

**CHAPTER - 6**  
**STUDY OF COINTEGRATION BETWEEN RUPEE/ NEPALESE RUPEE**  
**EXCHANGE RATE AND RELATIVE PRICE LEVEL IN DIFFERENT SUB-**  
**PERIODS**

**6.1 Introduction:**

This chapter entails a study of *cointegration* between exchange rate ( $e_t$ ) and relative price level ( $p_t$ ) in two different sub-periods viz 1976:1-1993:1 and 1993:2-2006:1. The sub periods were identified on the basis of the fact that the econometric relationship between  $e_t$  and  $p_t$  would be strikingly different from each other. Consequently, the nature of the *cointegration* between these two variables is expected to be different in two different sub-periods. The '*Johansen Cointegration Tests*' are being adopted for this purpose.

**6.2 The Johansen Cointegration Tests For the Sub-Periods 1976:1-1993:1:**

Results of the *Johansen Cointegration Tests* for  $e_t$  and  $p_t$  at level over the sub-period 1976:1-1993:1 are being presented through the Table 6.1 below.

**Table 6.1****Results of the Johansen Cointegration Tests for  $e_t$  and  $p_t$  at Level****Sub-Period: 1976:1-1993:1***Trend Assumption: Linear Deterministic Trend (Restricted)**Lag Interval in first difference: 1 to 4*

I Unrestricted Cointegration Rank $\lambda_{\text{trace}}$ Test					
Variables Involved: $e_t$ and $p_t$ At Level					
Null Hypothesis	Alternative Hypothesis	Eigen Value	Trace Statistic ( $\lambda_{\text{trace}}$ )	Critical Values	
				5%	1%
$r=0$	$r>0$	0.101	11.021	25.32	30.45
$r\leq 1$	$r>1$	0.058	3.933	12.25	16.26

II Unrestricted Cointegration Rank $\lambda_{\text{max}}$ Test					
Variables Involved: $e_t$ and $p_t$ At Level					
Null Hypothesis	Alternative Hypothesis	Eigen Value	Maximum Eigen Statistic ( $\lambda_{\text{max}}$ )	Critical Values	
				5%	1%
$r=0$	$r=0$	0.101	7.087	18.96	23.65
$r=1$	$r=2$	0.058	3.933	12.25	16.26

**6.3 Finding From The Table 6.1**

Results of the *Johansen Cointegration Test*, as given in the Table 6.1, show that in the sub-period 1976:1-1993:1

- i. for the null hypothesis  $r=0$  against the alternative hypothesis  $r>0$ ,  $\lambda_{\text{trace}}(0)=11.021$  is lower than the corresponding 5% and 1% critical values. It is not, therefore, possible to reject the *null hypothesis* of 'no cointegration' between  $e_t$  and  $p_t$  at level even at 5% level of significance.

- ii. for the null hypothesis  $r \leq 1$  against alternative hypothesis  $r > 1$ , the value of  $\lambda_{\text{trace}}(1)$  statistic is 3.933 which is lower than 1% and even 5% levels of significance. So the *null hypothesis* of  $r \leq 1$  cannot be rejected even at 5% level.
- iii. for the null hypothesis  $r = 0$  against alternative hypothesis  $r = 1$ , under  $\lambda_{\text{max}}$  test,  $\lambda_{\text{max}}(0,1)$  value is 7.087. It is clearly lower than the corresponding 1% and 5% critical values. It implies that the *null hypothesis of 'no cointegration'* between  $e_t$  and  $p_t$  cannot be rejected even at even 5% level.
- iv. for the null hypothesis  $r = 1$  against the alternative hypothesis  $r = 2$ , under  $\lambda_{\text{max}}$  test,  $\lambda_{\text{max}}(1,2) = 3.933$  falls short of the corresponding critical values at 5% and 1% levels. Consequently, the *null hypothesis of 'no cointegration'* between  $e_t$  and  $p_t$  appears to be accepted at even 5% level.

#### 6.4 Overview of the Findings From the Johansen Cointegration Tests:

It is observed from the findings of the *Johansen Cointegration Test* results, as given in Section 6.3, that in the sub-period 1976:1-1993:1.

- i. *there does not exist any cointegration between exchange rate ( $e_t$ ) and relative price level ( $p_t$ ) at level even at 5% level of significance.*
- ii.  *$e_t$  and  $p_t$  are, therefore, not  $CI(1,0)$ .*

#### 6.5 Economic Implications of Findings of Cointegration Study:

Absence of *cointegration* between exchange rate ( $e_t$ ) and relative price level ( $p_t$ ) *at level* in the sub-period 1976:1-1993:1 implies that there did exist no long-run relationship between exchange rate quoted for the currencies of the countries concerned and the relative price levels prevailing in different quarters of the sub-period. It further implies that the *exchange rates* between the currencies were not linked to their relative *purchasing power*. Thus *purchasing power* of currencies, as revealed by the relative price levels prevailing in the two countries, did not matter at all in the determination of the rate of exchange for the currencies. Thus the '*Law of One Price*' (LOOP) as dictated by the '*Purchasing Power Parity Doctrine*' was not established by the quoted exchange rates between the currencies concerned over the sub-period 1976:1-1993:1.

### 6.6 The Johansen Cointegration Tests for The Sub-Period 1993:2-2006:1:

The *Johansen Cointegration Test* results for the *level* data of exchange rate ( $e_t$ ) and relative price level ( $p_t$ ) over the Sub-Period 1993:2-2006:1 have been presented through the Table 6.2 below.

**Table 6.2**

**Results of the Johansen Cointegration Tests for  $e_t$  and  $p_t$  At Level  
Sub-Period: 1993:2-2006:1**

Trend Assumption: Linear Deterministic Trend (Restricted)

Lag Interval in first difference: 1 to 1

I Unrestricted Cointegration Rank $\lambda_{\text{trace}}$ Test					
Variables Involved: $e_t$ and $p_t$ At Level					
Null Hypothesis	Alternative Hypothesis	Eigen Value	Trace Statistic ( $\lambda_{\text{trace}}$ )	Critical Values	
				5%	1%
$r=0$	$r>0$	0.332	29.734	25.32	30.45
$r\leq 1$	$r>1$	0.153	8.676	12.25	16.26

II Unrestricted Cointegration Rank $\lambda_{\text{max}}$ Test					
Variables Involved: $e_t$ and $p_t$ At Level					
Null Hypothesis	Alternative Hypothesis	Eigen Value	Maximum Eigen Statistic ( $\lambda_{\text{max}}$ )	Critical Values	
				5%	1%
$r=0$	$r=1$	0.332	21.057	18.96	23.65
$r=1$	$r=2$	0.153	8.676	12.25	16.26

## 6.7 Findings From The Table 6.2

It is observed from the Table 6.2 that over the sub-period 1993:2-2006:1 in case of the *Johansen Cointegration Tests*

- i. for  $r=0$  against  $r>1$ ,  $\lambda_{\text{trace}}(0)=29.734$  exceeds the corresponding critical value at 5% level. This implies that the null hypothesis of the ‘*absence of cointegration*’ ( $r=0$ ) between  $e_t$  and  $p_t$  at level has been rejected at 5% level.
- ii. for  $r\leq 1$  against  $r>1$ ,  $\lambda_{\text{trace}}(1)=8.676$  falls short of the corresponding critical value even at 5% level. This implies that the ‘*null hypothesis of not more than one cointegrating relation*’ is accepted even at 5% level.
- iii. for  $r=0$  against  $r=1$ ,  $\lambda_{\text{max}}(0,1)=21.057$  exceed the corresponding critical value at 5% level of significance. Therefore, the *null hypothesis of non-existence of cointegration* between the variables ( $e_t$  and  $p_t$ ) is not accepted at 5% level.
- iv. for  $r=1$  against  $r=2$ ,  $\lambda_{\text{max}}(1,2)=8.676$  falls short of the corresponding critical value even at 5% level. Consequently, the *null hypothesis of the existence of only one cointegrating relation* appears to be accepted even at 5% level.

## 6.8 Overview of the Findings From the Johansen Cointegration Test (for the Sub-period 1993:2 – 2006:1)

*It is observed from the section 6.7 that over the Sub-Period 1993:2-2006:1*

- i. *there exists cointegration between  $e_t$  and  $p_t$  at level.*
- ii.  *$e_t$  and  $p_t$  are CI (1,0).*
- iii. *there exists one and only one cointegrating relation between  $e_t$  and  $p_t$  at level.*

## 6.9 Economic Implications of the Findings of Cointegration Study

The existence of *cointegration* between  $e_t$  and  $p_t$  at level implies that there did exist a long run relationship between exchange rate of currencies concerned with the relative price levels prevailing over the sub-period 1993:2 – 2006:1. This further implies that exchange rates for the currencies were in parity with the relative purchasing power of the currencies concerned. Moreover, *existence of one cointegrating relation* between the currencies establishes that exchange rates were uniquely related to their relative purchasing power.

It, therefore, follows that exchange rates in this sub-period 1993:2-2006:1 were so determined as to establish the '*Law of One Price*' (LOOP) in the realm of trade between the countries concerned.

#### 6.10 Summary of Findings in Chapter-6

The study in this Chapter (Chapter-6) is devoted to examining the *cointegration* between exchange rate ( $e_t$ ) and relative price level ( $p_t$ ) at level over two sub-periods, namely, 1979:1 – 1993:1 and 1993:2 – 2006:1. It has been confirmed that

- (i)  $e_t$  and  $p_t$  were  $I(1)$  variables in both the sub-periods.
  - (ii) there did exist no cointegration i.e. long-run equilibrium relation between exchange rate and relative price level in the sub-period 1976:1-1993:1. Consequently, exchange rates quoted for the currencies over the sub-period 1976:1-1993:1 were not at all related to the relative purchasing power of currencies concerned. So the doctrine of purchasing power parity did not hold good and the determination of exchange rates for the currencies failed to establish the '*Law of One Price*' (LOOP) in international trade between India and Nepal in the sub-period 1976:1-1993:1.
  - (iii) there did exist '*cointegration*' i.e. long-run equilibrium relation between exchange rate and relative price level in the sub-period 1993:2 – 2006:1. This implies that the purchasing power of currencies significantly determined the exchange rates quoted for the currencies over this sub-period. Thus exchange rates in this period were so determined as to establish the '*Law of One Price*' (LOOP) in international trade in the long-run. Consequently, the '*Purchasing Power Parity Doctrine*' seemed to hold good in the determination of exchange rates between Rupee and Nepalese Rupee in the sub-period 1993:2 – 2006:1.
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