CHAPTER 3

Methodology

3.1 Methodology

This study uses a simultaneous equation model. The data used in this investigation include the data set of 18 years panel data of 5 regions as follows: Bangkok, Central region, North region, Northeast region, and South region. All data set is starting from year 1996 to 2013. All variables of the data include:

Table 3.1: Variables

Variables	Sources
1. 43Employment (Em)	The office of National Economic and Social Development Board, National Statistical Office of Thailand and The Bank of Thailand
2. The growth rate of tax revenue (Tg)	The revenue department and Ministry of finance.
3. Gini coefficient in revenue (Ginire)	The office of National Economic and Social Development Board
5. Gini coefficient in expenditure (Gini)	The office of National Economic and Social Development Board

Table 3.1: Variables (continued)

Variables	Sources
6. Proportion of population living under regional poverty line (Pov)	The office of National Economic and Social Development Board
7. The ratio of medical profession per head (H)	The office of National Economic and Social Development Board
8. The growth rate of the ratio of medical equipment per head (Heg)	The office of National Economic and Social Development Board
9. GRP growth rate (GRP)	The office of National Economic and Social Development Board and National Statistical Office of Thailand

3.2 Research Process

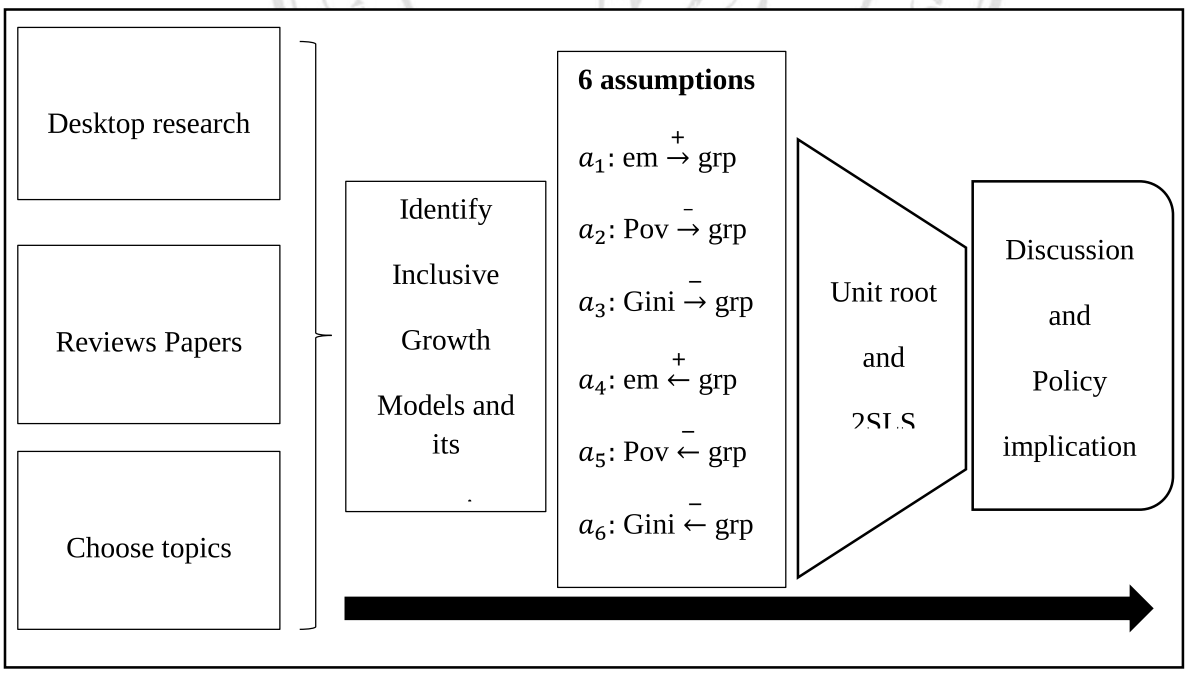

Figure 3.1 Research Process

3.3 Econometric Model

This study aims at studying the factors affecting inclusive growth in Thailand, the forward relationship between regional average years of education, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head and employment which lead to GRP growth, the relationship between the growth rate of tax revenue, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head and Gini coefficient in revenue which lead to GRP growth and the relationship between the growth rate of tax revenue, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head and proportion of population living under regional poverty line which lead to GRP growth. Also backward effect could be concluded that the country has inclusive growth.

According to various study including Croix and Vandenberghe (2004), Afzal et al. (2010), Beskaya, Savas, Samiloglu (2010), and Haldar and Mallik (N.D.) confirm that there is a direct relationship between human capital and employment. In addition, according to White and Anderson (2001), Ravallion and Chen (2003), Bhalla (2007), Ianchovichina and Lundstrom (2009), Habito (2009), McKinley (2011) and many more state that inclusive growth come from an encouragement of employment, poverty and inequality reduction. in this study, inequality will be divided into two ways: the inequality in revenue and expenditure. To examine the correlations between regional average years of education, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head and Employment which lead to GRP growth, while considering poverty and inequality as exogenous variables, we consider the following simultaneous equation model:

$$GRP_{it} = \alpha_0 + \alpha_1 Em_{it} + \alpha_2 Pov_{it} + \alpha_3 Ginire_{it} + \alpha_4 Gini + \varepsilon_{1it} \quad (3.1)$$

While,
$$Em_{it} = \alpha_5 + \alpha_6 Edu_{it} + \alpha_7 H_{it} + \alpha_8 Heg_{it} + \varepsilon_{2it} \quad (3.2)$$

where Em_{it} , Pov_{it}, Edu_{it}, $Gini_{it}$, $Ginire_{it}$, Heg_{it}, H_{it} and GRP_{it} denote employment, proportion of population living under regional poverty line, regional average years of education, Gini coefficient in expenditure, Gini coefficient in revenue, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. Moreover, $\alpha_n , n = 0\ to\ 8$ measure the causal effect, while, ε_{1it} and ε_{2it} denoted equation’s residual. These set of equations system conducted under the assumption of education and health care were positively related to employment, and employment, proportion of population living under regional poverty line and Gini coefficient could lead to growth.

According to Turnovsky and Fisher (1995), Feltenstein and Ha (1995), Devarajan et al. (1996) and Agenor and Neanidis (2006) state that government expenditure impact growth, and the government expenditure could finance by government tax revenue. To examine the forward effect between human capital, which represented by health care dimension and the role of government, which represented by the growth rate of tax revenue, and poverty rate, represented by the proportion of people living under regional poverty line, that finally leads to growth, we consider the following simultaneous equation model:

$$GRP_{it} = \alpha_0 + \alpha_1 Em_{it} + \alpha_2 Pov_{it} + \alpha_3 Ginire_{it} + \alpha_4 Gini + \varepsilon_{1it} \quad (3.1)$$

While,

$$Pov_{it} = \alpha_9 + \alpha_{10} Tg_{it} + \alpha_{11} H_{it} + \alpha_{12} Heg_{it} + \varepsilon_{3it} \quad (3.3)$$

where Em_{it} , Pov_{it}, Tg_{it}, $Gini_{it}$, Heg_{it}, H_{it} and GRP_{it} denote employment, proportion of population living under regional poverty line, the growth rate of tax revenue, Gini coefficient in expenditure, Gini coefficient in revenue, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. $\alpha_n, n = 9\ to\ 12$ Measure the causal effect, while, ε_{1it} and ε_{3it} denoted equation's residual.

To examine the forward effect between human capital, which represented by health care dimension and the role of government, which represented by the growth rate of tax revenue, and inequality rate, represented by Gini coefficient, that finally leads to growth, we consider the following simultaneous equation model:

$$GRP_{it} = \alpha_0 + \alpha_1 Em_{it} + \alpha_2 Pov_{it} + \alpha_3 Ginire_{it} + \alpha_4 Gini + \varepsilon_{1it} \quad (3.1)$$

While,

$$Gini_{it} = \alpha_{13} + \alpha_{14} Tg_{it} + \alpha_{15} H_{it} + \alpha_{16} Heg_{it} + \varepsilon_{4it} \quad (3.4)$$

where Em_{it} , Pov_{it}, Tg_{it}, $Gini_{it}$, Heg_{it}, H_{it} and GRP_{it} denote employment, proportion of population living under regional poverty line, the growth rate of tax revenue, Gini coefficient in expenditure, Gini coefficient in revenue, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. $\alpha_n, n = 13\ to\ 16$ measure the causal effect ,while , ε_{1it} and ε_{4it} denoted equation's residual.

To examine the backward effect of the first group, the model would test whether growth induce education and finally improve human capital or not, we considered simultaneous equation as follow:

$$Em_{it} = \alpha_{17} + \alpha_{18}GRP_{it} + \alpha_{19}Edu_{it} + \alpha_{20}H_{it} + \alpha_{21}Heg_{it} + \varepsilon_{5it} \qquad (3.5)$$

where Edu_{it}, Em_{it}, H_{it}, Heg_{it} and GRP_{it} denote regional average years of education, employment, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. $\alpha_n, n = 17 \ to \ 21$ measure the causal effect , while, ε_{5it} denoted equation's residual.

To examine the backward effect of the second group, the model would test whether growth induce lower rate of poverty and finally improve human capital in the health dimension and the role of government or not, we considered simultaneous equation as follow:

$$Pov_{it} = \alpha_{22} + \alpha_{23}GRP_{it} + \alpha_{24}Tg_{it} + \alpha_{25}H_{it} + \alpha_{26}Heg_{it} + \varepsilon_{6it} \qquad (3.6)$$

where Pov_{it}, Tg_{it}, Heg_{it}, H_{it} and GRP_{it} denote proportion of population living under regional poverty line, the growth rate of tax revenue, Gini coefficient, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. $\alpha_n, n = 22 \ to \ 26$ measure the causal effect , while, ε_{6it} denoted equation's residual.

To examine the backward effect of the second group, the model would test whether growth induce lower rate of inequality and finally improve human capital in the health dimension and the role of government or not, we considered simultaneous equation as follow:

$$Gini_{it} = \alpha_{22} + \alpha_{23}GRP_{it} + \alpha_{24}Tg_{it} + \alpha_{25}H_{it} + \alpha_{26}Heg_{it} + \varepsilon_{6it} \qquad (3.7)$$

where Tg_{it}, $Gini_{it}$, Heg_{it}, H_{it} and GRP_{it} denote the growth rate of tax revenue, Gini coefficient, the ratio of medical profession per head, the growth rate of the ratio of medical equipment per head, and GRP growth rate in year t of region. α_n, n measure the causal effect , while, ε_{35it} and ε_{36it} denoted equation's residual.

3.4 Unit root Test

To check the stationary of the series in the panel under cross-sectional dependence we use first- and second-generation unit root tests. Unit root test was conducted, first difference significant of data would use Levin–Lin–Chu test Levin base on Levin and Lin (1992, 1993) and Lin and Chu (2002), and second difference significant of data would use Pesaran test according to Pesaran (2003).

3.4.1 Levin-Lin-Chu Test: According to Levin et al. (2002), let y_{it} equal to panel data, i is cross sectional data (i=1,2,3,…,N) and t is time rang or time series data (t=1,2,3,…,T). The characteristic of all unit of data will equate in the first order, the main assumption state as follows:

$$\Delta y_{it} = \beta y_{i,t-1} + \sum_{j=1}^{\rho_i} \alpha_{ij} \Delta y_{it-j} + X'_{it}\gamma + \varepsilon_{it}$$

Where, Δy_{it} is the difference term of y_{it}

y_{it} is panel data

β is ρ-1

ρ_i is the lag order of each difference term

X'_{it} is exogenous variable

ε_{it} is error term

There are three step of applying unit root test according to Levin, Lin and Chu (LLC), LLC test.

1. Regress the ADF equation of each unit.
2. Calculate for long term and short term variation of each unit of the data under unit root assumptions
3. Find t-statistic by pooled estimation, if the t-statistic from the equation is significant. Means that the alternative hypothesis is rejected and the data is non stationary. However, if the t-statistic is not significant, means that the alternative hypothesis is accepted and the data is stationary.

3.4.2 The Pesaran Test: Pesaran (2003) has considered one-factor model with heterogeneous loading factors for residuals, he apply standard Dickey-Fuller or augmented Dickey-Fuller regression with cross section average of lagged levels and first differences of the individual series. If the residual are not correlated, the regression used for the i^{th}country would defined as:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + v_{i,t}$$

where $\bar{y}_{t-1} = (1/N)\sum_{i=1}^{N} y_{i,t-1}$ and $\Delta \bar{y}_t = (1/N)\sum_{i=1}^{N} y_{i,t}$. Denoted $t_i(N,T)$ the t-statistic of the OLS estimate of ρ_i.

The assumption of Persaran (2003), using ADF are stated as follows:

$$H_0: \alpha_1 = 0 \quad ,\text{for all i}$$

$$H_1: \alpha_1 \leq 0$$

While the test statistic is $\bar{t}_{NT} = (\sum_{i=1}^{N} t_{it_i}(P_i))/N$

3.5 Model Estimation

3.5.1. Two-Stage Least Squares (2SLS)

1.) Stage 1. Obtain the least squares predictions from the regression of Y_j on X.

2.) Stage 2. Estimate δ_j by least squares regression of y_j on $\hat{Y}_j$ and X_j.