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Testing the purchasing power parity in panel data

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Abstract

This paper empirically tests the purchasing power parity (PPP) using panel unit root tests. We employ a battery of panel unit root tests: LM-bar statistic [Testing for unit roots in heterogeneous panels, Working paper, University of Cambridge] is employed to account for serially correlated errors. The statistic proposed by Breitung [Adv. Econom. 15 (2000) 161.] and the KPSS-based statistic of Hadri [Econ. J. 3 (2000) 148.] are also used. In addition, we also employ a SUR estimator to account for possible cross-sectional effect. Data of 45 economies from 1980 to 1999 are used to test the PPP hypothesis. We find that these estimators tend to get supportive results when the data frequency becomes lower, which substantially characterizes the long-run property of the PPP hypothesis.

JEL classification: C22; C52; F31; F47
Keywords: PPP; Real exchange rate; Panel unit root; SUR estimator

1. Introduction

Purchasing power parity (PPP) is an important theoretical concept in economics because most macroeconomic models of open economy are built upon the long-run PPP hypothesis. Froot and Rogoff (1995) and Rogoff (1996) provide excellent discussions. The question of the existence of the unit root in the real exchange rate has substantial economic implications for the PPP hypothesis: if real exchange rate is stationary, then the PPP can be viewed as a

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good long-run approximation; if the real exchange rate is nonstationary, then the PPP serves no purpose. Many economists have tested the long-run PPP empirically and the evidence is mixed. Adler and Lehmann (1983) and Huizinga (1987) indicate that the real exchange rate follows a random walk. Several other studies such as by Edison (1987), Corbae and Ouliaris (1988), and Enders (1988) also fail to establish supportive evidence. This result is amply confirmed in more recent studies, for instance, Serletis and Zimonopoulos (1997). Not surprisingly, some recent studies have been much more supportive of the PPP hypothesis. Abuaf and Jorion (1990), Chen and Wu (2000), Johnson (1990), Kuo and Mikkola (1999), Lothian and Taylor (1996), and MacDonald (1993) have found evidence of mean reversion in the real exchange rates.

Some studies suggest that the widespread failure to find support in studies using relatively short series may be accounted for by the low power of conventional univariate unit root tests against persistent alternatives, typically for sample sizes that occur in practice. Thus, panel data have suggested for empirical analysis. The use of panel data allows the researcher far greater flexibility in modeling differences in behavior across individuals. This has also been proven quite satisfactory in improving the power of unit root tests. The additional cross-sectional dimension in the panel leads to better power properties of the panel tests as compared to the lower power of the standard individual-specific unit root test against near unit root alternatives for small samples. The low power of univariate tests is one of the main motivations for the use of panel unit root tests, as discussed by Im, Pesaran, and Shin (1997). The simulation presented by Im et al. show a substantial increase in power with an increased cross-sectional dimension in the panel, even for fairly short time series. Recent developments in nonstationary panel data have sparked a large body of literature. Quah (1994) proposes the unit root tests that exploit information from cross-sectional dimensions in inferring non-stationarity from panel data. Pedroni (1996, 1997) proposes a fully modified estimator for heterogeneous panels and derives asymptotic distributions for residual-based tests of cointegration for both homogeneous and heterogeneous panels. Hadri (2000), Im et al., Kao (1999) and Levin, Lin, and Chu (2001) constitute further important contributions along the line. Kao first examines the behavior of spurious panel regression. He has provided an asymptotic theory for the behavior of LSDV estimator in a model with $I(1)$ variables and showed that the OLS estimator is consistent for its true value, but the t statistic diverges so that the inferences about the regression coefficient are wrong with a probability that goes to 1.

The panel unit root tests have found wide application in testing the PPP hypothesis. Unfortunately, these results are also mixed. For example, those who support the PPP relationship are Coakley and Fuertes (1997), MacDonald (1996), Oh (1996), Papell (1997), Taylor and Sarno (1998), and Wu (1996). In contrast, O'Connell (1998) argues that the ignored cross-sectional dependence in the data greatly distorts the size of these panel data unit root tests. Once the intercountry dependence is controlled for, he did not find support for the PPP.

Methodologically, this paper plans to infer the PPP from the econometric analysis below. Firstly, we employ the LM-bar statistic proposed by Im et al. (1997), which allows different patterns of serially correlated errors. Secondly, Breitung (2000) finds that the losses of power are due to bias correction terms in Levin et al. (2001) and detrending bias in Im et al. Hence, Breitung proposes a λ_{UB} statistic to overcome the abovementioned bias problems. Finally, to