FACTORS INFLUENCING INCOME INEQUALITY IN THAILAND

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Abstract - This study examines the factors influencing income inequality and testing the conditional convergence in income inequality of each country in Thailand between 1996-2016 by using the Multivariate Autoregressive State-Space model. This model is an efficient tool in finding the correlation and estimated the missing data with Gaussian error via maximum likelihood using primarily an EM algorithm. Our results show a robust relationship between the economic growth and the change of income inequality in all regions in Thailand, the growth of gross regional product of the whole region have a little relationship with the change of income inequality. The other variables cause a different direction with the change of income inequality which depends on the individual character of each region. In the conditional convergence of income inequality testing, the result shows that income inequality in Bangkok become divergence, more inequality. In contrast, the income inequality of the other regions is getting to steady state income inequality converge.

Keywords - Income Inequality, Conditional Convergence, Multivariate Autoregressive State-Space (MARSS) Model.

I. INTRODUCTION

Income inequality is the factor affecting the societies and the economies in many countries. It makes the gap between the rich and the poor, people have different opportunity to accessa different benefit and improvement in their life. Moreover, the opportunities to access higher income of low sort group are lower than the high sort group continues to receive differentgains.

In Thailand, income inequality has been changed due to the endogenous and the exogenous crisis. The global financial crisis in 1998 and 2008 were the large situations affecting to the economy of Thailand[1]. The rising of minimum wage in 2013 was creating the economy disruption[2]. Furthermore, the flooding in 2011 was the endogenous situation which affecting to income inequality in Thailand.

The causes of income inequality come from many factors. Frist, the family structure was affecting income inequality. Chetty et al. 2014[3]said a child born to a relatively poor family in the city that has a low- income inequality will reduce income equality. However, if a child born in the city that more unequal, as a poor child is likely to remain poor as an adult. Moreover, a strong family structure is an important factor in supporting education and habits to succeed in the workplace. The breakdown in families was increasing income inequality in the US[4]. The other cause is the economic structure, the financial crisis and the change of policies are affecting income inequality.

The background of income inequality in Thailand are the regularly rising of economic growth for a long time following the National Economic and Social Development Plan, The gross domestic product is a strong increase with the national income and the per capita that continuing to improve in the standard of living. However, the quality of life is worse, the effect to economic growth creates highly poverty that the rich are richer which the poor remain poorer. Moreover, income inequality is increasing because of the gap in income between both rich people and poor people are larger. Then, the poverty was reducing follow the government policies, supporting education and health care, raising the minimum wage and promote the accessing technology. Therefore, the complete poverty alleviation is one part to increase the wealth of people, reducing the number of people below the poverty line, the trend of poverty is decreasing. Nevertheless, income inequality is rising because of that generate more gap between rich people and poor people, the policy cannot solve in their position anymore because are not the target.

Income inequality is represented by Gini index which is a popular indicator used to measure income. The index shows 0 responds to perfect income equality and 1 responds to perfect income inequality. Thailand has the fluctuation rate of Gini index between 0.44-0.53 since 1988. However, the Gini index of each region also has a difference with a different character of each region. Not only the geography of each region has not the same, but also the career, skills and culture are difference continue to the rate of Gini index have individual. Moreover, the Gini index of Northern region and Bangkok had increased but the others had declined at the start 1996. On the other hand, Gini index in 2016 had reduced in all region in Thailand with Gini index in 1996.

Motivated by this reason, this study aims to find the correlation of each factor that influences to the change of income inequality and the conditional convergence of the change of income inequality of Thailand. The analyze are using the Gini index and the factors affecting income to reduce the gap of income of people in Thailand. To estimate the parameter of interesting, we choose factors are the

growth of gross regional product, average year of schooling, mortality rate, under five years (per 1,000 live births), the minimum wages, mean year of schooling and Mobile cellular subscriptions (per 100 people) for proxy the variables to confirm the connection between the change of income inequality and the factors in Thailand between 1996-2016.

II. LITERATURE REVIEWS

The relationship between income inequality and others variable have been studied in several previous studies. Economic growth has positive effect on income inequality following Wahiba and Weriemmi (2014) [5]. However, Kuznets (1995) [6] and Araújo and Cabral (2014)[7]show the positive relationship between income inequality and growth in the short term and the relationship is invert to negative effect in the short term. More accessing and chancing in education and improvement of skills in the labor connected to reduce income inequality which studied by Wrasai (2015)[8]. Following Araújo and Cabral (2014)[1], who show an increasing in the life expectancy of individual was correlated with a decreasing in income inequality. Moreover, a rising income inequality is related with mortality at all per capita income[9]. Increasing of real minimum wage can lower income inequality and there is diminishing effect as the minimum wage increase because inflation has increased with minimum wage that helps to rising income inequality[10]. Technology accessing has been affected following Panichsombat (2016)[11], who shows internet use in more developed countries was more influence the Gini index than developing countries but the increase of internet use in Asia Pacific did not increase their inequality. The result shows developed countries have converged faster than developing countries. Furthermore, convergence was used to test income inequality by Bénabou (1996) [12] who found the convergence is testing with variety of data type. Ravallion (2001)[13]showed income inequality convergence tests, the result is converging to medium levels and Dhongde and Miao (2013) [14] who also test the convergence in income inequality across country.

III. METHODOLOGY

Scope of This Study

This study is a study about income inequality in Thailand in 1996-2016 that comprehensive 21 years. The secondary data were collected from the database which have yearly frequency including two geography views, whole country and each region which are Northern region, East-northern region, Southern region, Central region and Bangkok.

Data

The data are separated to five variables that reflect the income of people in Thailand. Gini index and the gross regional productare separated to each region which come from the National Economic and Social Development Board (NESDB) of Thailand. The others are annually y data, the mean years of schooling has been calculated from the Human Development Report of United Nation Development Programme, minimum Wage was recorded in the Bank of Thailand. Moreover, Mortality rate, under five years (per 1,000 live births) and Mobile cellular subscriptions (per 100 people) come from the World Bank indicator.

The original gross regional product which calculated by the National Economic and Social Development Board of Thailand has been separated in six regions, Northern region, East-northern region, Eastern region, Western region, Southern region, and Central region. However, the Gini index which is the dependent variable in this study has been separated into four regions, Northern region, East-northern region, Southern region and Central region, and Bangkok observed by the same source. Thus, this study will recalculate to get four regions and Bangkok by summing the gross province product from the same source.

Conditional Convergence Model

As this study has two purposes, finding the parameter that explains the effecting of factors to the change of income inequality and the conditional convergence of income inequality of each region in Thailand. This study will set up the linear equations to explain the proposes of the study as

$$\begin{aligned}\mathrm{GGINI}_{\mathrm{i.t}} = {} & \alpha + \rho_{\mathrm{i}}\mathrm{GINI}_{\mathrm{i,t}} + \beta_{1,\mathrm{i}}\log\left(\mathrm{GRP}_{\mathrm{i,t}}\right) + \\ & \beta_{2,\mathrm{i}}\log(\mathrm{EDU}_{\mathrm{t}}) + \beta_{3,\mathrm{i}}\log(\mathrm{MOR}_{\mathrm{t}}) + \\ & \beta_{4,\mathrm{i}}\log\left(\mathrm{MIN}_{\mathrm{WAGE}_{\mathrm{t}}}\right) + \beta_{5,\mathrm{i}}\log(\mathrm{MOBILE}_{\mathrm{t}}) + \varepsilon_{\mathrm{i,t}} \quad (1)\end{aligned}$$

where $\mathrm{GGINI}_{\mathrm{i,t}}$, $\mathrm{GINI}_{\mathrm{i,t}}$, and$\mathrm{GRP}_{\mathrm{i,t}}$is the change of Gini index, the Gini index, andthe gross regional product at time t, which have each region following Northern region, East-northern region, Southern region, Central region, and Bangkok.$\mathrm{EDU}_{\mathrm{t}}$ is the average year of schooling at time t.$\mathrm{MOR}_{\mathrm{t}}$ is the mortality rate under 5-year-old at time t. $\mathrm{MIN_WAGE}_{\mathrm{t}}$ is the minimum wage at time t.$\mathrm{MOBILE}_{\mathrm{t}}$ is the mobile cellular subscriptions (per 100 people) at time t.ρ_{i} and β_{i} is the relationship of this model, and $\varepsilon_{\mathrm{i,t}}$ is the error of this model.

Multivariate Autoregressive State-Space Model

First, the Gini index that is the important variable has been uncalculated in some years. The Multivariate Autoregressive State-Space model can solve this problem by using two processes of this model. The state process of finding the missing Gini index set as,

$$\mathrm{GINI}_{\mathrm{i,t}} = \mathrm{B}_{\mathrm{i}}\mathrm{GINI}_{\mathrm{i,t-1}} + \mathrm{w}_{\mathrm{i}}, \mathrm{w}_{\mathrm{i}} \sim \mathrm{MVN}(0, \mathrm{Q}_{\mathrm{i}}) \quad (2)$$

Then, the observation process of finding the missing Gini index would be

$$\mathrm{GINI}_{i,t} = Z_i \mathrm{GINI}_{i,t-1} + v_i, v_i \sim \mathrm{MVN}(0, R_i) \quad (3)$$

where $\mathrm{GINI}_{i,t}$is Gini index that is income inequality at time twhich have each region following Northern region, East-northern region, Southern region, Central region, and Bangkok.$B_i$and $Z_i$is the relationship between $\mathrm{GINI}_{i,t}$and $\mathrm{GINI}_{i,t-1}$of the state process and the observation process which have each region following Northern region, East-northern region, Southern region, Central region, and Bangkok.$w_i$and v_i is the identically distribution, zero-mean normal vectors the covariance matrix Q_i and R_i which have each region following Northern region, East-northern region, Southern region, Central region, and Bangkok.

Next, transform the models as the matrix form to estimating the missing Gini index.

The state process:

$$\left[\mathrm{GINI}_{i,t}\right]_{5\times22} = [B_i]_{5\times5}\left[\mathrm{GINI}_{i,t-1}\right]_{5\times22} + [w_i], [w_i] \sim \mathrm{MVN}(0, [Q_i]_{5\times5}) \quad (4)$$

The observation process:

$$\left[\mathrm{GINI}_{i,t}\right]_{5\times22} = [Z_i]_{5\times5}\left[\mathrm{GINI}_{i,t}\right]_{5\times22} + [v_i], [v_i] \sim \mathrm{MVN}(0, [R_i]_{5\times5}) \quad (5)$$

To show missing variable in Gini index, this study follows Holmes 2018[15] who usedMARSShatyt to estimate the value of missing Gini index. Then, the adjusting data are consisted with the purposes of this study. The Gini index is calculated by a differential to changing in term of the change of the Gini index.

To estimate the parameters, this study also uses the Multivariate Autoregressive State-Space model. The state process can be express as,

$$\mathrm{GINI}_{i,t} = B_i \mathrm{GINI}_{i,t-1} + w_i, w_i \sim \mathrm{MVN}(0, Q_i) \quad (6)$$

The observation process is set as,

$$\mathrm{GGINI}_{i,t} = \alpha + Z_i \mathrm{GINI}_{i,t} + D_{1,i} \log(\mathrm{GRP}_{i,t}) + D_{2,i} \log(\mathrm{EDU}_{i,t}) + D_{3,i} \log(\mathrm{MOR}_{i,t}) + D_{4,i} \log(\mathrm{MIN_WAGE}_{i,t}) + D_{6,i} \log(\mathrm{MOBILE}_{i,t}) + \varepsilon_{i,t} \quad (7)$$

where $D_i$are the coefficients relating the covariate variable that effects to GRP_t, EDU_t, MOR_t, $\mathrm{MIN_WAGE}_t$ and MOBILE_twhich consist of the following region, Northern region, East-northern region, Southern region, Central region, and Bangkok.Z_i is the parameter that allows the conditional convergence of income inequality of each region which is assumed to be equal to $(1 - e^{-\lambda\tau})$which consist of the following region, Northern region, East-northern region, Southern region, Central region, and Bangkok.$v_{i,t}$ is the noise observation, zero-mean normal vectors the covariance matrix Rwhich consist of the following region, Northern region, East-northern region, Southern region, Central region, and Bangkok.

Then, these processes become transfer to matrix form as,

The state process:

$$\left[\mathrm{GINI}_{i,t}\right]_{1\times21} = [B_i]_{1\times1}\left[\mathrm{GINI}_{i,t-1}\right]_{1\times21} + [w_i]_{1\times1}, [w_i]_{1\times1} \sim \mathrm{MVN}(0, [Q_i]_{1\times1}) \quad (8)$$

The observation process:

$$\left[\mathrm{GGINI}_{i,t}\right]_{1\times21} = \left[Z_{\mathrm{GINI}_i}\right]_{1\times1}\left[\mathrm{GINI}_{i,t}\right]_{1\times21} + \left[D_{\mathrm{GRP}_i} \quad D_{\mathrm{EDU}_i} \quad D_{\mathrm{MOR}_i} \quad D_{\mathrm{MIN_{WAGE}}_i} \quad D_{\mathrm{MOBILE}_i}\right]_{1\times5} \begin{bmatrix} d_{\mathrm{GRP}_{i,1996}} & \cdots & d_{\mathrm{GRP}_{i,2016}} \\ \vdots & \ddots & \vdots \\ d_{\mathrm{MOBILE}_{i,1996}} & \cdots & d_{\mathrm{MOBILE}_{i,2016}} \end{bmatrix}_{5\times21} + [V]_{1\times1}, [V]_{1\times1} \sim \mathrm{MVN}(0, [R_i]_{1\times1}) \quad (9)$$

IV. RESULT AND FICCUSSION

Descriptive analysis

The variables which use in this study have the original variable and the predicted variable, the Gini index is missing in some year of period in this study continue to find this variable. Then, the change of Gini index is also calculated from this Gini index.

To estimate the correlation, the data which are used in this study are also stationary with the Multivariate Autoregressive State-Space model in the state process. Moreover, this model is estimated the parameters with Gaussian error via maximum likelihood using primarily an EM algorithm (Holmes, 2018).

Correlation

According to Table 1, this table shows the correlation of the growth of gross regional product, the average year of schooling, the mortality rate under 5-year-old, the minimum wage, and the mobile cellular subscriptions (per 100 people) with the change of Gini index.

Variable	N	E	C	S	B
Z	0.00008 (1.82E-94, 5.57E-02)	0.00001 (2.09E-96,7.46E-02)	0.00001 (4.31E-91, 4.86E-02)	0.00006 (2.56E-92,5.85E-02)	0.11687 (3.79E-60, 1.19E-01)
GRP	0.00001 (4.03E-14, 5.40E-13)	0.00001 (-3.46E-13,1.55E-13)	0.00001 (-4.18E-14, 4.60E-14)	0.00001 (-1.45E-13,1.26E-13)	0.00001 (-2.40E-13,1.00E-13)
EDU	-0.014	0.01172 (-	-0.012	0.04921 (-	0.02065 (-

	84 (-0.07716, 0.04542)	0.09067,0.10891)	9 (-0.06577, 0.04166)	0.01482,0.114979)	0.08435,0.12833)
MOR	-0.04845 (-0.08221, -0.01677)	-0.00212 (-0.05096,0.04714)	0.00783 (-0.02009, 0.03584)	0.02811 (-0.00608,0.06330)	-0.02341 (-0.09181,0.04407)
MIN_WAGE	-0.00037 (-0.00098, 0.00025)	-0.0001 (-0.00076,0.00056)	0.00009 (-0.00025, 0.00043)	-0.00031 (-7.21E-04,9.50E-05)	-0.00059 (-0.00128,0.00012)
MOBILE	0.00114 (-0.00025, 0.00258)	-0.00002 (-0.00200,0.00197)	-0.0005 (-0.00178, 0.00077)	-0.00073 (-0.00213,0.00071)	0.00192 (-0.00024,0.00399)

Table 1: The estimated coefficient

The growth of the gross regional product and the mobile cellular subscriptions (per 100 people)have positive link with the change of income inequality of Northern region. The 1 percentage increasing in the growth of gross regional product does not cause the change of income inequality in Northern region change as much. Moreover, 1 percentage rising in the mobile cellular subscription (per 100 people) cause the change of income inequality in this region by 0.00114 percentage. However, The improvement 1 percentage of the average year of schooling, the mortality rate under 5-year-old, and the minimum wage willmake the change of income inequality in Northern region drop by 1.48401 percentage, 4.84505 percentage, and 0.03709 percentage respectively.

In East-Northern region, the change of income inequality is also impacted by the other factors. The average year of schooling increase by 1 percentage will rise the change of income inequality 0.01172 percentage. Nevertheless, the mortality tare under 5-year-old, the minimum wage, and the mobile cellular subscriptions (per 100 people) has negative relationship with the change of income inequality by 0.00212 percentage, 0.00010 percentage, and 0.00002 percentagerespectively. Moreover, the growth of gross regional product does not affect the change of income inequality as much.

The Central of Thailand has the relationship of the mortality rate under 5-year-old, and the minimum wage with the change of income inequality that positive relationship by 0.00783 percentage, and 0.00009 percentagerespectively. However, the growth of gross regional product does not response to the change of income inequality as much. The improvement of the average year of schooling and the mobile cellular subscription (per 100 people) 1 percentage would reduce the change of income inequality 0.01290 percentage and 0.00050 percentage respectively.

The change of income inequality in Southern of Thailandwill be reduced by the minimum wage and the mobile cellular subscription (per 100 people), develop 1 percentage of these variables get the change of income inequality down by 0.0003 percentage and 0.00073 percentagerespectively. The growth of the gross regional product 1 percentage does not influence the change of income inequality. In other way, the change of income inequality this region has positive relationship with the average year of schooling and the mortality rate under 5-year-old by 0.04921 percentage and 0.02811 percentage respectively.

The change of income inequality of Bangkok has been affected by the mortality rate under 5-year-old and the minimum wage in negative term. The development of the increasing of the mortality rate under 5-year-oldbecome the change of income inequality reducing 0.02341 percentage while1 percentage of raising the minimum wagecreate the 0.00059 percentage down of the change of income inequality in Bangkok. However, the change of the income inequality in southern region of Thailand has also affected by the average year of schooling and the mobile cellular subscription (per 100 people) in positive term, the increasing in these variables by 1 percentage will make the change of income inequality to rise by 0.02065 percentage and 0.00192 percentagerespectively. In addition, the growth of gross regional product of Bangkok does not affect the change of income inequality as much.

Conditional Convergence of Income Inequality

Special concern with row 2 in table 1, the Conditional convergence of income inequality are showed by the coefficient between the Gini index and the change of Gini index with adding the exogenous variables, the gross regional product, the average year of schooling, the mortality rate under 5-year-old, the minimum wage, and the mobile cellular subscriptions (per 100 people) as ρ variables. The result shows the positive parameter in Bangkok that means income inequality in these regions is diverging. However, the other regions show the estimated Z close to zero whichmean thereis steady state income inequality converge.

The distribution of the parameters

According to figure 1, there show the distribution of the parameters in this study which are separated to each region, Northern region, East-Northern region,

Central region, Southern region, and Bangkok. The distribution of the parameters of each region are non-normal distribution, the right-skewed distribution.

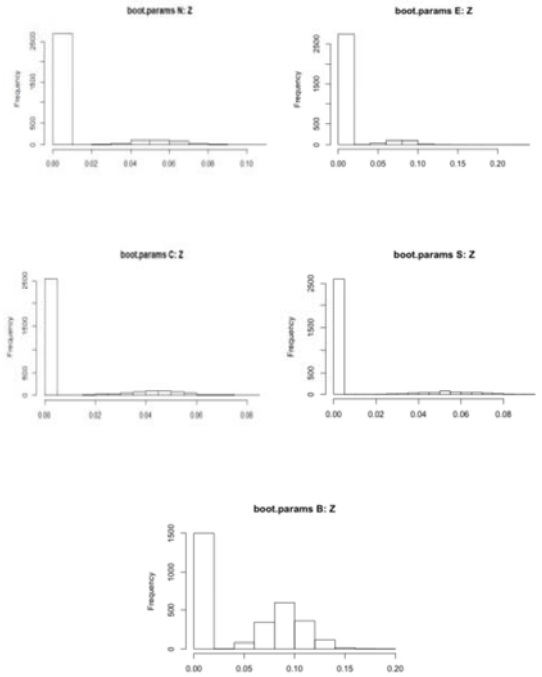


Figure 1:The distribution of the parameters and the data of each region

V. CONCLUSION

The income inequality is one of the big problems that must be concerned. The public and private sectors also realize the effect of the income inequality problem, they attempt to reduce the income inequality in Thailand. However, the income inequality which is showed by the Gini index cannot represent the whole country with one value. This study separates each region in Thailand to find the factors influencing income inequality, North region, East-Northern region, Central region, Southern region, and Bangkok. The result can show more response to make income inequality down in each region. The Multivariate Autoregressive State-Space model is used to solve the missing variable and find the estimated parameter. The estimate results show the robust has a positive relationship between the gross regional product and the change of Gini index but the economic growth will not create the change of income inequality increase as much. The average year of schooling increase the change of income inequality rate in East-Northern region, Southern region, and Bangkok, but decreases the change of income inequality rate in Northern region and Central region. The health sectors which is proxied by the mortality rate under 5-year-old is growing the change of income inequality in Central region and Southern region. However, this variable also cuts the change of income inequality in Northern region, East-Northern region, and Bangkok. Increasing of minimum wage make the change of income inequality rise in Central region, but the change of income inequality in the others are decline. The change of income inequality become rise with the accessing of technology that is proxy by the mobile cellular subscription (per 100 people) in Northern region and Bangkok, but it becomesto decrease with the increasing of the mobile cellular subscription (per 100 people). Furthermore, this study is showing the conditional convergence in income inequality of each region in Thailand. The result of this testing shows income inequality of Bangkok are diverging. It seems that Bangkok is becoming more unequal due to the migration inflow which increase the different individual characteristics of people in this area. However, the other regions are converge to steady state income inequality, the Gini index of these regions still have been changing slightly with a little ratio from the previous year in 1996-2016.

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