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Statistical Analysis on the Impact of Remittance Inflow to Nepalese Economy

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Abstract

Remittance income from migrant workers have grown to become an increasingly prominent source of external funding for many developing and least developed countries, including Nepal. Despite the importance of remittance in reducing unemployment and poverty in the country, the impact upon some of the key macroeconomic indicators is still not well explored. In this regard, utilizing the time series data from 1985-2014 collected from authentic sources, this paper has tried to shed light on the impact of remittances upon some macroeconomic indicators namely domestic consumption expenditure, domestic investment expenditure and GDP of Nepal. Remittance data has been modelled using Box-Jenkins methodology and the effects of different lags of remittance upon GDP of Nepal has been analyzed using a distributed lag model. The empirical results suggest that remittance has a positive, although statistically not significant impact upon the variables considered. The time series modeling of remittance data suggests a random walk model with no autoregressive as well as moving average component and is thus fitted by an ARIMA (0, 1, 0) model, which is further used for forecasting purpose. Finally, Almon approach to distributed lag model shows that GDP of Nepal is positively associated with current year's as well as preceding first, fourth and fifth years' remittance income.

Keywords: Remittance, Two Stage Least Squares, Box-Jenkins Methodology, Distributed lag model

1. Introduction

Economic growth and development processes are affected by the migration of people. In traditional viewpoint, people migrate when they are both pushed by lack of opportunities at home and pulled by the hope of economic gains elsewhere. Figures from United Nations Population Fund show that nowadays more than 244 million people i.e. 3.3 percent of the world total population live outside their country of birth [16]. Migration can have both negative as well as positive social, cultural and economic implications for countries of origin. Among all of those, remittances are the least controversial and most tangible outcomes of migration. In general terms, remittances are defined as the earnings international migrants send to family members in their country of origin and represent

one of the largest sources of financial flows to developing countries. Although migrants send their earnings in terms of kind and cash, the term remittance is generally limited to denote only monetary and cash transfers from host countries to home countries.

The World Bank reports that since 2000, remittances have increased sharply worldwide, having almost tripled to $529 billion in 2012. In 2015, worldwide remittance flows will reach $601 billion with developing countries receiving the greatest share of these flows ($441 billion) [17]. These inflows of cash constitute more than 10 percent of GDP in some 25 developing countries. The true size of remittance flows is perceived to be even significantly larger, as a large portion is sent through unofficial channels and goes unrecorded.

International migration is one of the key features of the globalized world. In the context of Nepal, international migration has a long history, dating back to the early 1800s when men from the hilly region of Gorkha were recruited into the army of the Sikh ruler Ranjit Singh in Lahore, then a part of India. The Anglo-Nepal Treaty of Peace and Friendship signed in 1816 recruited 3,000 Nepalese soldiers in British Gorkha regiment and inaugurated the culture of labor migration from Nepal, which continues to the present [14]. However, remittance has become one of the major components of GDP of Nepal since 1990s. Currently an estimated three million Nepalese are migrant workers who have gone abroad earning foreign currencies. This figure doesn't include the population who are employed in India, estimated to be around three million as per the findings in [6]. In the fiscal year 2013/14 remittance inflow to Nepal reached to NRs. 543.3billion, which is 29.1 percent of GDP of the country, see [11]. This is considered as a huge amount and has left positive impact to reduce problem of unemployment and poverty in the nation but its impact on the domestic consumption, investment and economic growth is questionable.

Various theoretical as well as empirical studies on different aspects of remittance have been conducted all over the world in the past. Evidences showing positive impact of remittances upon expenditures on housing, consumer durables, and non-land assets were found in the Philippines [7]. The studies agree about the unproductive use of remittances as revealed by another study by Lucke et al. [9] in the context of Moldovan economy that concludes remittances' recipients use the income from remittances in order to cover the expenses of their daily need and buy consumer durables. A major portion of remittance was found being used on consumption and other non-productive sectors including real estate and investments in gold; resulting from the poor investment environment caused by political instability in Nepal [3].

On the other hand, studies have also found the positive impact of remittances upon the investment made in receiving economies. Study conducted in Ghana supported the view that remittances can reduce poverty and increase investments in developing countries [1]. Similarly a positive and highly significant relationship between worker's remittances, real GDP and private investment and total consumption was observed in case of Pakistan economy. The study concluded that right policies can channel remittance flows into more productive investment activities in the future [18].

The impact of international remittances upon GDP and the economic growth has been controversial as both positive as well as negative impacts have been observed. Chami et al. [5] tried to find out if remittances behave similar to capital flows i.e. if they correlate positively with GDP and found significant negative influence on economic growth implying that remittances represent mere "compensatory transfers" providing support to poor families during difficult times. The long term effect of remittance inflow in Bosnia and Herzegovina were less favorable and had in many ways led to the deterioration in the economic and social sense with a negative effect on its growth and productivity [15]. On the opposite, other studies reported significant positive influence of remittance inflows on macroeconomic growth [4, 12]. Analysis of the impact of workers' remittances on economic growth of Azerbaijan and Armenia's economies concluded that workers' remittances are significant and have positive impact on economic growth and development [2]. In the context of Nepal, remittance income was found to have a positive impact upon the consumption and GDP. However, the productive investment caused by remittance was challenged by the study as a negative impact on the investment was seen [13].

This paper hence, aims to explore the impact of international remittances on key macroeconomic indicators, particularly domestic consumption expenditure, domestic investment expenditure and nominal GDP of Nepal. The interrelated equations developed form a simultaneous equation system and has been estimated by two stage least squares method. Also, the trend of remittance inflow and the way different lags of remittance influences nominal GDP has been analyzed using Box-Jenkins methodology and Almon's approach to distributed lag model respectively. The remaining part of the paper is structured as follows. Section 2 elaborates the data sources, models developed and analysis methodologies. The results are presented in section 3 before concluding the paper in section 4.

2. Data and Methodology

The variables used in the study are yearly reported values of private and public consumption expenditure, domestic investment expenditure, nominal GDP, remittance, commercial banks' industrial lending rates, export and import of goods and services from 1985 to 2014 taken from the publications of Nepal Rastra Bank, Central Bureau of Statistics and Ministry of Finance. The functional forms of the econometric relationship and the corresponding models employed in empirical analysis have been outlined below.

2.1 Consumption – Remittance model

According to the Keynesian model, consumption is based on the level of income. Also, in practice, present level of consumption depends not only upon the present level of income but also upon the past level of income. Because the present consumption depends on past consumption which is based on past production i.e. past GDP as well, the consumption function to analyze the impact of remittance on domestic private consumption is stated as:

$$PC_t = f(Y_t, \mathrm{Re}\, m_t, Y_{t-1})$$

Where, PC_t = Domestic private consumption expenditure

Y_t = GDP in nominal terms

Y_{t-1} = One year lagged GDP

Rem_t = Remittance earning

t = time period expressed in years

Domestic consumption expenditure includes both government consumption expenditure and private consumption expenditure but due to the fact that remittance generally affects private consumption, this function has just included the private consumption expenditure.

2.2 Investment – Remittance model

The present level of investment depends upon past investment as well and past investment is dependent upon past GDP. Also, the level of investment depends upon the interest rate because it is taken as cost of capital in business activity. So, to analyze the impact of remittance upon domestic investment, the investment function is developed as:

$$I_t = f(Y_t, \mathrm{Re}\, m_t, CBILR_t, Y_{t-1})$$

Where, I_t = Gross domestic investment expenditure

$CBILR_t$ = Commercial bank's industrial lending rate

2.3 GDP – Remittance model

In order to assess the impact of remittance upon the GDP, the function is developed as:

$$Y_t = f(C_t, I_t, \mathrm{Re}\, m_t, X_t, M_t)$$

Where, C_t = Gross domestic consumption expenditure (Private consumption expenditure + Public consumption expenditure)

X_t = Export

M_t = Import

The above functional forms are converted into econometric models in order to assess the relationship between the variables as illustrated below. The equations developed are linear in nature and are later transformed in to double log model. Double log model (also

called log linear model) is used to find the partial elasticity and the obtained results are presented in percentage form.

$$PC_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 \mathrm{Re}\, m_t + \alpha_3 Y_{t-1} + \varepsilon_{ct} \quad (1)$$

$$I_t = \beta_0 + \beta_1 Y_t + \beta_2 \mathrm{Re}\, m_t + \beta_3 CBILR_t + \beta_4 Y_{t-1} + \varepsilon_{it} \quad (2)$$

$$Y_t = \gamma_0 + \gamma_1 C_t + \gamma_2 I_t + \gamma_3 \mathrm{Re}\, m_t + \gamma_4 X_t + \gamma_5 M_t + \varepsilon_{yt} \quad (3)$$

In these equations α_i, β_i and γ_i (i=0, 1, 2, ----------5) are the parameters to be estimated and $\varepsilon_{ct}, \varepsilon_{it}$ and ε_{yt} are stochastic error terms.

For estimation of these equations, they have been transformed in to log linear models as shown below.

$$LnPC_t = \alpha_0 + \alpha_1 LnY_t + \alpha_2 Ln\, \mathrm{Re}\, m_t + \alpha_3 LnY_{t-1} + \varepsilon_{ct} \quad (4)$$

$$LnI_t = \beta_0 + \beta_1 LnY_t + \beta_2 Ln\, \mathrm{Re}\, m_t + \beta_3 CBILR_t + \beta_4 LnY_{t-1} + \varepsilon_{it} \quad (5)$$

$$LnY_t = \gamma_0 + \gamma_1 LnC_t + \gamma_2 LnI_t + \gamma_3 Ln\, \mathrm{Re}\, m_t + \gamma_4 LnX_t + \gamma_5 LnM_t + \varepsilon_{yt} \quad (6)$$

Identification of the equations is necessary before carrying out other statistical procedures. The order condition and rank condition are tested which are respectively the necessary and sufficient condition for the identification. The results of the test of identification are presented in Appendix A. It is found that using both the conditions, equation 4, 5 and 6 are identified.

2.4 ARIMA modeling for the remittance data

Box- Jenkins methodology has been applied to model the remittance data series which consists of the steps of Identification, Estimation, Diagnostic Checking and Forecasting. For this purpose, remittance has been considered as the dependent variable while time (in years) as the independent variable.

2.5 Distributed lag model

The current GDP of the nation is influenced not only by the current remittance earnings but also the earning in the past. In order to justify this concept, a distributed lag model has been fitted by taking nominal GDP as the dependent variable and remittance as the independent variable.

The distributed lag model used in the study can be outlined as:

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + ... + \beta_k X_{t-k} + \varepsilon_t$$

Where Y represents the nominal GDP, X represents remittance, k is the lag length and t is the time period expressed in years.

Depending upon how these coefficients behave, Shirley Almon suggested the degree of polynomial to study the relationship between the dependent variable and the lagged independent variable. If β_i's increase at first and then decrease, a second degree polynomial is appropriate while if β_i's follow a cylical fluctuation then a third degree polynomial is appropriate [8]. The polynomial model for the coefficients as suggested by Almon is;

$$\beta_i = \alpha_0 + \alpha_1 i + \alpha_2 i^2 + \cdots\cdots + \alpha_m i^m, m < k$$

Where m is the degree of polynomial, assumed less than k which is the maximum length of lags.

For instance, considering a second degree polynomial, the distributed lag model becomes,

$$Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + \cdots \ldots \ldots + \beta_k X_{t-k} + \varepsilon_t$$

$$= \alpha + \sum_{i=0}^{k} \beta_i X_{t-i} + \varepsilon_t$$

$$= \alpha + \sum_{i=0}^{k} (\alpha_0 + \alpha_1 i + \alpha_2 i^2) X_{t-i} + \varepsilon_t$$

$$= \alpha + \alpha_0 \sum_{i=0}^{k} X_{t-i} + \alpha_1 \sum_{i=0}^{k} i X_{t-i} + \alpha_2 \sum_{i=0}^{k} i^2 X_{t-i} + \varepsilon_t$$

$$= \alpha + \alpha_0 Z_{0t} + \alpha_1 Z_{1t} + \alpha_2 Z_{2t} + \varepsilon_t$$

Where $Z_{0t} = \sum_{i=0}^{k} X_{t-i}$

$$Z_{1t} = \sum_{i=0}^{k} i X_{t-i}$$

$$Z_{2t} = \sum_{i=0}^{k} i^2 X_{t-i}$$

Here Y is regressed on the constructed variable Z's, not on the original X variables. This equation can be estimated by OLS procedure provided that the stochastic disturbance term ε_t satisfies the assumption of the classical linear regression model.

In this approach, often the problem arises regarding the selection of appropriate lag to be employed in the independent variable. Of the different solutions to this problem, this study uses the method that relies on the statistical significances of the coefficients. In this method, usually a long lag length is initially chosen and the significance of the coefficients at the largest lag is tested. If the coefficients are found to be statistically

significant, the lag length is then shortened by one period. This continues until the trailing lag coefficient is statistically significant. For this study, the desired results are found at lag length k = 5. Also, the distribution of coefficients β_i's suggests fitting a second degree polynomial. Thus the degree of polynomial (m) = 2 and lag length (k) = 5 is used in this study.

3. Results

Nepalese workers have been migrating to various countries all over the world for employment. Various push and pull factors have led to a continuous increment in the number of Nepalese workers migrating abroad that everyday about 1500 youths are estimated going abroad from Nepal for employment [18]. During the year 1999/00, a total of 13,455 Nepalese were migrated to different countries for foreign employment, excluding India. With a continuous rise in this number, it was recorded as 527,814 for the year 2013/14 as shown in figure 1. Although India has been the major destination for Nepalese workers, no authentic data on number of migrant workers to India has been recorded due to open border between Nepal and India. In the year 2013/14, figure 2 shows that Malaysia became the main destination for Nepalese migrant workers as 41 percent of the workers migrated to Malaysia followed by Qatar, importing 24 percent of the workers.

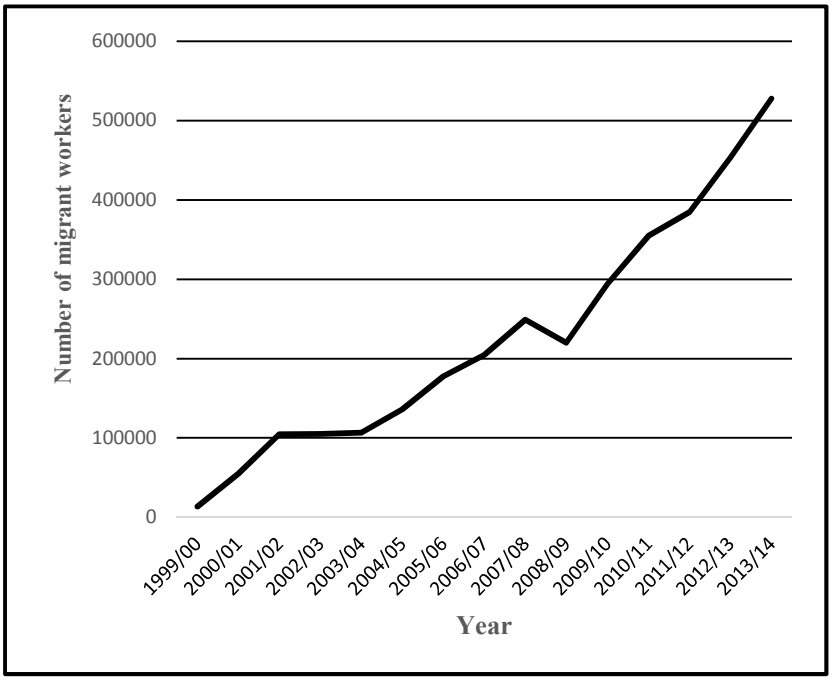

Figure 1: Trend of migration for foreign employment

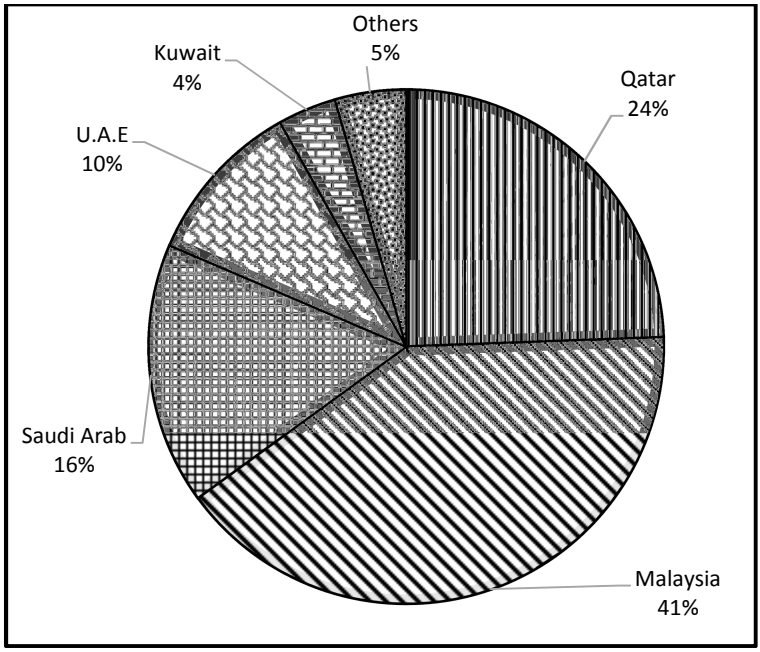

Figure 2: Main destinations of migrant workers (2013/14)

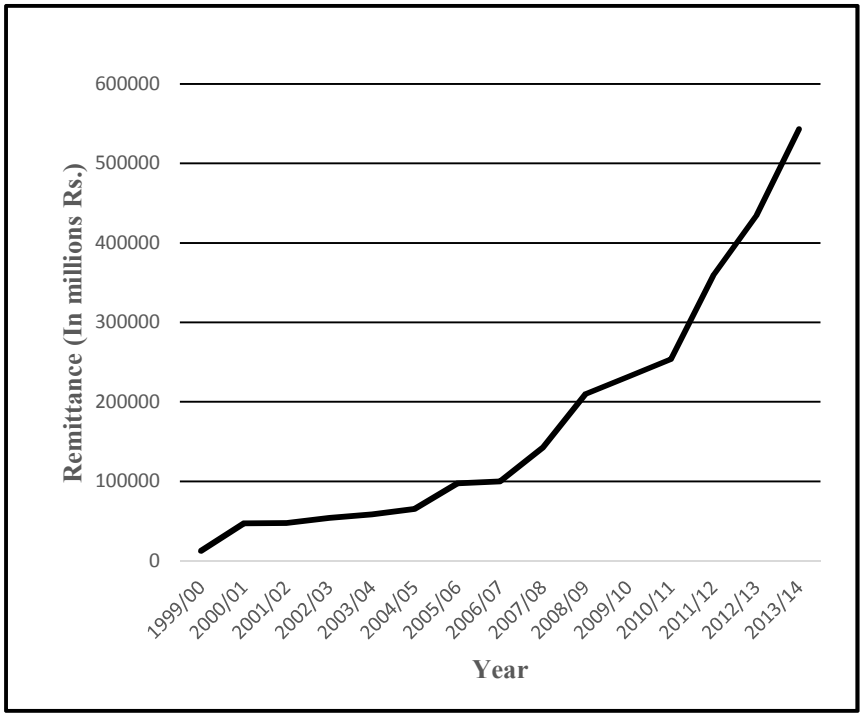

Figure 3: Trend of remittance inflow

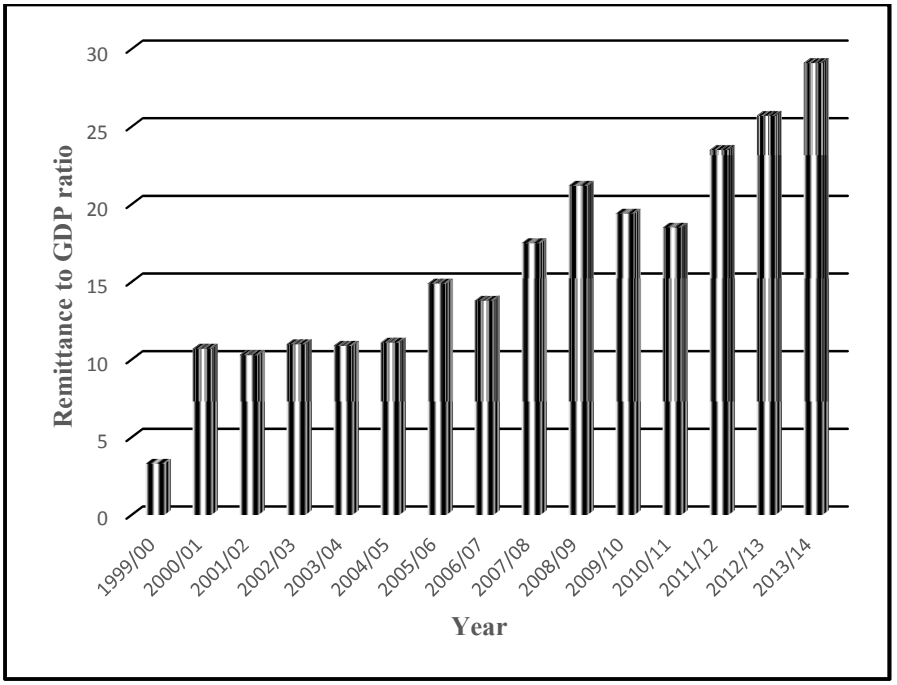

Figure 4: Remittance to GDP ratio

Figure 3 reveals that with the rise in number of Nepalese worker migrating abroad, the size of remittance received by the country is also increasing in the similar manner. Amount of remittance received during 1999/00 was Rs. 12,662.3 million which mounted up to Rs. 543,294.1 million in 2013/14. Similarly the ratio of remittance to GDP has also increased gradually with some minor fluctuations. During 1999/00, remittance to GDP ratio was 1:3.3.The pace of increment in remittance inflow went higher than the increment in GDP of Nepal that this ratio went up to 1:29.1 in 2013/14 as shown in figure 4.

3.1 Results of Two Stage Least-Squares procedure

The simultaneous equation system in this study is composed of three different equations and contain nine different variables. The summary statistics of the variables used in the study has been presented in Appendix B.

3.2 Estimation of the Consumption-Remittance model

The result obtained from 2SLS estimation for the Consumption-Remittance model is kept in Appendix C.1. After instrumenting the endogenous variable LnY_t, the adjusted R-squared shows that 99.97% of variation in the private consumption ($LnPC_t$) is explained by the three explanatory variables. The overall goodness of the fit of the model is also found to be significant.

The result shows that nominal GDP have a statistically significant impact upon the private consumption expenditure in Nepal. A unit percent increase in the nominal GDP will increase the private consumption expenditure by 1.06 percent on an average, other variables remaining the same. It is because with the increase in GDP, the households' income level will rise and their ability to consume food, non-food and services will increase consequently. The first objective of this study was to study the impact of remittance upon the private consumption expenditure. Although positive impact of remittance was observed upon the private consumption expenditure, the impact was not found to be statistically significant. Another explanatory variable lagged GDP was found to have a negative impact upon the private consumption expenditure but this impact was not significant.

3.2 Estimation of the Investment-Remittance model

In the Investment-Remittance model, the dependent variable was domestic investment in the nation. Except remittance, all other explanatory variables namely nominal GDP, CBILR and lagged GDP were found to have significant impact upon the dependent variable. Complete result is placed in Appendix C.2.

Nominal GDP had a statistically significant impact upon the domestic investment in the nation. A unit percent increase in the nominal GDP would increase the investment by 2.33 percent on an average, other variables remaining the same. As the consumption rises with the increase in GDP as shown in the previous model, it creates an environment to produce more to the producers in order to fulfil the increasing demand and thereby increasing the domestic investment in the nation.

Remittance was also found to have a positive impact upon the domestic investment but this impact was not statistically significant (P-value=0.601). This has somehow supported the literatures that have claimed that remittance earning is not only used for consumption purpose but also it has contributed to investment, in the context of Nepal. Still this is not an encouraging result which is because the country has lost young and creative minds which would contribute in the prosperity of the country by making fruitful investments. This fact can be considered as the major cost of the foreign employment.

In contrary to the general expectation, commercial banks' industrial lending rates was found to have a positive coefficient in the model which means the domestic investment increases although CBILR increase. This could be possibly because of the suitable environment created for investment in the nation in the last few years. Lastly, lagged GDP was also found to have a negative impact upon the domestic investment. However, both CBILR as well as lagged GDP were found weakly significant i.e. only at 10% level of significance.

3.3 Estimation of the GDP-Remittance model

In the GDP-Remittance model, nominal GDP was the dependent variable and there were five explanatory variables including the endogenous private investment. The result

presented in Appendix C.3 shows that all the explanatory variable except remittance had a statistically significant impact upon the nominal GDP of our country.

Total consumption was found to have a significant positive impact upon the GDP as higher consumption leads to higher investment in the nation which ultimately increases the GDP. Similarly, domestic investment was also found to be a significant factor to bring a change in the GDP. Higher investments in the nation leads to higher job opportunities raising the level of income of the people which ultimately tend to have a positive impact upon the GDP.

One of the major objective of this study was to find the impact of remittance upon the nominal GDP of the nation. The result shows that remittance has a positive impact upon the GDP but this impact was not found statistically significant (P-value=0.217). This has supported those literatures which claimed that major portion of the remittance earning is finished upon running households and consumption purpose. Still the remittance income hasn't been utilized in productive sectors which would raise the level of employment, level of income and thereby the GDP of our country.

Increase in export increases the level of employment in the nation and consequently the level of income. Therefore, positive impact of export upon the GDP was seen in this study. On the other hand, import of goods and services was found to have a negative impact upon the nominal GDP. This implied that mostly the imported goods were of consumable type, luxurious equipment, etc. which would not favor the economic growth of the country.

3.4 ARIMA modeling of the remittance data

For the modeling and forecasting of remittance data, this study has used models that are based on a methodology first developed by Box and Jenkins in 1976, known as ARIMA (Auto-Regressive Integrated Moving Average) methodology. To exercise the Box-Jenkins methodology, one should have a stationary time series. Therefore, first it is tested whether the remittance series is stationary or not. As previously shown, the remittance inflow has gradually increased with time and seems to be exponentially trending. Thus, with the log transformation, the unit root test is carried out with the first difference of the series as the dependent variable which gives the following result.

Table 1: Unit root test of the log-transformed series

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.2386	0.2334	1.0223	0.3157
Y_{t-1}	-0.0009	0.0237	-0.0378	0.9701

The null hypothesis for this test is that the series has a unit root. The p-value in the above result suggests that this hypothesis is accepted. Therefore, the given series has a unit root and is a non-stationary time series.

Next, the test for random walk is conducted. For a non-stationary series to be a random walk, it should transform into stationary series on first differencing and is denoted by I (1). To test whether the first differenced series has a unit root, the second difference of the series is taken as the dependent variable and the first difference of the differenced series as the independent variable. The result obtained is given in the table below.

Table 2: Unit root test of the first differenced series

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.2793	0.0658	4.2482	0.0002
ΔD_{t-1}	-1.2036	0.1917	-6.2781	0.0000

The null hypothesis that the series has a unit root is rejected indicating that the log-transformed remittance series has transformed into a stationary series on first differencing. Therefore, the series is proved to be a random walk. Now, in order to determine the model ARMA (p,q) i.e. the values of the parameters p and q, the correlogram as well as partial correlogram of the differenced log-transformed series are visually inspected. An AR (p) model has a PACF that truncates at lag p and an MA (q) has an ACF that truncates at lag q.

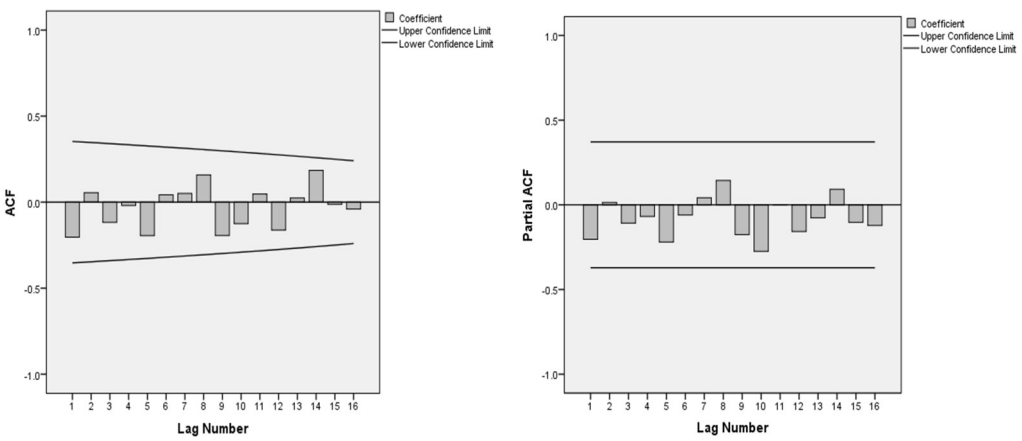

Figure 5: Correlogram and Partial Correlogram of log-transformed series (First difference)

Both the correlogram and partial correlogram show no significant spike at any lag. This means there is no indication of AR as well as MA component in the series. Hence, the first difference of the log-transformed remittance series is considered as an ARMA (0,0) process and the original log-transformed series is concluded to be of the nature ARIMA (0,1,0).

3.4.1 Estimation of the model parameters

The ARIMA (0,1,0) is a random walk model. If the series Y is not stationary, the simplest possible model for it is a random walk model which can be considered as a limiting case of an AR (1) model. In such a model the autoregressive coefficient is equal to 1. The prediction equation for this model can be written as,

$$\widehat{Y_t} = \delta + Y_{t-1}$$

Where the constant term is the average period-to-period change (i.e. the long-term drift) in Y.

The best fit model statistics presented in Appendix D suggests an ARIMA model outlined as shown below.

$$\widehat{Y_t} = 0.2386 + Y_{t-1}$$

The diagnostic test performed for this model satisfy the usual assumptions of the linear regression. The result is presented in Appendix D.1. On the basis of this model, forecasting of the remittance for upcoming years is done.

Table 3: Forecasted value of remittance

Year	Forecasted value of remittance (in log terms)	Forecasted value of remittance (In millions Rs.)
2015	13.4440	689691.7241
2016	13.6826	875543.3990
2017	13.9212	1111476.6450

3.5 Distributed lag model

The impact of remittance on GDP of Nepal has been analyzed by the methodology of distributed lag model by employing the annual data sets of nominal GDP and remittance during the period 1985-2014. The data are first transformed into logarithmic form as the original data sets exhibits exponentially increasing trend. With the degree of polynomial (m) = 2 and lag length (k) = 5 used in this study as described in the methodology section, the OLS regression of the dependent variable, nominal GDP(Y_t) on the constructed variables Z's produces following result. (Refer Appendix E and E.1 for complete regression result and the diagnostic tests respectively.)

$\ln GDP_t = 8.4964 + 0.2546Z_{0t} - 0.2315Z_{1t} + 0.0437Z_{2t}$

The estimates of the β coefficients are:

$$\widehat{\beta_i} = \widehat{\alpha_0} + \widehat{\alpha_1} i + \widehat{\alpha_2} i^2 \quad \forall\, i = 0,1,2,3,4,5\ (k)$$

$\beta_0 = \alpha_0 = 0.2546$

$\beta_1 = \alpha_0 + \alpha_1 + \alpha_2 = 0.0668$

$\beta_2 = \alpha_0 + 2\alpha_1 + 4\alpha_2 = -0.0336$

$\beta_3 = \alpha_0 + 3\alpha_1 + 9\alpha_2 = -0.0466$

$\beta_4 = \alpha_0 + 4\alpha_1 + 16\alpha_2 = 0.0278$

$\beta_5 = \alpha_0 + 5\alpha_1 + 25\alpha_2 = 0.1896$

Therefore, the Almon approach to distributed lag model yields:

$$Y_t = 8.4964 + 0.2546X_t + 0.0668X_{t-1} - 0.0336X_{t-2} - 0.0466X_{t-3} + 0.0278X_{t-4} + 0.1896X_{t-5}$$

Hence, it can be seen that the nominal GDP of Nepal is positively associated with current years' as well as preceding first, fourth and fifth years' remittance. However, the model suggests that it is negatively associated with preceding second and third years' remittance.

Distribution of β_i's:

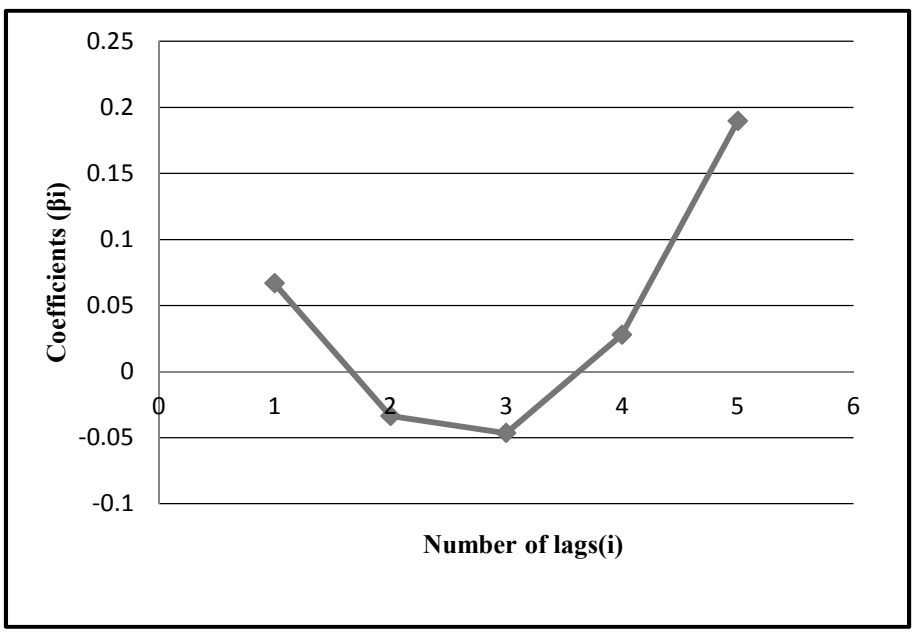

Figure 6: Distribution of βi's

The coefficients β_i's start with high value and then decrease and finally increase with one turning point. Generally the degree of polynomial should be at least one more than the number of turning points in the curve. Therefore, this study has used a second degree polynomial for the coefficients as suggested by the Almon approach to distributed lag models.

4. Conclusions

Foreign employment and remittance have become common issues particularly in the least developed and developing countries and has thus been able to draw the attention of researchers since quite a long time. Remittance has become an important source of foreign exchange and has been able to generate various impacts in the micro as well as macro level of the nation's economy. Remittance has been a key to solve the problem of unemployment and poverty in the receiving economies. However, the growth generating capacity of remittance has always remained a debatable issue. A number of studies conducted in the past in Nepal have made several arguments about the impacts of remittance although most of them were of qualitative nature. Also, the trend of remittance received and the way different lags of remittance affect the GDP has not been found to be analyzed using sophisticated econometric models. These identified issues motivated to carry out this research work.

Using the time series data from different authentic sources, this study has tried to analyze the impact of remittance on three major macroeconomic indicators of our country. The empirical results show that remittance has positive, although statistically not significant impact upon the macroeconomic indicators considered. In the time series ARIMA modelling of the remittance data, it has been found that the data is best fit by an ARIMA (0, 1, 0) model. The data is found to be stationary on first differencing and no auto-regressive as well as moving average components are seen. Also, a distributed lag model to study the impacts of lags of remittance on the nominal GDP, estimated by using Almon approach, shows that the nominal GDP is positively associated with current year's as well as preceding first, fourth and fifth years' remittance.

On the basis of findings from descriptive as well as analytical approaches made in this study, some policy implications can be drawn. Majority of the Nepalese workers are found to be migrated to Malaysia and gulf countries. The Economic Survey 2013/14 reports that 74 percent of the migrant workers are unskilled as such most of the workers are involved in construction and labor works with low wages. Thus the government should work to produce skilled labor force so they can get sophisticated jobs in the foreign land. Also new potential destinations for foreign employment should be identified as these countries are on the verge of achieving their development goals very soon. Next, the best way to utilize remittance income is to make investments in the home country. Although the impact of remittance upon investments is positive in Nepal, it is not found significant. In this regard, related stakeholders should take actions to encourage investments from the remittance income. Also, negative impact of import upon the GDP is seen which implies that most of the imports made are consumable

types or equipment that don't favor economic growth. Thus, the import of goods that can generate economic activities in the country should be promoted.

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Appendix

A. Test of Identification of the Equations

Under the order condition, for an equation to be identified, the total number of variables excluded from it but included in other equations must be at least equal to or greater than the number of equation of the system less one. Under the rank condition, the parameters of all the equations are written in a separate table, noting that the parameter of a variable excluded from an equation is equal to zero and is marked (√), if present. For a particular row chosen for identification, the columns that have excluded variables are taken and the elements in other rows are considered. If the number of both rows and columns, not including the chosen one, that are not all zero is one less than total number of equations, then the equation is identified. Otherwise it is not.

A.1 By order condition

Table 4: Test of identification by order condition

Equation	No. of excluded variables	Number of equation -1	Verdict
4	(5)	> 2	Since 5>2, equation 4 is overidentified.
5	(4)	> 2	Since 4>2, equation 4 is overidentified
6	(3)	> 2	Since 3>2, equation 4 is overidentified

A.2 By rank condition

Table 5: Test of identification by rank condition

Equation						No. of non-zero	Verdict
4	√	√	0	0	0	2 rows	Identified
	√	0	√	√	√	5 columns	
5	√	0	0	0		2 rows	Identified
	0	√	√	√		4 columns	
6	√	√	0			2 rows	Identified
	0	√	√			3 columns	

In this way, using both the conditions for identification, the equations under considerations are found to be identified.

B. Summary statistics

Table 6: Summary statistics of the variables used in the study

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
$LnPC_t$	29	12.538	1.012	10.709	14.216
LnI_t	29	11.409	1.228	9.268	13.603
LnY_t	29	12.761	1.042	10.882	14.491
$LnRem_t$	29	9.867	2.079	6.696	13.205
LnY_{t-1}	29	12.631	1.055	10.702	14.343
$CBILR_t$	29	13.644	2.850	10.000	18.500
LnC_t	29	12.649	1.017	10.817	14.343
LnM_t	29	11.568	1.194	9.325	13.593
LnX_t	29	10.879	1.018	8.780	12.328

C. Results of Two Stage Least Squares Estimation

C.1 Two Stage Least Squares result for Consumption-Remittance Model

Table 7: 2SLS Result for Consumption-Remittance Model

Dependent variable $LnPC_t$	2SLS Results
lnY_t	1.0594 (10.55)***
$LnRem_t$	0.0139 (1.65)
LnY_{t-1}	-0.1142 (-1.19)
Constant	0.3235 (2.31)**
Observations	29
R-Squared	0.9997
Adjusted R-Squared	0.9997
F-Statistic	(26687.12)***
Note: t-statistics in the parenthesis; *p<0.1, **p<0.05, ***p<0.01	
Instrumented: LnY_t Instruments: $LnRem_t$ LnY_{t-1} $CBILR_t$ LnC_t LnX_t LnM_t	

C.2 Two Stage Least Squares result for Investment-Remittance Model

Table 8: 2SLS Result for Investment-Remittance Model

Dependent variable LnI_t	2SLS Results
LnY_t	2.3314
	(3.75)***
$LnRem_t$	0.0382
	(0.53)
$CBILR_t$	0.0385
	(1.98)*
LnY_{t-1}	-1.1321
	(-1.98)*
Constant	-4.9453
	(-6.44)***
Observations	29
R-Squared	0.9939
Adjusted R-Squared	0.9929
F-Statistic	(981.84)***
Note: t-statistics in the parenthesis; *p<0.1, **p<0.05, ***p<0.01	
Instrumented: LnY_t	
Instruments: $LnRem_t$ LnY_{t-1} $CBILR_t$ LnC_t LnX_t LnM_t	

C.3 Two Stage Least Squares Estimation for GDP-Remittance Model

Table 9: 2SLS Result for GDP-Remittance Model

Dependent variable LnY_t	2SLS Results
LnC_t	0.9182
	(22.45)***
LnI_t	0.2897
	(3.06)***
$LnRem_t$	0.0092
	(1.27)
LnX_t	0.1751
	(3.35)***
LnM_t	-0.3648
	(-2.59)***
Constant	0.0659
	(0.36)

Observations	29
R-Squared	0.9999
Adjusted R-Squared	0.9999
F-Statistic	(59826.84)***
Note: t-statistics in the parenthesis; *p<0.1, **p<0.05, ***p<0.01	
Instrumented: LnI_t	
Instruments: $LnRem_t$ LnY_{t-1} $CBILR_t$ LnC_t LnX_t LnM_t	

D. Best fit model statistics for ARIMA model

Table 10: Regression result for ARIMA model

Dependent Variable ln Remt (Y_t)	OLS-Result of ARIMA (0,1,0)
Y_{t-1}	1.0000 (42.1941)***
Constant	0.2386 (1.0223)
Observations	29
R-Squared	0.9850
Adjusted R-Squared	0.9845
F-Statistic	(1777.8761)***
Note: t-statistics in the parentheses; *p<0.1,**p<0.05,***p<0.01	

D.1 Diagnostics of the fitted ARIMA model

Table 11: Diagnostics of the fitted ARIMA model

	Test Statistic	P-value	Null hypothesis	Decision
Kolmogorov-Smirnov test for normality	0.982	0.29	Normally distributed	Accept Null hypothesis
Breush-Godfrey LM test for autocorrelation	22.427	0.317	No serial correlation	Accept Null hypothesis
Breush-Pagan/Cook-Weisberg test for homoscedasticity	0.17	0.676	Constant variance	Accept Null hypothesis

E. Regression result for constructed variables in Distributed lag model

Table 12: Regression result for constructed variables in Distributed lag model

Dependent Variable lnGDP (Y_t)	OLS-Results for constructed variables
Z_{0t}	0.2546
	(3.44)***
Z_{1t}	-0.2315
	(-2.47)**
Z_{2t}	0.0437
	(2.37)**
Constant	8.4964
	(53.57)***
Observations	25
R Squared	0.9765
Adjusted R-Squared	0.9732
F-Statistic	(290.98)***

Note: t-statistics in the parentheses; *p<0.1,**p<0.05,***p<0.01

E.1 Diagnostics of the fitted model on constructed variables

Table 13: Diagnostics of the fitted model on constructed variables

	Test Statistic	P-value	Null hypothesis	Decision
Kolmogorov-Smirnov test for normality	0.47	0.98	Normally distributed	Accept Null hypothesis
Breush-Godfrey LM test for autocorrelation	24.936	0.204	No serial correlation	Accept Null hypothesis
Breush-Pagan/Cook-Weisberg test for homoscedasticity	0.82	0.366	Constant variance	Accept Null hypothesis