CHAPTER 4

Empirical Results

4.1 Data

This study mainly base on secondary data, panel data, collected from various databases such as books, journals, e-books, and internet, especially the data from national statistical office (NSO), the revenue department, and the Office of the National Economic and Social Development Board (NESDB). This research use panel data analysis, using the set of 18 years, the year 1996-2013, of GRP growth rate (GRP), Regional average years of education (Edu), Employment (Em), growth rate of tax revenue (Tg), Gini coefficient in revenue and expenditure's growth rate (Gigre and Gig), Proportion of population living under regional poverty line (Pov), the ratio of medical profession per head (H), and the growth rate of the ratio of medical equipment per head (Heg). The data analyzed by regions include Bangkok, Central, North, Northeast and South regions of Thailand.

4.2 Panel unit root test results

Panel unit root test of the data; regional average years of education, Employment rate, tax revenue, Gini coefficient, Proportion of population living under regional poverty line and GRP growth rate were test by two method, Levin, Lin and Chu test (LLC test) and The Persaran test. In LLC test the method would test under the condition of individual intercept, Individual intercept and trend and none, while in the Persaran test the method would test both with trend and without trend and the lag will be maximum at 2.

4.2.1 Levin, Lin and Chu test

Table 4.1: Levin, Lin and Chu test result

Variables	LLC test with individual intercept	LLC test with individual intercept and trend	LLC test with no individual intercept and trend
GRP Growth (GRP)	-7.95913 (0.0000***)	-7.14551 (0.0000***)	-5.56193 (0.0000***)
Regional average years of education (Edu)	-1.49573 (0.0674*)	10.5362 (1.0000)	8.44527 (1.0000)
Employment (Em)	-1.24557 (0.1065)	-2.12205 (0.0169**)	0.40151 (0.6560)
Growth rate of tax revenue (Tg)	-1.08658 (0.1386)	11.5117 (1.0000)	-1.78071 (0.0375**)
Gini coefficient in revenue's growth rate (Gigre)	-1.20931 (0.1133)	-0.88193 (0.1889)	-5.82700 (0.0000***)
Gini coefficient in expenditure's growth rate (Gig)	-2.40112 (0.0082***)	-2.13811 (0.0163**)	-7.05397 (0.0000***)
Proportion of population living under regional poverty line (Pov)	1.79667 (0.9638)	-2.20533 (0.0137**)	-3.59386 (0.0002***)
The ratio of medical profession per head (H)	-2.12188 (0.0169**)	-2.44426 (0.0073***)	-8.66322 (0.0000***)
Growth rate of the ratio of medical equipment per head (Heg)	-10.0296 (0.0000***)	-6.58718 (0.0000***)	-2.65206 (0.0040***)

*** Data is significant at 0.01 level, ** Data is significant at 0.05 level, * Data is significant at 0.10 level

Source: Calculation

From the table 4.1 found that, with individual intercept, the variables including GRP growth (GRP), Gini coefficient in expenditure's growth rate (Gig), the ratio of medical profession per head (H) and Growth rate of the ratio of medical equipment per head (Heg) are significant at 0.05 level (5% error exception), while, Regional average years of education (Edu) is significants at 0.10 level (10% error exception), Which could be interpret that these data are stationary at level, I(0) with individual intercept. However, Employment (Em), Growth rate of tax revenue (Tg), Gini coefficient in revenue's growth rate (Gigre), and Proportion of population living under regional poverty line (Pov) are not stationary with individual intercept. In the test with individual intercept and trend, found that, all variables including GRP growth (GRP), Employment (Em), Gini coefficient in expenditure's growth rate (Gig), Proportion of population living under regional poverty line (Pov), the ratio of medical profession per head (H), and Growth rate of the ratio of medical equipment per head (Heg) are significant at 0.05 level (5% error exception). Which could be interpret these data stationary at level, I(0) with individual intercept and trend. However, Regional average years of education (Edu), Growth rate of tax revenue (Tg) and Gini coefficient in revenue's growth rate (Gigre) are not stationary with individual intercept and trend. Moreover, the test with no individual intercept and trend found that, the variables GRP growth (GRP), Growth rate of tax revenue (Tg), Gini coefficient in both revenue and expenditure's growth rate (Gigre and Gig), Proportion of population living under regional poverty line (Pov), the ratio of medical profession per head (H), and Growth rate of the ratio of medical equipment per head (Heg) are significant at 0.05 level (5% error exception). Which could be interpret that these data are stationary at level, I(0) with no individual intercept and trend. However, Regional average years of education (Edu) and Employment (Em) are not stationary with no individual intercept and trend.

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4.2.2 The Persaran test

Table 4.2: Persaran test

Variables	Lag	Without trend	With trend	Variables	Lag	Without trend	With trend
GRP Growth (Growth)	0	-4.725 (0.000***)	-3.514 (0.000***)	Growth rate of tax revenue (Tg)	0	-4.069 (0.000***)	-3.577 (0.000***)
	1	2.574 (0.005***)	1.470 (0.071*)		1	5.332 (1.000)	5.667 (1.000)
	2	-2.047 (0.020**)	1.610 (0.054*)		2	9.422 (1.000)	8.811 (1.000)
Regional average years of education (Edu)	0	-1.463 (0.072*)	-3.397 (0.000***)	Gini coefficient in expenditure's growth rate (gig)	0	-4.985 (0.000***)	-3.646 (0.000***)
	1	-2.778 (0.003***)	-3.029 (0.001***)		1	-5.684 (0.000***)	-4.472 (0.000***)
	2	0.197 (0.578)	-1.003 (0.158)		2	1.711 (0.956)	3.379 (1.000)
Employment rate (Em)	0	-5.420 (0.000***)	-4.187 (0.000***)	Gini coefficient in revenue's growth rate (gigre)	0	-3.905 (0.000***)	-2.799 (0.003***)
	1	-7.855 (0.000***)	-6.482 (0.000***)		1	-3.423 (0.000***)	-3.087 (0.001***)
	2	-4.917 (0.000***)	-3.139 (0.001***)		2	0.157 (0.562)	0.070 (0.528)

*** Data is significant at 0.01 level, ** Data is significant at 0.05 level, * Data is significant at 0.10 level
Source: Calculation

Table 4.2: (continued)

Variables	Lag	Without trend	With trend	Variables	Lag	Without trend	With trend
The ratio of medical profession per head (H)	0	-1.487 (0.069)	0.290 (0.614)	Growth rate of the ratio of medical equipment per head (Heg)	0	-7.557 (0.000)	-6.380 (0.000)
	1	0.740 (0.770)	2.052 (0.980)		1	-2.336 (0.010)	-1.007 (0.157)
	2	1.511 (0.935)	2.295 (0.989)		2	0.193 (0.577)	1.526 (0.936)
Proportion of population living under regional poverty line (Pov)	0	-2.092 (0.018**)	-0.372 (0.355)				
	1	-1.670 (0.047**)	0.332 (0.630)				
	2	-1.609 (0.054*)	0.509 (0.695)				

*** Data is significant at 0.01 level, ** Data is significant at 0.05 level, * Data is significant at 0.10 level
Source: Calculation

From table 4.2, the test with no trend found that, GRP growth (GRP), Employment (Em), and Proportion of population living under regional poverty line (Pov) are stationary at 0.05 and 0.1 level with all lag number. Regional average years of education (Edu) and Growth rate of the ratio of medical equipment per head (Heg) are stationary at 0.05 and 0.1 level with lag 0 and 1. Growth rate of tax revenue (Tg) is stationary at 0.05 level with lag 0. Gini coefficient in both revenue and expenditure's growth rate (Gig and Gigre) are stationary at 0.01 level with lag 0 and 1, the ratio of medical profession per head (H) is stationary at 0.1 level with lag 0. This could be conclude that all data are stationary without trend using Persaran test with difference lag number. While, the test with trend found that, GRP growth (GRP) and Employment (Em) are stationary at 0.05 and 0.1 level with all lag number. Regional average years of education (Edu) and Gini coefficient in both revenue and expenditure's growth rate (Gig and Gigre) are stationary at 0.05 and 0.1 level with lag 0 and 1. Moreover, Growth rate of tax revenue (Tg) and Growth rate of the ratio of medical equipment per head (Heg) are stationary at 0.05 level with lag 0. However, proportion of population living under regional poverty line (Pov) and the ratio of medical profession per head (H) are not station at any level with trend.

4.3 2SLS test

In the panel unit root test, all of the data are stationary at level in both method, so the data could be used in the next process of testing for the correlations using 2SLS test in all model, the model will be divided into two main groups, forward and backward effects. In the first group, this group compose with three models that represent forward effects, in the first model employment (Em) instrumented by human capital (Edu, H and Heg) and finally leads to growth (GRP), in the second model poverty rate (Pov) is instrumented by human capital (H and Heg) and the growth rate of tax revenue (Tg) and finally leads to growth (GRP) and in the third model inequality rate (Ginire) is instrumented by human capital (H and Heg) and the growth rate of tax revenue (Tg) and finally leads to growth (GRP). The simple equation of the models in the first group are shown as follow:

$$GRP_{it} = \alpha_0 + \alpha_1 Em_{it} + \alpha_2 Pov_{it} + \alpha_3 Ginire_{it} + \alpha_4 Gini + \varepsilon_{1it} \quad (4.1)$$

While,
$$Em_{it} = \alpha_5 + \alpha_6 Edu_{it} + \alpha_7 H_{it} + \alpha_8 Heg_{it} + \varepsilon_{2it} \quad (4.2)$$

While,
$$Pov_{it} = \alpha_9 + \alpha_{10} Tg_{it} + \alpha_{11} H_{it} + \alpha_{12} Heg_{it} + \varepsilon_{3it} \quad (4.3)$$

While,
$$Ginire_{it} = \alpha_{13} + \alpha_{14} Tg_{it} + \alpha_{15} H_{it} + \alpha_{16} Heg_{it} + \varepsilon_{4it} \quad (4.4)$$

Table 4.3: 2SLS test results of the first group.

Models	The forward effect of human capital and employment (4.2)				
	Bangkok	Central	North	Northeast	South
2SLS	-2.6451	-7.3203	-4.1656	-10.2324	-2.3149
	(0.696)	(0.449)	(0.463)	(0.480)	(0.401)
	The forward effect of human capital, the role of government and poverty rate (4.3)				
2SLS	3.1309	1.1858	1.3490	3.0043	0.3648
	(0.002***)	(0.455)	(0.519)	(0.205)	(0.841)
	The forward effect of human capital, the role of government and inequality growth rate (4.4)				
2SLS	3.1265	0.5348	0.4564	1.8569	-0.3967
	(0.003***)	(0.722)	(0.745)	(0.191)	(0.781)

*** Data is significant at 0.01 level, ** Data is significant at 0.05 level, * Data is significant at 0.10 level

Source: Calculation

Table 4.3 shows 2SLS test result of the first group, the results shows that most of the forward effects of those three models are not significant at any level, except for Bangkok region in model 4.3 and 4.4. This conclude that, firstly, human capital does not have significant effect with employment and employment does not have significant effect with growth. Secondly, human capital (only H and Heg) and the growth rate of tax revenue in all region, except Bangkok, do not have significant effect with poverty and poverty does not have significant effect with growth. Thirdly, human capital (only H and Heg) and the growth rate of tax revenue in all region, except Bangkok, do not have significant effect with inequality and inequality does not have significant effect with growth.

In the second group, this group shows the backward effect of GRP growth and employment, poverty rate and inequality rate which finally leads back to induce human capital and the growth rate of tax revenue. In the first model, human capital (Edu, H and Heg) are induced by employment (Em) and employment (Em) is induced by growth (GRP). In the second model

$$Em_{it} = \alpha_{17} + \alpha_{18}GRP_{it} + \alpha_{19}Edu_{it} + \alpha_{20}H_{it} + \alpha_{21}Heg_{it} + \varepsilon_{5it} \qquad (4.5)$$

$$Pov_{it} = \alpha_{22} + \alpha_{23}GRP_{it} + \alpha_{24}Tg_{it} + \alpha_{25}H_{it} + \alpha_{26}Heg_{it} + \varepsilon_{6it} \qquad (4.6)$$

$$Gini_{it} = \alpha_{22} + \alpha_{23}GRP_{it} + \alpha_{24}Tg_{it} + \alpha_{25}H_{it} + \alpha_{26}Heg_{it} + \varepsilon_{6it} \qquad (4.7)$$

Table 4.6: 2SLS test results of the second group.

Models	Employment (4.5)				
	Bangkok	Central	North	Northeast	South
2SLS	3033691	6034468	3981956	9531837	2078532
	(0.000***)	(0.000***)	(0.000***)	(0.000***)	(0.000***)
	Poverty (4.6)				
2SLS	-3.955512	-1.158121	5.556871	-8.105644	2.121823
	(0.255)	(0.750)	(0.176)	(0.192)	(0.589)
	Inequality (4.7)				
2SLS	-1.966131	-3.925821	-3.782432	-7.762932	-3.124199
	(0.215)	(0.018**)	(0.044**)	(0.006***)	(0.081*)

*** Data is significant at 0.01 level, ** Data is significant at 0.05 level, * Data is significant at 0.10 level

Source: Calculation

Table 4.6 shows 2SLS test result in the second group, in the model of employment (4.5), the model is significant using 2SLS estimation. The result state that when employment (Em) is instrumented by growth (GRP), employment (Em) is significantly leads back to education (Edu) in all region at 0.01 level (1% error exception). In Bangkok, 1 percent higher in employment results in 3,033,691 increase in educated citizen. In Central region, 1 percent higher in employment results in 6,034,468 increase in educated citizen. In North region, 1 percent higher in employment results in 3,981,956 increase in educated citizen. In Northeast region, 1 percent higher in employment results in 9,531,837 increase in educated citizen. And in South region, 1 percent higher in employment results in 2,078,532 increase in educated citizen.

In the model of poverty (4.6), the model is not significant using 2SLS estimation. Shows that when poverty is instrumented by growth, poverty does not have any significant effect to the growth rate of tax revenue and human capital (H and Heg).

In the model of inequality (4.7), the model is significant using 2SLS estimation. The results show that, In Central region, the relationship is negative significant at 0.05 level (5% error exception). Means that when inequality is higher by 1 percent, human capital (H and Heg) and growth rate of tax revenue (Tg) will decrease by 3.92 percent. In North region, the relationship is negative significant at 0.05 level (5% error exception). Means that when inequality is higher by 1 percent, human capital (H and Heg) and growth rate of tax revenue (Tg) will decrease by 3.78 percent. In Northeast region, the relationship is negative significant at 0.01 level (1% error exception). Means that when inequality is higher by 1 percent, human capital (H and Heg) and growth rate of tax revenue (Tg) will decrease by 7.76 percent. In South region, the relationship is negative significant at 0.10 level (10% error exception). Means that when inequality is higher by 1 percent, human capital (H and Heg) and growth rate of tax revenue (Tg) will decrease by 3.12 percent.

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