

# Testing for nonlinear unit roots in the presence of a structural break with an application to the qualified PPP during the 1997 Asian financial crisis

Olivier Habimana, Kristofer Månsson✉, Pär Sjölander

First published: 29 January 2018

<https://doi.org/10.1002/ijfe.1613>

Citations: 6

## Abstract

This paper applies Monte Carlo simulations to evaluate the size and power properties in the presence of a structural break, for the standard Augmented Dickey-Fuller (ADF) test versus nonlinear exponential smooth transition autoregressive unit root tests. The break causes the tests to be undersized, and the statistical power considerably decreases. Moreover, the effect is intensified in small samples and very much increased for more persistent nonlinear series. As a remedy, we modify the standard ADF and exponential smooth transition autoregressive unit root tests in order to adjust for a structural break. This improves both the power and the size considerably, even though the empirical size still is lower than the nominal one. More persistent series are more affected by structural breaks, and the new tests are most powerful under the existence of a rather persistent nonlinear data generating process (which is an empirically relevant and common type of data generating process). The proposed tests are applied to investigate mean reversion in the real effective exchange rates of 5 East and Southeast Asian countries, taking into account the structural change in exchange rate regime brought about by the 1997 Asian financial crisis. The empirical findings corroborate our simulation results; the modified more powerful tests are able to reject the unit root in all 5 countries, whereas the tests that do not consider the structural break could only reject in one of these cases.

## REFERENCES

Clemente, J., Montañés, A., & Reyes, M. (1998). Testing for a unit root in variables with a double change in the mean. *Economics Letters*, 59, 175–182. [https://doi.org/10.1016/S0165-1765\(98\)00052-4](https://doi.org/10.1016/S0165-1765(98)00052-4)

[Web of Science®](#) | [Google Scholar](#)

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimator for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74, 427–431. <https://doi.org/10.2307/2286348>

[Web of Science®](#) | [Google Scholar](#)

Dornbusch, R., & Vogelsang, T. (1991). Real exchange rates and purchasing power parity. In J. Melo, & A. Sapir (Eds.), *Trade theory and economic reform: North, South, and East, essays in honor of Bela Balassa* (pp. 3–24). Cambridge, MA: Basil Blackwell.

[Web of Science®](#) | [Google Scholar](#)

Hegwood, N. D., & Papell, D. H. (1998). Quasi purchasing power parity. *International Journal of Finance and Economics*, 3, 279–289. [https://doi.org/10.1002/\(SICI\)1099-1158\(199810\)3:4<279::AID-IJFE83>3.0.CO;2-K](https://doi.org/10.1002/(SICI)1099-1158(199810)3:4<279::AID-IJFE83>3.0.CO;2-K)

[Web of Science®](#) | [Google Scholar](#)

Kapetanios, G., Shin, Y., & Snell, A. (2003). Testing for a unit root in the nonlinear STAR framework. *Journal of Econometrics*, 12, 359–379. [https://doi.org/10.1016/S0304-4076\(02\)00202-6](https://doi.org/10.1016/S0304-4076(02)00202-6)

[Web of Science®](#) | [Google Scholar](#)

Klau, M. and Fung, S., 2006. “ The new BIS effective exchange rate indices.” *BIS Quarterly Review*, March: 51–65. Bank for International Settlements. [http://www.bis.org/publ/qtrpdf/r\\_qt0603e.pdf](http://www.bis.org/publ/qtrpdf/r_qt0603e.pdf)

[Google Scholar](#)

Lee, D. J., & Son, J. (2013). Nonlinearity and structural breaks in monetary policy rules with stock prices. *Economic Modelling*, 31, 1–11. <https://doi.org/10.1016/j.econmod.2012.10.018>

[Web of Science®](#) | [Google Scholar](#)

Lumsdaine, R. L., & Papell, D. H. (1997). Multiple trend breaks and the unit-root hypothesis. *The Review of Economics and Statistics*, 79(2), 212–218 <http://www.jstor.org/stable/2951453>

[Web of Science®](#) | [Google Scholar](#)

Månsson, K., & Sjölander, P. (2014). Testing for nonlinear panel unit roots under cross-sectional dependency: With an application to the PPP hypothesis. *Economic Modelling*, 38, 121–132. <https://doi.org/10.1016/j.econmod.2013.12.013>

[Web of Science®](#) | [Google Scholar](#)

Nelson, C. R., & Plosser, C. (1982). Trends and random walks in macroeconomic time series. *Journal of Monetary Economics*, 10, 139–162. [https://doi.org/10.1016/0304-3932\(82\)90012-5](https://doi.org/10.1016/0304-3932(82)90012-5)

[PubMed](#) | [Web of Science®](#) | [Google Scholar](#)

Ohara, H. I. (1999). A unit root test with multiple trend breaks: A theory and application to US and Japanese macroeconomic time series. *The Japanese Economic Review*, 50, 266–290. <https://doi.org/10.1111/1468-5876.00119>

[Web of Science®](#) | [Google Scholar](#)

Patterson, K. D. (2012). *Unit root tests in time series, volume 2*. Palgrave Texts in Econometrics: Palgrave.

[Google Scholar](#)

Perron, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica*, 57, 1361–1401 <http://www.jstor.org/stable/1913712>

[Web of Science®](#) | [Google Scholar](#)

Perron, P. (1997). Further evidence on breaking trend functions in macroeconomic variables. *Journal of Econometrics*, 80, 355–385. [https://doi.org/10.1016/S0304-4076\(97\)00049-3](https://doi.org/10.1016/S0304-4076(97)00049-3)

[Web of Science®](#) | [Google Scholar](#)

Perron, P., & Vogelsang, T. J. (1992). Nonstationarity and level shifts with an application to purchasing power parity. *Journal of Business and Economic Statistics*, 10, 301–320. <https://doi.org/10.1080/07350015.1992.10509907>

[Web of Science®](#) | [Google Scholar](#)

Pradumna B. Rana 1998. The East Asian financial crisis—Implications for exchange rate management. EDRC Briefing Notes, Number 5, October. Asian Development Bank. <https://aric.adb.org/pdf/edrcbn/edrcbn05.pdf>

[Google Scholar](#)

Sollis, R. (2009). A simple unit root test against asymmetric STAR nonlinearity with an application to real exchange rates in Nordic countries. *Economic Modelling*, 26, 118–125. <https://doi.org/10.1016/j.econmod.2008.06.002>

[Web of Science®](#) | [Google Scholar](#)

Sollis, R., Leybourne, S. J., & Newbold, P. (2002). Tests for symmetric and asymmetric nonlinear mean reversion in real exchange rates. *Journal of Money, Credit, and Banking*, 34, 686–700 <http://www.jstor.org/stable/3270738>

[Web of Science®](#) | [Google Scholar](#)

Zivot, E., & Andrews, D. W. K. (1992). Further evidence on the great crash, the oil price shock and the unit root hypothesis. *Journal of Business and Economic Statistics*, 10, 251–270 <http://www.jstor.org/stable/1391541>

[Web of Science®](#) | [Google Scholar](#)

## **ABOUT WILEY ONLINE LIBRARY**

[Privacy Policy](#)

[Terms of Use](#)

[About Cookies](#)

[Manage Cookies](#)

[Accessibility](#)

[Wiley Research DE&I Statement and Publishing Policies](#)

[Developing World Access](#)

## **HELP & SUPPORT**

[Contact Us](#)

[Training and Support](#)

[DMCA & Reporting Piracy](#)

## **OPPORTUNITIES**

[Subscription Agents](#)

[Advertisers & Corporate Partners](#)

## **CONNECT WITH WILEY**

[The Wiley Network](#)

[Wiley Press Room](#)

Copyright © 1999-2025 John Wiley & Sons, Inc or related companies. All rights reserved, including rights for text and data mining and training of artificial intelligence technologies or similar technologies.

**WILEY**