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REMITTANCES AND REAL EXCHANGE RATES IN SOUTH ASIA: THE CASE OF NEPAL

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ABSTRACT

The significance of remittances in Nepal's economy warrants investigating their impact on its currency's exchange rate and other economic indicators. No academic research has documented this phenomenon in the case of Nepal. This paper attempts to bridge this literature gap by investigating the impact of economic variables including remittances on the foreign exchange rate of the Nepalese rupee. Autoregressive distributed lag (ARDL) of Pesaran et al. (2001) and Augmented-Dickey-Fuller (ADF) unit root tests are used to test for short-term and long-term co-integrations. Empirical results show that there is an evidence that increasing remittance inflows leads to currency depreciation in the short-run and currency appreciation in the in the long-run. However, the results are statistically significant only in the short-run. As for the other control variables, the net exports flows, was the only determinant of the real exchange rate that was statistically significant, implying that an increasing net exports leads to currency appreciation in the long-run. However, all determinants affects the exchange rates in the short-run.

Contribution/ Originality: This paper attempts to investigate the impact of economic variables including remittances on the foreign exchange rate of the Nepalese rupee.

1. INTRODUCTION

Following the methodology used in previous research to investigate the relationship between remittances and exchange rates of developing countries in different regions, this paper investigates the case of Nepal. A conclusive finding on the relationship is not yet decided. According to Barajas et al. (2010) neither the single-country nor panel evidence agrees on one single conclusion. While most of the research to date is indeed consistent with the conventional presumption that larger remittance receipts tend to appreciate the equilibrium real exchange rate, the finding are not unanimous on this issue. Lack of unanimity could be attributed to the unit-root test results indicating that the real exchange rate proved to be non-stationary in almost all countries.

The rest of the paper consists of the following sections. Section 2 discusses the structure of Nepal's economy; Section 3 sheds light on the relative contribution of remittances to GDPs in South Asia including Nepal; Section 4 provides a brief expose' of the Nepalese rupee; Section 5 reviews the relevant literature; Section 6 articulates the

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methodology and data used, and discusses the empirical results; and Section 7 concludes the paper with the objective of highlighting its real-world implications.

2. STRUCTURE OF NEPAL'S ECONOMY

The IMF Staff Report for the 2017 Article IV Consultation points out that Nepal's economy is rebounding following a slowdown caused by the 2015 earthquakes and trade disruptions. The Staff expects growth to reach 5.5 percent in 2016/17, supported by accommodative monetary policy and rising government spending. 2016/2017 inflation is low at 5% as prices and it may go up to 6% in 2018. The IMF Report points out that in the absence of strong policies and sustained reforms, growth would likely revert to the average of the past decade and fall short of substantially improving living standards and social indicators.

The IMF Report recommends, among other things that "future efforts should focus on strengthening key institutions and administrative capacity to overcome the chronic under-implementation of the budget and boost private investment and growth. When it comes to fiscal policy, Nepal should focus on facilitating post-earthquake reconstruction and medium-term growth through higher and better-quality public investment." As far as its monetary policy, it needs to be tightened to support the exchange rate peg and competitiveness by closing the inflation gap with India. Monetary management should be strengthened further building on recent steps to adopt an interest rate corridor. In addition, the Staff recommends "a financial reform by the way of a stronger supervision, more stringent loan classification and provisioning and upgrading of banks' risk management. Key priorities include strengthening policy implementation capacity, upgrading transportation infrastructure, improving the business climate, and developing the hydropower sector."

Based on IMF Report that after four years of surpluses, rising current and capital spending led to a deficit of 2.8 percent of GDP in 2016/17, Nepal's net public debt remained at 22 percent of GDP in 2016/17, government revenue data indicates that revenues rose by 22 percent (year-on-year) during the last 3 months. In April 2018, the year-to-year increase was 13 percent. However, central government spending rose 73 percent. This includes the third transfer of Nepalese rupee (NR) 75 billion from the central government to local governments. Gross domestic debt has stabilized at about NR 390 billion. Government deposits at the Nepal Rastra Bank, the central bank, were NR 274 billion including NR 72 billion from local governments.

Nepal's imports and exports has increased by 33 and 18 percent, respectively, in 2017 and 2018. According to IMF report, "private credit growth eased to 17 percent in March 2018, from a high of 32 percent in February 2017. Strong imports have raised the trade deficit. Even with robust remittances, this is pushing the current account into deficit (US$1.5bn deficit in the first eight months of 2017/18, compared to near balance in 2016/17)." Furthermore, the IMF reports that the reserve money increased by 7 percent by March 2018 while private sector credit growth stabilized, money supply measure M_2 grew by 15 percent by March 2018. On Nepal interest rates, the IMF points out that interbank interest rates were stabilizing above 4 percent on implementation of the interest rate corridor. When it comes to stock market performance in Nepal and India. In mid-April 2018, stock prices were down 21 percent from 2017. Nepal's bank stocks were down 24 percent from 2016.

Nepal's growth has lagged peers and per capita GDP, based on purchasing power parity (PPP), which has been lower than in the other Asian peer countries. Based on the IMF Report, Nepal's exports have been growing slower than GDP and are lower than in most peers. .Based on 2016 data, inflows of foreign direct investment (FDI) in Nepal remain small. As a result, the stock of foreign direct investment (FDI) is much smaller than in peer countries. On the other hand, compared to other countries, Nepal has very high remittances. This is why poverty declined to 24 percent of the population in 2010/11, thanks in part to the growth of remittances. Poverty is higher in rural and mountainous areas. The decline in poverty is reflected in an improvement in Nepal's UNDP Human Development Index. (HDI).

3. REMITTANCES TRENDS

World Remittances Trends. According to World Bank Report on Migration and Remittances (2017), remittance flows to low and middle income countries (LMICs) were projected to rebound by 4.8 percent to $450 billion in 2017 and is expected to grow 3.5 percent to reach $466 billion in 2018. Worldwide, remittance flows were projected to reach $596 billion in 2018. The welcome rebound in remittance flows, after two successive years of decline, is driven by stronger economic growth in the European Union, the Russian Federation, and the United States, according to the World Bank Report. In U.S. dollar terms, the recovery is further accentuated by the valuation effects of the recent strengthening of the euro, the British pound, and the ruble against the U.S. dollar.

"But structural constraints, such as de-risking behavior by international correspondent banks and increased regulatory burdens on money transfer operators (MTOs) continue to hinder the growth of remittances, especially through formal channels," according to the World Bank. In addition, longer-term risks remain: rising anti-immigration sentiments and stricter immigration policies in many remittance-source countries—including labor market "nationalization" policies in Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates,—are slowing down the hiring of foreign workers and dampening remittance flows.

Remittances Trends in Nepal: According to the World Bank Report on Migration and Remittances, remittances growth in the South Asia region is expected to remain weak with a modest 1.1 percent growth in 2017 due to the continuing impact of lower oil prices and "nationalization" polices leading to constrained labor market conditions in the GCC. This represents a slight improvement over the 6.1 percent remittance fall seen in 2016.

Nepal ranked first among South Asia countries in terms of the percentage of its remittance to GDP in 2017. Remittances represent 27.2% of its GDP (see Figure 1). Nepal received U.S. $6.3 billion in 2017, which puts the country at the fifth place in the South Asia region (see Figure 2). The region remains significantly dependent on remittances. Remittances exceeded 5 percent of GDP in 2017 for Pakistan, Bangladesh, Sri Lanka, and Nepal. Worldwide, Nepal ranked fourth in terms of percentage of remittance to GDP in 2017 (see Figure 3).
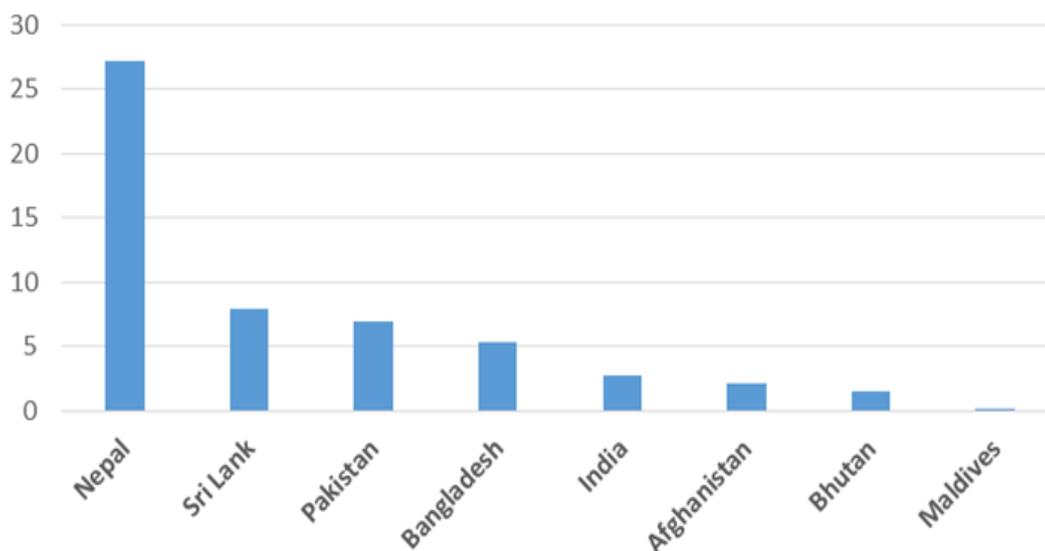

Figure-1. Nepal Leads South Asia in Remittance/GDP Ratio, 2017
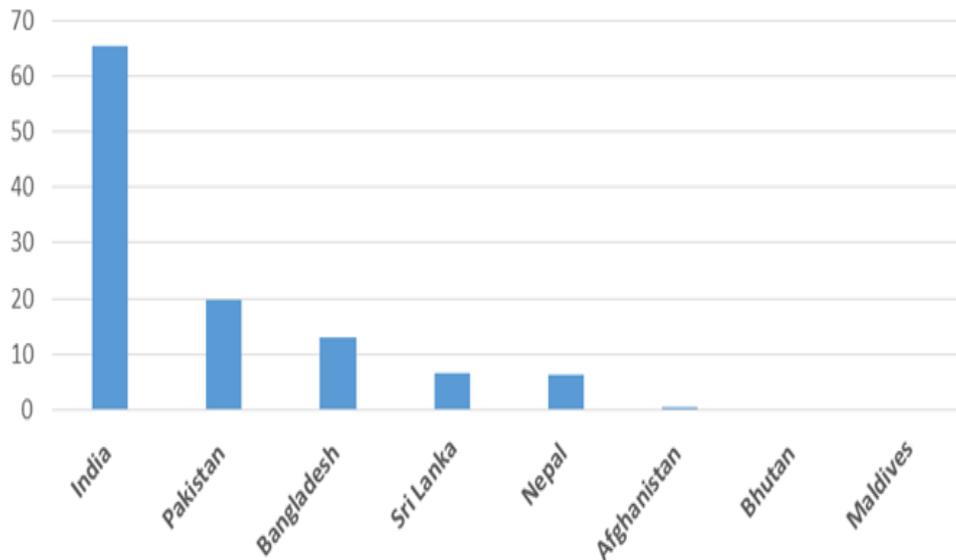**Source:** World Bank World Development Indicators, 2017.

Figure-2. Nepal Ranks 5th in South Asia Remittance Receivers ($Billion), 2017
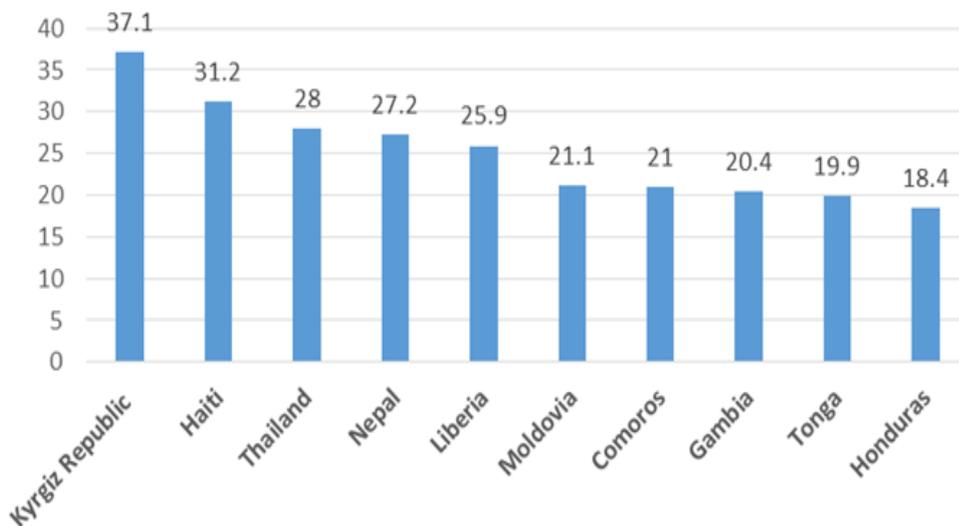**Source:** World Bank World Development Indicators, 2017.

Figure-3. Nepal Ranks 4th in the World in terms of Remittances/GDP Ratio, 2017
Source: World Bank World Development Indicators, 2017.

4. THE NEPALESE RUPEE

Rupee is Nepal's official currency. According to IMF Exchange Rate Arrangements,[1], Nepal is one of 42 countries whose currency, rupee, has conventional fixed peg arrangements, and it is one of the 34 countries which has a conventional fixed peg arrangement against a single currency (the country has an IMF-supported or other monetary program). The Nepalese rupee is pegged to the Indian rupee. The pegging to Indian rupee was last reviewed in 1994 when the exchange value was revised from 1.45 to 1.60 Nepalese rupee for every Indian rupee. The Nepalese rupee's exchange rate is determined by factors related to the Indian economy and currency. The IMF advocates that the exchange rate peg with the Indian rupee serves as a useful nominal anchor, and welcomes the authorities' decision to maintain it. The peg continues to benefit Nepal in view of its close economic relationship with India. Moreover, the recent depreciation creates an opportunity to benefit from enhanced international competitiveness, which would be boosted by structural measures to lower the cost of doing business. [2]

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[1] https://www.imf.org/external/np/mfd/er/2004/eng/0604.htm

[2] https://www.imf.org/en/News/Articles/2015/09/14/01/49/pr13385.

5. LITERATURE REVIEW

Many papers have investigated relationships between remittance and exchange rates covering individual or group of developing counties. For example, see Barajas *et al.* (2010); Barrett (2013); Hassan and Holmes (2013); Giuliano and Ruiz-Arranz (2009); Mongardini and Rayner (2009) and Osigwe and Obi (2016). No academic research has documented the phenomenon in Nepal. This paper tries to bridge the gap.

The IMF paper by Barajas *et al.* (2010) provides an excellent summary of the empirical studies on the relationship between remittance and exchange rates in many developing countries including Cape Verde, Pakistan, Jordan, Honduras, Jamaica, Nicaragua, Dominican Republic, El Salvador, and Guatemala. "The upshot is that neither the single-country nor panel evidence speaks with a single voice. While most of the research to date is indeed consistent with the conventional presumption that larger remittance receipts tend to appreciate the equilibrium real exchange rate, the verdict is not unanimous on this issue."

Barajas *et al.* (2010) turn to their own panel estimation, using a large set of countries as well as more recent data and a more complete set of real exchange rate fundamentals than those employed in earlier studies. Most importantly, however, because the real exchange rate proves to be nonstationary in almost all countries, and indeed proved to be nonstationary in their panel unit root tests, unlike the existing panel literature they focus specifically on the identification of common stochastic trends among the real exchange rate and its fundamental determinants, including worker remittance flows. As a result, they were able to estimate the effects of sustained changes in such flows on the *equilibrium*, rather than just the actual, real exchange rate.

In an earlier paper by Mongardini and Rayner (2009) they estimate the relationship between grants and remittances and the equilibrium real exchange rate in Sub-Saharan African (SSA) countries using panel techniques. The study's "results indicate that grants and remittances are not associated, in the long run, with an appreciation of the real effective exchange in SSA and are therefore not likely to give rise to "Dutch Disease" effects." The findings suggest that grants and remittances may be serving to "ease supply constraints or boost productivity in the non-tradable sector in the recipient economies."

In their paper, Hassan and Holmes (2013) examine the long-run relationship between remittances and the real exchange rate for developing countries using a panel cointegration approach. They employ an innovative method for the measurement of the multilateral real effective exchange rate and we focus on high remittance economies. They find a small inelastic, but significant, long-run relationship which confirms a "Dutch Disease" type effect. Short-run confirmation is given by a panel error correction model. Potential asymmetries in this relationship are explored using quintile regression analysis.

Giuliano and Ruiz-Arranz (2009) study one of the links between remittances and growth, in particular how local financial sector development influences a country's capacity to take advantage of remittances. "Using a newly-constructed dataset for remittances covering about 100 developing countries, we find that remittances boost growth in countries with less developed financial systems by providing an alternative way to finance investment and helping overcome liquidity constraints. This finding controls for the endogeneity of remittances and financial development, does not depend on the particular measure of financial sector development used, and is robust to a number of robustness tests, including threshold estimation. We also provide evidence that there could be an investment channel trough which remittances can promote growth especially when the financial sector does not meet the credit needs of the population."

Osigwe and Obi (2016) evaluate the impact of remittances on the real exchange rate of Nigeria's Naira. The results of cointegration analysis indicate evidence of a long run relationship among the variables whereas the normalized cointegration coefficients of the variables show that all the variables significantly affect the real exchange rate.

In another paper, Barrett (2013) investigates the impact that remittances have on the escalating exchange rate in the Jamaican economy over the period 1995-2010, controlling for other fundamental variables such as

government spending, official aid and the terms of trade. It empirically verified that remittances depreciated the real exchange rate, contradicting many studies. The results were obtained using the OLS estimation technique along with the traditional IS-MP model.

Research on Nepal is also discussed. Specifically, some research was done on the relationship between remittances and exchange rates of some specific developing countries in different regions. Pant and Budha (2016) investigates the remittances and exchange rate linkages in Nepal. The empirical results show that depreciation of the Nepalese currency has a positive impact on remittance inflows. Thapa (2002) tests the relationship between real effective exchange rate and GDP on the Nepalese economy. The empirical study shows that the traditional view holds for Nepal and implies that Nepal should at least keep the real exchange rate constant.

In addition to the above discussed papers on the relationship between remittances and exchange rates, many papers have expanded the scope of research to investigate the relationship between remittances and many economic variables. Many studies investigated the economic significance of workers remittances on economic growth in recipient countries (Yang, 2005; Adams and Richard, 2008; Singer, 2010; Lartey, 2016).

Adams and Richard (2008) "addresses this question by using new data on such variables as the skill composition of migrants, poverty, and interest and exchange rates to examine the determinants of remittances. The paper finds that the skill composition of migrants does matter in remittance determination. Countries which export a larger share of high-skilled (educated) migrants receive less per capita remittances than countries which export a larger proportion of low-skilled migrants. It also finds that the level of poverty in a labor-sending country does not have a positive impact on the level of remittances received."

Lartey (2016) findings indicate that "more flexible exchange rate regimes are associated with a greater increase in economic growth following an increase in remittances, but also that the impact of remittances on growth is positive under a fixed exchange rate regime. "The estimates suggest that a 1 percent increase in remittances increases per capita growth by about 0.79 percent under a fixed exchange rate regime, and that this effect increases by about 0.13 percent for a 1 point increase in the exchange rate flexibility index. The results further suggest that the effect of remittances under a fixed exchange rate regime is positive in less financially developed countries as well, but do not provide conclusive evidence that this effect varies inversely with exchange rate flexibility in such economies as theorized."

Singer (2010) argues that the international financial consequences of immigration exert a substantial influence on the choice of exchange rate regimes in the developing world. "Over the past two decades, migrant remittances have emerged as a significant source of external finance for developing countries, often exceeding conventional sources of capital such as foreign direct investment and bank lending. Remittances are unlike nearly all other capital flows in that they are stable and move counter-cyclically relative to the recipient country's economy. As a result, they mitigate the costs of forgone domestic monetary policy autonomy and also serve as an international risk-sharing mechanism for developing countries. The observable implication of these arguments is that remittances increase the likelihood that policymakers adopt fixed exchange rates."

Yang (2005) examines Philippine households' responses to overseas members' economic shocks. Overseas Filipinos work in dozens of foreign countries, which experienced sudden (and heterogeneous) changes in exchange rates due to the 1997 Asian financial crisis. "Appreciation of a migrant's currency against the Philippine peso leads to increases in household remittances received from overseas. The estimated elasticity of Philippine-peso remittances with respect to the Philippine/foreign exchange rate is 0.60. In addition, these positive income shocks lead to enhanced human capital accumulation and entrepreneurship in origin households. Favorable migrant shocks lead to greater child schooling, reduced child labor, and increased educational expenditure in origin households. More favorable exchange rate shocks also raise hours worked in self-employment, and lead to greater entry into relatively capital-intensive enterprises by migrants' origin households."

6. METHODOLOGY AND EMPIRICAL RESULTS

Updating a summary borrowed from Hassan and Holmes (2013) Table 1 below summarizes the relevant methodologies used in the past by some researchers. Of importance is Barajas *et al.* (2010) study, which points out that the standard approach in individual country studies is to include remittance flows in the set of fundamentals that enter co-integrating equation for the real exchange rate, together with other potential real exchange rate determinants. This paper is based on the annual data series of all the data from 1993 to 2016, except for the U.S. Treasury Bill which is used to measure the world interest rate (WIR). The data are from the World Development Indicators (WDI) compiled by the World Bank https://data.worldbank.org/. The data for the U.S. Treasury Bill is from the St. Louis Federal Reserved database (https://fred.stlouisfed.org/). Descriptive summary statistics of the data are reported in **Appendix A**. The real effective exchange rate (REER), which is more suitable for this study, is used based on Romer (2011) approach. It is defines as follows:

$$RER_t = NER_t * \left(\frac{CPI_{US,t}}{CPI_{Nepal,t}} \right). \tag{1}$$

Equation (1) states that the real exchange rate (RER_t) for Nepal depends on the nominal exchange rate (NER_t) for the price differential between US and Nepal, which is represented as the ratio of U.S. consumer price index ($CPI_{US,t}$) and Nepal's Consumer price index.($CPI_{Nepal,t}$). Figure 4 demonstrates the evolution of the computed RER.

Table-1. Updated Summary of Past Relevant Methodologies Used

Study	$REER = \beta_0 + \beta_1 REM + \beta_2 Z + u$	Dependent Variable	Independent Variables	Data Peri d
Amuedo-Dorantes and Pozo (2004)		Log of real exchange rate	Log of workers' remittances, log of foreign aid, log of GDP per capita log of terms of traded, log of government expenditure and	Panel; 1979 – 1998
	$\Delta REER = \beta_0 + \beta_1 \Delta REMRAT$		US interest rate	
Lopez *et al.* (2007)		Change in log of real effective exchange rate	Change in remittances (% of GDP), per capita GDP growth, change in terms of trade, government consumption (% of	Panel
	$REER = \beta_0 + \beta_1 \Delta REMRAT$		GDP), US – 6 month interest rate	
Barajas *et al.* (2010)	$REER = \beta_0 + \beta_1 REMRAT + \beta_2 Z + u$	Log of real effective exchange rate	Remittance to GDP, official aid/GDP, debt/GDP, real per capital GDP, fertility rate, terms of trade, consumption/GDP, agricultural prices, natural disasters	Panel
Lartey *et al.* (2012)	$REER = \beta_0 + \beta_1 REMRAT + \beta_2 Z + u$	Real effective exchange rate	Remittances to GDP, FDI (% of GDP), Non FDI private inflow (% of GDP), government expenditure growth, GDP per capita, M2 (% of GDP), terms of trade, export plus import (% of GDP), growth of GDP	Panel; 1992 – 2003
Izquierdo and Peter (2006)	$REER = \beta_0 + \beta_1 REM + \beta_2 Z + u$	Real effective exchange rate	Workers' remittances to GDP, average labor productivity, net international investment position (% of GDP), government consumption (% of GDP), terms of trade and export plus import (% Of GDP).	TS; 1960 – 2004

Source: Updated from Hassan and Holmes (2013).

Figure-4. Evolution of the Computed RER

After converting the nominal exchange rate into real exchange rate, we express all data in their natural logarithmic form so that the estimated coefficients represents the long-run elasticities, except for the world interest rate variable (WIR).

To this end, based on the empirical literature on the long-run relationship between the real exchange rates and remittances, the specified model is expressed as:

$$RER_t = f(REM_t, X_t)$$
(2)

In an equation form, equation (2) can be written as:

$$RER_t = \alpha_0 + \alpha_1 REM_t + X_t' \alpha_2 + \varepsilon_t$$
(3)

Equation (3) states that the computed real exchange rate (RER) depends on remittances as a percentage of GDP (REM), and other determinants of real exchange rates (X_t') and the last term is the idiosyncratic error term. Notwithstanding the data limitations, not all determinants of RER are included. However, to be consistent with the literature, we followed the standard approach employed in individual country studies which include remittance flows in the set of fundamentals that enter a co-integrating equation for the real exchange rate, together with other potential real exchange rate determinants (Barajas *et al.*, 2010). Specifically, the following three control variables are included:

- Government spending in constant US$ (GS) as a measure of the size of government. GS is expected to have negative relationship with RER.
- Trade balances percentage of GDP (NX) measures international competitiveness of Nepal, is the net exports of goods and services. NX is expected to have positive relationship with RER.
- World's interest rate (WIR). Annual averages of the U.S. Treasury Bill is used as a proxy. WIR is expected to have a positive relationship with RER based on interest rate parity model.

To assess the short-run and long-run dynamic effects of remittance on the real exchange rate, we adopt the autoregressive-distributed-lag (ARDL) bounds testing approach developed by Pesaran *et al.* (2001). The ARDL has several advantages over other time series techniques. First, the method can be applied irrespective of the variables being *I(0)* and/or *I(1)*. An implication is that unlike other methods, the ARDL does not require unit-root pre-

testing. Regardless of this advantage, we report the Augmented-Dickey-Fuller (ADF) unit root tests in Table 2 which shows evidence that the time series are integrated of the same order 1.

Table-2. Unit-root test results

Variables	ADF Stat	Mackinnon-p-value	Model specification
Levels			
RER	-1.49	0.83	Trend
REM	-1.54	0.82	Trend
GS	-1.38	0.87	Trend
NX	-1.69	0.76	Trend
WIR	-2.81	0.19	Trend
First difference			
RER	-3.65***	0.00	constant
REM	-4.35***	0.00	constant
GS	-4.60***	0.00	constant
NX	-5.36 ***	0.00	constant
WIR	-3.26**	0.02	constant

Notes: ***, (**) indicates significance at the 1% (5%) level. The lag length for the ADF test is selected based on the Akaike Information Criterion (AIC).

Second advantage of the ARDL approach is that both the long-run and the short-run relationship can be analyzed in a single reduced form equation while the conventional co-integration methods estimate the relationship using systems of equations. Lastly, the ARDL procedure fits the co-integration better in small samples (Lamotte *et al.*, 2013). This is important advantage because for the case of Nepal in which we have available for 23 years.

To assess the long-run effects and the short-run dynamics, the unrestricted error correction model (UECM) of ARDL specification is expressed as:

$$\Delta RER_t = \gamma_0 + \gamma_1 T + \sum_{i=1}^{k} b_i \Delta RER_{t-i} + \sum_{i=1}^{p1} c_i \Delta REM_{t-1} + \sum_{i=1}^{p2} d_i \Delta GS_{t-1} + \sum_{i=1}^{p3} f_i \Delta NX_{t-1}$$
$$+ \sum_{i=1}^{p4} g_i \Delta WIR_{t-i} + \lambda_1 REM_{t-1} + \lambda_2 GS_{t-1} + \lambda_3 NX_{t-1} + \lambda_4 WIR_{t-1} + \mu_i$$

(4)

Where p and k denotes lags, Δ is the difference operator and μ_i is the white-noise error term. The optimal lag is chosen based on either Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SIC). We first test whether there is a long run relationship using the bounds testing approach. The null hypothesis for the bounds test is that there is no co-integration (e.g. $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$) and the alternative hypothesis is that the variables are co-integrated (e.g. $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$) . Thus, the testing is based on *F*-statistic and we report these results in Table 3. Since the *F*-statistic falls above the upper critical bound at the 5% and 1% significance level, then we reject the null hypothesis that the remittance, the expressed determinants, and the exchange rate are not co-integrated. Therefore these results demonstrate that the series are co-integrated, implying that there is a long-run relationship.

Table-3. Bounds Test for Co-integration

		Critical Value bounds (5%)		Critical Value bounds (1%)	
	Test	I(0)	I(1)	I(0)	I(1)
F-Statistics	7.56**	2.86	4.01	3.74	5.06

Notes: ***, (**) indicates significance at the 1% (5%) level. The critical value bounds are from Pesaran *et al.* (2001).

We use the lag length of 3 for the estimation. The Null hypothesis is no levels of relationship. Based on the bounds test statistics we can fail to reject the null hypothesis of no co-integration.

After establishing that there is co-integration between the variables, then the next step involves estimation of the long-run and short-run relationship, which is for of Equation (5) and Equation (6) respectively.

$$RER_t = \alpha + \sum_{i=1}^{k} \beta_i\, RER_{t-i} + \sum_{i=1}^{p1} \gamma_i\, REM_{t-i} + \sum_{i=1}^{p2} \delta_i\, GS_{t-i} + \sum_{i=1}^{p3} \zeta_i\, NX_{t-i} + \sum_{i=1}^{p4} \eta_i\, WIR_{t-i} + \xi_i \tag{5}$$

$$\Delta RER_t = \alpha + \sum_{i=1}^{k} \varnothing_i\, \Delta RER_{t-i} + \sum_{i=1}^{p1} c_i\, \Delta REM_{t-i} + \sum_{i=1}^{p2} d_i\, \Delta GS_{t-i} + \sum_{i=1}^{p3} f_i\, \Delta NX_{t-i} + \sum_{i=1}^{p4} g_i\, \Delta WIR_{t-i} + \psi ECT_{t-1} + \varepsilon_i \tag{6}$$

Where ψ is the coefficient of the error-correcting term (henceforth, ECT_{t-1}). It is important to note that ψ from equation 6 represents the speed of convergence to the equilibrium and is supposed to be negative and statistically significant. The maximum number of lags for the *ARDL (k, p1, p2, p3, p4)* are supposed to be based on an information criterion. However, a maximum number of lags of *3* are used for all the estimations

The main objective of our study is to investigate the effect of remittance inflows on the real exchange rate. We revisit this question because, intuitively, the nature of the relationship between remittances and exchange rates cannot be determined *a priori*. This is because remittances inflows affect exchange rates indirectly, through their effect of recipient family's household income and whether or not families end up spending the money on goods and services rather than hoarding them. Therefore, one can argue that the increase in remittances can lead to either currency appreciation or depreciation. Coefficient estimates for Equation (5) and Equation (6) are shown in Table 4. The evidence shows that increased remittance inflows leads to currency depreciation in the short-run and currency appreciation in the long-run in Nepal. However, the effects are small and are statistically significant only in the short-run. Specifically we find evidence that a one percentage increase in remittance inflows leads to 0.06 percentage increase in the real exchange rate.

Table-4. ARDL Estimates of the Dynamic Effects of Remittances on the RER

Regressor	Coefficient	Standard Error	*t*-Statistics
The dependent variable is the real exchange rate.			
Panel A: Estimates of long- run coefficients			
REM	–0.06	0.04	–1.58
GS	–0.18	0.16	–1.07
NX	1.06**	0.44	2.43
WIR	–0.02	0.01	–1.46
Panel B: Estimates of short-run coefficients			
ΔRER_{t-2}	0.69	0.88	0.78
ΔRER_{t-3}	0.80	0.99	0.82
ΔREM_{t-1}	0.24	0.15	1.61
ΔREM_{t-2}	0.48**	0.12	4.07
ΔREM_{t-3}	0.18***	0.05	3.57
ΔGS_{t-1}	–0.58***	0.18	–3.24
ΔGS_{t-2}	0.84**	0.32	2.67
ΔGS_{t-3}	0.71**	0.24	2.92
ΔNX_{t-1}	–2.84**	1.01	–2.81
ΔNX_{t-2}	–3.89***	1.19	–3.26
ΔNX_{t-3}	–4.72**	1.86	–2.54
ΔWIR_{t-1}	0.11***	0.04	2.96
ΔWIR_{t-2}	–0.05	0.03	–1.40
ΔWIR_{t-3}	0.11***	0.04	3.01

Notes: ***, (**) indicates significance at the 1% (5%) level. Taking into consideration of data limitations, we used maximum of 3 lags was used for all the estimation

These results are consistent with those reported by Pant and Budha (2016) who find that "the effect of remittance flows on the equilibrium real exchange rate is not very robust, with the sign and statistical significance of the effect depending on the country sample being analyzed and, to a lesser extent, on the specific set of non-remittance fundamentals included in the co-integrating equation". Pant and Budha (2016) theoretical model predicted that remittance inflows leads to currency appreciation especially if a country has low trade/and or low capital openness. This observation suggests a presence of a none-linear relationship between exchange rates and remittance. For the case of Nepal, we also observe a similar pattern as remittance in-inflows leads to currency appreciation in the short- run but not in the long run.

As for the other control variables, the empirical results show that net exports flows was the only determinant of the real exchange rate that was statistically significant, and increasing net exports/trade balance leads to currency appreciation in the long-run. As stated earlier it is expected that exchange rates and government spending should have a negative relationship. Our results in Table 4, confirms this prediction for the case in Nepal for the long-run but in the short-run there is some evidence that increasing government spending leads to currency appreciation. It is important to note that according to the interest rate parity model, we expected to have a positive relationship with the real exchange rate. For the case of Nepal, this is only observed in the short-run.

7. CONCLUSION AND POLICY IMPLICATIONS

The significance of remittances in Nepal's economy warrants investigating their impact on its currency's exchange rate and other economic indicators. No academic research has documented the phenomenon. This paper attempts to bridge this literature gap by investigating the impact of economic variables including remittances on the foreign exchange rate of the Nepalese. This paper follows past literature documenting the relationship between remittances and exchange rates of individual developing countries worldwide. The dependency of Nepal on remittances from its overseas workers have been growing substantially for the last 15 years. Nepal ranked first in 2017 among South Asian countries in terms of its remittance to GDP ratio. Remittances represented 27.2% of its GDP. Nepal received U.S. $ 6.3 billion in 2017, which puts the country at the fifth place in the South Asia region. The region remains significantly dependent on remittances. Remittances exceeded 5 percent of GDP in 2017 for Pakistan, Bangladesh, Sri Lanka, and Nepal. Worldwide, Nepal ranked fourth in 2017 in terms of its remittances to GDP ratio. This paper investigates the impact of economic variables including remittances on the foreign exchange rate of the Nepalese rupee. Autoregressive distributed lag (ARDL) of

Pesaran *et al.* (2001) and Augmented-Dickey-Fuller (ADF) unit root tests are used to test for short-term and long-term co-integrations. Empirical results show that there is an evidence that increasing remittance inflows leads to currency depreciation in the short-run and currency appreciation in the in the long-run. However, the results are statistically significant only in the short-run. As for the other control variables, the net exports flows, was the only determinant of the real exchange rate that was statistically significant, implying that an increasing net exports leads to currency appreciation in the long-run. However all determinants affects the exchange rates in the short-run.

This study provides an experiment for the relationship between remittances and other variables, including the real exchange rates of the rupee. The contribution of the paper emanates from its practical implication for the impact of remittances on change in exchange rate of its rupee, whether in short-run or long-run could be a far reaching for monetary and fiscal policies of Nepal. The impacts of money supply, interest rates, inflation rates, and export competitiveness call for the Nepalese central bank to watch for the net remittances inflows and make sure that it would support rather than hinder the growth of the local economy. More coordination also should be made with the Central Bank of India, given the fact that the Nepalese rupee is pegged to the Indian rupee at a fixed exchange rate, but if remains floating with other convertible currencies. Having and IMF staff stationed in Nepal

that works in coordination with the central bank of Nepal could work as buffer against unexpected drastic changes in monetary policies.

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Appendix-A. Summary statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
RER	90.36	13.25	69.88	112.56
REM	13.81	11.24	0.98	31.43
GS	1.61E+09	3.57E+08	9.83E+08	2.31E+09
NX	-17.30	7.50	-29.90	-6.87
WIR	2.50	2.15	0.03	5.82