CHAPTER III

RESEARCH METHODOLOGY

The study is supposed to explore the relationship between money supply, remittance and investment in Nepal; hence, the longitudinal study design would be followed. It is quantitative in nature. It makes descriptive, analytical and inferential study of the research objectives. In this chapter, research design, nature and sources of data and methods of data analysis are discussed briefly.

3.1 Research Design

Concept on transmission mechanism of money supply and its working has been discussed on various grounds like, interest rate channel, exchange rate channel, asset price effect, credit channel for several years. Similarly, the real effect of remittance is also discussed. But due to the dynamic nature of remittance with world economic activity and money supply measures there is still gap about what is the good policy at different level of business cycle and economic development phase. This study uses the concepts from the various transmission mechanisms and combines them to remittance follow to Nepal in order to understand the policy effectiveness in national economy of Nepal.

At first the money supply and remittance increases the liquidity in the hands of households and financial sector, which increases the purchasing power and money illusion of the households in the economy and lending capacity of the financial institutions. Then these factors leads to the decline in the lending rate of the financial institutions (reduction in the cost of borrowing), increases demand for goods and services, replacement of public goods increases, which leads to the opportunity to the investors. Alternatively the factors pour funds in stock market which encourages firms to issue share and collect funds for the further investment and production that reduces the financial distress in the economy. And finally investment increases.

So, the study hypothesise that both money supply and remittance causes gross investment in the economy.

3.2 Nature and Sources of Data

The time series data on gross investment, narrow money supply (M1), broad money supply (M2), remittance, and lending rate of commercial banks in industrial sector are used in this study. The data is only collected up to fiscal year 2014 because of outlier nature of remittance data in fiscal year 2015 and during collection the data for fiscal year 2016 and fiscal year 2017 is estimated data.

This study is completely based on secondary sources data. The data on narrow money supply (M1), broad money supply (M2), remittance and lending rate of commercial banks are collected from various issues of *Quarterly Economic Bulletin* of Nepal Rastra Bank (NRB), data on gross capital formation is collected from various issues of *Economic Survey* published by Finance Ministry of Nepal.

3.3 Description of the Variables

In this research study, annual data on the macroeconomic variables like GFCF, M1, M2, REM, of Nepal and LDR of commercial banks of Nepal to industrial sector is used. GFCF represents the proxy for the gross capital formation in Nepal; M1 is proxy for narrow money supply by monetary authority (NRB) in Nepalese economy, M2 is used as proxy for broad money supply by monetary authority (NRB) in Nepalese economy, REM is used as the proxy for remittance inflow to Nepal and LDR is used as proxy for the lending rate charged by 'A' class commercial banks to industrial sector of Nepal. All the variables used in this study are illustrated in the following table:

Table 3.1: Description of the Variables

Variables	**Explanation**
RGFCF	'RGFCF' stands for real gross fixed capital formation which is calculated as RGFCF= $\frac{nominal\ RGFCF}{GDP\ deflator} X100$
RM1	'RM1' stands for real narrow money supply which is calculated as RM1= $\frac{nominal\ M1}{GDP\ deflator} X100$

RM2	'RM2' stands for real narrow money supply which is calculated as RM2= $\frac{nominal\ M2}{GDP\ deflator} X100$
RREM	'RREM' stands for real remittance which is calculated as RREM= $\frac{nominal\ REM}{GDP\ deflator} X100$
LDR	Lending rate of commercial bank to industrial sector in percentage which is calculated as the simple average of given quarterly lending rate of four quarters

Source: Researcher`s own calculation

3.3 Model Specification

In this study, gross fixed capital formation in Nepal is considered as to be affected by, narrow money supply, broad money supply remittance inflow of Nepal and lending rate of commercial bank which can be mathematically expressed as:

GFCF = f (RM1, RM2, RREM, LDR)

Where GFCF stands for Gross Fixed Capital Formation in Nepal, RM1 stands for narrow money supply in real terms, RM2 stands for real broad money supply in Nepal, RREM stands for Remittance inflow to Nepal in real terms and LDR stands for lending rate charged by commercial banks to industrial sector of Nepal in expressed in percentage term.

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The econometric model for above economic model can be written as:

$LNRGFCF_t = \alpha_0 + \beta_1 LNRM1_t + \beta_2 LNRM2_t + \beta_3 LNRREM_t - \beta_4 LNLDR_t + u_{1t}$

Dependent Variable:

LNRGFCF= natural log of real gross fixed capital formation based on 2001 base year

Independent Variables:

LNRM1 = natural log of real Narrow Money supply

LNRM2 = natural log of real broad Money supply

LNRREM = natural log of real remittance received

LNLDR = natural log of lending rate

α_0= intercept

β_i = coefficient

u= error term

t = time period

3.5 Tools of Data Analysis

Since all the variables are macroeconomic variables and annual data is available for all variables in the case of Nepal, so macro-econometrics or time series tools are used (Bhaumik, 2015). For the analysis of time series data, first of all stationary of data should be checked. If time series data are not stationary, then they cannot be used for further analysis of findings of the study cannot be generalized over time. Unit root test is performed to check the stationary of the time series data. There are different types of unit root test like Dickey Fuller (DF) test, Augmented Dickey-Fuller (ADF) test, Phillips-Perron test. In this research study, ADF test is used for checking the stationary of the data.

Quantitative relationship between two or more economic variables can be found out by applying co-integration tests. Like unit root test, there are different types of co-integration tests like Engle-Granger co-integration, Johansen co-integration, ECM co-integration.

In this research study, ADF test is used to find out the functional relationship between gross fixed capital formation and money supply (M1 & M2) and remittance in Nepal, which are discussed, in brief, below:

3.5.1 Unit Root Test

Unit root test tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis of unit root test is that the time series variable has a unit root and the alternative hypothesis is that the time series variable has no unit root. A time series variable is said to be stationary if its mean and variance over the time are constant and the covariance between two time periods is time invariant (Gujarati, Porter & Gunasekar, 2013). A commonly used test that is valid in large samples is the Augmented Dickey–Fuller test. Other popular tests include: Phillips–Perron test, KPSS test and ADF-GLS test. Since the sample size of this research study is 25 observations, ADF test is used to check the stationary of the time series macroeconomic variables used in the model.

3.5.2 ADF Test

Augmented Dickey–Fuller (ADF) test tests whether a unit root is present in a time series variable. The augmented Dickey–Fuller (ADF) statistic is a negative number. The more negative it is; the stronger the rejection of the hypothesis that the time series variable is non-stationary. The ADF test model is in the following form:

$$\Delta y_t = \alpha_0 + \beta_t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \ldots\ldots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Where; α_0 is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process. Testing β=0 implies that y_t follows a unit root process (Dickey & Fuller, 1979).

3.5.3 Engle-Granger Co-Integration Test

Among different co-integration tests, Engle-Granger co-integration test is one of the earliest and simple, yet powerful, tests of co-integration. In this test, first we run the OLS regression taking natural log of RGFCF of Nepal as dependent variables and others: natural log of narrow money supply in real terms (RM1), broad money supply in real terms (M2), remittance inflow in real terms (RREM), and lending rate (LDR) as independent variables. The multivariate regression equation can be expressed as:

$$LNRGFCF_t = \alpha_0 + \beta_1 LNRM1_t + \beta_2 LNRM2_t + \beta_3 LNRREM_t - \beta_4 LNLDR_t + u_t$$

The necessary condition required to apply Engle-Granger co-integration test is that all variables should be non-stationary at level but should be stationary at the first difference. Also, the sufficient condition required to apply Engle-Granger co-integration test is that the residual term of the regression model should be stationary at level form. The residual term of the regression model can be expressed as:

$$u_t = LRPGFCF_t - \alpha_0 - \beta_1 LRM1_t - \beta_2 LRM2_t - \beta_3 LRREM_t + \beta_4 LLDR_t$$

This equation represents the assumed economically meaningful steady state or equilibrium relationship among the variables. If the variables are co-integrated, they will show the common trend and also form a stationary relationship in the long run between the variables. Furthermore, under the co-integration approach, due to the properties of super converge, the estimated parameters can be viewed as correct estimates of the long-run steady state parameters, and the residual series can be used as an error correction term in an error correction model (ECM). The second step is to do a unit root test of the residual series obtained from the co-integrating regression above. For this purpose, we set up a unit root test (ADF test) of residual series as:

$$\Delta u_t = \alpha + \pi u_{t-1} + \sum_{i=1}^{k} \gamma i \Delta u(t-1) + vt$$

Where, the constant term α is to improve the efficiency of the estimate results. Under the assumption of null hypothesis of no co-integration among the variables, the estimated residual is I (1) because x1, t is I (1), and all parameters are zero in the long run. The empirical t-distribution is not identical to the Dickey-Fuller, though the tests are similar. The reason is that the unit root test is now applied to a variable derived from regression i.e. the estimated residual from an integrating regression. Thus, new critical values must be tabulated through simulation. The assumed hypothesis is no co-integration among variables. Thus, finding a significant π implies co-integration between variables. The alternative hypothesis is that the equation is a co-integrating equation, meaning that the integrated variable x1, t co-integrates at least with one of the variables. If the dependent variable is integrated with $d > 0$, and at least one regressor is also integrated of the same order, co-integration leads to a stationary I (0) residual. But, the test does not tell us if x1, t is co-integrating with all, some or only one of the variables. The lack of co-integration means that the residual has the same stochastic trend as the dependent variable. The integrated properties of the dependent variable will if there is no co-integration pass through the equation to the residual. The test statistics for H0: $\pi = 0$ (no co-integration) against Ha: $\pi < 0$ (co-integration), changes with the number of variables in the co-integrating equation, and in a limited sample also with the number of lags in the augmentation ($k > 0$). Asymptotically, the test is independent of which variable occurs on the left hand side of the co-integrating regression. By choosing one variable on the left hand side the co-integrating vector are said to be normalized around that variable, implicitly we are assuming that the normalization corresponds to some long-run economic meaningful relationship. But, this is not always correct in limited samples, there are evidence that normalization matters (Perron, 1995). If the variables in the co-integrating vectors have large differences in variances, some might be near integrated; such factors might affect the outcome of the co-integration test.

3.5.4 Error Correction Model (ECM)

The existence of co-integrating relationships indicates that there is long run relationship among the variables, and thereby Granger Causality among them, at least one direction as shown by Engle-Granger co-integration test. It means when two variables are co-integrated, there is long run relation between them or there may be disequilibrium in the short run. So, to correct this disequilibrium with the rate of adjustment and to reveal the short-run relationship among variables the co-integration term called error correction term is used under ECM framework, since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. The error term in the co-integrated regression equation is called equilibrium error term. This error term is used to tie the short run behavior of the dependent variable to its long run value. The ECM was introduced by Sargan (1964), and later popularized by Engle and Granger (1987). ECMs are a theoretically-driven approach useful for estimating both short-run and long-run effects of one-time series on another. ECMs directly estimate the speed at which a dependent variable returns to equilibrium after a change in other independent variables.

If long-run equilibrium relationship between the variables is:

$$\mathbf{y_t = \alpha_0 + \alpha 1x1_t + \alpha 2x2_t + v_t}$$

Then the usual ECM can be expressed as:

$$\mathbf{\Delta y_t = \beta_0 + \Sigma\ \beta_i \Delta y_{t-i} + \Sigma \gamma j \Delta x1_{t-j} + \Sigma \delta k \Delta x2_{t-k} + EC_{t-1} + e_t}$$

Where EC_{t-1} = (yt-1 -a0 - a1x1t-1 - a2x2t-1), and the as are the OLS estimates of the long run equilibrium equation.

Also, EC = error correction term
γ = error correction coefficient or speed of adjustment parameter

In our model if dependent and independent variables are co-integrated then there is a long run relationship between money supply, remittance and gross fixed capital formation in Nepal. Short-run relationship between these variables is conducted by using the ECM under the framework of co-integrating relationship.

The ECM used in this research study can be specified explicitly as follows:

$$\Delta LNRGFCF_t = \alpha_0 + \sum^{n}_{i=0}\beta_{1i}\Delta LNRM1_{t-i} + \sum^{n}_{i=0}\beta 2i\Delta LNRM2_{t-i} + \sum^{n}_{i=0}\beta_{3i}\Delta LNRREM_{t-i} - \sum^{n}_{i=0}\beta_{4i}\Delta LNLDR_{t-i} + \gamma ECM_{t-i} + u_t$$

Where, β_1, β_2, β_3, and β_4 and the coefficient of the lagged first difference variables (LNRM1, LNRM2, LNRREM, and LNLDR) provide the short run dynamics of the model. γ is the speed of adjustment parameter of ECM and shows the divergence/convergence towards the long run equilibrium. Positive value of γ indicates divergence and negative value indicates convergence.

3.5.5 Residual Diagnostic Test

Normality, no heteroscedasticity, no autocorrelation and no multicollinearity are the important assumptions/properties of the OLS estimation. If these properties are met, then it increases the validity and accuracy of the model. Following are the important residual diagnostic tests of ECM model:

3.5.5.1 Serial Correlation LM Test

The lag correlation of the residual series is called serial correlation. The null hypothesis of the serial correlation LM test is that there is no serial autocorrelation. The alternative hypothesis is there is serial autocorrelation in the model. The residual series of the ECM model should not have serial autocorrelation for the model to be valid.

3.5.5.2 Heteroscedasticity Test

One of the important properties of OLS method is that the variance of the random term is constant. If this property is violated, then it is called heteroscedasticity. It means that heteroscedasticity exists when values of variance of the random term are different for different observations. The null hypothesis of the heteroscedasticity test is that there is no heterosceasticity in the residual series of ECM model. The alternative hypothesis is there is heteroscedasticity in the model. If the residual series of the ECM have no heteroscedasticity, then the model is considered better.

3.5.5.3 Normality Test

The null hypothesis of the test is that the residual series of ECM model is normally distributed. If the residual series of the ECM are normality distributed, then the model is considered better. However, when there is the large number of observations, normality test is not much necessary (Gujarati, Porter, & Gunasekar, 2012). In this study, the Jarque-Berra (JB) test is performed to check whether the residual series are normality distributed

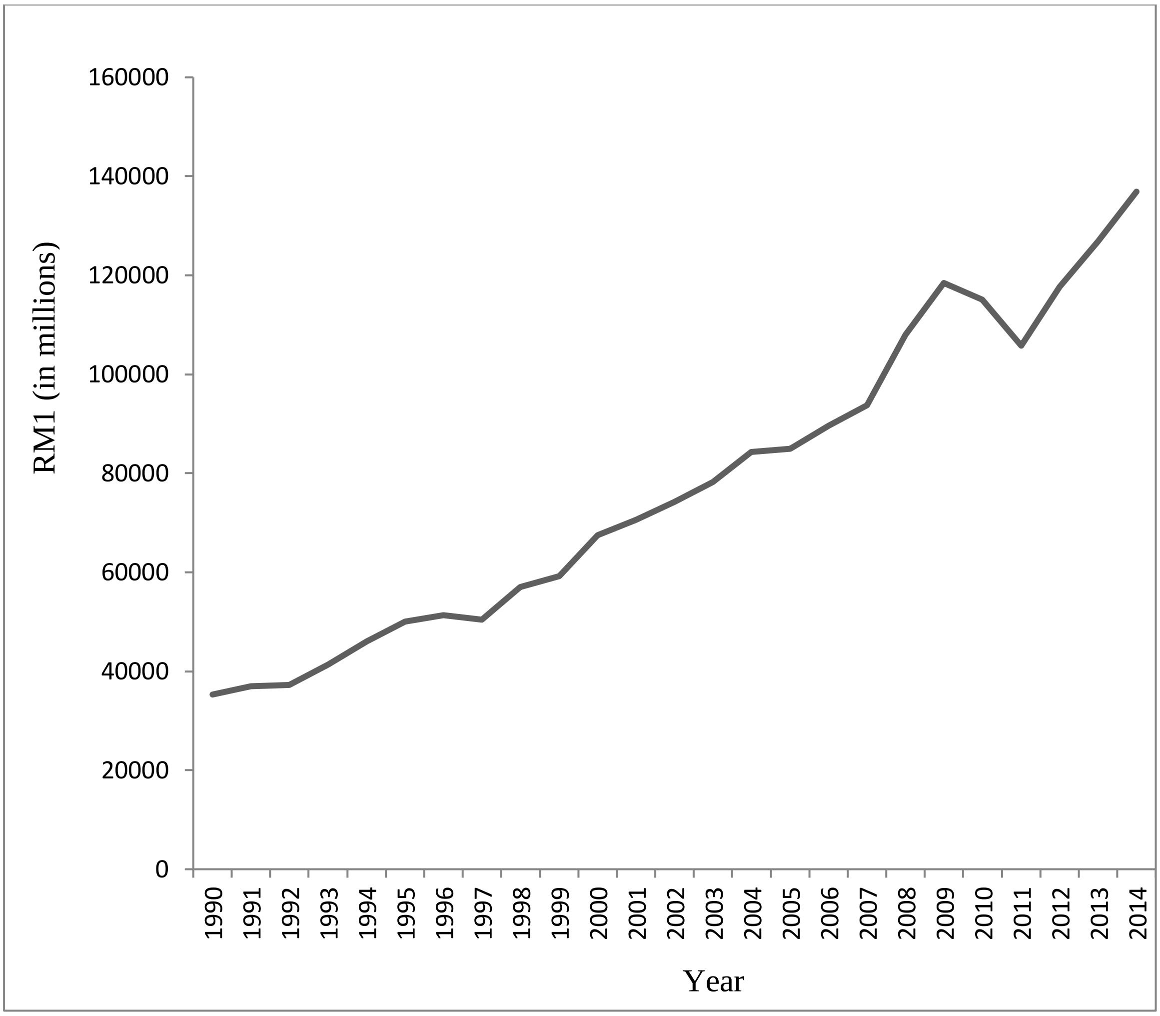
CHAPTER IV

ANALYSIS AND DATA INTERPRETATION

This chapter incorporates nature, trend and growth of narrow money supply (M1), broad money supply (M2), remittance (REM), lending rate (LDR) and gross fixed capital formation (GFCF) in Nepal. The descriptive analyses of the macroeconomic variables are discussed in this chapter. Data is presented in line graph and pie chart to analyse the nature, trend and growth of the included variables. This chapter also analyses the determinants of investment in Nepal using ECM model of co-integration. This chapter also analyses the result obtained from ECM co-integration test. This chapter tries to find the statistical relationship between remittance and investment in Nepal in the short run and in the long run.

4.1 Narrow Money Supply (M1) in Nepal

Real narrow money supply (RM1) for the first five year, starting from 1990, is 13.7 percentage of real GDP. For the second, third, fourth, and fifth five year average RM1 is 14.67 percentage, 16.67 percentage, 18.10 percentage, and 17.54 percentage respectively (see annex III). In the initial the RM1 has increased and later it is decreased. The later decrease in growth rate of RM1 is due to the action by NRB to curtail existing excess liquidity supply in bank and financial institutions, and to curb inflation in the economy.



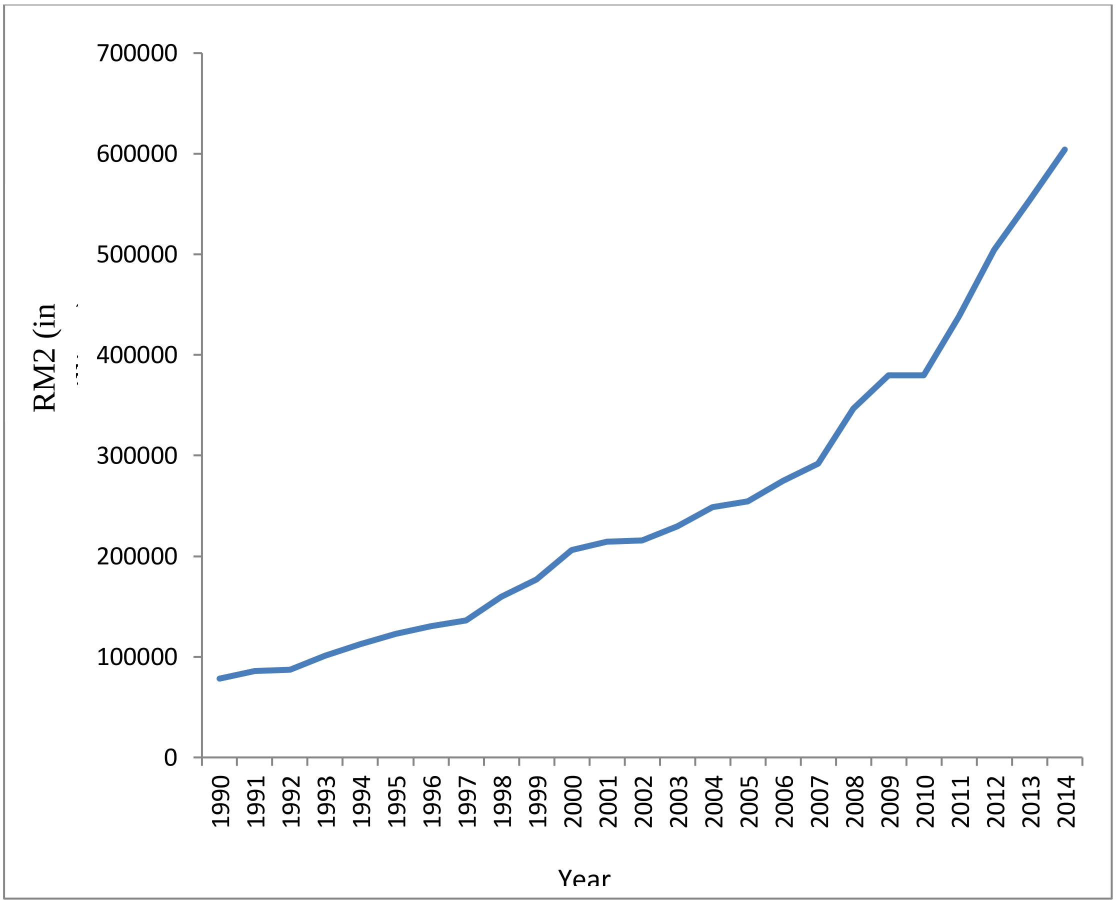
Source: Author`s calculation using excel and data from annex II.

Figure 4.1: Narrow money supply (M1) in Nepal

The above figure shows the trend of narrow money supply (M1) in Nepal from 1990 to 2014. The figure shows the real values of M1 in million. The highest percentage increase is in 2009 which is 19.87 percentages and the lowest is in 1992 which is 13.01 percentages. The last five years, from 2010 to 2014, the average increase in M1 is 16.14 percentage of GDP. During the study period, 1990-2014, the narrow money supply (M1) is increased to 354830 million in 2014 from 14223 million in 1990. The major reason behind such large and significant increase in M1 is the monetization of Nepalese economy and demand for the liquidity by the business sectors as well as household sector for the consumption and business purpose. In overall the trend of M1 is upward.

4.2 Broad Money Supply (M2)

Real broad money supply (RM2) for the first five year, starting from 1990, is 32.28 percentages of real GDP. For the second, third, fourth, and fifth five year average RM2 is 39.57 percentages, 49.60 percentages, 56.67 percentages, and 71.81 percentages respectively (see annex III). RM2 has increased throughout study period.



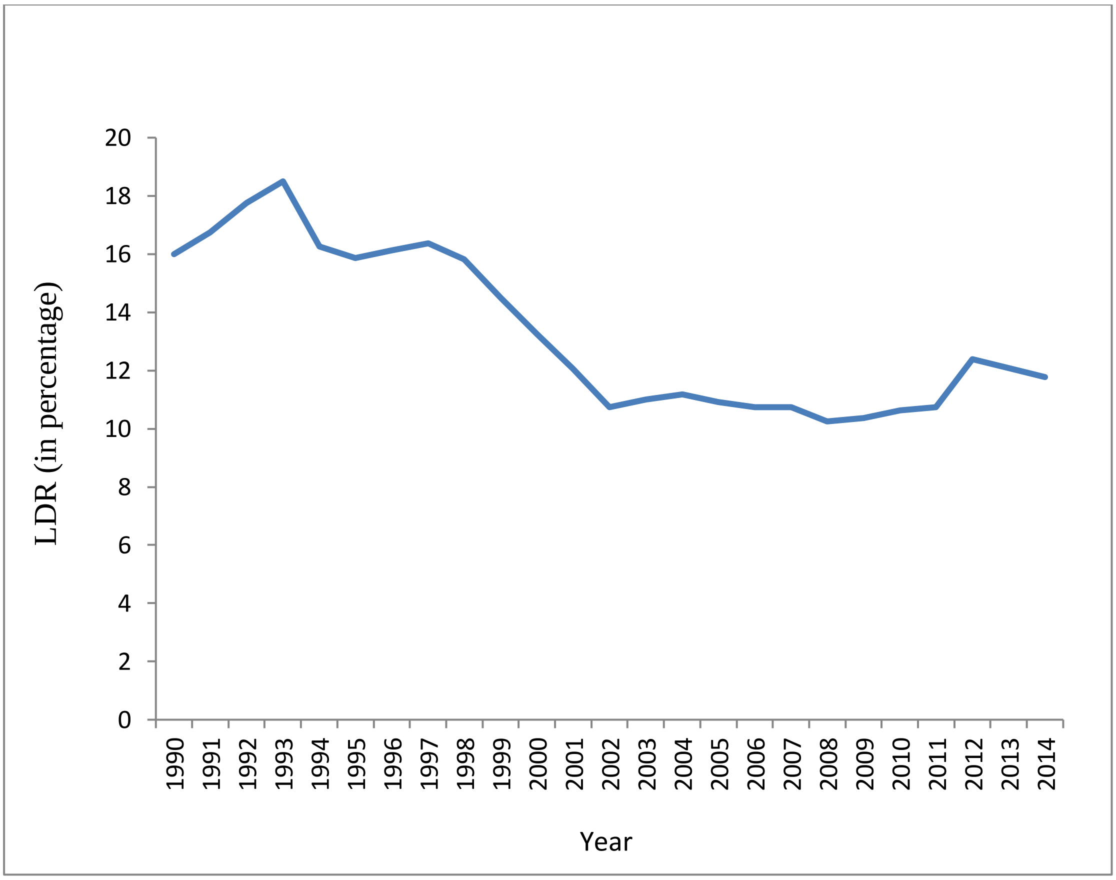
Source: Author`s calculation using excel and data from annex II

Figure 4.2: Broad Money Supply (M2) in Nepal

The above figure shows the trend of broad money supply (M2) in Nepal from 1990 to 2014. The figure shows the real values of M2 in million. The last five years, from 2010 to 2014, the average increase in M2 is 71.81 percentages of GDP. During the study period, 1990-2014, the narrow money supply (M1) is increased to 604154.01 million in 2014 from 78293.8 million in 1990. The major reason behind such large and significant increase in M2 is the monetization of Nepalese economy, expansion of overall GDP and demand for the liquidity by the business sectors as well as household sector for the consumption and business purpose. In overall the trend of M2 is upward.

4.3 Lending Rate of Commercial Banks (LDR)

The industrial lending rate of commercial bank (LDR) for the first five year, starting from 1990, is 17.04 percentages. For the second, third, fourth, and fifth five year average LDR is 15.74 percentages, 11.65 percentages, 10.61 percentages, and 11.53 percentages respectively (see annex III). In the initial the LDR has decreased due to the expansionary monetary policy adopted by NRB and later it is increased due to reduction in growth rate of RM1 by NRB to manage excess liquidity and inflation in the economy.



Source: Author`s calculation using excel and data form annex II.

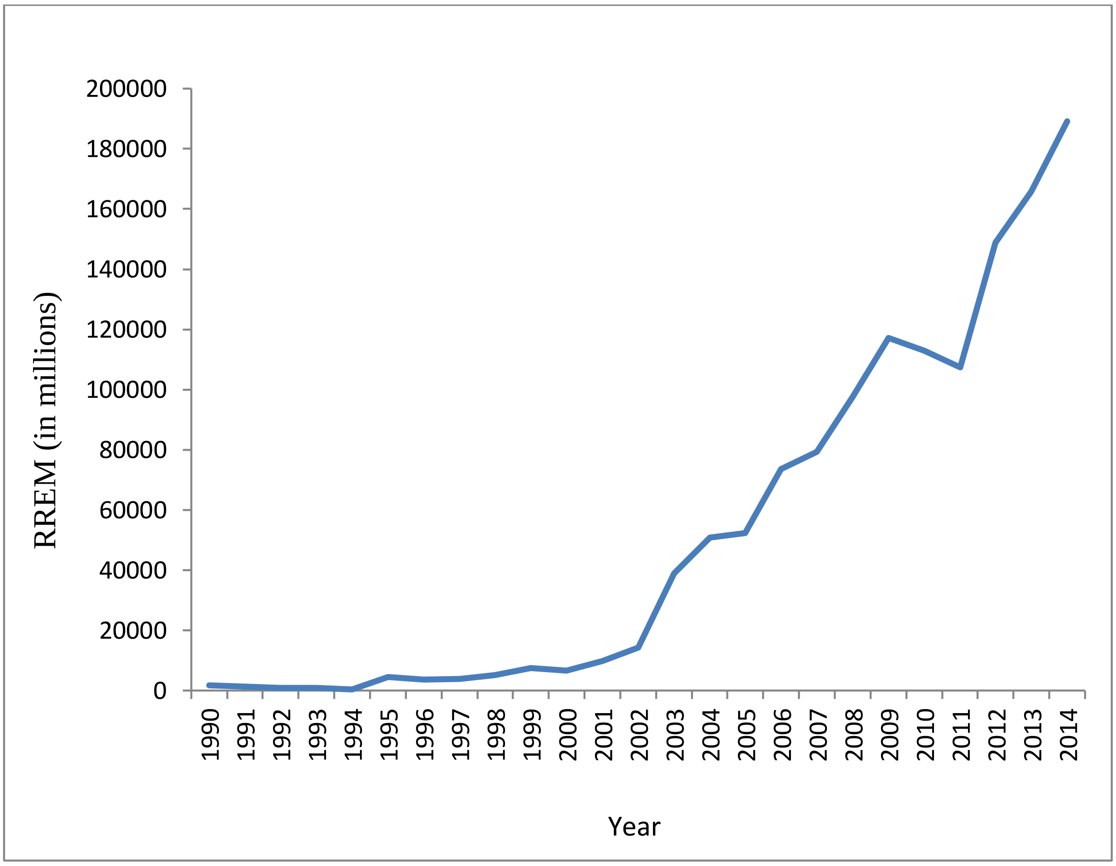
Figure 4.3: Lending Rate to Industrial Sector by Commercial Banks of Nepal

The above figure shows the trend of lending rate (LDR) in Nepal from 1990 to 2014. The figure shows the percentage value of LDR. The early five years from 1990 to

1994, the average LDR was 17.05 percentages. The last five years, from 2010 to 2014, the average LDR is 11.53 percentages. During the study period, 1990-2014, the LDR is decreased to 11.78 percentages in 2014 from 16 percentages in 1990. The major reason behind such significant decrease in LDR is the increase in money supply and loan able fund to commercial banks through remittance. In overall, the trend of LDR is downward.

4.4 Remittance in Nepal (REM)

Real remittance (RREM) for the first five year, starting from 1990, is 0.37 percentages of real GDP. For the second, third, fourth, and fifth five year average RREM is 1.34 percentages, 5.21 percentages, 15.23 percentages, and 20.9 percentages respectively (see annex III). The RREM has increased slowly at first and later it has increased sharply because wave of temporary migration by Nepalese youth to third country for job purpose.



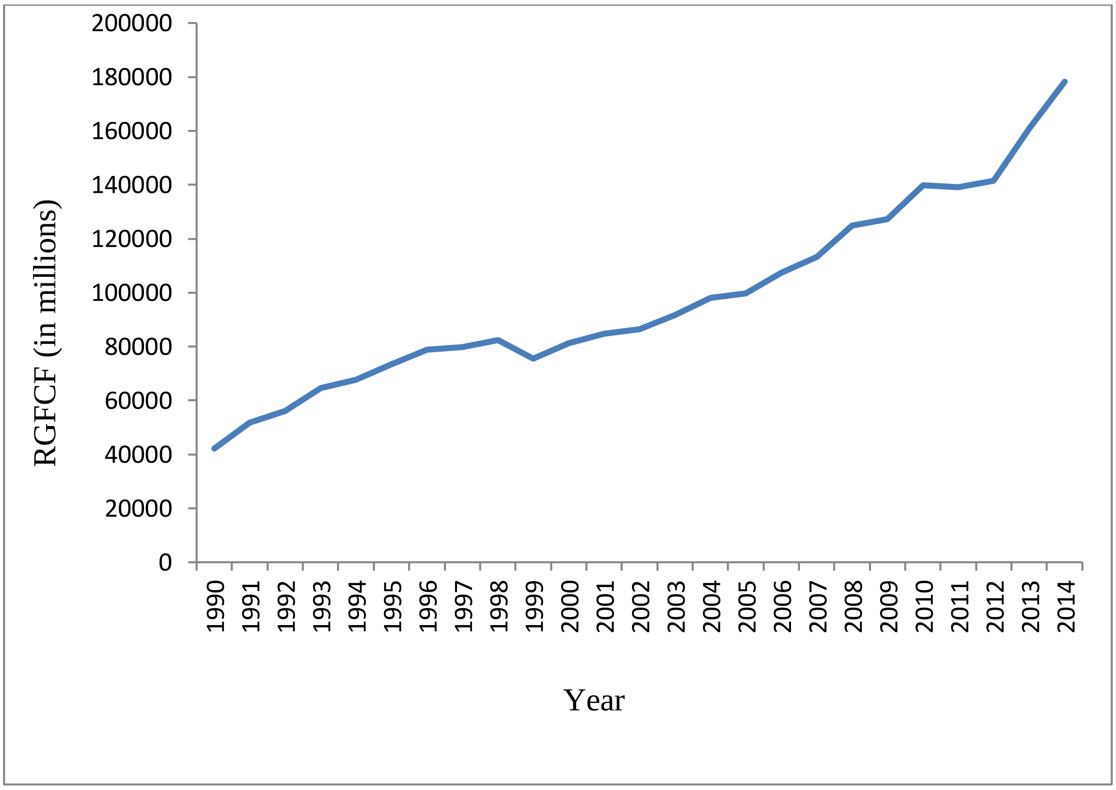
Source: Author`s calculation using excel and data from annex II.

Figure 4.4: Remittance inflow in Nepal

The above figure shows the trend of remittance flow (RREM) in Nepal from 1990 to 2014. The figure shows the real values of RREM in million. The last five years, from 2010 to 2014, the average RREM is 144808.22 million. While the early five years, from 1990 to 1994, the average RREM was 1010.21million. During the study period, 1990-2014, real remittance is increased to 189159.92 million in 2014 from 1679.4 million in 1990. The major reason behind such large and significant increase in RREM is integration of Nepalese economy to global world and migration of Nepalese labour forces to third world for employment. In overall the trend of RREM is upward.

4.5 Gross Fixed Capital Formation (GFCF)

The real gross fixed capital formation (RGFCF) for the first five year, starting from 1990, is 19.56 percentage of real GDP. For the second, third, fourth, and fifth five year average RGFCF is 21.42 percentages, 19.67 percentages, 20.99 percentages, and 22.10 percentages respectively (see annex III). In the initial the RGFCF has increased then decreased and later it is again increased at slow pace. The decrease in capital formation during 2001-2005 is because of maoist insurgency and political instability.



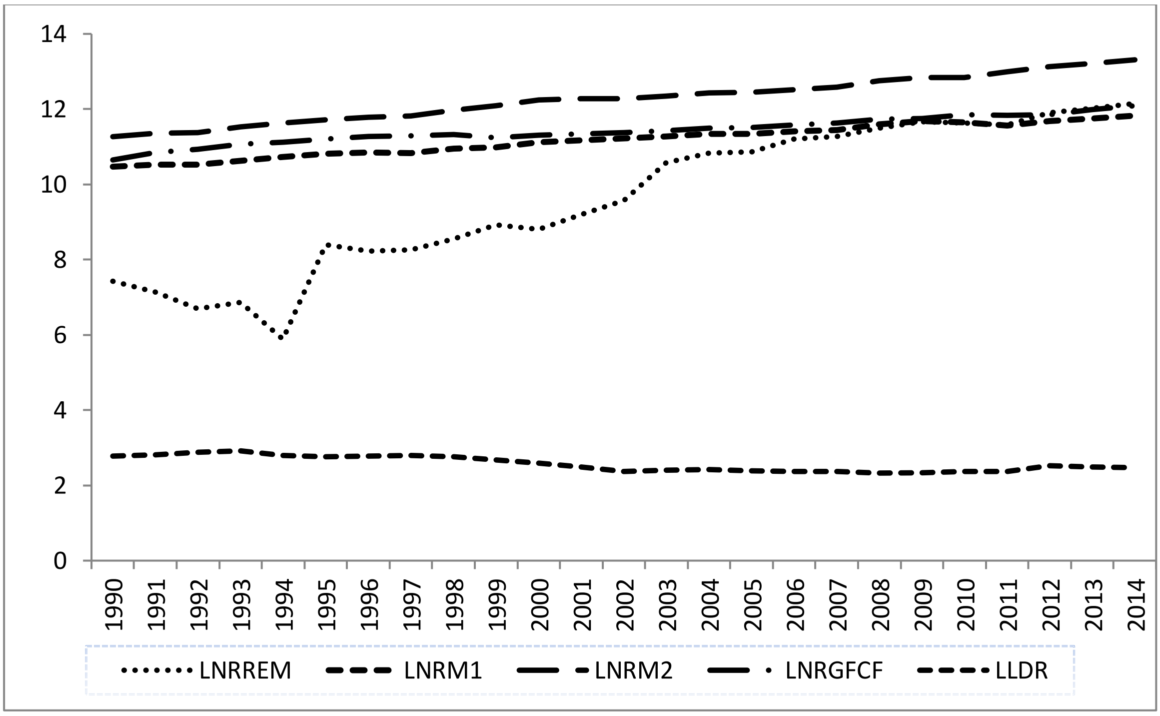
Source: Author`s calculation using excel and data from annex II.

Figure 4.5: Real Gross fixed capital formation in Nepal

The above figure shows the trend of Real Gross Fixed Capital Formation (RGFCF) in Nepal from 1990 to 2014. The figure shows the real values of RGFCF in million. The last five years, from 2010 to 2014, the average RGFCF is 151947.25 million. While the early five years, from 1990 to 1994, the average RGFCF was 56468.08 million. During the study period, 1990-2014, real investment is increased to 178245.91 million in 2014 from 42188.59 million in 1990. The major reason behind such large and significant increase in RGFCF is money supply and remittance flow. In overall the trend of RGFCF is upward.

4.6 Graph of Macroeconomic Variables included in the Investment Model

The log value of LNRREM is more fluctuated than other variables` log value (see annex IV).



Source*:* Author's calculation using excel

Figure 4.6: Graph of Variables included in the Investment Model

Figure 5.1 shows the graph of natural logarithm of RGFCF, RM1, RM2, RREM, and LDR together for the time period 1990 to 2014. All these macro-economic variables show upward trend with time except LDR as it is in decreasing trend with time. RGFCF, RM1, RM2 are increasing gradually and consistently as the fluctuation is about constant. While RREM is increasing at faster rate than other variables and is fluctuating more frequently. And LDR is decreasing quite slowly because the fluctuation is small.

4.7 Unit Root Test Results

Table 4.1: Augmented Dickey-Fuller Tests

Variable	Level		First Difference		Order of Integration
	Intercept	Intercept & Trend	Intercept	Intercept & Trend	
LNRGFCF	-1.385 [.572]	-3.355 [.081]	-5.190* [.0004]	-4.885* [.0037]	I(1)
LNRM1	-2.072 [.256]	-2.628 [.271]	-5.033* [.0006]	-5.822* [.0006]	I(1)
LNRM2	0.090 [.9581]	-2.171 [0.4828]	-4.770* [.001]	-4.680* [.0057]	I(1)
LNRREM	-0.629 [.846]	-3.414 [.073]	-6.733* [.0000]	-6.562* [.0001]	I(1)
LLDR	-0.989 [.740]	-0.904 [.939]	-3.505** [0.0173]	-3.561*** [.0.0562]	I(1)

Source*:* Author's calculation using eviews10

Note:

1. H0: has a unit root (non-stationary)
   H1: does not has a unit root (stationary)
2. * shows 1 percentage level of significance
3. ** shows 5 percentage level of significance
4. *** shows 10 percentage level of significance

Augmented Dickey-Fuller (ADF) tests have been used to check the stationary of dependent and independent variables involved in the model of this research study. ADF test result shows that natural logarithm of LNRGFCF series is non-stationary at level both in the intercept, and intercept and trend form. It is stationary at the first difference both in the intercept, and intercept and trend form at 1 percentage level of significance. So, LNRGFCF is stationary at I (1) at 1 percentage level of significance.

The natural log of RM1 series is a non-stationary at level both in the intercept, and intercept and trend form. It is stationary at the first difference both in the intercept, and intercept and trend form at 1 percentage level of significance. So, order of integration of LNRM1 is I (1). Similarly, natural log of RM2 is non-stationary at level both in the intercept, and intercept and trend form. It is stationary at the first difference both in the intercept, and intercept and trend form at 1 percentage level of significance. So, the order of integration of LNRM2 is I (1). Similarly, the natural log of RREM has unit root at level both in the intercept, and intercept and trend form. It is stationary at the first difference both in the intercept, and intercept and trend form at 1 percentage level of significance. It means that LNRREM is stationary at I (1). Similarly, the natural log of LDR series has unit root at level both in the intercept, intercept and trend form. It is stationary at the first difference in the intercept form at 5 percentage level of significance and, is stationary at 10 percentage level of significance at first difference in intercept and trend form. It means that LNLDR is stationary at I (1). In this way, natural log of RGFCF, RM1, RM2, RREM and LDR are stationary at I (1). Since all variables are integrated at I (1), Engle-Granger co-integration test is selected to analyze the short run and long run relationship between the dependent and independent variables specified in the model.

4.8 Engle-Granger Co-Integration Test

In Engle-Granger Co-integration test, first OLS regression result is obtained. Secondly, the unit root test of residual series of the OLS regression is checked. If the residual series is stationary at level, there exists a co-integration between the dependent and independent variables. Then OLS regression result is used to explain the long run relationship between the variables while the ECM is used to explain the short run dynamics of the variables involved in the model.

4.8.1 Diagnostic Test

Diagnostic test is performed for the evaluation of whether the model is spurious or not. Since all the variables are non-stationary at level form, the OLS estimation should be spurious. Following table shows the diagnostic test of the model;

Table 4.2: Diagnostic Test

Diagnostic Test	**Value**
R- squared	0.9761
Adjusted R-squared	0.9713
F-statistics	204.6203(p value = 0.000)
D-W test	1.495
$\chi 2$(Autocorrelation)	0.4541(p value)
$\chi 2$(Normality) /JB test	0.503(p value 0.777)
$\chi 2$(Heteroscedasticity) /BPG test	0.3009(p value)

Source*:* Author's calculation using eviews10 (from Annex V and VII)

From above table 4.2, it is clear that the R-squared and adjusted R-squared values are respectively 0.9761 and 0.9713 showing spurious regression. But, the OLS regression model is in overall good as the F-statistics value is statistically significant at 1 percentage level of significance. Similarly, for time series econometrics to be more valid, there should not be autocorrelation and the B-G serial correlation LM test shows that the residual of the regression model is free from autocorrelation as the p-value is 0.4541. Similarly, the JB test shows that error term of the OLS regression is normally distributed. Also, BPG test result shows that the variance of the residual series for the given OLS regression model is homogeneously distributed.

4.8.2 Unit Root Test of the Residual Series

Table 4.3: Unit Root Test of the Residual

Variable	Level		Order of Integration
	Intercept	Intercept & Trend	
ECT_t	-3.100 [0.0437]	-3.710 [0.0421]	I(0)

Source: Author`s calculation using Eviews 10 and data from annex VIII.

Note: Engle-Granger critical values: 1%=-5.416; 5%=-4.700; 10%=-4.348

Table 4.3 shows unit root test of the residual series, of the OLS regression, for the investment model. The error correction term (ECT) - residual series- is stationary at level, both in the intercept and intercept and trend form, at 5 percentage level of significance. This is verified by the fact that the t-statistic value of the residual is smaller than Engle-Granger critical value for five variables case at 5 percentage level of significance (i.e. -4.70). This implies that we can apply Engle-Granger Co-integration test for the given model and OLS regression would explain the long run relationship between dependent and independent variables involved in the model.

4.8.3 Long Run Dynamics of the Model

In the case of Engle-Granger Co-integration test, if all variables- both dependent and independent variables- are non-stationary at I (0) but stationary at the first differenced I (1), and the residual series of the given regression model is stationary at level, the OLS explains the long run relationship between dependent and independent variables of the given regression model. The OLS regression equation for the investment model can be expressed as:

$$LNRGFCF_t = \alpha_0 + \beta_1 LNRM1_t + \beta_2 LNRM2_t + \beta_3 LNRREM_t - \beta_4 LNLDR_t + u_{1t}$$

Where, α_0 is constant term; β_1, β_2, β_3, and β_4 are the coefficient of LNRM1, LNRM2, LNRREM and LNLDR respectively; and is the residual term.

Table 4.4: OLS Regression Result

Dependent Variable: LNRGFCF				
Method: Ordinary Least Square				
Number of Observations: 25				
Variable	Coefficient	Std. Error	t-statistic	Probability
C	-3.251	1.807	-1.798	0.087
LNRM1	1.201	0.325	3.688	.0015
LNRM2	-0.031	0.191	-0.161	0.873
LNRREM	-0.010	0.025	-0.425	.6749
LNLDR	0.676	0.172	3.926	0.0008

Source: Author's calculation using eviews10 (Annex V)

In the above table 5.4, OLS regression result of the model is given. Here, natural log of RGFCF is the dependent variables and natural log of RM1, RM2, RREM, and LDR are explanatory variables. Above table shows the coefficient value, standard error, t-statistic and p- values of the explanatory variables of the investment model. The coefficient of RM1 is positive and statistically significant at 5 percentage level of significance. It implies that there exists positive relationship between Investment and narrow money supply in Nepal. The coefficient value of LNRM2 is negative and is not statistically significant. This means that there is no long run relationship between investment and broad money supply in Nepal. The coefficient value of LNRREM is, also, negative and is not statistically significant which provides a conclusion that there is no any statistically significant, long run relationship between investment and remittance flow in Nepal. The coefficient value of LLDR is positive, and statistically significant, at 1 percentage level of significance. This implies that, in the long run, there exists positive and statistically significant relationship between investment and lending rate in Nepal.

The estimated long run investment function of Nepal can be expressed as:

$$LNRGFCF = -3.251 + 1.201LNRM1 + 0.676LNLDR$$

The above equation shows that in the long run Nepalese investment is the function of LNRM1 and LNLDR. There exists long run relationship between LNRGFCF and LNRM1, and LNLDR. So, narrow money supply, and lending rate are the determinants of Nepalese investment in the long run. From above table, narrow money supply (RM1) and lending rate to industries are found to affect Nepalese investment positively. Above OLS regression equation shows that, in the long run, 1 percentage increase in narrow money supply causes 1.201 percentages increase in investment in Nepal. Similarly, 1 percentage increases in lending rate causes 0.676 percentages increase in investment in Nepal in the long run.

Since the establishment of Nepal Bank Limited in 1937 the Nepalese monetary system is directly or indirectly affected by the central authority. However, the effectiveness of Nepalese monetary policy is in its creeping stage. The Nepalese economy is in the course of monetization. So, the money supply affects capital formation in Nepal.

When money supply increases the transaction of goods and services ease and peoples demand more goods. When demand for goods and services increases the producers sense opportunity and they are motivated for production of those goods. Similarly, the increase in money supply also increased the demand for stocks and hence there is opportunity for capital generation and investment.

The various transmission mechanisms states that the increase in money supply somehow directly or indirectly increases the capital formation in the economy and hence investment. From the table of Annex, it is clear that, the money supply affects almost through all transmission mechanism ultimately investment in the economy. The narrow money supply (M1) and gross fixed capital formation (GFCF) has positive trend hence, it is obvious to have positive relationship between money supply and investment in Nepal.

The variable of the interest of this research, narrow money supply is found statistically significant and positive. This suggests that the money supply by central authority have positive relationship with investment in Nepal. This empirical result can be satisfactorily explained with the theoretical models of transmission mechanism, like Tobin`s q channel, Bank lending channel, Balance sheet channel, Cash flow channel, Unanticipated price level channel as explained by Mishkin 2004. The monetarists argue that the policy intended money supply affects output and employment. Similarly, the Keynesians also argue that at less than full employment level the money affects output and employment. In the case of Nepal the growth of M1 is quit steady (see figure 4.6) and also the economy is in less than full employment (almost all resources are used below its full potentiality, for eg. Hydroelectricity), so RM1 and RGFCF have positive relationship.

But, as empirical finding reflects, the lending rate has opposite effect in Nepal against the existing theory of investment. The against theory finding of interest rate highlights the possibility of high Marginal Efficiency of Capital (MEC) discussed by Keynesian School of Thought. The fall in interest rate against the rise in money supply is very low compared to growth difference in capital formation (see figure 4.6). This may be the cause such finding. Another cause of such result may be the amateur level of Nepalese monetary system.

And as per the findings on remittance it shows no any significant role of remittance in investment in Nepal. It suggests that the remittance is basically used for other purposes than capital formation. The remittance may be used for the loan repayment, unproductive property acquisition, and heavy consumption. Most part of remittance income in Nepal has been used for importing goods from rest of the world. Nepal is one of the most import liberalized country in the world. The larger share of import in Nepal's total trade and its large share (for instance, in 2015, import expressed as percentage of GDP -import/GDP- is 36.5 percentage) clarifies this. So, remittance income has been used for importing goods from abroad and imported goods lowers price level in the domestic market.

4.8.4 Short Run Dynamics of the Model

Table 4.5: Short Run Dynamics (ECM)

Dependent Variable: D(LNRGFCF)				
Method: Ordinary Least Square				
Number of observation: 24 after adjustments				
Variable	Coefficient	Std. Error	t-statistic	Prob.
C	0.035	0.017	1.997	0.061
D(LNRM1)	0.488	0.197	2.469	0.023
D(LRM2)	0.046	0.219	0.212	0.834
D(LNRREM)	-0.004	0.014	-0.348	0.731
D(LLDR)	0.499	0.146	3.401	0.0032
ECT_{t-1}	-0.722	0.165	-4.352	0.0004
R-squared 0.611				
Adjusted R-squared 0.504				
Durbin-Watson stat 1.64				

Source: Annex VIII

Here in the above table 4.5, short run coefficients of the independent variables and their corresponding p-values are given. The estimated short run investment function can be expressed as:

$$LNRGFCF = 0.035 + 0.488\ LNRM1 + 0.499\ LLDR - 0.722\ ECT_{t-1}$$

The coefficient value of co-integrating equation (ECT_{t-1}) must be negative and statistically significant for the model to be good. Here the error correction coefficient (ECT) is negative (- 0.722), as required, and is significant at 1 percentage level of significance. It shows the convergence of variables effect to equilibrium. The ECM value suggests that there is quick adjustment in the investment of Nepal when RM1 and LDR changes. The co-integrating equation value of the above equation suggests that the system can get back to equilibrium (adjustment) at the speed of 72.2 percentages.

The above co-integrating equation suggests that in the short run investment of Nepal is affected by narrow money supply and lending rate of commercial banks only. In the short run, both narrow money supply and lending rate has positively affect Nepalese investment. And, there has been no effect of broad money supply, real remittance on investment in the short run.

Modern quantity theory of money argues that increase in money supply affects output and employment in short run; in long run it only affects price level largely than employment and output. So, it is theoretically obvious for narrow money supply to have statistically significant relationship with investment.

Nepal is in its early stage of development and monetization so the effect of money supply is somehow significantly (5 percentages level of significance) affecting investment. But, the real contribution is yet to be integrated. And, also the role of remittance, due to higher dependency on import, on investment is in its neutral phase.

REFERENCES

Bhaumik, Shankar, Kumar. (2015). *Principles of econometrics a modern approach using eviews.* New Delhi, India: Oxford University Press.

Budha, B. B. (2012). Demand for money in Nepal: An ECM bounds testing approach. *Nepal Rastra Bank Working Paper* 12.

Budha, B. B. (2013). The bank lending channel of monetary policy of Nepal: Evidence from bank level. *NRB Working Paper, 17* NRB.

Budha, B. B. (2015). Monetary policy Transmission in Nepal. *Nepal Rastra Bank Working Paper,* 29. NRB.

Barajas, A., Chami, R., Ebeke, C. and Oeking, A. (2016). What`s different about monetary policy transmission in remittance-dependent countries? *International Monetary Fund Working Paper series,* wp/16/44. IMF.

Chavas, Jean-Paul and Bomley, Daniel W. (2008). On the origins and evolving role of money. *Journal of Institutional and Theoretical Economics, 164*(4) , 624-651. Retrieved from http://www.jstor.org/ /40752722.

Dillard, Dudley (1958). *The economics of John Maynard Keynes: The theory of a monetary economy.* London, UK: Crosby Lockwood & Son Ltd.

Fontana, Giuseppe (2004). "Hicks on monetary theory and history: money as endogenous money". *Cambridge Journal of Economics, 28,* 73-88

Friedman, Milton (1968). The role of monetary policy. *The american economic review, 58*(1), 1-17. Retrieved from http://links.jstor.org/sici?sici=0002-828228 196803%2958%3A1%3C 1%3ATROMP%3E2.O.C0%3B2-6

Gaudel, Y. S. (2003). *Monetary system of Nepal.* Yamuna vihar, Delhi, India: Adroit Publishers. India.

Gujarati, D.N., Porter, D. C., &Gunasekar, S. (2012). *Basic econometrics.* India: McGraw Hill

Gupta, Suraj B. (2012). *Monetary economics: Institutions, theory and policy.* Ramnagar, New Delhi: S. Chand & Company Ltd. India.

Gyanwali, R. P. (2012). Causal relationship between money, price and income in asian countries (1964-2011). *The Economic Journal of Nepal, 35*(1), 137.

Khatiwada, Yuba Raj (1994). *Some aspects of monetary policy in Nepal.* New Delhi, India: South Asian Publishers.

Komura, Chikara (1982). Money, income, and causality. *Southern Economic Journal, 49*(1), 19-34. Retrieved from http://www.jstor.org/stable/1058539.

Kulkarni, Kishore G. (1999). *Modern monetary theory*. Delhi, India: Macmillan India Limited, Delhi, India.

Mishkin, Frederic S. (2004), *The economics of money, banking and financial markets*. Pearson Addision Wesley series

Mishkin, Frederic S. (1995). Symposium on the monetary transmission mechanism. *The Journal of Economic Perspective, 9*(4), 3-10. Retrieved from http://www.jstore.org/

Mishkin, Frederic S. (2001). The transmission mechanism and the role of asset prices in monetary policy. *National Bureau of Economic Research*, working paper 8617(December). Retrieved from http://www.nber.org/papers/w8617.

Mishkin et al. (2010). How has the monetary transmission mechanism evolved over time? *Finance and Economics Discussion Series Divisions of Research & Monetary Affairs.* Federal Reserve Board, Washington, D.C.

Mishra, Prachi & Montiel, Peter (2012). How effective is monetary transmission in low-income countries? A survey of the empirical evidence. *International Monetary Fund working paper series*. WP/12/143.

Mitchell, Wesley C. (1944). The role of money in economic history. *The Journal of Economic History,4,*61-67. Retrieved from http://www.jstor.org/stable/2113259

MOF (various issues). *Economic survey of Nepal.* Kathmandu: Ministry of Finance, Nepal Government.

Mohanty, Deepak (2014). Evidence on interest rate channel of monetary policy transmission in India. In D. Mohanty (Ed.), *Monetary policy, sovereign debt and financial stability: The new trilemma*. (PP. 21-77). New Delhi, India: Cambridge University Press India Pvt. Ltd. Cambridge House, India.

Pant, Bhubanesh and Budha B. B.. (2016). Remittance and exchange rate linkage: Experience of Nepal. *NRB Working Paper, 33.* Nepal Rastra Bank.

Paudel, Bamdev (2003). Money and its role of income stabilization: An econometric diagnosis. *NRB Economic Review: Occasional Paper, 15*(17). NRB.

Nepal Rastra Bank. (2017) a. *Quarterly economic bulletin.* Kathmandu: NRB.

Sayed Abou, El-Seoud Mohamed (2014). Testing the relationship between money supply and GDP in Bahrain. *International Journal of Economics, Commerce and Management.* II, 5. Retrieved from http://ijecm.co.uk/

Shapiro, Edward (2001). *Macroeconomic analysis.* New Delhi, India: Galgotia Publications Pvt. Ltd.

Takahashi, Fusaji (1971). Money supply and economic growth. *Econometrica, 39*(2), 285-303. Retrieved from http://www.jstor.org/stable/1913346

Tobin, James (1965). "Money and economic growth" *Eonometrica, 33*(4), 671-684. Retrieved from http://www.jstor.org/stable/1910352

Timsina, Neelam (2014). Bank credit and economic growth in Nepal: An empirical analysis. *NRB Working Paper,* 22. NRB.

Vithessonthi, Chaiporn, Schwaninger Markus and O. Müller, Matthias (2017). Monetary policy, bank lending and corporate investment. *International Review of Financial Analysis.*

World Bank Group (2016). *Migration and remittances factbook 2016.* World Bank.

ANNEX X: THE LINK BETWEEN MONETARY POLICY AND GDP: MONETARY TRANSMISSION MECHANISMS

MONETARY POLICY

	INTEREST RATE CHANNEL	OTHER ASSET PRICE EFFECTS			CREDIT VIEW				
TRANSMISSION MECHANISMS	Traditional Interest Rate Effects	Exchange Rate Effects on Net Exports	Tobin`S ‘q’ Theory	Wealth Effects	Bank Lending Channel	Balance Sheet Channel	Cash Flow Channel	Unanticipated Price Level Channel	Household Liquidity Effects
FLOW	Monetary Policy Real Interest rates	Monetary Policy Real Interest Rates	Monetary Policy Stock Prices Tobin`s q	Monetary Policy Stock Prices Financial wealth	Monetary Policy Bank Deposits Bank loans	Monetary policy Stock prices Moral Hazard Adverse Selection Lending Activity	Monetary policy Nominal interest rates Cash flow Moral hazard, adverse selection Lending activity	Monetary policy Unanticipated price level Moral hazard, adverse selection Lending activity	Monetary policy Stock prices Financial wealth Probability of financial distress
COMPONENETS OF SPENDING (GDP)	Investment Residential Housing Consumer Durable Expenditure	Net Exports	Investment	Consumption	Investment Residential Housing	Investment	Investment	Investment	Residential Housing Consumer Durable Expenditure

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