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A Complementary Test for ADF Test with An Application to the Exchange Rates Returns

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Abstract

This study shows that augmented Dickey-Fuller (ADF) test failed to detect covariance nonstationary series. Supportive of [Ahamada \(2004\)](#), this study finds that the cumulative sums of squares procedure in [Inclán and Tiao \(1994\)](#) is useful to complement the ADF test. As illustration, the ADF test indicates that there is no unit root in the returns of Japanese yen/US dollar, British pound/ US dollar and Swiss franc/US. However, the complementary test reveals that each of these returns contains heterogeneous variance. To sum, it can be concluded that these exchange rate returns are covariance nonstationary although there is no unit root.

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1. Introduction

A basic requirement for time series modelling is that the series under study must be weakly stationary, i.e. it has constant mean and covariance. Numerous stationary tests have been developed in the past to test for stationarity and the popularly applied tests include the augmented Dickey-Fuller (ADF) test (Fuller 1976, Dickey and Fuller 1979), Phillips-Perron (PP) test (Phillips 1987, Phillips and Perron 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test (Kwiatkowski *et al.* 1992). Lately, Ahamada (2004) demonstrates via a simulation exercise that KPSS test fails to detect a form of nonstationarity due to a shift in the unconditional variance. They pointed out that the non-rejection of the null hypothesis of no unit root in the KPSS test does not necessarily imply the stationarity of the data, as there is a possibility that the data may exhibit heterogeneous unconditional variance. The author further proposed a complementary test to complete the KPSS testing procedure and the complementary test was shown to be useful detecting the nonstationary covariance of the daily returns of US dollar/Euro exchange rate, in which the KPSS test has failed to do so.

Given the surprising defect in one of the most powerful stationary test, it is interesting to find out whether the most commonly utilised ADF test is robust against nonstationary covariance. As such, the this simulation study is conducted to examine whether the ADF test is able to detect nonstationary covariance. Besides, the performance of the