on the other hand.

In Thailand, there are few researches on the relationship between aged labor force and economic growth rate by using time series panel data, most of studies focus on government policies towards aged populations, for example, Kongtong Y and Romprasert S. (2015) studied the government policy used to support the Thailand ageing population sustainably. They raised the problem that the ageing population could be the most important and urgent factor in labor force instead of gender as before. Haque et al. (2016) also pointed out that in Thailand the active ageing level of older population is improved but is not so high, so, this gives rooms for Thai government to promote "active levels" (working activities involvement of older persons). But, the government should focus on elders' health needs and extend more longer work lives and arranging lifelong learning program for older persons too.

Research methodology

Similar to previous studies, the current research starts with Cobb and Douglas production function, and use two factors: educational level of labor force and the substitution rate between the change of total labor force and those labor force available but not looking for jobs to analysis the economic growth rate for Thailand.

Data

All quarterly data from year 2009 to 2018 are collected from National Statistical Office or NSO database.

Theoretical model

Cobb Douglas production function:

$Y_t=At*K^{\alpha}_t*L^{\beta}_t$ (1) Where $\alpha + \beta = 1$, or $\beta = 1- \alpha$, and $0<\alpha<1$, $0<\beta<1$;

A stands for the level of technology which will be proxied by the number of patents granted of Thailand. K represents stock or physical capital and L denotes as the labor force, Y is the total national output (Romer. M. P, 1994). Subscript t means all these data are time series panel data.

Similar to the methodology used by Elgin and Tumen (2012), when considering the inverse elasticity of substitution rate between the change rate of total labor force and those labor force available but not looking for jobs, λ is introduced into the function and assumed has exponential relationship with labor, so, it represents an inverse elasticity of substitution of labor force. The equation (1) is changed to be:

$Y_t=At*K^{\alpha}_t*L^{\beta}_t = Y_t=At*K^{\alpha}_t*L^{1- \alpha- \lambda}$ (2)

As the inverse elasticity of substitution rate is measured by the change rate between numbers labor force available but not looking for jobs at time t and time t-1 divided by the change rate between total numbers of labor force at time t and time t-1, so, if λ is positive then the effect will not be good for total output, for example, if total labor force increase while the numbers labor force available but not looking for jobs also increase, or total labor force decrease and the numbers labor force available but not looking for jobs decrease too, then, the, λ, the inverse elasticity of substitution rate is positive. The current study summarizes four patterns in which the inverse elasticity of substitution rate may affect GDP in either positive or negative ways:

Total Labor Force	Not Looking for Job/Available	Effects on GDP
a. Increase	Increase	Negative (λ is positive)
b. Increase	Decrease	Positive (λ is negative)
c. Decrease	Increase	Negative (λ is positive)
d. Decrease	Decrease	Negative (λ is positive)

According to Maestas et al. (2016), If the high education can be used to offset the decrement on national output caused by increasing aged population, and enhance the GDP growth (Erdem and Tugcu, 2010), the proportional labor force with high education should be significantly affect the total output, so, parameter φ will be additive to the labor assumed by exponential relationship too, then the equation will be:

$Y_t=At*K^{\alpha}_t*L_t^{1- \alpha- \lambda + \varphi}$ (3)

φ is measured by the number of high educational labor force (whose educational level is above the general

Vocational graduated) divided by the number of total labor force.

The current study tries to research on effects from the change of labor force' structure on national output only, based on equation (3), if the national output reaches its local highest or lowest points, the condition for such local highest and lowest points of national output must be:

$dY/dL = (1- \alpha- \lambda + \varphi)\, At*K_t^{\alpha}*L^{- \alpha- \lambda + \varphi =} 0$ (4), and the properties of concavity or convexity of the equation (3) requires that $1- \alpha- \lambda + \varphi > 0$, 0, or < 0 （5） together with that

$d^2Y/ dL^2 = (1- \alpha- \lambda + \varphi)(- \alpha- \lambda + \varphi)\, At*K_t^{\alpha}*L^{- \alpha- \lambda + \varphi-1} < 0$, 0, or >0, so, the equation (3) is either concave or convex will be subject to:

$(1- \alpha- \lambda + \varphi)(- \alpha- \lambda + \varphi) < 0$, 0, or >0 （6）

For testing the time series panel data and simulating the national output under different value of α, the equation (3) can be transformed as:

$Ln(Y_t) = Ln(A_{t-3}) + \alpha Ln(K_t) + (1- \alpha- \lambda + \varphi) Ln(L_t) + \varepsilon_t$ (7)

As A stands for the level of technology which will be proxied by the number of patents granted of Thailand, it is reasonable to assume that these patents granted has lagged effects on the GDP, and it will not be changed more during that year, so, lagged three value (A_{t-3}) is used as one independent variable.

Discussion

Figure 1 shows the trend of growth on GDP (in natural logarithm value) of Thailand from 2009 to 2017, and Figure 2 shows the natural logarithm value for GDP, Physical Capital and Total Labor Force of Thailand from 2009 to 2017. From these two figures, especially in the fourth quarter of year 2016 to the fourth quarter of the 2017, the GDP of Thailand moves in a same direction with that of physical capital, while, the total labor force had been reducing during the same period.

As the current study focus on two important factors which may affect the GDP of Thailand, one is the inverse elasticity of substitution of labor force and another is the relative educational level of the total labor force, so, the Figure 4 and 5 present the descriptive change of these two factors during 2009 to 2017 period.

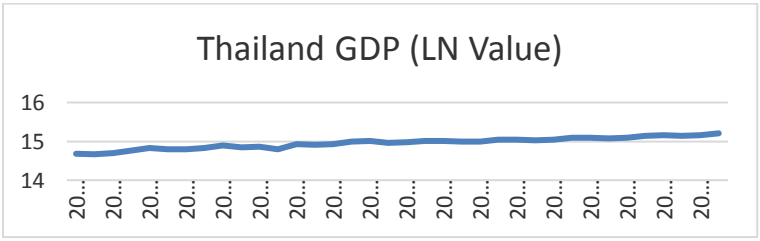

Figure 1 The trend of growth of GDP of Thailand (LN Value) from 2009 to 2017

Figure 3 discovers the change of the Total labor force of Thailand during year 2009 to 2017, the total labor force was fluctuated and shown reducing trend from year 2016 to 2017.

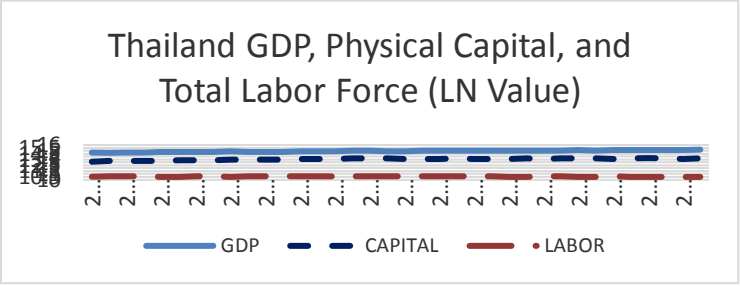

Figure 2 Thailand GDP, Physical capital and total labor force (LN Value)

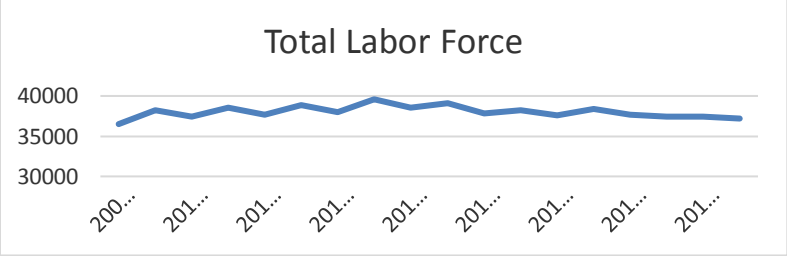

Figure 3 The total labor force of Thailand (2009-2017)

From Figure 4, the λ, the reverse elasticity of substitution of labor force fluctuated mostly above the zero, in other words, these values are more in positive than that in negative, such positive values imply that available but not looking jobs moves in same direction with total labor force, which affect the GDP of Thailand in a negative way. However, when compare the trend of λ with the trend of GDP, the current study found that such negative effects seem to have in advance influences on GDP, for example, when the reaches its local highest point between the forth quarter of year 2009 and the first quarter of year 2010, the quarterly GDP of Thailand slided to its local lowest point around the third quarter of 2010, such phenomenon can also be found between the second quarter in 2013 and the fourth quarter in 2013 and so on.

When compare Figure 5 with Figure 1 and Figure 3, the percentage of high educational level of labor force, ϕ, had been increasing during the studying period no matter the fluctuations of both GDP of Thailand and total labor force available.

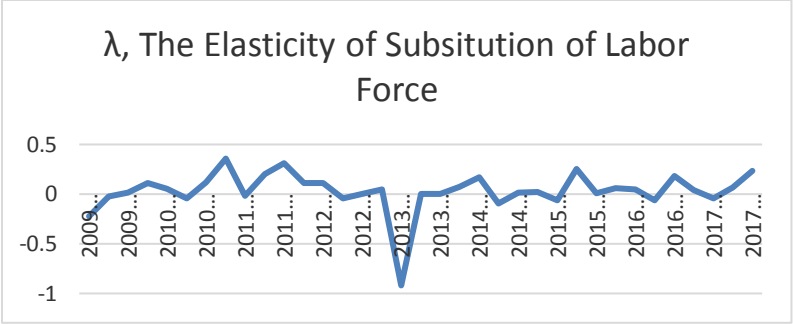

Figure 4 λ, The inverse elasticity of substitution of labor force

Most important point is that even total labor force was reduced in the year 2017, the percentage of high educational level of labor moves in a same way of the GDP of Thailand, so, it seems to have a positive correlation ship with the growth of GDP beside the effect of physical capital.

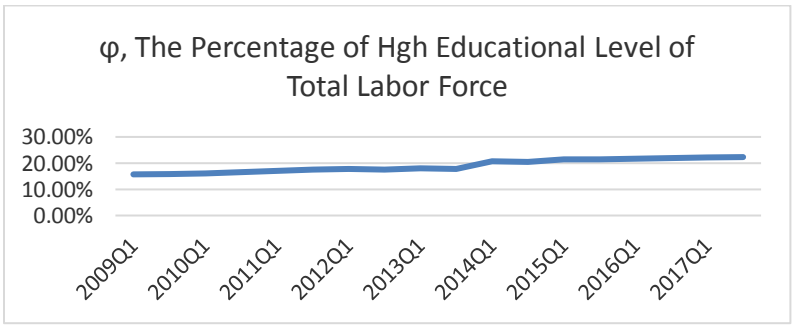

Figure 5 ϕ, The percentage of high educational level of total labor force

Table 1 and Table 2 confirmed assumptions of negative effect of λ and positive effect of ϕ on GDP of Thailand.

Table 1 The correlation ship between quarterly GDP and λ

Items	λ Value	GDP
λ Value	1	
GDP	-0.3506	1

From Table 1, the value of λ has negative correlation ship with lagged two quarterly GDP, the value is -0.3506, while from Table 2, the value of ϕ has a positive effect on concurrent quarterly GDP, its correlation ship value is 0.9116.

Generally, above findings reaffirmed the assumptions, which represented in equation (7), that the reverse elasticity of substitution of labor force has a negative effect on GDP while the high educational level of labor force has a positive effect on GDP.

Table 2 The correlation ship between quarterly GDP and ϕ

Items	**GDP**	**ϕ Value**
GDP	1	
ϕ Value	0.9116	1

The multiple regression results from equation (7) were presented in Table 3.

Table 3 Results of regression on GDP (Quarterly, in LN value)

Dependent Variable: GDP
Method: Least Squares
Sample (adjusted): 4 33
Included observations: 30 after adjustments

Models	Total Labor Force	Employed Labor Only	Employed Labor Minus Labor not at Work	Labor Educational Level under Vocational	Labor Educational Level Above Vocational
Variables	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
A_{t-3}	0.1797	0.1768	0.1698	0.2023	-0.0299
	(8.29)***	(7.98)***	(7.57)***	(7.27)***	(-1.01)
Capital	0.4122	0.4308	0.4561	0.5105	0.5532
	(5.54)***	(5.72)***	(6.03)***	(6.56)***	(5.01) ***
Labor	0.7657	0.7446	0.7177	0.6403	0.8473
	(8.97)***	(8.62)***	(8.25)***	(7.32)***	(4.75) ***
R-Squared	0.9242	0.9197	0.9145	0.8991	0.8362
Adjusted R2	0..9186	0.9138	0.9082	0.8917	0.8241
D-W Stat	1.8825	1.8476	1.7694	1.6821	1.2121

*Remark: T-Statistics in Parentheses. ***: Statistically significant on 99% Confident Level.*

Table 3 shows that under the different levels of technology, the physical capital amount and different proportion of labor forces both have significant effect on quarterly GDP of Thailand at 99% confident level.

When total labor force included, the coefficients for Technology proxy A, capital and labor are 0.179, 0.412, and 0.765 respectively, these results imply that during the research period 2009 to 2017, the GDP of Thailand mainly relied on more labor than that on capital.

However, when the labor employed only, the coefficients of labor decreases and coefficients of capital increases, comparing with that when total labor force involved. Meanwhile, the coefficient of Technology proxy A reduces as well. Such results on coefficients of each independent variable reveal that when the model included less labor, the coefficient for technology proxy decreased, coefficient of capital increased and coefficient of labor decreased, in other words, when there is less labor available in production, the gross output of Thailand mainly relied on physical capital, other than Technology.

But, when the total labor force is divided into other two different group: the group of labor's educational level under general vocational level and the group of labor's educational level above the vocational level, the empirical results discover that when the number of labor force available is less, the coefficient of labor became more, but the coefficient of capital increase too no matter the number of labor available changes, also, the coefficient of technology proxy increase significantly when compared with the first three results of regressions. But, when there are only labors with higher educational level, the coefficient of labor increase to be 0.8473, but the coefficient of technology proxy because insignificant. These may suggest that the higher educational labors play a more important role on GDP of Thailand beside that of Technology.

As the highest coefficients of physical capital, α, is significant at 0.5532, and the lowest coefficient of labor is 0.6403 during years 2009 to 2017, this suggest that Thailand economy has been in the transition process from labor intensive to capital intensive during that period, also, the combinations of coefficients of physical capital and labors are all more than 1 under each scenario, therefore, Thailand economy has been increasing returns to scale, so, every unit of capital or labor input will increase high marginal total output of Thailand, consequently, the incorporative effects of the inverse elasticity of substitution of labor force and the educational level of these labors on GDP of Thailand are needed to be explored more further.

According to the equations (4), if $(1- \alpha- \lambda + \varphi)$ equals to 0, then, $1- \alpha$ must equals to $\lambda - \varphi$, as the coefficient of physical capital, α, will be assumed to increase in the future, so, $1- \alpha$ will be lower than current level, however, when the total labor force will shrink, which means that Thailand will fall into an aged society, the industries need more high educational labor force to utilize the capital and apparatus, but the relative educational level will be increased when older persons involved, as the result, the minus consequences between the inverse elasticity of substitution of labor force and the percentage of educational level of labor force can be positive, zero or negative, such changes will enable equation (3) to be concave at some points

then, reach its highest points or lowest points and convex. While, the equation (6) can be negative or positive, for instance, when α is more than 0.65, while, the φ equals to 0.20, the production function shape will be a strict concave if and only if λ is more than -0.45 but less than 0.55, or the production function shape will be a strict convex if and only if λ is less than -0.45, such concavity and convexity of production function can be observed from the Figure 1.

Summarily, based on equations (4), (5) and (6), if there are more physical capital used in production and high educational labor force percentage available, the production function will become more convex, which will be beneficial to gross output of Thailand even though the total labor force will be reduced, or in other words, Thailand fall into an aged society.

To reinforce this summary, another scenario can be used to describe the such property of production function: when α is 0.75 and, then, the φ is at 0.60, then, the concavity or convexity will be depended on the results of -0.15-λ, the production function with high probability to be in property of a strict convex than a strict concave.

Conclusion

As the process of ageing population has been accelerating so fast unprecedently in Asia and Pacific region, therefore, how to solve problems under this ageing population is not only economic issue but also political issue for every government. So, there is a need to research on this topic from different perspectives.

In the current study, two important factors are analyzed. These two factors are the educational level of labor force (φ) and the inverse elasticity of substitution of labor force between the change rate of total labor force and those labor force available but not looking for jobs (λ).

When Thailand has been transiting from labor intensive to capital intensive, and there is a trend of declination of total labor force, meanwhile, the relative change of number of labors available but not looking jobs has either positive or negative effect on the gross output of Thailand (GDP), then, the educational levels of labor force play more and more important role on the GDP of Thailand, especially, The findings from this study suggest that a high overall educational level of labor force can be used to offset the high aging labor force changes, for example, in the current study, the labor whose ages over 60 years was not deducted from total labor force, conversely, these aged labor force increase overall educational level to some extent. As the result, the decreasing population or decreasing labor force can coexist with sustained economic growth. These conclusions echo some previous researches (Erdem E. and Tugcu C.T, 2011; Elgin C. and Tumen S., 2012; Sukpaiboonwat S. et al. ,2014; Kongtong Y and Romprasert S., 2015; Haque et al., 2016).

Therefore, the findings from the current study have both theoretical and practical implications

Theoretical implications

As the aging factor become more important than gender as the key ingredient in analyzing working or labor force, so, how to set a theoretical framework to study the effects of this phenomenon on national economic growth rate is quite meaningful. Distinguished from previous studies, the current research uses both the educational level of total labor force and the inverse elasticity of substitution rate between the change rate of total labor force and the change rate of labor available but not looking for jobs to explore more deeply on the labors' effects of economic growth of Thailand. These two factors can well explain the pattern of the national economic growth in the current study.

Practical implications

Given relative higher percentage of labor force available but not looking for jobs.in Thailand for each period, for example, some new graduates, the increasing aged persons, which is common phenomenon during the economic transition from labor intensive to capital intensive and under lower fertility rate , the Thai government may either encouraging these labor force available but not looking for jobs to be employed in industries via more incentive initiatives, for example, incentives for entrepreneurship on emerging industries, train these labors according to future needs in different industries, or extend longer working time span for the older persons, offer them with flexible and suitable jobs so as to including these older persons in the labor force to reduce the inverse elasticity of substitution rate of labor force and enhance the overall educational level simultaneously. These methods can really improve the economic growth rate for Thailand, so as to increase per capita as fast as possible before Thailand fully fall into aged society around 2024.

The limitation of the current study is that the current study just analyzed on the effect of labor force structure, let the capital changes as the exogenous factor, for example, foreign direct investment, so, the results of this research may not fully reflect the effects from interactions between the labor force and capital factor which is endogenous. Also, the number of patents granted is used as the technology proxy in this study should be explored more in details as not all patents can be transferred into new technologies.

Future study may be concentrated on these comprehensive or combined effects between the three factors: technologies, capital and labors.

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