CHAPTER 4

Empirical Analysis

In this chapter, the relationship between the economic growth and infrastructure investment will be examined in two ways: exploratory data analysis and descriptive analysis. The first section deals with the data running and data analysing by using ARDL model to find out the relationship between economic growth and infrastructure investment. The facts that how GDP growth affected the infrastructure investment, how employment and capital stock related each other, and how investment had impacts on GDP growth will be discussed based on the empirical results. In the second section, the relationship between the economic growth and investment will be discussed by using descriptive statistics.

4.1 Exploratory data analysis

The exploratory data analysis is conducted in three steps. The stage of the first is to check the stationary condition of the data set by using the Augmented Dickey-Fuller because in order to use ARDL estimation all the time-series data have to be stationary at level and first different. Second, later constructing sure that all the data are stationary at level and first different co-integration test using the Bounds Test for the sample period was done. In the third stage, if the test shows that the dependent and independent variables are co-integrated, then the long run and short run elasticity are computed. Finally, the ECM was estimated for the sample period.

4.1.1 Augmented Dickey-Fuller Unit Root Tests

In order to use ARDL estimation and to find out the co-integration between the four variables, such as GDP, INF, EMP and K, it is needed to check whether all the data are stationary or not. Accordingly, Augmented Dickey-Fuller unit root test is used to check the stationary quality of the time series variables. The null hypothesis for this

test is that time-series is stationary. If the test statistics is less than 5%, the null hypothesis cannot be rejected, which means that the time-series is stationary. In Table 4.1 is the ADF unit root tests are recorded.

Table 4.1 Augmented Dickey-Fuller unit root tests results

Variables	ADF Test statistics	5% Critical value	10% Critical value	Deterministic Regressors	Lags	Results
lnGDP	-4.380527 (0.0030)	-3.020686	-2.650413	Intercept	5	Stationary
lnINF	-5.927624 (0.0001)	-2.998064	-2.638752	Intercept	5	Stationary
lnEMP	-4.777279 (0.0010)	-2.998064	-2.638752	Intercept	5	Stationary
lnK	-2.981671 (0.0517)	-2.998064	-2.638752	Intercept	5	Stationary

Source: Calculation ( ) = P-Value

According to ADF unit root test all independent variables, i.e. INF, EMP and K in Table 4.1 are of I(1) and dependent variable of GDP is also stationary at first different I(1) in testing with intercept. Therefore, by testing with intercept, null hypothesis cannot be rejected for all time-series that is they are stationary. And so, the appropriate technique to co-integration is the ARDL approach to co-integration by using

Bound test. The following Table 4.2 mentioned by testing ADF unit root test with intercept and trend results.

Table 4.2 Augmented Dickey-Fuller unit root tests results

Variables	ADF Test statistics	5% Critical value	10% Critical value	Deterministic Regressors	Lags	Results
lnGDP	-4.183102 (0.0185)	-3.658446	-3.268973	Intercept &Trend	5	Stationary
lnINF	-7.693197 (0.0000)	-3.622033	-3.248592	Intercept &Trend	5	Stationary
lnEMP	-4.586153 (0.0070)	-3.622033	-3.248592	Intercept & Trend	5	Stationary
lnK	-2.618572 (0.2760)	-3.622033	-3.248592	Intercept & Trend	5	Non-Stationary

Source: Calculation ( ) =P-Value

Table 4.3 Order of Integration

	ADF	
Variables	Intercept	Intercept and Trend
lnGDP	(I_1)	(I_1)
lnINF	(I_1)	(I_1)
lnEMP	(I_1)	(I_1)
lnK	(I_1)	

Source: Calculation

41

A summary of unit root test results regarding order of integration based on different unit root criteria such as ADF Test is given in Table 4.3.Showing lnGDP, lnINF, lnEMP and lnK, in Table 4.3 are of I (1) none of the variables is of I (2). So the appropriate technique to co-integration is the ARDL approach to co-integration.

4.1.2 Bound Test

After constructing sure that all the variables are stationary at level I(0), and I(1) ARDL bound test can be carried out. Even though there is certain rule for automatic selecting lag length for ARDL model. Akaike information Criterion (AIC), the number of lags can also be defined as four. The calculated F-statistics are reported in table 4.4 for GDP, INF, EMP and K as shown below:

Table 4.4 F-Statistics for Bound Test

Variables	F-Test	Lag Length	The number of k
ΔlnGDP{F_{GDP}(lnGDP\ lnINF, lnEMP, lnK)}	31.62044	4	3

Source: Calculation (3.65-4.66, 3.15-4.08, 2.79-3.67 and 2.37-3.2 are the lower and upper critical values for bounds testing ARDL for 1%, 2.5%, 5% and 10% significance levels, respectively.)

In table 4.4 shows the calculated F-statistics. The value of F- statistics was tested to know the existence of a LR relationship among variables of Myanmar economy and Infrastructure-economic investment. From table 4.4 mentioned the cointegration among the economic growth; INF, EMP and K in Model 1 exist when economic growth is the dependent variable because it is at 4 lag length F-value that is higher than the lower bound and upper bound value. The null hypothesis of no cointrgration among economic growth, INF, EMP and K is also rejected and that there is indeed a cointegration relationship among the variables in the model

To assess equation 3.1, concerning the effect of infrastructure investment, employment and capital stock on economic growth, we estimated equation 3.7 by using ARDL approach. The results of dynamic ARDL (4, 4, 4, 4) model are reported in Table

4.5. In this result, LNGDP serves dependent variable and independent variables are LNINF, LNEMP and LNK.

Table 4.5 ARDL (4, 4, 4, 4,) Based on Akaike info criterion (Dependen Variable=GDP)

Regressor	Coefficient	T-Statistic (Prob.)
LNGDP(-1)	-1.083558	-6.115961(0.1032)
LNGDP(-2)	-1.030061	-3.259656(0.1895)
LNGDP(-3)	-1.251998	-3.418385(0.1812)
LNGDP(-4)	-1.082950	-2.138670 (0.2784
LNINF	-5.220716	-1.094514 (0.4713)
LNINF(-1)	-8.678732	-1.554449 (0.3639)
LNINF(-2)	5.263603	0.845804 (0.5531)
LNINF (-3)	3.627462	0.621475(0.6460)
LNINF (-4)	5.211383	1.024076 (0.4924)
LNEMP	-1.803385	-0.633494 (0.6405)
LNEMP(-1)	3.081737	0.911608 (0.5294)
LNEMP(-2)	3.650775	1.824944 (0.3191)
LNEMP(-3)	6.221099	3.616366(0.171)
LNEMP(-4)	-8.872626	-4.036105 (0.1717)
LNK	8.342030	1.388150 (0.3974)
LNK(-1)	-7.006909	-1.120627 (0.4638)
LNK(-2)	-3.265646	-0.321978 (0.7189)
LNK (-3)	5.53992	0.472643 (0.7189)
LNK (-4)	6.053992	0.576056 (0.6673)
C	-88.48478	-2.428451(0.2487)

Source: Calculation R^2 = 0.99, F-stat = 38.96006 (0.1255)

43

Table 4.6 Results of the LR coefficients using ARDL (4, 4, 4, 4) (Dependent Variable is LNGDP from 1988-1989 to 2012-2013

Regressor	Coefficient	T-Ratio (Prob.)	ARDL Model
LNINF	0.037257	0.03905(0.97)	ARDL(4,4,4,4)
LNEMP	0.418018	0.385421(0.76)	ARDL(4,4,4,4)
LNK	1.773549	2.100864(0.28)	ARDL(4,4,4,4)
Constant	-16.240010	-5.358060(0.11)	ARDL(4,4,4,4)

Source: Calculation

From Table 4.6, the coefficient of infrastructure stock, employment and capital stock are positive and statistically significant, indicating that infrastructure investment; employment and capital stock enhance economic growth in the LR. Infrastructure investment rate has positive impact on economic growth (about 0.03%) at 5% significant level in LR. This is consistent with the findings of Peter Perkins, Johannfedderje and Johnliz(2005), James Heintz, Robert Pollin, Heidi Garrett-Peltier (2009), Wolassa L. Kumo(2012) and Sakineh Sojoodi, Fakhri Mohseni Zonuzi and Nasim Mehin Aslani Nia(2012).

The next stage of analysis is the estimation of ECM of ARDL (4, 4, 4, 4) for the variable economic growth. After examining LR relationship among variables, the SR dynamics of these variables can be determined by ECM estimation of ARDL model based on equation 3.1. ECM specification for ARDL (4, 4, 4, 4) model is represented in Table 4.7.

Table 4.7 ECM Results for Selected ARDL (4, 4, 4, 4) Model based on AIC

Variables	Coefficients	Prob.
D(LNGDP(-1))	3.365009	0.031
D(LNGDP(-2))	2.334947	0.039
D(LNGDP(-3))	1.082950	0.052
D(LNINF)	-5.220716	0.125
D(LNINF(-1))	-14.102448	0.070
D(LNINF(-2))	-8.838845	0.078
D(LNINF(-3))	-5.211383	0.105
D(LNEMP)	-1.803385	0.229
D(LNEMP(-1))	-0.999247	0.291
D(LNEMP(-2))	2.651528	0.097
D(LNEMP(-3))	8.872626	0.033
D(LNK)	8.8342030	0.106
D(LNK(-1)	-8.328181	0.118
D(LNK(-2)	-11.593827	0.131
D(LNK(-3)	-6.053992	0.204
CoinEq(-1)	-5.448567	0.022

Source: Calculation

ECM (-1): -5.448567(0.0226), ECM = LNGDP- (0.0373*LNINF + 0.4180*LNEMP
+1.7735*LNK -16.2400)

4.1.3 ECM Estimation

The coefficient of lagged ECM (-1) in this model is -5.448567and this means that in each period, about 5.44 % of shocks can be justified as a long-run trend. The coefficient of SR ECM is negative relationship. It indicates that, in Myanmar, economic growth, infrastructure stock, employment and capital stock are co-integrated when economic growth serves as dependent variables. On the SR, infrastructure stock, and capital stock are negative effect on economic growth found. The positive and significant effect of infrastructure stock on economic growth is found by both LR and SR dynamics models. The significant effect of employment on economic growth is supported in SR as well as in LR. And also the significant effect of capital stock on economic growth is found in the short-run and long-run.

4.1.4 Diagnostic Tests

Some diagnostic tests for all models were carried out for Heteroskedasticity Test, Normality that is based on a test of Skewness and Kurtosis of residual.

Table 4.8 Results of Diagnostic Test

Test Name	Test Statistics (Prob.)
Heteroskedasticity	0.475500 (0.836)
Normality	0.0303 (0.714)

Source: Calculation

4.2 Descriptive analysis

This study deals with the infrastructure investment of Myanmar, during the period starting from 1988-1989 to 2012- 2013. In this section of analysis, descriptive statistic of Myanmar's infrastructure investment of the period is discussed with some investment reforms which took place in the period. As the investment plays a central role in Myanmar's sector, it is also included in this descriptive analysis section.

4.2.1 Economic Growth, Structure and Transformation

The economy of Myanmar had been growing at rationally enviable rates even before then On average, it grew at 5.1 percent between 2005/06 and 2009/10 and could have been higher if not for the devastation caused by cyclone Nargis in 2008 when growth slowed down to 3.6 percent. However, since the transition started, the economy has grown at an average of 6.7 percent. Reforms so far and reengagement with the international community have stimulated growth, and most economic and some social indicators have generally improved. In 2013, the economy grew an estimated 7.5% from 5.3% in 2010, led by increased gas production and exports, services, construction, and foreign direct investment (FDI) (Department, 2014). Myanmar's real growth rate is 4.5 percent in 2005-2006. In 2006-2007, Myanmar's real growth rate grows up 7.0 percent and 5.5 percent in 2007-2008. However, 2008-2009 economic growth rates fall to 3.6 percent because Myanmar suffered the massive destruction caused by hurricane Nargis. And then, Myanmar's annual real GDP growth rates grow up 5.1, 5.3, 5.9, and 7.3 percent in the fiscal year 2010 to 2013[1]. However, continued strong real GDP growth is caused by construction, gas production and services as well as foreign direct investment and exports of commodities.

Table 4.9 GDP, Real GDP, Employment, Infrastructure Stock and Capital Stock during the period 1988-1989 to 2012-2013(Millions)

Year	GDP (Kyats)	Real GDP (Kyats)	INF (Kyats)	EMP (person)	K (Kyats)
1988-1989	76242.7	47141	132801.3	16036	386354.6
1989-1990	124666.3	48883.1	135975.6	15221	377565.3
1990-1991	151941.4	50259	147011.63	15737	383601.8
1991-1992	186902.4	49933.3	144928.13	16007	387576.1
1992-1993	249394.7	54756.6	154101	16469	392437.3
1993-1994	360320.7	58063.9	159971.6	16820	396371.3

---

[1] World Bank, 2004, Myanmar Ending Poverty and boosting shared prosperity in a time of transition

Table 4.9 GDP, Real GDP, Employment, Infrastructure Stock and Capital Stock during the period 1988-1989 to 2012-2013(Millions) (Continued)

Year	GDP (Kyats)	Real GDP (Kyats)	INF (Kyats)	EMP (person)	K (Kyats)
1994-1995	472773.7	62406.1	168527.9	17230	405659.9
1995-1996	604729.1	66741.6	174260.6	17587	428148.8
1996-1997	791930	71042	178101.6	17964	453365.8
1997-1998	1119509	75123	182456.1	18359	471219.8
1998-1999	1609776	79460	194539.9	19069	499998
1999-2000	2190320	88157	203361.1	19425	528325.5
2000-2001	2552732.5	100274.8	217935	19781	569116
2001-2002	35484722	111650	220439.5	20137	610372.4
2002-2003	5625254.7	125076.5	231085.4	20493	628162.6
2003-2004	7716616.2	142387.7	234661.1	21522	646844.9
2004-2005	9078928.5	216758.4696	237342.8	25829	657932
2005-2006	12286765.4	283150.863	246474.4	26132	663063.4
2006-2007	16852757.8	325915.3687	253597	26435	679281.9
2007-2008	23331693.2	371973.9366	259152.6	26720	713812.8
2008-2009	2923328.8	37694.10733	263486	27054	759416.7
2009-2010	33905665.6	384784.4387	269500.9	27373	823498.4
2010-2011	39776764.9	430391.3103	274252.7	27740	915780.5
2011-2012	46307887.7	463078.877	278006.6	28163	929256.1
2012-2013	51259260	464915.51	280972.2	28571	944787.7

Source: Ministry of National Planning and Economic Development issued the review of the Financial, Economic and Social Development