CHAPTER FIVE

IMPACT OF REMITTANCE ON INFLATION

Though a number of factors are responsible causing inflation in Nepal, this chapter is devoted to analyzing the impact of remittance along with instability, and growing population on inflation in Nepal. The next chapter endeavors to examine the role of Nepalese money supply and Indian inflation on price level in the economy of Nepal.

5.1 Political Instability

Over the past several decades Nepal has witnessed significant political instability. Since the restoration of multi-party democracy in 1990 alone, more than eighteen different governments have been formed and numerous cabinet reshuffles and no-confidence motions have occurred. A Maoist insurgency launched in earnest in 1996 has resulted in more than 15,000 deaths and considerable damage has been inflicted upon both public and private infrastructure and assets. Since 1990, a number of strikes and other political activities have caused the country's economy close to being fully paralyzed.

Though multiparty democracy is claimed to be the best political system in a country, Nepal has victimized by political instability after restoration of multiparty democracy in 1990. No government has been run full-fledge after 1990. Feng (1997) opines that irregular changes in government bring political instability. In contrast to the uncertainty caused by regime interruption resulting from irregular government change, major regular government change offers policy adjustments without fundamental change in the political order. In the short run, major regular government change may create uncertainty in some economic areas, and its effect on growth may be ambiguous. In the long run, however, major regular government change reflects a pattern of system adjustability and government accountability in favor of economic performance, and is thus likely to produce higher growth (Feng, 1997, p. 397).

Due to the political instability, there have been problems in policy formulations. Even if some policies are formulated, such formulated policies could not have been implemented effectively when government changed within very short period. After it as new government was formed, same problems were experienced. This political

instability in Nepal has slowed the pace of industrialization. New investors could not have been attracted to invest in industries including hydropower. Nepal has been able to generate hydropower less than one percent of its total potential. Inadequate electricity, poor road infrastructure and slow pace of industrialization are mainly due to the political instability in Nepal. In the absence of these factors, Nepal is compelled to depend upon imports from India and other countries. If commodities are imported, instead of producing them in own country, the price level automatically rises. Same has occurred in Nepal also and double digit inflation is being experienced for last eight years.

Nepal does not lack resources for economic development as it was mentioned in the past. The donors can provide aid. In addition, remittance inflows have been increasing, which can be used to import capital and technology. Many domestic and non-resident Nepali are ready to invest in industries and social infrastructure. Moreover, Nepal can easily attract foreign direct investments because of tremendous potentiality in hydropower and tourism, and being in a strategic location between two growing nations China and India. Despite this, the ongoing political conundrum has been keeping Nepal as a hostage to start off economic prosperity. So long as economic prosperity is not gained, price stability is impossible. So, for economic prosperity, first there should be political stability and economic prosperity, in turn, brings price stability in a country.

5.2 Remittance

Remittance plays crucial role in the economic development of developing and underdeveloped countries. It has both positive and negative effect on the economy by contributing economic growth and economic development. As a positive effect, Yaseen (2012) discusses that the spread channels by which the funds of remittances of the emigrated workers can have positive effects on the growth of their home country; The transmitted funds can fund the dynamic investment, moreover , when these funds are deposited in financial institutions whether local or intentional in terms of savings, this will imply a significant increasing and raising in the financial resources of these financial institutions, hence it will encouraging these institutions to expand its performance by granting more credit to the companies in their markets for short or long term loans, and granted by non banking financial institutions to companies or

households; on the other hand, when the families of the emigrated workers encounter difficulties of credit rationing, the remittances enable them to get out of these difficulties and are able to finance their needs for consumption or their capital expenditures. Of course, in order this effect takes place, it is necessary that the families which receive these funds, be driven to do that.

In the literacy on remittances, one finds a number of theoretical as well empirical papers in which the impacts of the remittances on the macroeconomic performance of the recipient countries are estimated to be rather negative. These negative effects can be gathered and analyzed around three analytical topics: first, the insensible monetary penalty of the entry of foreign currencies in a low developed country open to the movements of capital, this throughout their sound effects on the exchange rate level of the home currency and on the domestic price level. Second, the uses of these funds, either within the family of the migrant worker or by the worker himself who chooses to spend his savings through real estate investment. Finally, the effect of the remittances can be also negative in terms of lacking among the members of the family remained in home country. These types of risk are considered as critical from a macroeconomic point.

The remittances, in some beneficiary countries or families, can stimulate members of the family who profit from these incomes, living in the country of migrants' origin, to be satisfied to live within this without working or by withdrawing from the local labor market; one observes also scenarios in which these recipients use remittances while launching themselves in showy consumptions or of luxury goods often imported from abroad, certain expenditure in projects not very relevant or in badly studied investments can lead to the wasting of these funds.

Reinhart and Rogoff (2004) opine that different exchange rate regimes have considerably a number of effects on macroeconomic variables in the economy. Under a fixed exchange rate regime, for instance, an increase in remittances will move resources from the tradable to the non-tradable sector. This will result in an increase in the price level. Since the exchange rate is fixed, the country cannot adjust its international relative prices after a negative shock to the tradable sector. The nominal depreciation is, thus, prevented, and as a result, the tradable output contracts and the price level rises.

On the other hand, under a flexible exchange rate regime, since international relative prices can be adjusted following a large inflow of remittance, the resulting effect will be a rising price level and appreciation of the exchange rate. Ball, et.al. (2012) provides evidence that the fixed exchange rate regime the remittance temporarily increases inflation and GDP in small open economy. Likewise, Narayan, et.al. (2011) studied the impact of remittance on inflation for 54 developing countries employing Arellano and Bond panel dynamic estimator, Arellano and Bover, Blundel and Bond system generalized moments and found that remittance generates inflation. According to them, the effect of remittance on inflation is more pronounced in the long run.

5.3 Population Growth

Population growth is closely tied to economic development. On the one hand, labor shortages will slow the rate of economic growth in industrialized countries, but on the other hand, a high birthrate in a developing country may stress limited renewable resources. Governments in western and other industrialized countries like Japan are challenged to create effective immigration policies and programs to increase the birthrate, while countries with weaker economies pursue public health policies to reduce population growth. Globally, a smaller population presents multiple benefits from an ecological perspective, but some economies are challenged by low birthrates and are redirecting their need for unskilled labor to countries with higher population and lower wage demands.

Population increase put forth supplementary strain on natural resource utilization. People have to fed, housed, and dressed; as population raises, the requirement for food and materials swells. The escalating utilization of land and resources, at some position go beyond the carrying facility and causes the natural resources ineffective or exhausted. This could effect in economic hardship. Specifically every addition in population has directed to more troubles than settlement. As high growth of population takes place in the country, the resources will be emptied in investing basic infrastructure such as schooling, health care, even feeding etc. in such a situation, there will be less saving that causes less capital formation. As a result, scarcity of output is causing price to rise.

5.4 Trend of Remittance in Nepal

As Nepal introduced trade and economic liberalization policies in the mid-1980s, the international labor market gradually opened up to the job-seeking Nepali youths. Though there was a long history of labor migration in the country, Nepal witnessed most of the young population migrating every year for the search of work abroad in the recent decades because of economic as well non-economic factors. The work related emigration, excluding India, increased from about ten thousands in early 1990s to more than 300 thousands in 2010.

Table-5.1 portrays the flow of remittance income and percentage change in remittance from 1999/00 to 2011/12. The Table reveals that remittance income has increased by 62.44 % from 1999/00 to 2000/01 and this percentage increase reduced to 48.91 % in FY 2001/02. Remittance is found to be increased by 185.33 % in FY 2002/03. The FY 2002/03 was extremely favorable for Nepalese economy in terms of remittance. After 2002/03, the remittance incomes are found to be increasing at fluctuating rate.

Table-5.1: Remittance Income and Percentage Change

Year	Remittance (Million Rs)	Percentage Change	Year	Remittance (Million Rs)	Percentage Change
1999/00	603.14	-	2006/07	13942.15	29.79
2000/01	979.76	62.44	2007/08	19421.56	39.30
2001/02	1458.98	48.91	2008/09	21399.89	10.18
2002/03	4163	185.33	2009/10	23296.32	8.86
2003/04	5662.98	36.03	2010/11	33336.68	43.09
2004/05	6178.48	9.10	2011/12	9274.86	50.11
2005/06	10741.74	15.81			

Source: Economic Survey 2013/14

Figure-5.1: Line Graph of Remittance

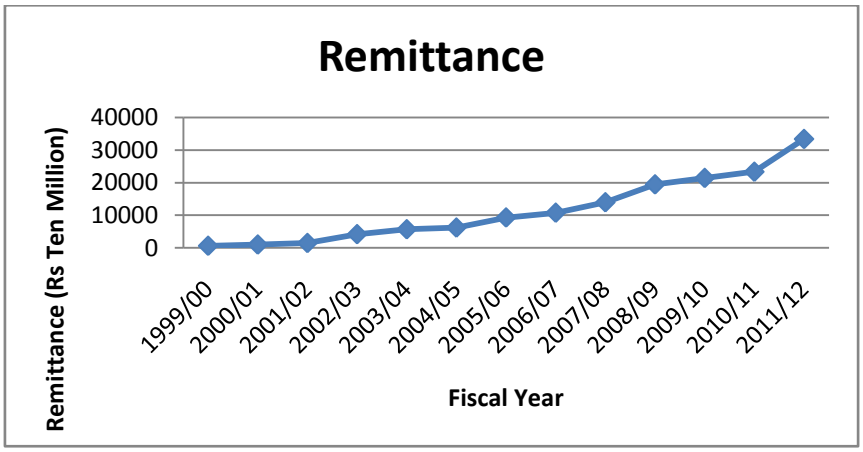


Figure-5.1 represents line graph of remittance income (Ten Million Rs) from FY 1999/00 to 2011/12. The flow of remittance is found to be increasing continuously during the study period as reported by rising line of remittance.

5.4.1 Trend of Remittance by Hodrick-Prescott Filter

The Hodrick-Prescott Filter is a smoothing method that is widely used among macroeconomists to obtain a smooth estimate of the long-term trend component of a series. The method was first used in a working paper (circulated in the early 1980's and published in 1997) by Hodrick and Prescott to analyze postwar U.S. business cycles.

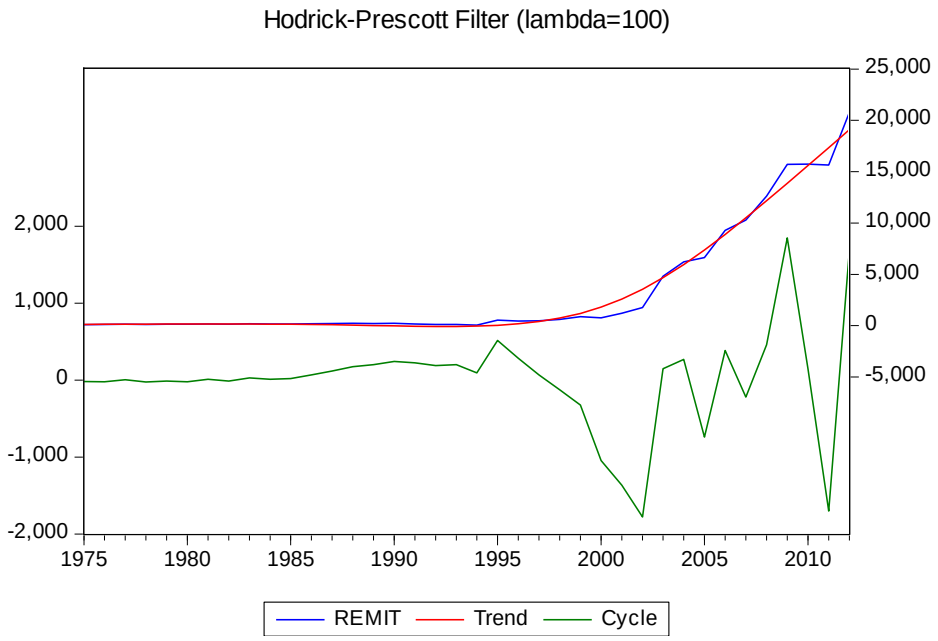
Technically, the Hodrick-Prescott (HP) filter is a two-sided linear filter that computes the smoothed series s of y by minimizing the variance of y around , subject to a penalty that constrains the second difference of s. That is, the HP filter chooses s to minimize:

$$\sum_{t=1}^{T}(y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1}\left((s_{t+1} - s_t) - (s_t - s_{t-1})\right)^2 \qquad (5.1)$$

The penalty parameter λ controls the smoothness of the series σ. The larger the λ, the smoother the σ. As $\lambda = \infty$, s approaches a linear trend.

Figure-5.2 presents the trend of remittance in real terms by Hodric-Prescott (H-P) filter, which suggests that remittance had started at the review period at around Rs101 (in ten million) and continued in three digits till 2000 and thereafter increased to four digits from 2001. This continued to increase in all periods except slight fall in 2011.

Figure-5.2: Trend of Remittance (Real) by H-P Filter



5.5 Empirical Analysis

(Impact of Remittance, Population Growth and Political Instability on Inflation)

In order to analyze the impact of remittance, population growth and political instability on inflation empirically, the econometric techniques such as Johansen's Cointegration Test, Vector Error Correction Models and Granger Causality Test have been used. Though the present research has employed the quarterly data sets of money supply and price level, in this section annual data sets of remittance, population growth and inflation have been used. The quarterly data of population is not available in Nepal. Likewise, data associated with remittance are also not available on quarterly basis. That is why, for analyzing the impact of remittance, population growth[18] and political instability on inflation, annual data[19] sets of concerned variable are used. For political instability, the dummy variable has been used for which dummy takes the value 1 for presence of political instability and otherwise zero. In Nepal, the political instability has been experienced since 1996 and till the last of study year. However, there was more or less political stability prior to 1996 though there was party-less

[18] The data on Population is taken from World Bank Fact Book 2014.

[19] The data on CPI and Remittance are taken from Economic Survey 2012/13 (Ministry of Finance, Kathmandu, Nepal).

Panchayat system in Nepal. Therefore, the dummy takes 1 for each year after 1995 and 0 prior to 1996.

The annual data sets of CPI have been transformed into logarithmic form. The $LnCPI$ is found to be non-stationary at level form and stationary at first difference. The first difference[20] of $LnCPI$ is represented as P_t and it is the representative of inflation. The nominal data sets of remittance are first converted into real term taking 2005/06 as base year and transformed into logarithmic form. $LnRemittance$ is also found to be non-stationary at level form and stationary at first difference. The first difference of $LnRemittance$ is represented by $Remit_t$. Similarly, first difference of $LnPopulation$ is taken as the proxy of population growth and represented by PG_t. In Nepal, the political instability is associated with frequent changes in government and non-occurrence of local level election. After the restoration of multiparty democracy in 1990, full-fledged government was conducted till 1996. Thereafter, due to political instability in Nepal, government changed frequently that brought political instability. The last local election was held in 1999. Thereafter, the local level election has not been held up to the present time. Due to the political instability, there was lacking of policy variables to control inflation. Two types of dummies have been used in the present study as the representatives of political instability. The first is the frequent changes of government and second is the non-occurrence of local level election.

The functional form of inflation is given by:

$$P_t = f(Remit_t, \mathrm{PG_t}, \mathrm{Polins_t})$$

Under $\mathrm{Polins_t}$, two dummies such as $\mathrm{Govch_t}$ and $Noelct_t$ have been used which represent Government Change and No Election in local level respectively.

In linear form,

$$P_t = \alpha_1 Remit_t + \alpha_2 \mathrm{PG_t} + \alpha_3 \mathrm{Govch_t} + \alpha_4 Noelct_t + \varepsilon_t \qquad (5.2)$$

[20] However, the non-stationary variables are used in Cointegration and VEC models and stationary variables are used in Granger Causality test.

5.5.1 Johansen's Cointegration Test

Before carrying out the cointegration test of Johansen, it is necessary to find out the appropriate lag of the concerned variables under analysis length. There are various criteria for selecting the lag length. Table-5.2 reveals the selection of lag length through VAR technique.

Table-5.2: VAR Lag Order Selection Criterion

(Endogenous variables $P_t, Remit_t, PG_t$)

Lag	Log L	LR	FPE	AIC	SC	HQ
0	8.8370	NA	0.0001	-0.353763	-0.21771	-0.3079
1	214.3926	361.2794	9.48e-10	-12.2662	-11.7220	-12.0831
2	258.4506	69.42475	1.15e-10	-14.3909	-13.4386*	-14.0705*
3	264.7296	8.7524	1.41e-10	-14.2260	-12.8655	-13.7682
4	279.8747	18.357*	1.05e-10*	-14.5984	-12.8298	-14.0033
5	289.1739	9.5809	1.18e-10	-14.6166*	-12.4398	-13.8841

It is observed from the Table- 5.2 that HQ and SC statistics for lags 2 are significant at 5 % level. So lags 2 are selected for each endogenous variable in their autoregressive and distributed lag structure in estimable cointegrating equations and VEC models.

The Johansen method of cointegration is based on Max-Eigen and Trace Statistic value. The following results have been revealed for Johansen approach while allowing linear deterministic trend (intercept and trend in cointegrating equation and no intercept in VAR) in the data.

Table 5.3: Cointegration Test Based on Maximum Eigen Value ($\lambda_{\max}$)

Endogenous Variables: $P_t, Remit_t, PG_t$ and $Polins_t$(Govech and No Elect) as exogenous variable

Order of VAR = 2 Sample: 1975-2012

H_0	H_a	λ_i	$\lambda_{\max}$	0.05 Critical Value
r = 0*	r = 1	0.5596	28.7029	25.8232
r ≤1*	r = 2	0.3178	13.3864	19.3870

Table-5.4: Cointegration Test Based on Trace Statistic (λ_{Trace})

H_0	H_a	λ_i	λ_{Trace}	0.05 Critical Value
r = 0*	r = 1	0.5596	53.6639	42.9152
r ≤1*	r = 2	0.3178	24.9610	25.8721

Using second order VAR of the three endogenous variables ($P_t, Remit_t, PG_t$) and Polins_t as exogenous variable under investigation, the hypothesis of r = 0 is strongly rejected in favor of the alternative hypotheses r = 1 employing the maximum Eigen-value test as reported by the 4th column of Table 5.3. The maximum Eigen-value test of r = 1 versus r = 2 fails to reject the null hypothesis of k = 1, implying one cointegrating vector. Based on the Maximum Eigen-Value Test, one cointegrating vector (r =1) is detected among the endogenous variables $P_t, Remit_t, PG_t$ and Polins_t as exogenous variable. Thus, on the basis of maximum Eigen-value test, the variables under study are found to be cointegrated.

Turning to the trace test as reported by Table 5.4, the null hypothesis r ≤1 cannot be rejected while the hypotheses r = 0 is rejected at 5 percent significant level indicating one cointegrating vector (r =1). The Trace test also indicates that the variables under study are cointegrated.

Both Maximum Eigen-Value test and Trace Test indicate that the variables $P_t, Remit_t$ *and* PG_t are cointegrated, there is found to be long run equilibrium relation among these variables during the study period 1975-2012.

5.5.2 Vector Error Correction (VEC) Models

A vector error correction (VEC) model is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the *error correction* term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

As indicated by VAR lag selection criteria in Table-5.2, lags 2 are suitable for each endogenous variable in accordance with SC and HQ criteria. The estimable VEC models are presented as:

$$dP_t = \gamma_1 + \rho_1 Z_{1_{t-1}} + \alpha_1 dP_{t-1} + \alpha_2 dp_{t-2} + \alpha_3 dRemit_{t-1} + \alpha_4 dRemit_{t-2} + \alpha_5 dPG_{t-1} + \alpha_6 dPG_{t-2} + \mu_1 Govch_t + \mu_2 Noelc_t + \varepsilon_{1t} \quad (5.3)$$

(dP_t as dependent variable and dP_t at lag 1 and 2, $dRemit_t$, dPG_t at lag 1 and 2; and $Govch_t$ *and* $Noelc_t$ as independent/exogenous variables)

$$dRemit_t = \gamma_2 + \rho_2 Z_{2_{t-1}} + \beta_1 dP_{t-1} + \beta_2 dp_{t-2} + \beta_3 dRemit_{t-1} + \beta_4 dRemit_{t-2} + \beta_5 dPG_{t-1} + \beta_6 dPG_{t-2} + \mu_1{}' Govch_t + \mu_2{}' Noelc_t + \varepsilon_{1t} \quad (5.4)$$

($dRemit_t$ as dependent variable and dP_t at lag 1 and 2, $dRemit_t$ as well as dPG_t at lag 1 and 2 and $Govch_t$ *and* $Noelc_t$ as independent/exogenous variables)[21]

The results from Vector Error Correction Models of equation (5.3) are presented through Table-5.5. From Table-5.5, it is observed that:

i) With dP_t as dependent variable the coefficient of error correction term ($Z_{1_{t-1}}$), ρ = -0.44 is significant at 1% level, which indicates that the short run shocks significantly affect the long run relationship among the variables $dP_t, dRemit_t, dPG_t$ and $Polinst_t$.

ii) The negative value of ρ = -0.44 indicates that dP_t , following any positive short run shocks, declined. Consequently, the short run shocks appeared to pull down the dP_t below the long run equilibrium level.

iii) The absolute value of the coefficient of Z_{t-1} to be lower than unity, i.e. $|\rho_1| < 1$, which implies that dP_t converged to the long run equilibrium level following a short run shocks. Thus, long run relationship between dP_t as dependent variable and$dRemit_t, dPG_t$ and; $Govch_t$ *and* $Noelc_t$ independent variables is found to be stable. Consequently, the short run dynamics defined an 'equilibrium' process.

[21] Other equations can be formulated by the similar process.

iv) The coefficient of $dRemit_{t-1}$ is positive and significant only at 10% level. This implies that there is little economic significance regarding the relationship between inflation and remittance in short run. The remittance at time $'t-1'$ is found causing the inflation at time $'t'$.

Table-5.5: Vector Error Correction Modeling

Dependent Variable: dP_t

Variable	Coefficient	Std. Error	t-Statistic
$Constant$	γ_i = -0.1256	0.0852	-1.4731
Z_{1t-1}	ρ_1 = -0.4404	0.1275	-3.4521
dP_{t-1}	α_2 = 0.1452	0.1459	0.9952
dP_{t-2}	α_3 = -3000	0.1465	-2.0479
dPG_{t-1}	α_4 = -3.9583	11.2216	-0.3527
dPG_{t-2}	α_5 =13.5690	12.2348	1.1090
$dRemit_{t-1}$	β_1 = 0.0343	0.0183	1.8699
$dRemit_{t-2}$	β_2 = 0.0071	0.0147	0.4841
$Govch_t$	μ_1= 0.0213	0.0243	0.1132
$Noele_t$	μ_2= 0.0045	0.0123	0.1932

5.5.3 Granger Causality Test Based on Wald Test

In order to know the causality among the variables under study, we have applied the Granger causality/ Block exogeneity Wald test (Enders, 2003, p. 284). This test detects whether the lags of one variable can Granger-cause any other variables in the VAR system. The null hypothesis is that all lags of one variable can be excluded from each equation in the VAR system. For example, this test helps to answer whether or not all lags of $dRemit_t$ can be excluded from the equation of dP_t or not. Rejection of the null hypothesis means that if all lags of $dRemit_t$ cannot be excluded from the dP_t equation then dP_t is an endogenous variable and there is causality of $dRemit_t$ on dP_t. The test statistic is (Enders, 2003, p. 282)

$$(T-3\rho-1)(Log|\sum re|-Log|\sum un|)-\chi^2(2\rho) \tag{5.5}$$

Where T is the number of observations; $\sum un$ is variance/covariance matrices of the unrestricted VAR system; $\sum re$ is variance/covariance matrices of the restricted system when the lag of a variable is excluded from the VAR system; and p is the number of lags of the variable that is excluded from the VAR system.

The results from VEC Granger causality/block exogeneity Wald test have been presented through Table-5.6 that portrays the block exogeneity Wald tests of three

equations. Equation first has the dependent variable dP_t; equation second and third have the dependent variables dPG_t and $dRemit_t$ respectively. Equation first has the hypotheses:

H_{01}: dPG_t does not Granger cause dP_t up to lag 2 H_{a1}: dPG_t Granger causes dP_t up to lag 2

H_{02}: $dRemit_t$ does not Granger cause dP_t up to lag 2 H_{a2}: $dRemit_t$ Granger causes dP_t up to lag 2.

Table-5.6: VEC Granger Causality/Block Exogeneity Wald Tests

Dependent Variable: dP_t Exogenous Variable $Polins_t$

Excluded	Chi-square	DF	Prob.
dPG_t	7.7205	2	0.0211
$dRemit_t$	3.8000	2	0.1496

The probability value of excluded variable dPG_t is 0.0211 and Chi-square statistic at 2 degree of freedom is 7.720. There is strong evidence of rejecting the null hypothesis H_{01} as indicated by Chi-square statistic and probability value. This allows us to consider the alternative hypothesis H_{a1}. Therefore, it can be concluded that dPG_t up to its 2 lags has Granger caused dP_t.

However, the null hypothesisH_{02}: $dRemit_t$does not Granger cause dP_t up to lag 2, cannot be rejected as implied by low χ^2 and high probability value. This concludes that $dRemit_t$ up to lag 2 has not Granger caused dP_t.

It is, therefore, under VEC model, only the dependent variable dP_t is found Granger caused by the independent variable, dPG_t up to lags 2. Hence, it can be concluded that Nepalese inflation is caused by population growth. There is no evidence of remittance causing inflation in Nepal during the study period 1975-2012.

5.6 Stability of VEC Model

For the stability of the estimated VEC model of equation (5.3), we perform the Portmanteau test and VEC Heteroscedasticity test to examine whether any autocorrelation exists in residuals. If residuals of estimated VEC model of equation

(5.3) are not autocorrelated, then the model bears the property of stability or efficiency.

5.6.1 Portmanteau Test

A Portmanteau test computes the multivariate Box-Pierce/Ljung-Box Q-statistics for residual serial correlation up to the specified order (Lütkepohl, 1991, 4.4.21 & 4.4.23). We report both the Q-statistics and the adjusted Q-statistics (with a small sample correction). Under the null hypothesis of no serial correlation up to lag h , both statistics are approximately distributed χ^2 with degrees of freedom $k^2(h-p)$ where p is the VAR lag order. The asymptotic distribution is approximated in the sense that it requires the MA coefficients to be zero for lags $> h-p$. Therefore, this approximation will be poor if the roots of the AR polynomial are close to one and h is small. In fact, the degree of freedom becomes negative for $h < p$.

The null hypothesis for Portmanteau test is: there are no autocorrelations up to lag h.

To reject or accept the null hypothesis depends on the corresponding probabilities of Q-statistic and Adjusted Q-statistic. If these Q-statistic and Adjusted Q-statistic are not significant up to lag h, then there is no evidence of rejecting the null hypothesis. Otherwise, the null hypothesis is rejected.

If null hypothesis is not rejected, the residuals are not correlated and the estimated VAR/VEC model is claimed to be stable model. Table-5.7 presents the Portmanteau test of the residuals based on VEC model of equation (5.3) with modification[22].

The estimated VEC model (5.3) after excluding the exogenous variable, political instability becomes:

$$dP_t = -0.1537 - 0.3187Z_{1_{t-1}} + 0.0884dP_{t-1} - 0.3394 * dp_{t-2} + 0.0213dRemit_{t-1}$$

(-2.1605)[23] (-3.997) (0.624) (-2.3676) (1.374)

$$+0.0035dRemit_{t-2} - 7.4303dPG_{t-1} + 19.1492dPG_{t-2}$$

(0.2546) (-0.7014) (1.5133) (5.6)

[22] The VEC model of equation (5.3) has included $political\ instability$ such as government changes and no election as exogenous variable, but the DF and Probability values of Portmanteau test of residuals may not be of the VEC model with exogenous variable. Therefore, we develop the VEC model excluding the exogenous variable and apply Portmanteau test.

[23] Figure in parenthesis shows t-statistic.

From estimated VEC model of equation (5.6) with dP_t as dependent variable (where $Polinst_t$ as exogenous variable is avoided), it is observed that

i) The coefficient of error correction term ($Z_{1_{t-1}}$), ρ = -0.31 is significant at 1% level, which indicates that the short run shocks significantly affect the long run relationship among the variables $dP_t, dRemit_t\ and\ dPG_t$. The speed of convergence of equilibrium of (0.31) implies that inflations are adjusted by 31 % of the past two year's deviation from equilibrium.

ii) The negative value of ρ = -0.31 indicates that dP_t , following any positive short run shocks, declined. Consequently, the short run shocks appeared to pull down the dP_t below the long run equilibrium level.

iii) The absolute value of the coefficient of Z_{t-1} to be lower than unity, i.e. $|\rho_1| < 1$, which implies that dP_t converged to the long run equilibrium level following a short run shocks. Thus, long run relationship between dP_t as dependent variable and $dRemit_t\ and\ dPG_t$ independent variables is found to be stable. Consequently, the short run dynamics defined an 'equilibrium' process.

After estimating VEC model in equation (5.6), our next job is to check the stability test VEC residuals through Portmanteau Tests for Autocorrelations.

In Table-5.7, the Q-statistic and Adjusted Q-statistic of VEC Residual Portmanteau tests are not significant as reported by their corresponding probability values. The null hypothesis 'no residual autocorrelations up to lag $h = 5$' cannot be rejected, which implies that the VEC residuals are not autocorrelated. No autocorrelation of VEC residuals as implied by Portmanteau tests represents the goodness of fit of the VEC model with dP_t as dependent variable and $dRemit_t\ and\ dPG_t$ as independent variables up to lag 2.

Table-5.7: VEC Residual Portmanteau Tests for Autocorrelations

Null Hypothesis: no residual autocorrelations up to lag h

Lags	Q-Stat	Prob.	Adj. Q-Stat.	Prob.	DF
1	1.7680	NA*	1.8200	NA*	NA*
2	15.4451	NA*	16.3260	NA*	NA*
3	19.1469	0.2611	20.3749	0.2038	16
4	29.7947	0.2321	32.3966	0.1469	25
5	42.6650	0.1464	47.4119	0.0630	34

5.6.2 VEC Heteroscedasticity Test

White's (1980) test is a test of the null hypothesis of no heteroscedasticity against heteroscedasticity of unknown, general form. The test statistic is computed by an auxiliary regression, where we regress the squared residuals on all possible (non redundant) cross products
of the regressors.

The $(T \times R^2)$ statistic is White's test statistic, computed as the number of observations times the centered $R^2$from the test regression. The exact finite sample distribution of the F-statistic under H_0 is not known, but White's test statistic is asymptotically distributed as a χ^2 with degrees of freedom equal to the number of slope coefficients (excluding the constant) in the test regression.

If H_0 is not rejected as reported by the χ^2-statistic and its corresponding probability value, it can be concluded that the VEC residuals are not suffering from heteroscedasticity problem, and the estimated VEC model is consistent. Table-5.8 reveals the results from VEC Residual Heteroscedasticity Tests.

Table-5.8: VEC Residual Heteroscedasticity Tests

Joint test:

Chi-sq	df	Prob.
84.30282	84	0.4702

Individual components:

VEC Residual Heteroscedasticity Tests: No Cross Terms (only levels and squares)

Dependent	R-squared	F(14,20)	Prob.	Chi-sq(14)	Prob.
res1× res1	0.5000	1.4285	0.2272	17.5001	0.2305
res2× res2	0.3281	0.6978	0.7520	11.4861	0.6475
res3× res3	0.6609*	2.7850	0.0181	23.1337	0.0581
res2× res1	0.3759	0.8604	0.6064	13.1565	0.5142
res3× res1	0.6188	2.3196	0.0419	21.6604	0.0859
res3× res2	0.3889	0.9094	0.5636	13.6140	0.4788

Looking at the individual component (lower part of Table-5.8), R^2 of res3× res3 is found to be significant as implied by F-statistic (but not by χ^2-statistic) rejecting the null hypothesis. However, the χ^2-statistic of Joint test implies that the null hypothesis is not rejected, which means residuals are homoscedastic. Thus, the VEC Residual Heteroscedasticity test confirms that there is no heteroscedasticity problem in the residuals of estimated VEC model of equation (5.6). Thus, the estimated VEC model is econometrically meaning full and sound.

5.7 Conclusion of Chapter Five

The Chapter Five concludes:

- Inflation, remittance, population growth and political instability (exogenous variable) are cointegrated. There is one cointegrating vector among the variables as reported by Johansen's Cointegration test.
- The short run shocks significantly affect the long run relationship among the variables under study as reported by VEC modeling.
- There is little economic significance between inflation and remittance for which the remittance at lag 1 has caused the inflation.

- As reported by Granger causality/block erogeneity Wald test, Nepalese inflation is found Granger caused by population growth only. The inflation is not Granger caused by remittance during the study period.
- The VEC model of equation (5.3) failed to represent the stability condition due to the inclusion of political instability (government change and no election) as the exogenous variable. The Portmanteau test of autocorrelation denied to estimate the values till it is removed.
- After removing the dummies for political instability (exogenous variables) from equation (5.3), we have formulated VEC model (5.6).
- VEC model (5.6) shows that short run shocks significantly affect the long run relationship among the variables under study.
- The coefficient of error correction term $Z_{1_{t-1}}$ of equation (5.4) is significant at 0.01 level, implying the short run shocks significantly affect long run relationship between the variables under study.
- No autocorrelation and heteroscedasticity have been detected in the residuals of the VEC model (5.6).
- VEC model (5.6) is the econometrically meaning full model.