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Convergence in Income Inequality and Growth under Public Investment in Human Capital: The Case of Thailand

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Abstract

In this paper, I examine convergence in income inequality and economic growth under two governmental regimes on human capital where the first one has only education subsidy and the second one has education subsidy and research & development investment. This study using endogenous growth framework with human capital and technological progress hypothesized that, under education and research & development investment, human capital and technological progress can produce a higher global effect to the country in the long run. This will result in the convergence in income where poor dynasty/regions grow faster than rich dynasty/regions in the long run. From model simulation, I found that, in the poor economy, when adding a research & development investment in addition to education subsidy, convergence in income and long-run economic growth perform better than another scenario which has only education subsidy. Empirically, this pattern has been validated on Thailand's provincial level where conditional convergence of growth rate per capita among these provinces tends to converge faster between the periods of 2000 – 2009.

***Keywords*: Convergence in Income Inequality; Education Subsidy; Growth ; Research & Development**

1. Introduction

During the past two decades of Thailand National Development Plan evolution, the concerns of issues in human capital development and long-run country economic growth are higher when the topics of income inequality and competitiveness are written down by numerous researchers nowadays as the country's major economic structural problems.

While the situation of income inequality looked severed in the mid ninety century as the historic world indicators shown, there were numerous attempts to restructure the education system in order to provide equal chance of education for all children which this embodied human capital could help increase their lifetime income and improve the standards of living for the people in the country. According to the Ministry of

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Education, the system itself failed to improve the quality of provided education as the dropout from school rate was about 50 per cent and proficiency tests scores were below the expected standards although education budget was spent aggressively compared to other branches of development.

For growth development, Thai economic growth depends largely on investments which consist of domestic and foreign direct investment. According to the data cited from the Thailand Bureau of Budget and Board of Investment, domestic investment budget has been declined and decentralized since the beginning of the year 2000 while foreign direct investment increased from promotions over the same period of time. Growth was stimulated from funds outside its economy. In the long-run economy, this scenario looked ambiguous when the labour force survey over the year 2000 to 2009 showed that most labour forces are concentrated in low-income jobs and they are not well educated as represented in worsen science & technology competitiveness indicators, according to data from the National Research Council of Thailand and The National Statistics Office. This also resulted in higher income for the highly educated workers that can engage in a proper industry while it leaves the others to be involuntarily poor. This resulted in a higher income inequality as was represented in the Gini coefficient by the end of year 2009.

For provincial level, it depicts the same picture as in the individual aspect. There are many provinces in the Central region and some provinces in the other regions that received an advantage of capitals agglomeration and grew rapidly over this period, while many rural provinces in the Northern, Northeastern and Southern parts have been left undeveloped and still remain poor. In some developing countries, many countries in this region and China boost up their education and science & development budget in the late twentieth century. This questioned Thai policy makers about whether or not Thailand should invest more on research & development in addition to education policies and these policies will give us a convergence in income and growth.

2. Methodology

2.1. Endogenous Growth Model with Human Capital Accumulation and Technological Progress

The model is closely developed to the works of Galor and Tsiddon, 1997 and Schäper, 2003. The model presented here is a small open overlapping-generations economy (OLG) model which assuming basic classical economic assumptions as following; perfect market competitions, sticky physical rental price, constant population size, heterogeneous human capital and income in initial stage, all transactions occur at the end of each period, and externality effect of parental human capital on human capital accumulation; income distribution; and growth.

2.1.1. Production

Production technology is assumed constant return with endogenous technological progress, neoclassical and stationary across time. In each period, a good has been produced homogenously, which can be consumed, invested, or saved.

$$Y_t = (A_t L_t)^{1-\kappa-\eta} H_t^{\eta} K_t^{\kappa} \tag{1}$$

Where Y_t is the output produced at time t as the function of the amounts of labour and human and physical capital employed at time t, L_t, H_t, and K_t , corresponds to the technology, A_t . The small letters denote to per effective unit of labour. The parameter η and κ capture the partial production elasticity of each input. This function also satisfied the Inada conditions. Moreover, physical capital K_t depreciates after each period.

2.1.2. Factor Price

Under perfect competition, producers' objective is to optimize their profit by choosing the amounts of each input to be employed in the production function. Where r_t and w_t are return form physical capital and wage rate respectively. The rate of return to physical capital is stationary at r^* since the world interest rate can be observed and there is no barrier for international lending and borrowing. Up to this point, the ratio of physical capital to efficiency labour is stationary. Therefore wage income depends on technological progress and the amount of the individual's human capital:

$$w_t = A_t w\left(\bar{k}\right) = A_t \bar{w}. \tag{2}$$

2.1.3. Technological Progress

The level of productivity in $t+1$ depends on the amount of average parental human capital in the period t:

$$A_{t+1} = A\left(h_t\right) = \begin{cases} A^1 & if\ h_t < \hat{h} \\ A^2 & if\ h_t > \hat{h} \end{cases}. \tag{3}$$

N is a constant number of individual in a generation. Next, the technological progress follows a threshold exogenously in this model. Only two levels of technology are observed in this economy when $A^2 > A^1$.

2.1.4. Individual Problem

Each individual lives for three periods and has an identical preference and production function of human capital, but differs in their initial human capital due to the different stage of each parental human capital. The model assumed the Cobb-Douglas technology for human capital formation increasing at the diminishing rate over time. The individual human capital at t+1 consists of capital investment in human capital, x_t^i , and the parental human capital, h_t^i.

$$h_{t+1}^i = \mu + x_t^{i^\alpha} h_t^{i^{\beta\left(h_t^i\right)}} \tag{4}$$

If the individual does not invest there is still raw labour with no skills acquired, $\mu > 0$. Both parameters α and β measures the influences of physical capital investment in human capital and parental human capital respectively. The model also assumed that β depends on the parental human capital and decreases with higher values. This results in the diminishing complementarity between capital investment in human capital, x_t^i , and the parental human capital, h_t^i. The individual's labour income, I, in the period $t+1$ is given by (5) where the individual supplies a quantity of human capital times the wage rate. The leisure denoted as $l_{t+1}{}^i$.

$$I_{t+1}^i = w_{t+1} h_{t+1}^i = A_{t+1} \bar{w} h_{t+1}^i (1 - l_{t+1}^i) \tag{5}$$

For the 1st period, Individual borrows capital at rate r^* in order to consume and invest. For the 2nd period, after paying back his debt from the 1st period, the individual allocates his income for consumption, and savings. For the 3rd period, gross return from the 2nd period and savings will be consumed in this period. Next, individual maximizes the assumed the utility function of constant intertemporal elasticity of substitution λ (CIES) with rate of the time preference ρ subject to constraints of each period.

$$U^{i}\left(c_{t}^{t,i},c_{t+1}^{t,i},c_{t+2}^{t,i},l_{t+1}^{i}\right)=\frac{c_{t}^{t,i1-\lambda}-1}{1-\lambda}+\frac{1}{1+\rho}\left[\frac{c_{t+1}^{t,i\,1-\lambda}-1}{1-\lambda}+lnl_{t+1}^{i}\right]+\left(\frac{1}{1+\rho}\right)^{2}\left[\frac{c_{t+2}^{t,i\,1-\lambda}-1}{1-\lambda}\right] \tag{6}$$

The optimal amount of capital investment in human capital is:

$$x_{t}^{i}=\left[(1-l_{t+1}^{i})\ \alpha A_{t+1}\overline{w}(h_{t}^{i})^{\beta\left(h_{t}^{i}\right)}/(1+r^{*})\right]^{1/(1-\alpha)}. \tag{7}$$

Let's assumes:

$$\lim_{h_{t}^{i}\to 0}\Omega(A_{t+1},h_{t}^{i})=0,\ \lim_{h_{t}^{i}\to\infty}\Omega(A_{t+1},h_{t}^{i})=0\ and\ \Omega\left(A_{t+1},h_{t}^{i}\right)>h_{t}^{i}. \tag{7.1}$$

For some $h_t^i > 0$, this results in the multiple equilibriums which cannot be solved analytically. As in the work of Schäper, 2003, there four possible steady states in the economy. $h^b(A^1)$ is unstable while $h^a(A^1)$ and $h^c(A^1)$ are locally stable, for a certain level of technology, A^1. The initial starting point determines the equilibrium for the poor. For a level of technology A^2, the economy develops monotonically towards a higher steady state, $h^d(A^2)$ regardless the initial starting point of human capital. Thus, a change at a certain level of technology can lead to a change in transitional dynamics.

2.1.5. Dynamics of Human Capital Accumulation

In this section, there are two types of dynasty, $i = H, L$, which have a same preference and production function with human capital but differs in parental human capital. The rich household (H) starts at the right of the unstable equilibrium, $h^b(A^1)$, while the poor household (L) starts at the lowest equilibrium, $h^a(A^1)$. I define $\theta = N^L / N$ as the ratio of the poor households and $1-\theta = N^H / N$ as the rich households to the all households. At time 0 the average human capital is set to be below the threshold, In the first stage of development, the human capital between two dynasties is diverging due to the effect of local externality. When human capital accumulation of H dynasty raises the level of the average human capital high enough to pass the threshold $\hat{h}$ at t^*, the global externality dominates the local effect. The economy develops toward higher steady state equilibrium and two dynasties converge to its own new equilibrium. This results in convergence in income in the long–run economy. The dynamic distribution of human capital of the rich and poor household are:

$$h_{t+1}^{H}=\mu+\left[(1-l_{t}^{H})\ \alpha A_{t}\overline{w}/(1+r^{*})\right]^{\frac{\alpha}{1-\alpha}}\left(h^{b}\left(A^{1}\right)+\varepsilon\right)^{\frac{\beta\left(h_{t}^{H}\right)}{1-\alpha}}, \tag{8}$$

$$h_{t+1}^{L}=\mu+\left[(1-l_{t}^{L})\ \alpha A_{1}\overline{w}/(1+r^{*})\right]^{\frac{\alpha}{1-\alpha}} h_{t}^{a\,\frac{\beta\left(h_{t}^{L}\right)}{1-\alpha}}, \tag{9}$$

With $h_1^H > h_0^H = h^b\left(A^1\right)+\varepsilon$ and $I_1^H > I_0^H$.

2.1.6. Research & Development and Education Policy

Under regular policy, there is only an education subsidy for both dynasties, assuming that government budget is balanced. Income taxation rates for the rich and the poor households, τ_{t+1}^{H} and τ_{t+1}^{L}, are imposed on the second period of their lives, $t+1$. The amount of tax revenue, T_t^{ED}, is equal to the sum of all income taxation from all dynasties and also equal to the amount that the government invests for all children in the economy, $N\pi_t$ which is:

$$T_t^{ED} = N^L \tau_t^L A_t \bar{w} h_t^L (1 - l_t^L) + N^H \tau_t^H A_t \bar{w} h_t^H (1 - l_t^H) = N\pi_t \,. \tag{10}$$

After repeating algebra the dynamic distribution of human capital of each dynasty equals to:

$$h_{t+1}^i = \mu + \pi_t + \left[(1-\tau_t^i)(1-l_t^i)\ \alpha A_1 \bar{w} / (1+r^*)\right]^{\frac{\alpha}{1-\alpha}} h_t^{a^{\frac{\beta\left(h_t^i\right)}{1-\alpha}}} \,. \tag{11}$$

Where π_t is the public investment, τ_{t+1}^i is income tax on each individual and $i = H, L$. Now, human capital accumulation is higher because of public subsidy but also lower due to tax distortion in the period $t+1$.

The hybrid policy is that there are both education subsidy and research & development policy in this economy. I further assume that only high human capital dynasty can access to this type of investment. Let $\tau_{t+1}^{H\ a}$ be the new tax rate for the rich household and it follows;

$$\tau_{t+1}^{H\ a} > \tau_{t+1}^H > \tau_{t+1}^L \,. \tag{12}$$

The amount of tax revenue, T_t^{ED}, remain the same as in equation (10) while the amount of tax revenue from the rich household, T_t^{RD}, equals to the incremental budget which is a new tax revenue from the rich dynasty and equals to the amount invested in research & development. Then research & development investment budget is:

$$T_t^{RD} = N^H A_t \bar{w} h_t^H \left(1 - l_t^H\right) [\tau_t^H - \tau_t^{Ha}] = N^H \delta_t^a \,. \tag{13}$$

Hence, the dynamic human capital equation for the rich households is given as follows:

$$h_{t+1}^H = \mu + \pi_t + \delta_t^a + [(1-\tau_t^{Ha})(1-l_t^H)\ \alpha A_t \bar{w}) / (1+r^*)]^{\frac{\alpha}{1-\alpha}} \left(h^b\left(A^1\right) + \varepsilon\right)^{\frac{\beta\left(h_t^H\right)}{1-\alpha}} \,. \tag{14}$$

The rich household’s physical investment in human capital decreases, from the new policy. An incremental of income taxation rate on the rich households increases the research & development investment but also decreases the amount of education subsidy in the early state because the public investment is in the linear form while the private investment in the exponential form. Thus a higher tax rate for the rich households reduces the overall income and education budget.

From the model, it explains the role of human capital investments made by government. The income inequality in the early stage of development is widening by the initial endowments and level of human capital investments of each dynasty. However, both education and research & development investments will increase the average level of human capital accumulation of the economy by leveraging the human capital accumulation of each dynasty and accelerating the convergence in income. Hence, at time t^*, the effect of global externality dominates. The economy shifts to the higher technology, A^2, and two dynasties share the higher dynamic path of new equilibrium. This results in the higher economic growth and more convergence in income where poor individual income grows faster than rich individual income.

2.2. Extended Version of Augmented Solow Model

Theoretically, by relaxing the assumption of endogenous growth model, let's assumes $0 < \eta, \kappa, \varphi,\ \eta + \kappa + \varphi < 1$ because I want to ensure the convergence in income per capita. Otherwise, this will result in the non-decreasing returns to the set of reproducible factors of production. This implies that the province that save more, the economy will growth faster and that convergence needs not to exist among provinces even if they are sharing the similar preference and level of technology, according to the work of Mankiw et al., 1992. From equation (1), the production function called "augmented model" that they performed tests on the empirical data in 1992. Their model was extended from the original textbook Solow model which has only physical and labour factor. As I describe the effect of research & development investment in the endogenous growth model and from the works of Nonneman and Vanhoudt, 1996 and Keller and Poutvaara, 2005 the new production function model is now in the form of:

$$Y_t = (A_t L_t)^{1-\kappa-\eta-\varphi} H_t^{\eta} R_t^{\varphi} K_t^{\kappa}\,. \tag{15}$$

The per capita version is rewritten as:

$$y_t = j_t^{\eta} r_t^{\varphi} k_t^{\kappa}\,. \tag{15.1}$$

I assume equal depreciation rates (ω) for these production factors. From assumption of $0 < \eta, \kappa, \varphi,\ \eta + \kappa + \varphi < 1$ and the sufficient conditions, then one can solve for the level of income per effective unit of labour as the following:

$$\begin{aligned}\ln(y_t) = \ln(A_0) + gt + \frac{\eta}{1-\kappa-\eta-\varphi}\ln(s_j) + \frac{\kappa}{1-\kappa-\eta-\varphi}\ln(s_k) + \frac{\varphi}{1-\kappa-\eta-\varphi}\ln(s_r)\\ -\frac{\eta+\kappa+\varphi}{1-\kappa-\eta-\varphi}\ln(n+g+\omega)\end{aligned}\,. \tag{16}$$

This equation shows that level of income per effective unit of labour is a function of population growth, n, physical and human capital and research and development factor. s_j and s_k denote to saving that go to human capital and physical capital accumulation respectively. The additional variable s_r denotes to research & development investment. Let y_t^* denotes to a steady state of income per effective unit of labour from equation (16). By using Taylor approximation around the steady state, let ψ denotes to speed of convergence that depends on population growth, n, technology progress, g, depreciation rate, ω, and partial elasticity of each capital. The variable y_0 is level of income per effective unit of labour at initial period. One can get:

$$\begin{aligned} ln\left(\frac{y_t}{y_0}\right) = \left(1-e^{\psi t}\right)\left(\frac{\eta}{1-\kappa-\eta-\varphi}\right)\ln(s_j) + \left(1-e^{\psi t}\right)\left(\frac{\kappa}{1-\kappa-\eta-\varphi}\right)\ln(s_k) + \left(1-e^{\psi t}\right)\left(\frac{\varphi}{1-\kappa-\eta-\varphi}\right)\ln(s_r)\\ -\left(1-e^{\psi t}\right)\left(\frac{\eta+\kappa+\varphi}{1-\kappa-\eta-\varphi}\right)\ln(n+g+\omega) - (1-e^{\psi t})ln\ (y_0)\end{aligned}\,. \tag{17}$$

Then income now depends on the factors that determine the steady state and initial level of income, y_0, from the extended Solow model. It predicts that the coefficient of $ln\ (y_0)$, must vary between –1 and 0. The closer the value is to – 1 the faster the convergence will be.

3. Findings

3.1. Model Simulation

I examine the effect of human capital policies on individual income and long-run economic growth by adding a new variable that is research & development investment to the model, which consists of the rich and poor dynasty. The numerical analysis conducts and compares the results from two regimes of human capital policy; one has only education subsidy and the other has both education subsidy and research & development policy. Most of parameters I used in this section are obtained from the work of Schäper, 2003 and sensitivity analysis.

For the human capital accumulation part under the regular policy, wealth of both dynasties has been redistributed to everyone in this economy by education subsidy policy. Under hybrid policy, more wealth of the rich group also has been transferred to everyone in their group equally while education policy remains the same. I consider this policy as a tool which helps pulling the top income group rather than pushing everyone in the economy. From simulations, the results show that under hybrid policy income gap between rich and poor group is smaller than what happens in the regular policy, because more wealth from the rich group has been taxed by government. However, individual income of each group decreases in the short run since the growth of human capital accumulation of the rich and poor depends more on public investment function which is set to be in linear form. Government raises income tax of the rich group then makes an investment in research & development with this incremental budget. Individual income of the rich group shifts down because the level effect of human capital accumulation (public investment) cannot overcome the exponential effect (private investment) in the early state until the second and third generation. For the poor group, their income slightly declines since the education budget decreases as income taxation revenue from the rich group is lower compared to what I found in the regular policy. The overall gap of individual income under hybrid policy is smaller than in the regular policy. The growth of individual income of the poor group under hybrid policy is faster than the one under regular policy. Within 5 generations the simulation shows that values of overall individual income growth for the poor and the rich group under regular policy are 2.37 and 1.50 respectively, while the overall values of individual income growth for the poor and the rich group under hybrid policy are 2.27 and 1.30 respectively. For both regimes, the poor individual's income grows faster than the rich's and the difference of growth rate between the two groups is higher under the policy that consists of both education and research & development policy. This results in more convergence in individual income of these two groups. In this model, each group can have different steady states of income and the gap between steady states of income mainly depends on these factors which are technology level and income taxation rates.

For economic growth, long-run growth is better under the hybrid policy. The economy is allowed to have less income inequality and it gains a higher level of economic growth in the long-run, with the new efficiency tradeoff. Since there is more technology investment embodied in the economy, this has a significant effect on raising both groups' income. Hence, the long-run budget for human capital investment grows further and accelerates the economy to reach a new higher steady state in the second generation.

3.2. Conditional Convergence Empirics

First of all, provinces are descending ranked by average gross provincial product per capita over the period of 2000 to 2009. There are the 76 provinces of Thailand in the sample. The data are annual and covers the period 2000 to 2009. Due to data limitation, I assume $g + \omega = 0.5$ as in Mankiw et al., 1992. Equation (16) and (17) will be estimated by least square method with variables according to table 2, in order to test the hypothesis of conditional convergence and simulation prediction.

Table 2. Definition of Variables

Variable	Definition
y_T	Gross Provincial Product per capita in 2009
y_0	Gross Provincial Product per capita in 2000
n	Average growth rate of provincial population
S_k	Average share of provincial domestic investment to GPP
Sj	Difference of ratio of highly educated labour to employed labour between 2009 and 2000
S_r	Difference of the growth rate of real provincial research & development investment between the year of 2001-2003 and 2007-2009

Data were obtained from Office of National Economic and Social Development Board (NESDB) and National Statistics Office Thailand (NSO). In order to avoid the problem of negative estimated coefficient of human capital, I use the difference in level of each human capital variable instead as Mincerian approach as in Lemieux, 2006 Arcand and Béatrice, 2002 and Jones, 1996. Since provincial research & development investments are not available except the value on national level, I calculate this variable based on research & development per capita as in the model framework. Then this assumes the mobility of this variable is free. The correlations among these variable are low. Note that number 1 stands for original textbook Solow model; 2 stands for augmented Solow model; and 3 stands for extended version.

3.3. Growth and its Convergence among the 76 Thailand Provinces

From table 3, the growth regression under the extended version of the augmented model shows that domestic and research & development investment have significant effect on growth rate of GPP per capita in the year 2009. The population growth has a negative sign but is statistically insignificant. The difference of ratio of highly educated labour to employed labour which is the proxy for human capital is positive but again insignificant. The level of adjusted R-square is slightly higher than those that are in the original and augmented Solow model. According to convergence regression, when adding the research & development variable into the model, the estimation results show that the extended version of the augmented model performs better than the others. Both the research & development variable and the difference of the ratio of highly educated labour to employed labour are significantly positive and they do improve the estimated regression. The estimated coefficient of growth rate of GPP per capita in the year 2000 still has a statistical significant negative value which moves closer to – 1. This makes the speed of convergence increase (ψ) by 21.98 per cent from the value of 0.18 to 0.22, for the augmented model and extended version of the augmented model respectively. The adjusted R-square is higher with the value of 0.65 compared to the value of 0.29 and 0.36 in the original textbook Solow and augmented Solow model respectively. The domestic investment has a negative sign, because domestic investment budget decreased over the empirical years and there was a change in budget allocation where the government moved their money from provinces in the Central region to provinces located in the Northern, Northeastern, and some provinces in the Southern region. In accordance with what theory suggests, population growth has a negative sign for both regressions. However, it is statistically insignificant.

Table 3. Growth Regressions and Conditional Convergence Regressions

76 provinces	GPP per capita in 2009		
	1	2	3
Natural log of n+0.05	-0.024	-0.156	-0.649
	(0.87)	(0.88)	(0.82)
Natural log of physical capital ln(s_k)	-0.774[a]	-0.770[a]	-0.758[a]
	(0.05)	(0.05)	(0.04)
Human capital (s_j)	-	1.878	2.015
		(1.33)	(1.37)
R&D investment (s_r)	-	-	0.576[a]
			(0.13)
Constant	7.772[a]	7.950[a]	7.007[a]
	(1.91)	(1.92)	(1.81)
Adj. R^2	0.88	0.884	0.9

76 provinces	Growth of GPP per capita		
	1	2	3
Natural log of GPP per cap in 2000	-0.155[b]	-0.168[a]	-0.201[a]
	(0.07)	(0.07)	(0.06)
Natural log of n+0.05	-0.313	-0.269	-0.664
	(0.55)	(0.56)	(0.52)
Natural log of physical capital ln(s_k)	-0.1	-0.108[b]	-0.125[a]
	(0.06)	(0.06)	(0.05)
Human capital (s_j)	-	0.966[b]	1.114[a]
		(0.6)	(0.48)
R&D investment (s_r)	-	-	0.467[a]
			(0.1)
Constant	1.209	1.398	0.893
	(1.35)	(1.37)	(1.29)
Adj R^2	0.086	0.11	0.34
Implied Speed of Convergence	0.17	0.18	0.22
Speed of Convergence Gain (%)		8.9	21.98

a. Significant at 5% level. b. Significant at 10% level. c. Standard errors are in the parenthesis

3.4. Socio Economic Surveys and some other statistical data

From Socio Economic Surveys of 2000 and 2009, by comparing means between these two years, it shows that the overall average of each aspect has significant changes over the periods. The overall household head average age and average number of adults have significant positive changes, while the overall average size of households and numbers of children have significant negative changes. The overall average number of household earners significantly decline due to world economic downturn in the year 2009. For the overall average income and expenditure per capita, their means are positively changed with 5 per cent level significance. For education policy, National Statistics Office Thailand (NSO) data present that, in 2009, over 50 per cent of highly educated household heads are rich compared to the value in 2000. The fraction of highly educated household heads is still high in the highest quintile group. However, when looking at the household income share between the year 1988 and 2009, the ratio between the (20 per cent) highest household income group to the (20 per cent) lowest household income group is still moving around 11 to 13 while rich households have more than 60 per cent of income share and the poor households have only less than 5 per cent, according to the Office of National Economic and Social Development Board (NESDB). In 2000, most households' socio-economic class in the lowest quintile group is still the farm operators and labourers. This pattern is consistent with the year 2009. However, for the rest of the groups, their households' socio-economic classes diverge from the class of entrepreneurs and professional labourers to the other classes which are other employees and farm operators. With the level of education being higher for the highest quintile group, these labourers either do not stay in the professional and high-skilled works. Due to the unavailability of demand side data, the data of employed labours classified by type of work from the National Statistics Office Thailand (NSO) show evidence of growth rate of labour for each type of work which can represent the demand for each of it. This conforms to the previous analysis. The growth rates of labour between year 2009 and 2000 of each type of occupation show that there are only 20 to 28 per cent increase of labour in the occupation of professionals and technicians, while there was about a 60 per cent increase of labour in market service, shops and market sales work. Although the growth rate of labour of elementary occupations and plant/machine operator and assembler works are only 16.06 and 16.88 per cent respectively, their number of workers are 2 to 3 time larger than the number of workers in professional and technical occupations. The year-on-year growth rates of labour of skilled workers is declining while year-on-year growth rates of labour of elementary and shop workers are increasing. In addition, Thai labour force surveys also show that average youth (age 15-24) unemployment rate between 2000 and 2009 is around 5.21 per cent compared to the value of 4.45 per cent of the period of 1990 to 1999. Moreover, the unemployment rate of labours who obtain a degree in tertiary education rises from 9 to 19 per cent in 2001 and 2009 respectively while the rate of other types of educated labour remain almost unchanged.

4. Policy recommendations

For policy recommendation, I suggest a higher investment in research & development for Thailand to create technological progress and long-run economic growth, since it is relatively low compared to neighboring countries. Recently, Thai government budgets are mainly focuses on education subsidy and it failed in the sense of both quality and efficiency. Although budget can increase a number of students per year but it is not compatible with the country demand for labour where the government is trying to improve the education level but fails to create more innovative jobs for them. The labour force surveys also show that skilled jobs decline while unskilled jobs increase rapidly as wage share of labour declined sharply in the last 10 years. The government must provide a certain change of technology level in the economy with both research & development and education are invested concurrently and harmoniously.

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