CHAPTER - 13
SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

13.1 Introduction:

The relationship between Rupee/Nepalese Rupee exchange rate (e_t) and relative price level (p_t) has initially been studied in Chapters 4 and 5. The summary of the main findings on different aspects of such relationship is being presented below.

13.2 Stationarity of Exchange Rate (e_t) and Relative Price Level (p_t) Series (in Chapter 4) in the Historical Dataset for the Period 1976:1-2006:1

The study in Chapter 4 testified that both Exchange Rate (e_t) and Relative Price Level (p_t) series in the Historical Dataset for the Period 1976:1-2006:1.

i. *had 'unit roots' in them at level and these were 'non-stationary' by nature.*

ii. *did not entail any 'deterministic trend'.*

iii. *were stationary upon first differencing.*

iv. *were, therefore, integrated of order one such that $e_t \sim I(1)$ and $p_t \sim I(1)$.*

13.3 Cointegration Between Exchange Rate (e_t) and Relative Price Level (p_t) (Period 1976:1-2006:1)

Study in the Chapter 5 has been devoted to examining the existence of *cointegration* between two non-stationary variables, viz. exchange rate (e_t) and relative price level (p_t) at level. The study is carried through the *Johansen Tests of Cointegration*. The findings in Section 5.3 and 5.4 are as follows.

i. *Rupee/Nepalese Rupee Exchange rate (e_t) was not cointegrated with the relative price (p_t) at level, and therefore.*

ii.   Exchange rate and relative price level series were not CI(1,0).

iii.   The absence of 'cointegration' between e_t and p_t at level testified for the absence of long-run relationship between Rupee/Nepalese Rupee Exchange rate (e_t) and relative price level (p_t) over the period 1976:1 - 2006:1.

iv.   Rupee/ Nepalese Rupee exchange rate (e_t), therefore, was not in parity with the relative purchasing power of currencies of the trading countries concerned.

v.   The 'Purchasing Parity Doctrine' of Exchange rate did not hold good in case of the quoted rates of exchange between Indian Currency (Rupee) and Nepalese Currency (Nepalese Rupee) over the period of study (1976 :1 - 2006 :1).

13.4   Stationarity and Cointegration of Exchange Rate(e_t) and Relative Price Level (p_t) Under Two Different Sub-Periods [1976:1 - 1993:1 and 1993:2-2006 :1]

Two different sub-periods have been identified in the Historical Dataset ranging over 1976:1 - 2006:1. These sub-periods encompass two different structural relations between e_t ant p_t at level. The statonarity of e_t ant p_t in these two sub-periods [1976:1-1993:1 and 1993:2-2006:1] has also been examined in Chapter 5. The major findings are as follows.

In both the sub- periods 1976:1 - 1993:1 and 1993:2 - 2006:1

i.   both e_t and p_t at level were non-stationary.

ii.   both e_t and p_t attained stationarity upon first differencing.

iii.   both e_t ant p_t were, therefore, integrated of order one. Consequently,

iv. $e_t \sim I(1)$ and $p_t \sim I(1)$.

13.5   Cointegration Between Exchange Rate (e_t) and Relative Price Level (p_t) in Two Different Sub-periods [1976:1-1993:1 and 1993:2-2006:1] [Chapter 6]

The cointegration between exchange rate (e_t) and relative price level (p_t) has been examined in Chapter 6 under two different sub-periods, viz, 1976:1-1993:1 and 1993:2-2006:1. The summary of the findings is being presented in Sections 13.5.1 and 13.5.2.

13.5.1 Cointegration Between e_t and p_t at level in the Sub-period 1976:1 - 1993:1

The findings on the *Cointegration* between e_t ant p_t in the sub-period 1976:1 - 1993:1 are as follows.

i.   *e_t and p_t were not cointegrated at level,*

ii.   *e_t and p_t were not CI(1,0).*

iii.   *e_t and p_t were CI(1,1)*

iv.   *There did not exist, therefore, any long-run relationship between Rupee/Nepalese Rupee exchange rate (e_t) and the relative price (p_t) at level in this sub - period.*

v.   *There did exist, therefore, no evidence in favour of parity of Rupee/Nepalese Rupee exchange rate with the purchasing power of currencies concerned i.e, the relative price level prevailing in the two countries concerned during the period 1976:1-1993:1.*

13.5.2 Cointegration Between e_t ant p_t at Level in the Sub-Period 1993:2 - 2006:1

Findings from the study of *cointegration* between e_t and p_t at level in the sub-period 1993:2 -2006:1 are summarized below:

i.   *e_t and p_t were cointegrated.*

ii.   *e_t and p_t were CI(1,0).*

iii.   *There did exist, therefore, a long-run equilibrium relationship between Rupee/Nepalese Rupee exchange rate and relative price at level in the period 1993:2 - 2006:1.*

iv.   *The Rupee / Nepalese Rupee exchange rates were found to be in parity with the relative purchasing power of the currencies concerned. Thus the doctrine of 'Purchasing Power Parity' seemed to hold good in the matter of determination of Rupee / Nepalese Rupee exchange rate in the sub-period 1993:2 - 2006:1.*

13.6 Dynamics of Short-Run Shocks and the Stability of Long-run Relationship Between Exchange Rate(e_t) and Relative Price Level (p_t) [Chapter 7]

Cointegration study in Chapter 6 confirms the existence of long-run relationship between Rupee/Nepalese Rupee exchange rate (e_t) and relative price level (p_t) in the sub-period 1993:2 - 2006:1. The stability of the long-run relationship between e_t and p_t has been examined in Chapter 7 through the estimation of an appropriate *Vector Error Correction Model* (VECM) for e_t and p_t. If the short-run shocks, transmitted through the e_t and p_t channels, converge before long, the long-run relationships would be considered **'Stable'**. The study with the **VEC Model** in Chapter 7 establishes that in the sub-period 1993:2-2006:1

i. *the long-run relationship that exchange rate (e_t) maintained with the relative price level (p_t) was 'stable'. The shocks, transmitted through the exchange rate channel, failed to exert any significant impact on the long-run relationship. Consequently, exchange rate, in response to an unanticipated shocks transmitted through the exchange rate channel, failed to display any significant adjustment in its values in order to bridge the short-run deviation from its 'target' level.*

ii. *the shocks, transmitted through relative price level channel, had significant impact on the long-run relationship and these provided damped oscillations. Consequently, the short-run dynamics of relative price level defined a 'stable equilibrium process'.*

iii. *these did exist 'Uni-directional short-run Granger Causality' running from relative price level (p_t) to exchange rate (e_t).*

iv. *exchange rate, on the other hand, **failed to Granger Cause** relative price level in the short-run.*

13.7 Causal Relationship Between Rupee / Nepalese Rupee Exchange Rate and Relative Price Level in the Long-run [Chapter 8]

The long-run causal relationship between Rupee/Nepalese Rupee Exchange rate [$E_t = \Delta e_t$] and relative price level [$P_t = \Delta p_t$] has been studied with the estimation of an appropriate *Unrestricted Vector Autoregressive (UVAR) Model* in Chapter 8 for the period 1993:2-2006:1. Main findings of the study in Chapter 8 are as follows :

i. *Four Period (quarter) back rise in relative price level led to appreciation of exchange rate (i.e. fall in Rupee / Nepalese Rupee Exchange Rate).*

ii. *Relative price level, thus,* **'Granger Caused'** *exchange rate over the period of study (1993: 2 - 20006:1).*

iii. *Exchange rate (E_t) was found to be negatively and non- proportionately related to previous two period (quarter) exchange rates.*

iv. *Relative price level (P_t) was positively and non-proportionately related to four period (quarter) back relative price level.*

v. *Relative price level (P_t) variations were not related to variations in any earlier period (quarter) exchange rate(E_t). Thus exchange rate(E_t) failed to* **'Granger Cause'** *relative price level (P_t) during this period (1993:2 - 2006:1).*

vi. *Relative price level (P_t), therefore, appeared to be* **exogenous** *in the* **VAR** *system.*

It is, therefore, observed in Chapter 8 that over the period of study (1993:2 - 2006:1)

i. *relative price level (P_t)* **Granger Caused** *exchange rate (E_t).*

ii. *exchange rate (E_t)* **'failed to Granger Cause'** *relative price level (P_t).*

iii. *there did exist, therefore,* **Uni-directional Granger Causality'** *running from relative price level (P_t) to exchange rate.*

iv. *relative price level (P_t) virtually emerged as an* **'exogenous'** *variable in the* **VAR** *system.*

13.8   Intervention Analysis Through the Study of Impulse Response Function in Chapter 9

In Chapter 9 we have sought to examine the responses of both exchange rate (E_t) and relative price level (P_t) to shocks transmitted through the channels of exchange rate and relative price level. The *'Intervention Analysis'* in this Chapter involves the study of the *Impulse Response Functions* of both the endogenous variables, namely, E_t and P_t. The study reveals that

i.   *E_t exhibited an immediate response by rising above the long-run equilibrium base in response to shocks transmitted through the exchange rate channel.*

ii.   *E_t, henceforth displayed a downward trend and attains the long-run equilibrium base quickly. This feature testifies for the 'Stability' of the long-run base and it lends a support to the **'Overshooting Phenomenon'**, proposed by Dornbusch.*

iii. *E_t, in response to relative price level impulses, attained the long-run equilibrium level after significant variations in several successive periods. This testifies for the fact that relative price level impulses played a significant role in generating short- run variations in exchange rate around its long-run equilibrium base. Thus 'Granger Causality' running from relative price level to exchange rate got confirmed by the Intervention Analysis through the study of Impulse Response Functions'.*

iv.   *short-run variations in relative price level were mainly due to impulses, transmitted through the channel of relative price level.*

v.   *exchange rate shocks failed to generate significant variations in relative price level.*

These findings essentially give forth two important features of responses of exchange rate and relative price level to different types of shocks. These are as follows:

i.   *Each endogenous variable exhibited significant responses to shocks transmitted through its own channel.*

ii.   *Only relative Price level shocks evoked significant short-run variations in exchange rate while relative price level remained insoluted to exchange rate shocks.*

13.9   Intervention Analysis Through The Study of Variance Decomposition [in Chapter 10]

Chapter 10 has been devoted to the *Intervention Analysis* through variance decompositions of 20-period-ahead forecast errors for exchange rate and relative price level in the sub-period 1993:2-2006:1. The main findings are as follows:

i.   *Exchange rate shocks predominantly accounted for the forecast error variances of exchange rate.*

ii.   *Relative price level shocks also accounted for a significant part of the forecast error variances of exchange rate.*

iii.   *Forecast error variances for relative price level were mainly due to shocks transmitted through relative price level channel.*

iv.   *Exchange rate shocks failed to explain any significant part of 20-period-ahead forecasts of exchange rate.*

All these findings of the *Variance Decomposition Study* in the sub-period 1993:2-2006:1 testify for

i.   *the existence of 'Predictive Causality' (i.e 'Granger Causality') running from relative price level to exchange rate.*

ii.   *the absence of 'Predictive Causality' running form exchange rate to relative price level.*

iii.   *the **exogeniety** of relative price level in the VAR system.*

13.10 Study of Granger Causality Between Exchange Rate and Relative Price Level Through the Estimation of a Restricted VAR Model [in Chapter 11]

The *'Unrestricted VAR (2.4) Model'* estimated in Chapter 8 is 'over parameterized' because of the specification of uniformity in the *auto-regressive* and *distributed lag structures* for the equation of each endogenous variables. As a result, such an 'U*nrestricted VAR Model'* becomes less informative about the precise nature and direction of *Granger Causality* between the variables concerned. In order to ensure precision in the analysis a *'Restrictive VAR Model'* has been estimated in Chapter 11 to reconsider the nature and direction of *'Granger Causality'* between the variables concerned for the period of study (1993:2 - 2006:1).

It has been observed in Sections 11.6-11.10 that over the period of study 1993:2-2006:1

i.   *exchange rate was 'Granger Caused' by relative price level.*

ii.   *exchange rate failed to 'Granger Cause' relative price level.*

iii. *their did exist, therefore, the 'Uni-directional Granger Causality' running from relative price level to exchange rate.*

iv.   *relative price level emerged as 'exogenous' variable in the system.*

These findings are in conformity with those obtained in the study with the estimated *'Unrestricted VAR Model'* in Chapter 8.

13.11 Spectral Analysis of the Relationship Between Rupee/Nepalese Rupee Exchange Rate (E_t) and Relative Price Level (P_t) in the Sub - Period 1993:2 - 2006:1 [Chapter 12]

The relationship between Rupee / Nepalese Rupee exchange rate (E_t) and relative price level (P_t) has been examined in Chapter 12 through the *'Spectral Analysis'*. The *'Frequency Domain'* study is expected to supplant and supplement the *'Time Domain'* study carried in Chapters 5 through 11.

In the 'Spectral Analysis'

i.   the 'Cospectrum' for E_t and P_t exhibited dominant periodicities at periods 2,3 and 4. This testifies for the existence of 'Cointegration' and the 'stable' long-run relationship between E_t and P_t.

ii. the 'Gain Spectrum' for E_t and P_t testified for the existence of 'Uni-directional Causality' from relative price level (P_t) to Exchange rate (E_t) over the period 1993:2 - 2006:1.

iii. the 'Coherence Spectrum' for E_t and P_t confirmed that the long-run relationship between these variables was 'strong' and 'stable'.

iv. the 'Phase Spectrum' for these variable confirmed that relative price level 'Granger Caused' exchange rate over the period of study (1993:2 - 2006:1).

13.12 Conclusions:

All these findings give forth some basic fundamental features of the relations between Rupee / Nepalese Rupee exchange rate anal relative price level over the period of study 1976:1 - 2006:1. These features are as follows:

I. Absence of long-run relationship between Exchange Rate (e_t) and Relative Price Level (p_t) in the Historical Dataset.

There did exist no 'cointegration' between Rupee / Nepalese Rupee exchange rate and relative price level in the historical dataset (1976:1 - 2006:1). Consequently, exchange rate failed to maintain any long-run relationship with relative price level over the period of study.

II. No Evidence in Favour of Purchasing Power Parity Doctrine in The Matter of Determination of Rupee / Nepalese Rupee Exchange Rate in the Historical Dataset (1976:1 - 2006:1).

Absence of 'Cointegration' between exchange rate and relative price level testifies that Rupee / Nepalese Rupee exchange rate was not in parity with the relative purchasing power of the currencies concerned over the period of the study (1976:1-2006:1). As a

result, 'Purchasing Power Parity Doctrine', remained invalidated by the determination of exchange rate between the currencies concerned over the period of study. Thus the Rupee / Nepalese Rupee exchange rate failed to establish the 'Law of One price' (LOOP) for the goods in international trade between India and Nepal during this period (1976:1-2006:1).

III. 'Structural Shift' in Historical Datasets

The historical dataset (1976:1 -2006:1) is marked by the presence of two sub-periods corresponding to the 'structural shifts' in the process of exchange rate determination. These sub - periods in the historical dataset (1976:1 - 2006:1) comprise of

i.   the period 1976:1 - 1993:1

ii.   the period 1993:2 - 2006:1

These sub-periods essentially corresponded to the *'Paradigm shift'* with respect to the determination of exchange rate. The first sub-period (1976:1 - 1993:1) represented the period of the *'Crawling Peg'* System followed in India and Nepal. The second sub-period (1993:2 - 2006:1) represented the period of *'Market Determinations'* system which was marked by the *'Floating'* of exchange rate in the market.

IV.   No Evidence in Favour of the 'Purchasing Power Party Doctrine' in the first Sub-period (1976:1 -1993:1)

There was no 'Cointegration' between Rupee / Nepalese Rupee Exchange rate and relative price level in the sub-period 1976:1 -1993:1. Thus exchange rate, over this period, did not maintain any long-run relationship with relative price level. Exchange rates between Rupee and Nepalese Rupee, therefore, were not in parity with the relative purchasing power of the currencies over this sub-period. Consequently, the determinations of Exchange rate between the currencies (viz. Rupee and Nepalese Rupee) over this sub-period did not conform to the 'Purchasing Power Parity Doctrine'.

V. Evidence in Favour of 'Purchasing Power Parity Doctrine' in the Second Sub - Period (1993:2 -2006:1)

There did exist 'Cointegration' between Rupee / Nepalese Rupee exchange rate and relative price level in the sub - period (1993 :2 -2006 :1). Thus exchange rate in this sub - period maintained a long-run relationship with relative price level. Exchange rates between the currencies (Rupee and Nepalese Rupee) were in parity with the relative purchasing power of the currencies concerned during this period. Consequently, exchange rates between the currencies established the 'Law of One Price' (LOOP) for goods in international trade between India and Nepal during the period 1993:2 -2006:1 when market forces were allowed by both the countries to determine exchange rates of the currencies concerned.

VI. Unfailing Maintenance of Purchasing Power Purity Doctrine Over the Sub-period 1993:2-2006:1.

Both the 'Time Domain' and 'Frequency Domain' studies establish that Rupee / Nepalese Rupee exchange rate maintained a stable long-run relationship with relative price level over the second sub-period (1993:2-2006:1) under 'Currency Float System'. Consequently, the 'Purchasing Power Parity Doctrine' had been consistently valid over the second sub - period (1993 :2 -2006 :1).

VII. Uni-directonal Granger Causality From Relative Price Level to Exchange rate.

Exchange rate variations were found to be '*Granger Caused*' by those in relative price level during 1993:2 -2006:1. Thus the equation of long-run relation between exchange rate and relative price level could as well be effectively used for the prediction of exchange rate with relative price level in the vector of regressors for exchange rate.

Thus the incidence of '*Unidirectional Granger Causality*' from relative price level to exchange rate further confirmed the consistent validity of the '*Purchasing Power Parity Doctrine*' in the determination of 'Rupee / Nepalese Rupee Exchange rate' during (1993:2 -2006:1).

Its may, therefore, be concluded in a nut-shell that, in case of determination of Rupee / Nepalese Rupee exchange rate over the period of study (1976:1-2006:1),

i.   *the 'Purchasing Power Parity Doctrine' was not valid during (1976:1 -1993:1) when 'Crawling Peg System' was operative in both India and Nepal.*

ii. *the 'Purchasing Power Parity, Doctrine' was valid during (1993:2 -2006:1) when 'Market Determination Systems' was operative in both the countries concerned.*

iii. *exchange rate was "Granger Caused' by relative price level during the period (1932:2 -2006:1). Consequently, efficient prediction of future exchange rate could be done on the basis of relative price level existing in countries concerned.*

13.13 Public Policy Implications:

The study centres around the issue — how far Rupee/Nepalese Rupee exchange rates did conform to the 'Purchasing Power Parity Doctrine' over the period 1976:1 - 2006:1. The findings of the study indicate that Rupee/Nepalese Rupee exchange rates

i.   were not in parity with the relative purchasing power of currencies concerned during 1976:1 - 1993:1.

ii. conformed to the 'Purchasing Power Policy Doctrine' during 1993:2 - 2006:1 only.

These findings bear immense economic implications along with profound public policy relevance as stated below.

a. Terms of Trade became *'neutral'* and fevourable for the expansion of trade during 1993:2 - 2006:1.

Expansion of bilateral trade between two countries becomes possible when *'trade creation'* materializes but *'trade diversion'* does not take place. It happens when *'terms of trade'* become 'neutral' in the sense that these do not unduly favour any trade partner at the cost of another. But *'terms of trade'* become *'neutral'* when real exchange rates remain constant over time. Such *time-invariance* of real exchange rates takes place when nominal exchange rates conform to the relative purchasing power of currencies

concerned. In such case, as inflation rates vary in trading countries over time, relative purchasing power of currencies concerned also vary inversely over time in the same proportion. If *'Purchasing Power Parity Doctrine'* holds, then nominal exchange rates vary accordingly. Consequently, real exchange rate remains invariant over time and *'terms of trade'* become *'neutral'*. Now that Rupee/Nepalese Rupee exchange rates conformed to the *'Purchasing Power Party Doctrine'* during 1993:2-2006:1, terms of trade remained *'neutral'* for both India and Nepal ever this period. Such exchange rates were condusive for expansion of trade between these two countries. If exchange rates continue to be so in years to come, then Indo - Nepalese trade relations are expected to be stronger over time.

b. A Snag in Indo – Nepalese Trade Relation in 1989 – 1991: An Explanation

Rupee/Nepalese Rupee exchange rates were not in party with relative purchasing power of currencies concerned during 1976:1-1993:1. Terms of trade, therefore, were not *neutral* during this period. It favoured either of the partners against another. Such exchange rates were not condusive for trade expansion between the countries concerned.

As a matter of fact, in 1989 - 92 a snag in Indo - Nepalese trade relation took place when Nepal sought to proactive diversion of trade from India to China. Adverse terms of trade were quoted by Nepal as one of the reasons triggering such trade diversion. Indo - Nepalese trade suffered a lot during this period.

However, as soon as exchange rates, since 1993:1 reached parity with relative purchasing power of currencies concerned, terms of trade become *neutral*. Consequently, Indo-Nepalese trade relations also become normal.

Thus the findings of diversion of Rupee/Nepalese Rupee exchange rates from the purchasing power parity level during 1976:1-1993:1 in our study helps explain the occurrence of snag in Indo-Nepalese trade relation in 1989-92.

c. Importance of Market Determination System Established

Rupee/Nepalese Rupee exchange rates failed to be in parity with the relative purchasing power of currencies concerned during 1976:1-1993:1 when *'Crawling Peg System'* of exchange rate determination which prevailed in both India and Nepal. Under this system, market forces were not allowed to determine the equilibrium exchange rate. On the contrary, exchange rates were determined through interventions from the respective monetary authorities concerned.

Under the *'Crawling Peg system'* exchange rates deviated from the equilibrium level and terms of trade failed to be *'neutral'*. This hindered the expansion of bilateral trade. However, as soon as market forces were allowed to determine the equilibrium exchange rates, terms of trade become *'neutral'* which paved the way for the expansion of bilateral trade between India and Nepal.

It, therefore, follows that institutional intervention in the matter of determination of exchange rate may not be condusive for trade-expansion. On the contrary, floating exchange rate system where market forces freely determine exchange rates would always promote trade expansion. In such case, market forces remove all the imbalances in terms of trade so that trade could expand.

The findings from the present study, therefore, implicitly establish the lesson that market determination system is *'trade-favouring'* by nature and therefore, all inhibitions to free play of market forces be removed for the sake of expansion of trade.