CHAPTER 3

Methodology

3.1 Conceptual Framework

This research explores the analysis of LR and SR relationship among infrastructure investment, employment, capital stock and GDP of Myanmar by using autoregressive distributive lag (ARDL) model to estimate the SR and LR of those variables. The function of the theoretical framework of economic growth can be written as the following below:

$$GDP = f(INF, EMP, K) \quad (3.1)$$

According to the National Income Identity, the total national income (GDP) is affected by overall investment, consumption, government expenditure, export and import. Nevertheless, as this paper focuses only on the relationship between infrastructure investment and economic growth. In this model, the next four variables are not included. As the ARDL approach to cointegration test by using bound test and ECM test were used to analyses the relationship among all variables.

3.2 Variables Used in the Model

The variables used in this study consist of endogenous variables such as the nominal and real GDP, Infrastructure investment, Employment and Capital stock of Myanmar. The following table show the design of the variables and measurements used in this study.

Table 3.1 Design of the variables

Concept	Variables	Indicators	Measures	Symbols
Real Gross Domestic Product	Gross Domestic Product	Million Kyats	(Nominal GDP/GDP deflator)*100	GDP
Infrastructure Stock	Infrastructure Investment	Million Kyats	$(K_{t+1}=(1-\delta)K_t + I_t)$	INF
Employment	Employment	Thousand People	(Labor Force = Employment + Unemployment)	EMP
Capital Stock	Capital Stock	Million Kyats	$(K_{t+1} =(1-\delta) K_t + I_t)$	K

Source: Calculation

In this study all of the four variables are converted into growth rate terms as following:

GDP = Growth Domestic Product in terms of growth rate

INF = Infrastructure Investment

EMP = Employment

K = Capital Stock

3.3 Hypothesis of the Study

The main objective of this study is to investigate the relationship between infrastructure investment and economic growth in Myanmar. According to this objective, two hypotheses can be stated as follows:

Hypothesis 1: Infrastructure Investment has an impact on economic growth of Myanmar over the period of 1988-1989 to 2012-2013.

Hypothesis 2: Infrastructure investment is the main factor which lead to the economic growth of Myanmar compare with employment and capital stock.

3.4 Research Methodology

3.4.1 ADF Unit Root Test

Augmented Dickey-Fuller (ADF) unit root test should be tested in order to check and create sure that all variables stationary or not stationary in of I(1) in level and none of these variables is of I(2) or higher order. For doing so, ADF unit root test can be used as the following:

Table 3.2 Hypothesis Test

Unit Root Test	ADF Unit Root Test
Null Hypothesis: H0	Time-Series is stationary.
Alternative Hypothesis: H1	Time-Series is not stationary.
Statistic test	t-Statistic
Prob. <0.1	0.00 – 0.10

$$\Delta GDP_t = \beta_0 + \phi_0 GDP_{t-1} + \beta_1 t + \sum_{j=1}^{p} \phi j \, \Delta GDP_{t-j} + \varepsilon_{t1} \quad (3.2)$$

$$\Delta INF_t = \gamma_0 + \varphi_0 INF_{t-1} + \gamma_1 t + \sum_{j=1}^{p} \varphi j \, \Delta INF_{t-j} + \varepsilon_{t2} \quad (3.3)$$

$$\Delta EMP_t = \alpha_0 + \psi_0 EMP_{t-1} + \alpha_1 t + \sum_{j=1}^{p} \psi j \, \Delta EMP_{t-j} + \varepsilon_{t3} \quad (3.4)$$

$$\Delta K_t = \delta_0 + \vartheta_0 K_{t-1} + \delta_1 t + \sum_{j=1}^{p} \vartheta \, \Delta K_{t-j} + \varepsilon_{t4} \quad (3.5)$$

In ADF unit root test, if the result of test statistics of a variable is less than the critical value in absolute terms, then the null hypothesis cannot be rejected, meaning that the variable has no unit root and is stationary. Thus, we can test variables at level or 1st difference. If the result of test statistics those variables are greater than the critical

value in absolute terms, then null hypothesis can be rejected, meaning that the variable has non-stationary.

3.4.2 Autoregressive Distributed Lag Model

After ensuring that all of variables are stationary at level I(0) and first different I(1), ARDL approach to co-integration can be estimated. The ARDL model is adopted for a mixed order of integration at level I(0) and first different I(1). In the case of yearly data, the maximum order of lags in the ARDL model is p. The ARDL approach to co-integration is the following equation below;

$$GDP_t = \beta_0 + \beta_1(INF_t) + \beta_2(EMP_t) + \beta_3(K_t) + \varepsilon_t \quad (3.6)$$

Where,

GDP_t = dependent variable time series data at t-time

INF_t = First independent variables time series data at t-time

EMP_t = Second independent variables time series data at t-time

K_t = Third independent variables time series data at t-time

ε_t = a vector of stochastic error terms;

β_0 , β_1, β_2 , β_3 , β_4 = parameters;

For the above equation, the error correction version of ARDL approach to cointegration model is given as below;

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta INF_{t-i} + \sum_{i=1}^{p} \beta_{2i} \Delta EMP_{t-i} + \sum_{i=1}^{p} \beta_{3i} \Delta K_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{4i} \Delta GDP_{t-i} + \beta_5 GDP_{t-1} + \beta_6 INF_{t-1} + \beta_7 EMP_{t-1}$$
$$+ \beta_8 K_{t-1} + \varepsilon_{1t} \quad (3.7)$$

β_1, β_2, β_3, β_4, of equation (3.7) represents the SR dynamics of model as well as where the next part with β_5, β_6, β_7, β_8, represents the LR relationship among in

all variables. And then we take natural log in equation (3.7) then will be written as equation (3.8) and showed as below that;

$$\Delta\, lnGDP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\, \Delta lnINF_{t-i} + \sum_{i=1}^{p} \beta_{2i}\, \Delta \ln EMP_{t-i} + \sum_{i=1}^{p} \beta_{3i}\, \Delta lnK_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{4i}\, \Delta lnGDP_{t-i} + \beta_5 lnGDP_{t-1} + \beta_6 lnINF_{t-1}$$
$$+ \beta_7 lnEMP_{t-1} + \beta_8 lnK_{t-1} + \varepsilon_{1t} \qquad (3.8)$$

The ARDL approach to cointegration must use F-test for testing the existence of the long-run relationship among dependent and independent variables. The null hypotheses of no cointegration amongst the variables are as follows;

$$(H_0 :\ \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0)$$

And against the alternative hypothesis

$$(H_1 :\ \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0)$$

The F-statistic is estimated thus if the value of the test statistics is above the critical bound values, then the null of no long-run relationship between dependent and independent variables are rejected irrespective of the order of integration. On the other hand, if the value of the test statistics is below the critical bound values, then the null of no long-run relationship between dependent and independent variables are not rejected.

$$\Delta \ln GDP_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\, \Delta INF_{t-i} + \sum_{i=1}^{p} \beta_{2i}\, \Delta EMP_{t-i} + \sum_{i=1}^{p} \beta_{3i}\, \Delta K_{t-i}$$
$$+ \sum_{i=1}^{p} \beta_{4i}\, \Delta GDP_{t-i} + \varepsilon_t \qquad (3.9)$$

Then the variable addition variables test is performed by adding GDP_{t-1}, INF_{t-1}, EMP_{t-1}, K_{t-1} into the equation. The F-statistic tests the joint null hypothesis that the coefficients of these variables are zero for this level. This can be denoted as

F(GDP \ INF, EMP, K). This is compared to the critical value bonds computed by Pesaran, Shin and Smith (1996) (Reungsri, 2010).

3.4.3 Error Correction Estimation

After confirming that all variables are stationary at level I(0) and I(1), ECM model can be estimated.

$$\Delta\, GDP_t \;=\; \alpha_0 + \beta_1\, \Delta INF_t \;+ \gamma_1\, \Delta EMP_t + \delta_t\, \Delta\, K_t + \emptyset_1\, u_{t-1} + \varepsilon_t \qquad (3.10)$$

ECM estimation analyses and explains to correct the equilibrium error in one period by the next period. And then, this model shows $\emptyset_1$, the absolute value mentioned how quickly the equilibrium is restored.

3.4.4 Bound Test

Co-integration analysis by using Bound test into the ARDL model can be used to know the about LR relationship among the variables based on the ECM estimation. The hypotheses of Bound test are shown in the following table:

Table 3.3 Bound Test

Test	Cointegration Test
Null Hypothesis: H0	No long run relationships exist
Alternative Hypothesis: H1	Long run relationships exist
Test Statistic	F-Statistic
Prob. <0.1	0.00 – 0.10

$$Y_t = b_0 + b_1 X_t + u_t$$

$$u_t = Y_t - b_0 - b_1 X_t$$

3.5 Descriptive statistics

In this part, the infrastructure investment of the past twenty five years is analysed with a different approach. Based on the unlocking the potential of Myanmar, there are some discussions about investment should be made to provide an essential infrastructure support for economic growth and development. As the economic and social infrastructure

investment, also plays a key role in Myanmar economic growth with these countries are discussed in this part.

3.6 Data of the Study

3.6.1 Data Collection

The data collection for the study is quite wide-ranging. All the data to be used in econometric models are taken from various issues of Review of the Financial, Economic and Social Condition published by Ministry of National Planning and Economic Development and central statistical year books (CSO), Asian Development Bank and World Bank.

They can provide sufficient level of information and data on national accounts and investment statistics of Myanmar. Regarding the methodology section, GDP, infrastructure investment, employment and capital stock data are required for doing ARDL model estimation and ECM analysis among these four variables. In order to increase the strength of this analysis, sufficient time series data on GDP, infrastructure investment, employment and capital stock are needed. For this reason, annual data of GDP, infrastructure investment, employment and capital stock are taken from 1988-1989 to 2012-2013. The reason for which the data set is started collecting from 1988 is because for running time-series data observations are required. Thus, at the end, there are 25 time series data for each variable regarding econometric analysis and growth rate forms of all these four variables are used in ARDL model estimations and ECM analysis.

3.6.2 Data Description

The following table describes the descriptive statistics of the data used in this study.

Table 3.4 Descriptive Statistics of the variables

Variables	Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Annual Real GDP					
GDP	25	11.67471	0.848765	10.53726	13.04961

Table 3.4 Descriptive Statistics of the variables (Continued)

Variables	Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Infrastructure Stock					
INF	25	12.22552	0.245204	11.79661	12.54601
Employment					
EMP	25	9.941731	0.220629	9.630431	10.26015
Capital Stock					
K	25	13.23487	0.308900	12.84150	13.75872

Source: Calculated