



## Impact of Remittance, Money Supply and Inflation on Economic Growth of Nepal: Using Autoregressive Distributed Lag Model (ARDL)

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### Abstract

Remittances have become a major source of funding in developing countries. A time series analysis was conducted by taking the 25 years data of economic growth as a dependent variable while remittance, money supply and Inflation as independent variables form the annual report of Economic survey of Nepal (2020/21). The autoregressive distributive lag (ARDL) was used to study the relationship among the variables. The trend of economic growth and total percentage of economic growth is in increasing order. The relation between them was found as  $LN(\text{Economic Growth}) = 8.0740 + 0.220 * LNREM + 0.3123 * LNM2 - 0.0802 * LNINF$ . The stability test of long-run coefficient including short run was studied using ARDL model and are confirmed using Cumulative Sum chart (CUSUM) and cumulative sum of squares test (CUSUMSQ) test. Finding shows that there is long run positive relationship between remittance, money supply, inflation on economic growth of Nepal. From the analysis it is clear that coefficients of error correction are highly significant this indicate that adjustment to long-term equilibrium in the dynamic model and ARDL model showed all the independent variables had positive impact on economic growth of Nepal.

**Keywords** ARDL, Economic Growth, ECM, M2, Inflation

### 1. Background

Remittances, or the transfer of income from migrant workers to their home nations, have become a major source of funding in developing countries. Most studies suggest that inbound remittances have a positive influence in developing countries, such as raising living standards and allowing individuals to meet their basic necessities. However, academics produce a range of findings and recommendations when it relates to long-term sustainable development in overall economic indicators. (Walmsley et al., 2017) support the premise that remittances contribute to all the economic development through increasing economic activity in the country. On the other hand, have discovered that while remittance aids short-term economic growth, relying on it more heavily in the long run diminishes total production (economic growth) by reducing the workers available to work.

Economic growth relies on how remittances are used in receiving nations to determine the economic impact of remittances. Through consumption and investment, inward remittance has an impact on economic growth and other economic and development indices. Remittances assist the entire national economy in the countries where they are sent, as well as the beneficiaries' families and communities (Adams Jr & Page, 2005). In the last two decades, the number of migrants has increased, as have remittances to underdeveloped nations (Martin, 2006). Many studies have indicated that remittances and trade boost economic growth; nonetheless, the role of trade and worker remittance in economic growth is a hotly debated topic. Many empirical research has shown that worker remittances have a substantial and positive relationship with economic development (Azam, 2015), although other researchers have raised concerns about their beneficial impact on economic growth (Kaphle, 2018).

In Nepal, worker remittances have expanded substantially over the previous two decades, and remittances have remained the country's primary source of foreign currency earnings (Murata, 2018). In terms of trade, it has risen steadily and at a rapid pace since deregulation. Government liberal policies enhanced both import and export, allowing businesses to embrace new technology, get products at a lower cost, improve customer welfare, and profit from the trade liberalization spillover effect. The objective of this research is to find the relationship between remittances, Money supply and inflation on Economic Growth of Nepal: Using Autoregressive Distributed Lag Model (ARDL).

Remittance inflows are positively correlated with the broad money supply, although relative to the total inflow for the current year (Ojha, 2019). Broad money growth is inversely connected to remittance receipt and similarly significant at the 5% significant level. This is to be expected given that an economy is believed to perform better when there is more money in circulation (Denis et al., 2013).

## 2. Methods

### Model specification

A time series analysis was conducted by taking the 25 years (from 1994/55 to 2019/20) secondary data (MoF, 2020/21) of Economic growth (Rs. In 10 Millions), remittance, money supply (M2) and Inflation form the annual report of Economic survey of Nepal (2020/21). The relationship among economic growth, remittance, money supply (M2), Inflation has been presented in the form of regression equation. In the functional relationship economic growth is taken as dependent variable while remittance, money supply (M2), Inflation is taken as independent variables. The mathematical model was based on the methodology used by Shah et. al (2020) to establish the relationship remittance, money supply and inflation with economic growth. Above relationship can be expressed in the following regression model

Economic Growth = function (remittance, money supply (M2), Inflation)

$$\text{Economic growth} = \beta_0 + \beta_1 \text{Rem} + \beta_2 \text{M2} + \beta_3 \text{Inflation} + \epsilon_1$$

$$\text{LNEconomic growth} = \beta_0 + \beta_1 \text{LNRem} + \beta_2 \text{LNM2} + \beta_3 \text{LNInflation} + \epsilon_1$$

Economic growth indicate the market price and  $\beta_0$ ,  $\beta_1$ , and  $\beta_2$  are Coefficient of parameters used int the regression equation and  $\epsilon_1$  is the error term.

### The autoregressive distributive lag (ARDL)

The autoregressive distributive lag (ARDL) was used to examine the short term and long-term relationship between the remittances, money supply (M2), Inflation on Economic growth. Before using cointegration we need to find the order of integration of each dependent and independent variables under study. If the order of integration is I(2) or more in that condition we can't use ARDL model. Unit root test was used to determine the stationary or not of the variables (economic growth, remittance, money supply (M2), Inflation) (Shah, 2020). Augmented Dickey-Fuller (ADF) test were used to determine whether the variables are stationary or not. If the variables are not stationary then we need to change in to stationary either by using differencing or log transformation.

### Test of co-integration

Cointegration analysis was carried out to determine the existence of long-run relationship that exists between the dependent and independent variable. When one or all of the variables is/are non-stationary at level which means they have stochastic trend which need to be convert into stationary by differentiation or log transformation. Essentially, it is used to check if the independent variables can predict the dependent variable now (short-run) or in the future (long-run). The long run relationship among the variables was examined using Johansen Cointegration framework.

### ARDL bounds test

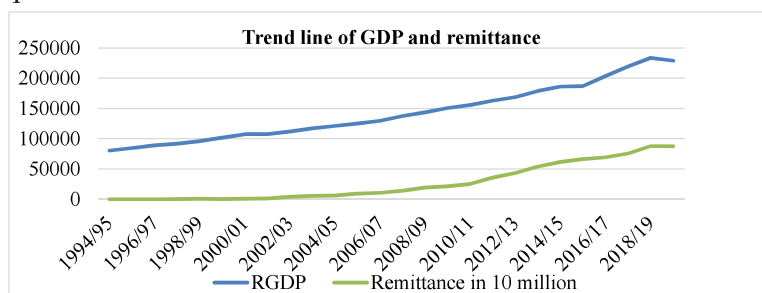
ARDL bounds test to find the long run relationship between independent and dependent variables which is better than others classical cointegration tests (Bahmani-Oskooee & Ng, 2002). For this we need to determine whether the data are I(0) or I(1). And then error correction model (ECM) is used analysis.

### Error correction model (ECM)

Error Correction representation of Autoregressive Distributive Lag Model Co-integration in the variables which can be assess thought of error correction model (ECM). Individual Co-efficient of the lagged values were used to find short run dynamics while.

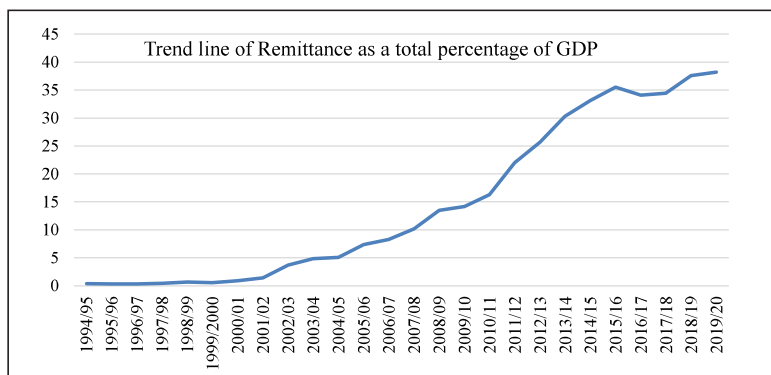
## 3. Result

Following figure 1 shows the trend line of economic growth and remittance from fiscal year 1994/95 to 2019/20. The trends line shows that the relationship between both variable is in positive direction.



**Fig.1:** Relationship between economic growth and remittance

Following figure 2 shows the trend line of remittance as a total percentage of economic growth from fiscal year 1994/95 to 2019/20. Trend line shows that the ratio of remittance to economic growth is in positive direction.



**Fig. 2:** Remittance as a total percentage of economic growth

**Empirical analysis**

**Augmented dickey-fuller (ADF) test**

To confirm the presence of the stationarity between the variables (economic growth, remittance, money supply(M2), Inflation), the Augmented Dickey- Fuller (ADF) test was performed at level and first difference by using e-views 10 data software. The result of the ADF test is presented in the following table:

**Table 1:** Augmented Dickey-Fuller (ADF) Unit Root Test for Stationary

Variables	At level		At First Difference	
	t-Statistics	p-Value	t-Statistics	p-Value
LNECONOMIC GROWTH	1.120039	0.9963	-5.09674	0.0005
LNRem	-1.43427	0.5493	-4.08863	0.0045
LN M2	0.527955	0.9843	-3.23099	0.0305
LnInf	-2.42426	0.1456	-5.36352	0.0002

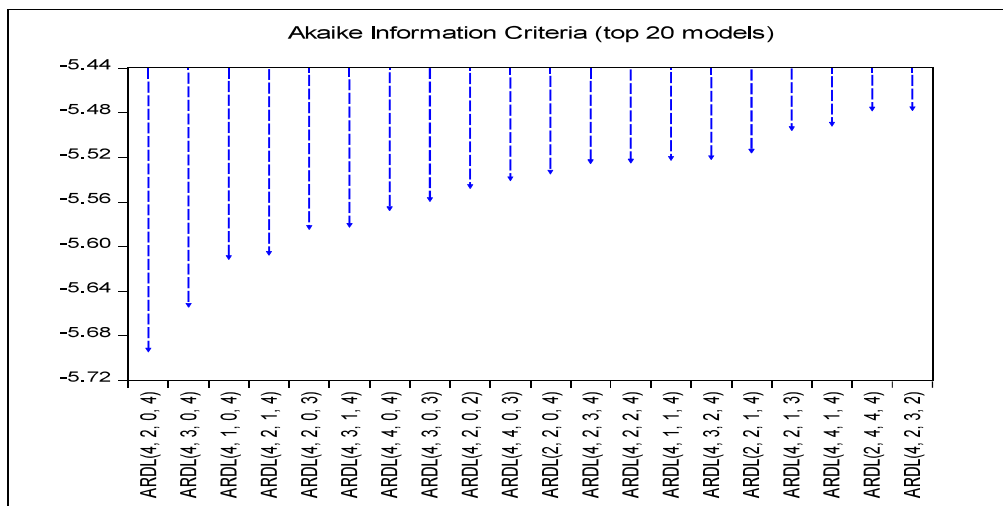
Above table1 shows the result of ADF test, which explained that the all four variables (economic growth, remittance, money supply(M2), Inflation) are not stationary at level I(0). So, the ordinary differencing has been used for all four variables. It was concluded that all four variables are stationary. Here, the four variables become stationary after first difference. Which indicate that order of integration is one I(1).

**Table 2:** Autoregressive Distributed Lag (ARDL) Approach (Taking Dependent variable as LNeconomic growth) to Estimated Long Run Coefficient

Variable	Coefficient	Std. Error	t-Statistic	p-value
C	8.073989	0.676677	11.93182	<0.001
LNREM	0.2197	0.048307	-0.45471	0.0661

LN <sub>M2</sub>	0.312347	0.095325	3.276661	0.0112
LN <sub>NINF</sub>	-0.08016	0.026085	-3.07296	0.0153

$$\text{LNECONOMIC GROWTH} = 8.0740 + 0.220 * \text{LNREM} + 0.3123 * \text{LN}_{M2} - 0.0802 * \text{LN}_{NINF}$$



Above table 2 shows the long run estimate of the model. The result of above table indicates that LN<sub>M2</sub> and LN<sub>NINF</sub> is significant at 5% level and LN<sub>REM</sub> is significant at 1% level of significance. This implies that the remittance, money supply (M<sub>2</sub>), Inflation are important factors in determining the economic growth of a country (p-value < 0.01). This model also shows that if remittance is increased by one unit, economic growth will be increased by 0.27 units while, if import is increased by one unit, economic growth will be increased by 0.165 units.

**ARDL bounds testing method**

In order to study the cointegration between dependent and independent variables Autoregressive Distributed Lag (ARDL) bounds were used. The result is presented as below

Hypothesis

Ho: No cointegrating equation No. of repressors	Value of Statistics
Computed F-statics	7.211905
5% Critical value	
Value in Lower Bound	2.79
Value in Upper Bound	3.67

Above table give the calculated value of F test is 7.211905 which is more than upper bound (3.67) at 95% confidence interval. This implies that economic growth is cointegrated with remittance, money supply (M<sub>2</sub>), Inflation. This result shows that there is long run relation among variables (i.e variables are cointegrated).

**ECM model**

Error correction model (ECM) were used to find the short and long run relationship among variables in time series regression model. The finding of ECM is shown as:

**Table 4:** Estimated Long-run Coefficient: ARDL (4, 2, 0, 4) Selected by Schwarz Bayesian Criterion-ECM

Variable	Coefficient	Std.Error	t-statistic	p-value
ECM	-0.50816	0.069095	-7.35454	<0.0001

Above result (table 4) shows that error correction coefficient is 0.50816 with p-value = <0.001. This result is significant at 10% and 5% level of significance and indicate that there is a moderate speed of convergent to equilibrium.

**Residual diagnostic: Correlogram**

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob*
		1 0.101	0.101	0.2549	0.614
		2 -0.074	-0.085	0.3983	0.819
		3 0.363	0.386	4.0617	0.255
		4 -0.132	-0.277	4.5728	0.334
		5 -0.201	-0.064	5.8240	0.324
		6 0.063	-0.094	5.9549	0.428
		7 -0.011	0.143	5.9591	0.545
		8 -0.037	0.017	6.0111	0.646
		9 0.002	-0.052	6.0113	0.739
		10 0.031	-0.015	6.0528	0.811
		11 -0.145	-0.200	7.0646	0.794
		12 -0.134	-0.029	8.0156	0.784

Breusch Godfrey Serial Correlation LM Test

Ho: No serial correlation at up to lag 2

**Table 5:** Testing of serial correlation

F-statistics	p-value
0.535617	0.6109

The above table 5 showed the serial correlation in which the probability is 0.6109 (do not reject Ho) which signify that there is absence of serial correlation up to two lags.

Following result shows the short run dynamic coefficients associated with long-run relationships derived from error correction model (ECM). The finding of error corrections terms in the models shows the strong significant association. The value of error correction in the model were found to be -0.50816 which suggested that deviations from the remittance to economic growth (economic growth) adjust quickly. In CUSUM



and CUSUMSQ statistics values are plotted with respect to the break points. In the chart (CUSUM and CUSUMSQ) if statistics values are lies between 95% confidence interval, it shows all the coefficients given regression are stable.

**Table 5:** Error Correction Model for the Selected ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	p-value
D(LNECONOMIC GROWTH(-1))	0.280406	0.159174	1.76163	0.1162
D(LNECONOMIC GROWTH(-2))	-0.43967	0.138739	-3.16904	0.0132
D(LNECONOMIC GROWTH(-3))	-0.55083	0.138703	-3.97126	0.0041
D(LNREM)	0.073013	0.014614	4.996237	0.0011
D(LNREM(-1))	-0.03117	0.014705	-2.1198	0.0668
D(LNINF)	-0.03748	0.00639	-5.86429	0.0004
D(LNINF(-1))	0.052249	0.009263	5.640541	0.0005
D(LNINF(-2))	0.028271	0.00624	4.530253	0.0019
D(LNINF(-3))	0.017963	0.006106	2.941869	0.0187
CointEq(-1)*	-0.50816	0.069095	-7.35454	0.0001

**Table 6:** Model Adequacy test

R-squared	0.898067	Mean dependent var	0.04152
Adjusted R-squared	0.821616	S.D. dependent var	0.02384
S.E. of regression	0.010068	Akaike info criterion	-6.056
Sum squared residual	0.001216	Schwarz criterion	-5.5601
Log likelihood	76.6159	Hannan-Quinn criter.	-5.9392
Durbin-Watson stat	2.505084		

In order to check the overall fitness of model we use to test serial correlation, normality and heteroscedasticity. The stability test of long-run coefficient including short run dynamics of the estimated ARDL model are confirmed using CUSUM and CUSUMSQ test. Following figure suggested that, the plotted lines are lies between 5% critical bounds. This means all coefficients and the ECM are found to be stable.

#### 4. Conclusion

This study was carried out to find the impact of remittance, Money supply, inflation on Economic Growth of Nepal from the period of 1994/95 to 2019/2020, using Autoregressive Distributed Lag Model (ARDL). The result of this research shows that there is long run positive relationship between remittance, money supply, inflation on economic growth of Nepal. The ARDL model has lag 4 and it was found to be best and stable model because there is absence of serial auto correlation, absence of heteroskedasticity and the residuals were found to be this indicate that there is long-

term equilibrium among variables. This suggested that form ARDL model all there independent variables had positive impact on economic growth of Nepal.

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