APPENDIX A

A.1 Dickey Fuller Unit Root Test

The Augmented Dickey Fuller (ADF) test is used (Dickey and Fuller, 1981). This test is based on the following regression:

$$\Delta X_t = \alpha_0 + \alpha_1 t + \beta X_{t-1} + \sum_{j-1}^{k} \gamma_j \Delta X_{t-j} + \varepsilon_t$$

where Δ is the difference operator and ε_t is the stationary random error. The null hypothesis is that X_t is a nonstationary series and it is rejected when β is significantly negative. The constant and trend terms are retained only if they are significantly different from zero. The optimal number of lags, *k*, is determined by minimising the Akaike information criterion.

A.2 Panel Unit Root Test

The Levin and Lin (LL) panel unit root test is based on the following regression:

$$\Delta y_{i,t} = \alpha_0 + \rho y_{i,t-1} + \delta t + \phi_i + \gamma_t + \varepsilon_{i,t}$$
$$i = 1, 2, \ldots..., N, \; t = 1, 2, \ldots\ldots, T$$

where α_0 is constant, δt implies the time trend, ϕ_i is the individual specific effect across the origin and γ_t indicates the individual specific effect over the time. The LL test considered for six sub-cases of the above model considering the specification of the regression equation[34] (i.e. the inclusion of individual specific intercepts and time trends). In contrast to the LL test, the Im, Pesaran and Shin (IPS) panel unit root test contains heterogenous adjustment processes and pools the t-statistics from univariate independent ADF regressions. IPS relaxes the restricted assumption first-order autoregressive coefficient across the region (which is constant in the LL test) and suggests it varies across the regions.

[34] For details of the estimation procedures, see Levin and Lin (1993).