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Role of Remittances in Economic Growth: Evidence from Nepal

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Abstract

This paper analyses the dynamic roles of remittance on the process of economic growth of Nepal using time-series annual data for 37 years from 1981-2017. The basic tools of data analysis are vector error correction model, long-run structural modeling, Granger causality test, generalized impulse response functions, persistence profile, and variance decomposition analysis. The paper shows that the remittance inflow and economic growth have bidirectional relationship in the long run, but there is no relationship in the short run. Remittance affects the dynamics of other variables like investment, financial development, and investment on human capital which indirectly affect the performance of the economy through these variables. Findings indicate that remittance could promote financial development in the short run. It also shows the possibility of negative shocks in remittance flow could have a permanent negative effect on educational attainment. It concludes that an environment for investment should be created for enhancing the role of remittance on economic growth. Policies promoting flow of remittance through formal channels and financial literacy should be effective tools for channelizing remittance for economic growth. The government should prioritize the educational sector to prevent dropout of the students from schools when the households are hit negatively due to remittance shocks.

Keywords: *Remittance, Economic Growth, Time-series analysis, Nepal, Co-integration.*

JEL Classifications: *F24, F43, C32, O53, C51.*

Introduction

Remittances have emerged as one of the most important financial flows and source of development financing towards low- and middle-income countries in last few decades (Ratha, 2003). Nepal is one of the highest remittances-receiving

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countries in the world in terms of share of the GDP. In 2017, Nepal received 6.92 billion USD which is equivalent to 27.8 percent of gross domestic product (GDP) of Nepal (World Bank, 2018). Nepal was among the top five countries to receive highest amount of remittances in terms of remittances as share of GDP in 2017. The remittance flow remained stable from 1981 to 2001 and increased drastically thereafter. Throughout the study period (1981-2017), the economy grew at the average annual growth rate of 4.4 percent while remittances grew at the rate of 19 percent. The remittance flow has helped in reducing poverty and progress in human development (World Bank, 2016), maintaining balance of payment, and relaxing foreign exchange constraints in Nepal (Pant, 2006).

The higher flows of remittances during the study period in Nepal are also coincided with many socio-economic and political changes in Nepal. Until 1985, Nepal followed state-led inward-looking protectionist economic policies which was followed by the implementation of the structural adjustment programms (SAPs) from 1985 due to the balance of payment crisis in the first half of 1980s (Khanal et al., 2005). In 1990, the regime-shift took place by throwing autocratic party less 'Panchayat System' and restoration of the democracy. The restoration of the democracy along with the SAPs of 1980s led Nepal towards liberalization and privatization of the economy. This marks the huge policy departure in Nepal. This also led to increase in work-related migrants in foreign countries accompanied by the higher demand for labor created by the 'Oil Boom' in the Gulf countries (Shrestha, 2008).

Shortly after the restoration of the democracy, Nepal entered in a decade long civil conflicts (i.e. 1996-2006) followed by the transitional governance till the Nepal's transition to 'Federal Governance' in 2015. During this period, prolonged political instability remained main feature of Nepal. During all these periods, especially after 2001, the international labor migration and remittance remained as the important feature of the economy of Nepal. In last three decades, the prominence and importance of remittance has increased with the increase in the flow of remittances as well as the change in the migration destinations from traditional destination of India to Gulf and other developed countries.

The economic growth in Nepal during the study period remained low and erratic with low level of productivity, high subsistence agricultural economic base, stagnation in manufacturing sector, and limited absorption capacity of the service sectors (Basnett et al., 2014). In last three decades, the structural transformation took place from agriculture to service sector without major expansion of manufacturing sector lowering overall growth potential of the country (Khan, 2020). During this period, labor migration and remittances have remained one of the important lifelines which have helped to keep floating in the economy of Nepal (Shrestha, 2008; Sapkota, 2013). Despite the poor performance of the economy, there has been a significant reduction in poverty

and improvement in social indicators of health and education (Dahal, 2014; Wagle & Devkota, 2018).

While the welfare impacts of the remittances in Nepal have been acknowledged in the literature, the role of remittances in economic growth in Nepal is not conclusively and the number of studies focusing on this are limited (Dahal 2014). So, it is interesting to explore whether remittances have any long-term effects in economic growth of Nepal and exploring the constraining/facilitating factors for economic growth. The systematic analysis of the effect of remittances on growth could provide a better insight in formulating development policies as policy measures could be useful to moderating the effects of remittances in the economy. For instance, it is argued that Nepal may stick into low-growth equilibrium with high migration and high remittances unless the current development practices are drastically changed (Cosic et al. (2017). It highlights the need for better understanding the role of remittances in the economic growth process. So, the paper examines the dynamic relationships between remittances and economic growth in Nepal along with other variables like investment, financial development, and human development over the period of 1981 to 2017.

This paper is organized in such a way that the review of literature is presented after the section of introduction. Then, data and methodology of the study are presented in which nature and sources of data, model specification, and variables description are included. Similarly, in data presentation and analysis, descriptive statistics, preliminary analysis, long run and short run relationship (long run structural modeling (LRSM) and VECM estimation), Granger causality test, and robustness check are presented. Finally, conclusion and discussion of the study are presented.

Review of Literature

There are several studies that focus on the roles of remittances on economic growth and its major determinants like financial development, poverty reduction, and 'Dutch Disease' effects instead of directly focusing of economic growth. Shrestha (2008) has emphasized the role of remittances in maintaining macro-economic stability in Nepal by using descriptive analysis for the period of 1990/91 to 2005/05 and also discussed the potential of remittance in economic development. Dahal (2014) by using descriptive analysis has also explored the association of remittances with financial development, productivity, and human capital accumulation. The study found the mixed effects of these determinants on growth. Dhungel (2014) by using ARDL bound approach finds that one percent increase in remittances leads to 0.36 percent increase in GDP in long-run. Similarly, Kaphle (2018) using Vector Error Correction model also found positive long-term effects between remittances and economic development whereas no statistically significant effects in short run.

Shakya and Gonpu (2021), on the other hand, showed that remittances have no significant effects on GDP growth in Nepal. In contrast to these findings, Sapkota (2013), and Taguchi and Lama (2016) found the 'Dutch Disease' type of effect of remittances in Nepal which leads negative effects on the economic growth. Uprety (2017) concludes that there is a negative impact on economic growth of Nepal in short-run while no significant effects in long-run. However, there are limited studies on linkages between remittances and economic growth in Nepal. The brief overview of the existing literature shows that the effects of remittances on economic growth are so far not conclusive and oftentimes contrasting findings. The mechanism in which the remittances are impacting on the economy of Nepal is not explored in detail. Nepal may stick into low growth equilibrium with high migration and high remittances unless the current development practices are drastically changed (Cosic et al. 2017).

The brief review of literature shows that there is no conclusive evidence on the impact of remittances on economic growth in Nepal. Hence, this paper attempts to fill up this gap by exploring and examining dynamic role of remittances on economic growth of Nepal through different channels of investment, financial development, and human development that could have make a significant role in the economy**.**

Data and Methodology

Nature and Sources of Data

The study is based on secondary sources of data that are taken from World Development Indicators (WDI) database published by the World Bank using for 37 years of annual data from 1981 to 2017. The data on remittances in WDI is available form 1993 onward only. So, the paper the data on remittances estimated by Giuliano and Ruiz-Arranz (2009) who used the desk-data from IMF to estimate the remittances data from 1975- 2002 for 100 countries. So, to create the longer data frame, remittance data form Giuliano and Ruiz-Arranz (2009) for 1981 to 1992 is used and the data from 1993 to 2017 from WDI database is used to complete the series. Given the data constraint, this procedure is the best possible way to collect the data on remittance.

Model Specification

This study uses the augmented Solow Growth framework to investigate the long-run relationship between remittances and economic growth in Nepal. Following Rao (2010), Shabaz (2012), and Mankiw et al. (1992), the study uses following long-run Cobb-Douglas production function:[2]

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \qquad 0 < \alpha < 1 \qquad (1)$$

2 See Rao (2010) and Rao & Hassan (2011) for advantages of using extended Cobb-Douglas production function while studying economic growth using time-series data.

Where, Y_t = Output of the economy; A_t = Stock of technology; K_t = Capital stock; L_t = labor, α = Elasticity of capital, and $(1 - \alpha)$ = Elasticity of labor.

Dividing eq^n (1) by L, we get: $y_t = A_t k_t^{\alpha}$ (2)

Where y_t and k_t represent per capita output and per capita capital stock respectively.

In the Solow growth accounting framework, the long run growth rate is determined by growth of the stock of technology (A_t). The Cobb–Douglas production function is extended by assuming that remittances along with other variables can endogenously determine the stock of technology and impact the long run growth through their effects on technological progress. Hence, it is assumed that the stock of technology A_t takes the following form:

$$A_t = \phi R_t^{\delta} Z_t^{\rho} \ldots\ldots\ldots\ldots\ldots (3)$$

Where, R_t = Remittances; Z_t = Other factors that affect technology like investment, financial development and human development etc.; δ = Elasticity of remittances; ρ = Elasticity of Z, and ϕ is time invariant constant.

By substituting the eq^n (3) from (2), it becomes:

$$y_t = \left(\phi R_t^{\delta} Z_t^{\rho}\right) k_t^{\alpha} \ldots. (4)$$

Taking log on both sides, eq^n (4) can be written as -

$$\ln y_t = \ln \phi + \delta \ln R_t + \rho \ln Z_t + \alpha \ln k_t \ldots. (5)$$

This model specification forms the basis for the empirical analysis of the study.

In time series analysis, when the variables are not stationary, the estimation of the model gives the spurious regression (Asteriou & Hall, 2015). When the variables in the model are non-stationary at level and stationary, at first difference i.e. I(1), eq^n (5) may be estimated as:

$$\Delta \ln y_t = \gamma + \sigma \Delta \ln R_t + \omega \Delta \ln Z_t + \varphi \Delta \ln k_t + \Delta \varepsilon_t \ldots. (6)$$

This solves the problem of spurious regression. However, eq^n (6) captures only short-run relationships among the variables. However, the study is interested in capturing the long-run relationship between the variables. Hence, to capture both long-run and short-run dynamics of the model, the study uses Vector Error Correction Model (VECM) framework. Following Johanson methodology (Johansen, 1988, 1991), the VECM is represented as:

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \cdots + \Gamma_{p-1} \Delta Y_{t-p-1} + \alpha\beta' Y_{t-1} + \mu \ldots. (7)$$

Where,

$\Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \cdots + \Gamma_{p-1} \Delta Y_{t-p-1})$ and $\alpha\beta' Y_{t-p}$ are Vector Autoregressive (VAR) in the first difference and error-correction components

respectively. Y_t is $n \times 1$ vector of variables of integrated of I(1). ε_t is the $n \times 1$ vector of white noise error terms and μ is the $n \times 1$ vector of constant terms. Γ_i is a the $n \times n$ matrix that represents short-run adjustments among variables across n equations of pth lag. Similarly, β is $n \times r$ matrix of co-integrating vectors, and α is the $n \times r$ matrix of speed of adjustment parameters representing the speed of error correction mechanism. The use of 'Δ' is the first difference operator.

For estimating the equation, some preliminary analysis is required. First unit root tests are carried out to confirm that the variables in the model are of I(1). After confirming that the variables are of I(1), Johanson's methodology is followed to check for the co-integration among the variables in the system. Once the number of co-integrating relationships among the variables is established, the long run structural modelling, long-run Granger causality and short-run Granger causality analysis is carried out.

Description of Variables

The study used five of both dependent and independent variables that are as following presented in Table 1.

Table 1: Variables Description

Variables	Description
ln GDP	Real gross domestic product per capita in log value is the dependent variable which is the proxy variable of economic growth.
ln REM	Percentage share of total remittances inflow to GDP in log value is the core independent variable.
ln GCF	Percentage share of total gross fixed capital formation to GDP in log value is the controlled independent variable which is the proxy variable of investment.
ln CRE	Percentage share of total domestic credit to private sector to GDP in log value is another controlled independent variable which is the proxy variable of financial development.
ln EDU	Gross secondary school enrolments in log value is also the controlled independent variable which is the proxy variable of human development.

Source: Author's representation, 2022.

Data Presentation and Analysis

Descriptive Statistics

Table 2 shows the basic descriptive statistics of the variables used in the analysis. The table shows the mean, minimum, maximum, and standard deviation

of the variables used in this study. The data shows that there is not much variation in real GDP per capita and gross fixed capital formation during the study period while there is variation in remittance inflow.

Table 2: Descriptive Statistics

Statistics	ln GDP	ln REM	ln GCF	ln CRE	ln EDU
Mean	6.105	1.559	3.234	3.196	3.706
Maximum	6.658	3.448	3.846	4.392	4.305
Minimum	5.655	-0.024	2.842	2.091	2.921
Std. Dev.	0.287	1.321	0.265	0.71	0.347

Source: Author's calculation, 2022.

Preliminary Analysis

Some preliminary analysis like unit root tests, co-integration test, and model fit analysis is carried out (See: Appendix I). Three test statistics namely Augmented Dicky Fuller (ADF), Phillips-Perron (PP), Kwaiatkoski-Phillips-Schmidt-Shin (KPSS) tests are used to check the stationarity of the time series data. Based on these test statistics, it is concluded that all the series under consideration are of I (1). (See: Appendix II)

Using the Johansen methodology, the possibility of long-run (co-integrating) relationship between the variables is checked within VECM framework. The sequential steps outlined by Asteriou and Hall (2015) and Brooks (2014) were followed to carry out co-integration test. In the first step, the standard VAR model is estimated with variables used in the study. The appropriate VAR model with optimal lag length is selected using information criteria (AIC & BIC). Several diagnostic tests are also carried out for confirming the lag length for VAR model (available on request from the authors). Based on the analysis, lag length of 3 was chosen for further analysis (See: Appendix II).

Similarly, VECM was estimated to check whether the co-integrating relationship exists between the variables. It is used 'Pantula Principle' and 'VEC Stability Check' and 'Roots of Characteristic Polynomial of VEC Model' to select the appropriate intercept / trend specifications for VEC model (See: Appendices III, IV, and V). Based on analysis, VEC model (with intercept in CE and VAR but no trends) was selected. Based on this model, it is concluded that the presence of two co-integrating vectors in the model and proceed with this specification for further analysis (See: Appendix VI).

Long Run and Short Run Relationship

Long Run Structural Modeling (LRSM) and VECM Estimation

Once the co-integrating relation and rank of the integration is established, it is used this information to estimate the VECM. The analysis shows the rank of integration (r = 2), which means there exists two co-integrating equations / vectors (CVs). These co-integration relations are built into the VEC model specification. So, it restricts the long-run behavior (β) of the endogenous variables to converge to their co-integrating relationships while allowing for short-run (α) adjustment dynamics. The long-run parameters (β) are uniquely defined based on the eigenvalues which, however, are not useful in making economic interpretation of the estimated coefficients. Hence, to recover economically meaningful coefficients, the study used long-run structural modeling by applying just-identifying and over-identifying restriction (Pesaran & shin, 2002). First, it is imposed ($k = r^2 = 4$) just-identifying restrictions on each co-integrating vector. The restrictions are imposed on ln GDP and ln CRE.

The study chooses ln GDP as it is the main variable of interest (Dependent variable) while ln CRE is chosen as the study is interested to see how our main explanatory variables, ln REM, may be related to ln CRE. As the proxy of financial development, ln CRE is often the most discussed channel through which remittances may have an effect on the economy. The study imposes normalizing restriction of unity on these variables. Table 3 presents the result of long-run co-integrating relationship with just-identifying restrictions.

Table 3: Co-integrating Vectors with Just Identifying Restrictions

Co-integrating Eqn1:	**Coint. Eqn. 1**	**Coint. Eqn. 2**
Constant	- 2.785	4.235
ln GDP (-1)	1	0
	(none)	(none)
ln CRE (-1)	0	1
	(none)	(none)
ln GCF (-1)	- 0.457	0.104
	(- 0.126)	(- 0.44)
ln REM (-1)	- 0.059	- 0.03
	(- 0.017)	(- 0.059)
ln EDU (-1)	- 0.47	- 2.076
	(- 0.089)	(- 0.311)

Source: Author's calculation, 2022.

Table 4: Over Identifying Restrictions Test

Variables	Coint. Eq^n. 1	Coint. Eq^n. 2	Chi Square	p- value
ln REM	B = 0		6.132	0.013
ln REM	-	B = 0	0.125	0.723
ln REM	B = 0	B = 0	7.208	0.027
ln GCF	B = 0	-	4.798	0.028
ln GCF	-	B = 0	0.019	0.89
ln GCF	B = 0	B = 0	6.146	0.046
ln EDU	B = 0	-	11.226	0.004
ln EDU	-	B = 0	7.061	0.008
ln EDU	B = 0	B = 0	11.226	0.004

Source: Author's calculation, 2022.

The study imposes the over-identifying restriction of zero on other variables of interest to check the significance of these variables in the co-integrating vectors. It is sequentially checked the over-identifying restriction of three variables ln REM, ln EDU and ln CRE. The results for the over-identifying tests are presented in Table 4. The over-identifying restriction test shows that the coefficient of ln GCF and ln REM are not rejected at 5 percent level of significance both individually and jointly in co-intigration vector equation 2 (CV2). Hence, these two variables are excluded in long-run co-integrating relation in CV2. Based on over-identification test, the final co-integrating vectors are identified which is given as following. The value of t-statistics is reported in parenthesis.

$$ln \quad GDP = 2.775 + 0.058 \underset{(-3.482)}{ln\ REM} + 0.461 \underset{(-3.698)}{ln\ GCF} + 0.470 \underset{(-5.327)}{ln\ EDU} \ldots\ldots \quad (8)$$

$$ln\ CRE = -4.480 + 2.064 \underset{(-15.276)}{ln\ EDU} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

From final co-integrating vectors, it is observed that ln REM, ln GCF and ln EDU have positive effects on GDP per capita in the long run. Similarly, ln EDU has positive effects on ln CRE in the long run. It is, however, to be noted that the effect of remittances in smaller compared to other variables in the model. One percent increase in remittances - GDP ratio leads to about 0.06 percent increase in GDP per capita growth in long-run ceteris paribus. It is stated that when there exists more than one co-integrating vectors, the first 'eigen' vector with largest 'eigen' value may be chosen (Chakraborty, 2010); (Maysami & Koh, 2000). Hence, following them, it is also presented the long run co-integrating vector based on first 'eigen' vector in given eq^n 10. The results are similar both qualitatively and quantitatively as above. The variable ln CRE shows negative effects in the long-term co-integrating relation. However, it is not statistically significant at 5 percent level.

$$\text{ln GDP} = -2.574 + 0.060\ \underset{(-3.466)}{ln\ REM} + 0.452\ ln \underset{(-2.971)}{GCF} - 0.050\ ln \underset{(0.727)}{CRE} + 0.574\ ln \underset{(-4.825)}{EDU}. \quad (10)$$

After estimating co-integrating relations, the short-run adjustment dynamics can be inferred from the VEC model. The results of the VEC model and diagnostic tests for the model fit is presented in Table 6 which shows that the short-run dynamics of GDP is affected by its own lagged values and (second) lagged value of ln GCF. Other variables like ln REM, ln CRE and ln EDU have not statistically significant effect in determining short-run fluctuations on ln GDP. It is also observed that both lagged error correction terms (ECTs) for ln GDP equation are significant. The first lagged error correction term ($ECT1_{t-1}$ = − 0.196) corresponding to CV1 indicates that about 20 percent of the fluctuation in the previous period in long-run equilibrium is corrected by ln GDP equation in present period.

Granger Causality Test

Once the co-integrating relations among the variables are established, the study checked out for the direction and causality among the variables. One of the important features of VAR / VECM framework is that it allows for the test of casual relationship among time series variables commonly known as Granger causality. In simplest term, Granger causality refers whether the effects of past values of a variable X_t has an effect on the current value of another variable Z_t (Enders, 2015). When co-integration exists between the variables, short run and long run causality can be inferred from VEC framework (Granger, 1988; Chan & Woo, 2013). Long run causal relationship can be inferred from lagged error correction term in 'α' which is tested by estimating the LR statistics under zero row restrictions on 'α' (Chan & Woo, 2013). The short-run causality can be inferred from the impacts of the sum of the lags of each explanatory variable on the dependent variables which can be detected using the standard Wald test (Chan & Woo, 2013).

Table 5: Results from VECMs and Diagnostic Tests

Error Correction:	D(ln GDP)	D(ln REM)	D(ln GCF)	D(ln CRE)	D(ln EDU)
Constant	0.054	-0.056	0.027	0.166	0.002
Standard Errors	(0.007)**	(0.120)	(0.052)	(0.045)**	(0.025)
Coint. Eq^n 1	-0.196	1.987	-0.273	-0.498	0.127
Standard Errors	(0.04)**	(0.702)**	(0.304)	(0.266)	(0.148)
Coint. Eq^n 2	0.038	0.432	-0.04	-0.208	0.069
Standard Errors	(0.013)**	(0.227)	(0.098)	(0.086)*	(0.048)
D (ln GDP (-1))	-0.311	1.796	0.115	-0.476	0.176
Standard Errors	(0.119)*	(2.071)	(0.896)	(0.786)	(0.437)
D (ln GDP (-2))	-0.428	4.391	-2.41	-2.117	0.238
Standard Errors	(0.125)**	(2.179)*	(0.942)*	(0.827)*	(0.459)

D (ln REM (-1))	-0.015	-0.014	0.014	0.143	-0.05
Standard Errors	(0.010)	(0.180)	(0.078)	(0.068)*	(0.038)
D (ln REM (-2))	-0.008	-0.003	0.075	-0.087	0.04
Standard Errors	(0.009)	(0.164)	(0.071)	(0.062)	(0.035)
D (ln GCF (-1))	-0.051	0.09	-0.55	0.118	-0.041
Standard Errors	(0.029)	(0.508)	(0.220)*	(0.193)	(0.107)
D(ln GCF (-2)	-0.119	1.45	-0.462	0.184	-0.12
Standard Errors	(0.031)**	(0.536)*	(0.232)*	(0.204)	(0.113)
D (ln CRE (-1))	-0.014	-0.678	0.214	0.205	-0.035
Standard Errors	(0.027)	(0.467)	(0.202)	(0.177)	(0.099)
D(ln CRE (-2))	0.001	-0.618	0.546	-0.087	0.076
Standard Errors	(0.029)	(0.512)	(0.221)*	(0.194)	(0.108)
D (ln EDU (-1))	0.018	0.819	0.325	-0.73	0.557
Standard Errors	(0.054)	(0.934)	(0.404)	(0.354)*	(0.197}*
D (ln EDU (-2))	0.015	-0.125	0.433	-0.661	0.095
Standard Errors	(0.062)	(1.073)	(0.464)	(0.407)	(0.226)
R-squared	0.702	0.602	0.5	0.558	0.419
S.E. Equation	0.013	0.23	0.1	0.087	0.049
Serial Correlation LM X^2 (2)	2.882	15.485**	2.312	8.394*	0.919
Normality X^2 (2)	0.186	7.967*	2.783	2.472	3.867
Heteroscedasticity X^2 (1)	0.392	27.862**	0.003	2.282	0.815
ARCH X^2 (2)	2.122	0.25	0.013	1.031	4.499
Functional form X^2 (1)	0.047	9.165	2.179	2.211	10.009**

Source: Author's calculation, 2022.
Note: a) S.E. is reported in parenthesis.
b) ** at 1% and * at 5% level of statistical significance respectively.

To infer the long-run relationship, the study uses the weak exogeneity test which enables us to explain the dynamic long run relationship between real GDP and other variables. The test result is re-presented in Table 6 which is initially reported in Table 5. The table shows that ECT_s (α) is statistically significant for ln GDP and ln REM whereas ln GCF and ln EDU are statistically not significant in CV1. This shows that the ln GDP and ln REM are endogenous whereas ln GCF and ln EDU are exogenous. From this, the study infers that the long-run relationship between ln GDP and ln REM and the Granger causality may run in either or both directions between the variables.

ln GCF and ln EDU have unidirectional causality running towards ln GDP and / or ln REM which implies that there is no long run feedback from ln GDP and ln REM to these variables. Similarly, in CV2, ln CRE is endogenous whereas ln EDU is exogenous. This shows the Granger causality is running from ln EDU to ln CRE in the long run. The economic interpretation of these results is that the dynamics of the remittances is affected by the growth of the GDP whereas the dynamics of gross capital formation and education level are not affected by the real GDP in the long run. Similarly, dynamics of the education level is not affected by the financial development in the long run.

Table 6: Error Correction Terms and Long-run Granger Causality Analysis

Error Correction	D (ln GDP)	D (ln REM)	D (ln GCF)	D (ln CRE)	D (ln EDU)
Coint. Eq^{n}1	- 0.196	1.987	- 0.273	- 0.498	0.127
	(0.040)**	(0.702)**	- 0.304	- 0.266	- 0.148
Coint. Eq^{n}2	0.038	0.432	- 0.04	- 0.208	0.069
	(0.013)**	- 0.227	- 0.098	(0.086)*	- 0.048
CV1	ENDO	ENDO	EXO	-	EXO
CV2	-	-	-	ENDO	EXO

Source: Author's calculation, 2022.
Note: ** at 1% and * at 5% level of statistical significance respectively.

To infer the short-run dynamics, Granger causality / block exogeneity test is carried out. The test results as presented in Table 7 show that bidirectional causality between ln GDP and the gross fixed capital formation (ln GCF) in short run. There is no direct impact of remittances on the economy growth. There is unidirectional causality from ln GCF to ln REM and from ln REM to ln CRE. Similarly, the short-run dynamics of the ln CRE is affected by ln EDU, ln GDP, and ln REM whereas ln CRE affects ln GCF. For easier interpretation, the Granger causality test results are presented in the given graphical presentation in Figure 1. The arrowhead in the figure represents the direction of the causality. Overall, the test results show that remittances have no direct effects on economic growth. Similarly, other factors which are frequently seen as the determinants of economic growth like education and financial development also have no direct impacts on the GDP in the short run. These factors have indirect effects on the economic growth through their effects on GCF.

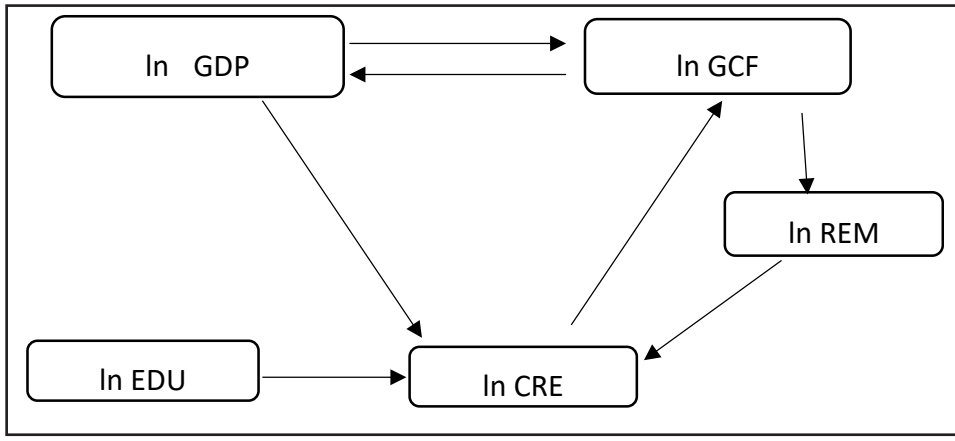
Table 7: Granger Causality / Block Exogeneity Test

Dependent Variable	Wald Test Statistics				
	D (ln GDP)	D (ln REM)	D (ln GCF)	D (ln CRE)	D (ln EDU)
D (ln GDP)	-	2.43	14.62**	0.25	0.22
D (ln REM)	4.38	-	8.28*	3.74	0.83
D (ln GCF)	6.85*	1.31	-	8.15*	1.79
D (ln CRE)	6.78*	6.06*	1.01	-	9.70**
D (ln EDU)	0.38	2.82	1.07	0.61	-

Source: Author's calculation, 2022.
Note: ** at 1% and * at 5% level of statistical significance respectively.

Combining the results from the long-run and short-run causal analysis, it can be drawn the following insights from the results. Remittances have no direct affects the GDP in the short-run but there is affect GDP in the long-run. Similarly, education also has effects on GDP results in the long-run which are not evident from the short-run dynamics. Similarly, in the short run, remittances seem to have effects on financial development. But, in the long run, remittances have no effects on financial development.

Figure 1: Schematic Short Run Granger Causality



Source: Author's creation, 2022.

Robustness Check

To establish the reliability and validity of the estimate produced by VEC model, the study used several diagnostic tests (for serial autocorrelation, heteroskedasticity, and normality test and also dynamic stability tests. Similarly, the study carried out Generalized Impulse Response Function (GIRF) and Generalized error forecast variance decomposition which are in line with the findings of VECM model establishing the robustness of our analysis. The results

and findings of these analysis are not presented for the sake of brevity of the paper and is available on request from the author.

The robustness of the analysis may, however, be jeopardized from the 'Spurious Regression' due to non-stationary of the time series (Granger & Newbold, 1974). To address this issue, the unit root tests, and Johansen's co-integration test were carried out and established the presence of co-integration (See: Appendix I). However, the structural breaks in the time-series (somehow ad hoc) choices to be made about the prior model specification like choice of the deterministic parts, lag length selection, and innovation process distribution may impact the model estimation of the study (Ghouse et al., 2018). Hence, further robustness check was carried out for structural breaks, Gregory-Hansen (G-H) co-integration test (Gregory & Hansen, 1996a, 1996b), and Bayer and Hanck (2013) test of non-co-integration test (available on request from the authors). The analysis shows that our VEC model specification is robust to structural breaks.

Conclusion and Discussion

The study used VECM methodology to explore the dynamic relationship between economic growth and remittances. After establishing co-integrating relationships between the variables of the system, the Long Run Structural Modelling (LRSM) was carried out which shows that there is long-run relationship between remittances and GDP per capita. To discover the short-run dynamics among the variables, the VECM was carried out which showed that remittances do not contribute to economic growth in short-run.

Next, the study checked for the direction of causality among the variables for both long-run and short-run relationships. To infer the direction of long-run causality, the weak exogeneity test was carried out. The analysis showed that there is bidirectional causality between the remittances and GDP per capita in the long run. On the other hand, ln GCF and ln EDU have unidirectional causality running to ln GDP and/or ln REM. To check for the short-run causality, the study applied Granger causality/block homogeneity test. The result showed that there is bidirectional causality between the ln GDP and the ln GCF in the short run. However, there is no direct causality between remittances and the ln GDP. There is one way causality from ln GCF to ln REM and from ln REM to ln CRE in short run.

Similarly, the study used Generalized impulse response function and Generalized forecast variance decomposition analysis which showed that the shock in the remittance flow have slightly negative impact on real GDP per capita during the forecast horizon (of ten years). The analysis showed that remittances play important role in the economic growth in Nepal and shaping the dynamics of other variables in the system.

However, the study found that remittance inflow has small but positive and significant effects on economic growth in the long run. But, in the short run, the effects are not significant. There is bi-directional causality between the remittance and GDP per capita in the long run. The dynamic analysis of the relation between remittances and other variables in the system showed that any negative shocks in the remittances have negative impact on economic growth during the forecast horizon (of ten years). Similarly, except for human capital, remittance response to shocks in other variables in the system in the counter-cyclical manner. The system is dynamically stable with shocks in the system are established within 5 to 6 years of the shocks. Overall analysis showed that remittances have a significant effect on the long-run economic growth and influence the dynamics of other variables in the system.

The findings of the study are in line of existing literature which show remittances have small but positive impact on the economic growth (Cazachevici et al., 2020). In short run, remittances have no effect on economic growth. These findings are consistent with previous study which echoed that the remittances received by households are mostly spent in consumption purpose and are not invested in productive uses (CBS, 2011) which may not direct impact on the economic growth in short run. However, even in the short run, remittances may have indirect effects on economic growth via other channels. Our analysis showed that the remittances have causal impact financial development (Proxied by GDP share of credit to private sector) which may, in turn, affect the economic growth in short run. The analysis of the study also showed that human capital (Proxied by Gross enrollment in secondary education) has the highest and persistent effect on the economic growth in long-run. Several household-level studies have shown that remittances help in improving the educational attainment in remittance-receiving households (Mansour et al., 2011; Thapa & Acharya, 2017; Zhunio et al., 2012). So, remittances can also help in economic growth in long-run through its impact on human capital formation.

This finding corroborates with stable but low average economic growth rate and sustained achievement in human development indicators in Nepal even after prolonged political instability and civil conflicts in Nepal. Overall, remittance inflow has direct and indirect positive impact on the economic growth of Nepal. While highlighting the positive impact of remittances on economic growth on Nepal, an equally important, if not more, factors to be addressed is the welfare of the migrant workers themselves who have the prime sources of the remittances. Nepali migrant workers are employed mainly as unskilled workers and are often subjected corrosive and exploitative working environment (MoLE, 2014). Moreover, other social impacts associated with labor migration and the remittances inflow should also be addressed while emphasizing the positive impact of the remittances. There are several pros and cons of remittance flow at both micro and macro levels beyond its impact on economic growth (Amuedo-

Dorantes, 2014). Hence, better understanding of the impact of the remittances is needed for formulating policy measures as well.

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Appendix I: Unit Root Test

Augmented Dicky Fuller (ADF) Test					
	Level		**First Difference**		
Variables	**Const.**	**Const. with trend**	**Const.**	**Const. with trend**	**Inference**
ln GDP	1.641	- 1.693	- 1.855	- 7.543***	I(1)
ln REM	- 0.145	- 1.822	- 1.99	- 5.037***	I(1)
ln EDU	- 0.771	- 2.83	- 4.070***	- 3.948**	I(1)
ln GCF	- 0.562	- 2.273	- 7.278***	- 7.182***	I(1)
ln CRE	0.069	- 3.342	- 4.958***	- 4.854***	I(1)
Phillips-Perron (PP) Test					
	Level		**First Difference**		
Variables	**Const.**	**Const. with trend**	**Const.**	**Const. with trend**	**Inference**
ln RGDP	2.866	- 1.637	- 6.979***	- 8.375***	I(1)
ln REM	- 0.36	- 2.055	- 5.296***	- 5.315***	I(1)
ln EDU	- 1.689	- 3.017	- 4.101***	- 4.011**	I(1)
ln GCF	- 0.106	- 2.8	- 7.617***	- 7.680***	I(1)
ln CRE	0.084	- 3.054	- 5.065***	-5.022***	I(1)
Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test					
	Level		**First Difference**		
Variables	**Const.**	**Const. with trend**	**Const.**	**Const. with trend**	**Inference**
ln GDP	0.785***	0.139	0.521**	0.087	I(1)
ln REM	1.330***	0.133	0.2	0.128	I(1)
ln EDU	0.408	0.091	0.165	0.117	I(0)/I(1)
ln GCF	0.405	0.123	0.162	0.071	I(0)/I(1)
ln CRE	2.875***	0.062	0.064	0.046	I(1)

Co-integration testing and testing for model fit

Appendix II: Lag Length Selection Criterion for VAR Model

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
1	216.376	NA	6.39E-12*	-11.598	-10.465*	-11.217*
2	236.457	27.993	9.39E-12	-11.300	-9.033	-10.537
3	270.425	37.056	7.07E-12	-11.844*	-8.443	-10.670
4	292.373	17.292	1.56E-11	-11.659	-7.1241	-10.133
Note: * indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						

FPE: Final prediction error				
AIC: Akaike information criterion				
SC: Schwarz information criterion				
HQ: Hannan-Quinn information criterion				

Appendix III: Test of Model Fit (VAR Model)

Test	VAR (1)		VAR (3)	
	Stat	p-value	Stat.	p-value
Joint Normality (Jarque-Bera) test	43.641	0.000	18.005	0.055
Serial correlation LM test	27.133	0.349	24.734	0.477
Heteroskedasticity test (joint)	161.517	0.246	466.715	0.283

Note: Lag-length for serial correlation test are selected as 1 & 3 for VAR(1) & VAR(3) models respectively.

Appendix IV: Pantula Principle

Hypothesis		Trace Statistic					
		Model 2		Model 3		Model 4	
Null	Alternative	Statistic	Critical Value	Statistic	Critical Value	Statistic	Critical Value
r = 0	r =1	55.907	34.4	34.612	33.64	40.055	37.86
r ≤ 1	r = 2	31.630	28.27	28.923	27.42	33.013	31.79
r ≤ 2	r = 3	19.217*	22.04	18.497	21.12	26.278	25.42
r ≤ 3	r = 4	11.206	15.87	10.045	14.88	15.625	19.22
r ≤ 4	r = 5	7.632	9.16	0.0409	8.07	9.857	12.39
Maximal Eigen Value Statistics							
r = 0	r ≥ 1	125.592	75.98	92.118	70.49	124.830	87.17
r ≤ 1	r ≥ 2	69.685	53.48	57.506	48.88	84.775	63
r ≤ 2	r ≥ 3	38.055	34.87	28.582*	31.54	51.761	42.34
r ≤ 3	r ≥ 4	18.837	20.18	10.086	17.86	25.484	25.77
r ≤ 4	r = 5	7.632	9.16	0.0410	8.07	9.857	12.39

Note: a) Critical value is given for 5% significance level.
b) * Denotes the first time when the null hypothesis is not rejected for the 5% significance level.

Appendix V: VEC Stability Condition Check

Roots of Characteristic Polynomial (modulus)		
Model 2, r = 2	**Model 2, r = 3**	**Model 3, r = 2**
1.002	1.011	1
1	1	1
1	1	0.962
1	0.907	0.927
0.896	0.907	0.927
0.896	0.893	0.907
0.779	0.893	0.907
0.779	0.571	0.569
0.602	0.571	0.569
0.602	0.558	0.564
0.597	0.553	0.546
0.487	0.551	0.546
0.431	0.551	0.523
0.369	0.443	0.43
0.369	0.443	0.43

Appendix VI: Co-integration Test

Hypothesized No. of CE(s)	**Eigen Value**	**Statistic**	**Critical Value (0.05)**	**Prob.****
Unrestricted Co-integration Rank Test (Trace)				
None *	0.712	104.549	69.819	0
At most 1 *	0.654	63.515	47.856	0.001
At most 2	0.448	28.454	29.797	0.071
At most 3	0.228	8.837	15.495	0.381
At most 4	0.009	0.307	3.841	0.58
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
None *	0.712	41.033	33.877	0.006
At most 1 *	0.654	35.061	27.584	0.005
At most 2	0.448	19.617	21.132	0.08
At most 3	0.228	8.53	14.265	0.327
At most 4	0.009	0.307	3.841	0.58

Note: a) * Denotes rejection of the hypothesis at the 0.05 level.
b) ** MacKinnon-Haug-Michelis (1999) p-values.