ELSEVIER

Review of Financial Economics 17 (2008) 92–111

RFE
Review of Financial Economics

www.elsevier.com/locate/econbase

Bivariate relative city price convergence in the United States: 1918–1997☆

Robert J. Sonora *

Department of Economics, School of Business Administration, Fort Lewis College, Durango, 81303 CO, United States

Received 18 September 2005; received in revised form 31 January 2007; accepted 19 February 2007
Available online 19 March 2007

Abstract

As in international tests of purchasing power parity, panel unit root tests have been successful in rejecting a unit root process in U.S. city relative prices over the period 1918–1997. However, there is an empirical question of what the rejection of a 'panel unit root', particularly with respect to real exchange rates, means. This paper employs a variety of univariate unit root and cointegration tests which have recently come to the fore. These tests improve the power and reduce size distortion found in standard unit root and cointegration tests such as the Dickey–Fuller and Phillips–Perron tests. I find considerable evidence for rejecting a unit root process in the majority of U.S. city relative prices over the entire sample period and two subperiods. Less successful are stationarity tests conducted on regions of the U.S.

JEL classification: E31; F22
Keywords: Price index convergence; Purchasing power parity; Unit root tests; Cointegration

1. Introduction

This paper investigates relative price level convergence within a single currency area, the United States. This is motivated by the relative lack of success of empirical research in real exchange rate

☆ This is an updated version of a paper first presented at the Western Economic International annual conference in Seattle, WA, July 2002. I would like to thank the participants for their helpful comments, in particular John Devereux. Discussions with Bill Crowder and comments from an anonymous referee were also beneficial. Any mistakes are mine and mine alone.
* Tel. +1 970 247 7296.
E-mail address: Sonora_t@fortlewis.edu.

1058-3300/$ - see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.rfe.2007.02.010

convergence with international data, particularly the slow speed of convergence rate, dubbed the purchasing power puzzle by Rogoff (1996). This has generated interest in using intranational price convergence using relative city prices to gain insight as to the source of slow convergence, and to act as a benchmark for international PPP. Using standard unit root tests Parsley and Wei (1996) find evidence for the law of one price (LOP) for a variety of traded and nontraded goods between U.S. cities. Convergence rates, calculated using half-lives, were on the order of 5 months to 4 years for goods ranging from perishable traded goods to nontraded goods and services. While not an empirical test of PPP, their results do favor city real exchange rate mean reversion. Using ADF tests of intercity price convergence tests using standard univariate unit root tests have not been overly successful (e.g. Chen & Devereux, 2002) and, therefore, intercity relative price analysis has relied on the improved power of panel unit root tests.

Tests of intranational price convergence, using relative city Consumer Price Indices (CPIs), have been successfully conducted by Culver and Papell (1999), Cecchetti, Mark, and Sonora (2002), and Sonora (2005) using panel unit root tests devised by Levin and Lin (1996) and Im, Pesaran, and Shin (1997). Interestingly, these studies relied on panel methods for increases in power despite the relatively long length of the time series.

Cecchetti et al. (2002) find that estimates of intra-U.S. price convergence rates are longer than those found in international real exchange rate convergence — half-lives of 5 to 8 years compared with the two to four year estimates in the international PPP literature. Culver and Papell (1999) find that mean reversion between Canadian city prices is about one to two years faster than those found using U.S. CPI data over roughly the same period. Similarly, Sonora (2005) shows significant evidence for mean reversion across Mexican cities with panel half-life estimates in the one to two year range, considerably quicker than the U.S. or Canada.

Rather than relying on panel unit root tests, this paper tests for the existence of relative price convergence between cities using more theoretically intuitive, and familiar, univariate relative prices. A potential complaint leveled at panel tests is that in rejecting nonstationarity among a panel of series as a whole they "disregard" the $I(1)$ series present, that is, series which are stationary dominate the $I(1)$ series so the nonstationary series appear stationary, for example, Breuer, McNown, and Wallace (2001).

Relatively new and more powerful unit root tests have been devised to overcome the power and size distortions associated with standard tests — such as the Phillips and Perron (1988) and Augmented Dickey-Fuller (ADF) unit root tests, and the Engle and Granger (1987) and Jöhansen (1988, 1991) cointegration tests. I employ five of these which include the 'modified ADF' (MADF) and Phillips–Perron tests which rely on local GLS detrending first developed by Elliot, Rothenberg, and Stock (1996) and Ng and Perron (1996, 1998).

Next, Hansen (1995) argues that examining time series data in isolation ignores other factors which may influence its dynamics. He suggests including an additional stationary variable in the 'co-variate ADF' (CADF) regression which, he shows, reduces the regression standard error improving the power of the test. Amara and Papell (2006) use the CADF test on post-Bretton Woods real exchange rate data with some success, though less successful than using the Modified GLS tests of Elliot et al. (1996). Contrary to the majority of unit root tests which have a null of nonstationarity, the Kwiatowski, Phillips, Schmidt, and Shin (KPSS, 1991) test looks for evidence of a stationary process.

While the above tests conduct unit root tests on the relative city prices, the Horvath and Watson (HW, 1995) test modifies the Jöhansen methodology when the cointegrating vector is pre-specified and made of 1s, 0s, and − 1s. Using Monte Carlo experiments Edison, Gagnon, and Melick (1997) show this test has more power than the standard Jöhansen test.