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Beyond the purchasing power parity: testing for cointegration and causality between exchange rates, prices, and interest rates

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Abstract

This paper reexamines the causality between the dollar and the yen in a multivariate framework with the aid of cointegration and error-correcting modeling for the 1951–94 period. The Phillips-Perron tests and Johansen's tests are performed. While causality from interest rates to exchange rates is found in the short run, no causality between prices and exchange rates is found in the short run. However, causality is found running from relative prices to exchange rates along with interest rates between the U.S. and Japan in the long run, which supports the long-run PPP hypothesis. © 1999 Elsevier Science Ltd. All rights reserved.

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1. Introduction

The theory of Purchasing Power Parity (PPP) states that exchange rates between any two currencies will adjust to reflect changes in the relative price levels of the two countries. In empirical studies, earlier work focused primarily on exploring the correlation between exchange rates and relative price levels of the two countries in question. The PPP hypothesis has been rejected in the short run by numerous studies (Frenkel, 1981). Whether or not such a relationship holds in the long run, however, has also not been without controversy in the literature. Earlier regression studies

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(e.g., Roll, 1979; Frenkel, 1981a,b; Adler and Lemann, 1983; Cumby and Obstfeld, 1984 among others) found little or no support for the PPP hypothesis in the long-run. Although these previous correlation-based studies made significant contributions at the time, their weakness is that they attempted to equate correlation with causation. In addition, these studies failed to conduct the pretest for the unit roots and cointegration. It has been shown that using nonstationary data may yield spurious causality results (Granger and Newbold, 1974).

More recently, applying the cointegration approach, Corbae and Quliaris (1988), Taylor (1988), Mark (1990) and Fisher and Park (1991) failed to find cointegration between the series of exchange rates and relative prices, suggesting that they tend to drift apart without bound. Applying both cointegration tests and error correction modeling (ECM), Enders (1988), however, produced mixed support for PPP while Cheung and Lai (1993a,b) and Chen (1995) and Chen (1995) found supportive evidence of PPP in the long run. Overall, under floating rates, it is found that the price ratio and the nominal exchange rate neither causes the other. Under fixed rates, the situation depends upon the type of the country, small country as opposed to reserve-currency country, but in any event it is found that neither price level is determined by the exchange rate.

These recent studies have made a significant contribution by applying the techniques of cointegration in testing for the PPP hypothesis. Yet, they suffer from one or more of the following problems: (1) attempting to equate cointegration with causation; (2) arbitrarily choosing the lag length; (3) omitting other relevant variables; (4) testing cointegration, yet failing to test causality; and (5) considering the error-correcting model (ECM), but failing to look for the second source of causality. It is worth noting that any of these shortcomings can produce misleading and invalid causal inferences. A need therefore exists to investigate causality between exchange rates and relative prices using more advanced methods.

This paper does so by investigating causality between exchange rates and relative prices for the U.S. and Japan in a multivariate framework using Hsiao's version of the Granger causality method with the aid of cointegration and error-correction modeling. In addition, this study conducts a VAR analysis and a test for super exogeneity. The remainder of the paper is organized as follows. The second section presents the methodology and model. Subsequent sections report and discuss the empirical results, conclusions and policy implications, respectively.

2. Methodology and model

The Granger causality test (1969 and 1980) is quite simple and straightforward. A variable x_t is said to Granger-cause y_t if the autoregressive-based prediction of the current value of y_t is improved by adding past values of x_t . The Granger causality test method is chosen in this study over alternative techniques in light of the favorable Monte Carlo evidence reported by Guilkey and Salemi (1982), and by Geweke et al. (1983), particularly for small samples in applied work. Moreover, the Granger testing procedure can be readily generalized from a bivariate to a multivariate system.

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