# **Appendix**

 



Where indicates dummy variable showing mean shift occurred at point with time break while  is trend shift variable. Model 4 is used for empirical estimation. Accordingly,

 

The null hypothesis of unit root break date is which indicates that the series is not stationary with a drift not having information about structural break point while  hypothesis implies that the variable is found to be trend-stationary with one unknown time break.

Under CMR unit root test, we wish to test the following null hypothesis:

as against the alternative hypothesis:



Where  is a pulse variable that takes the value 1 if and 0 otherwise,  and 0 otherwise.  and are the time periods when the mean is being modified.

The unit root hypothesis testing if the two breaks belong to the innovational outlier takes place by first estimating the following model and testing whether:



If the shifts are supposed to be better represented as additive outliers, then we can test the unit root null hypothesis through the following two-steps. The first step is to remove the deterministic part of the variable by estimating the following model:

 

Second, we carry out the test for the hypothesis in the following model:

 