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Inflation targeting and real exchange rates: A bias correction approach

Jaebeom Kim *

Department of Economics, Oklahoma State University, Stillwater, OK 74078, USA

HIGHLIGHTS

- We investigate whether inflation targeting (IT) affects purchasing power parity.
- A bias correction method in a system with cross-sectional dependence is employed.
- Implicit deflators for durable goods' and service consumptions are employed.
- IT plays an important role in providing favorable evidence for long-run PPP.

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ABSTRACT

This paper examines whether inflation targeting (IT) influences purchasing power parity (PPP) by a bias correction approach under cross-sectional dependence. The recursive mean adjustment (RMA) method proposed by So and Shin (1999) and Shin and So (2001) is employed to correct a downward bias in half-life estimates of real exchange rates. More importantly, the empirical results show that IT lowers variability of real exchange rates and plays an important role in providing favorable evidence for long-run PPP.

1. Introduction

The present paper investigates whether inflation targeting (IT) influences purchasing power parity (PPP) by a bias correction approach with cross-sectional dependence. The main question in this study is whether the IT helps provide favorable evidence for PPP.[1] The important consideration in the present paper is that under IT, the high degree of transparency and accountability of monetary policy limits not only variability in inflation but also that in the real exchange rate at a long horizon, thereby stabilizing real exchange rates to a significant amount relative to the cases under alternative monetary policy.[2] If this were the case in countries under IT, it would be likely to result in favor of PPP. The other question of fundamental and empirical importance to this study is the degree to which the behaviors of goods and capital markets across countries can be measured by the level of economic integration. The answer to this question depends on the degree of economic integration between markets across economies. Because of the high persistence of exchange rates as well as of goods prices, least squares (LS) estimates of parity might appear to suffer from a downward bias in

* Tel.: +1 405 744 7359; fax: +1 405 744 5180.
E-mail address: jb.kim@okstate.edu.

[1] A number of studies of OECD countries provide support for long-run PPP based on panel data. One common explanation for this finding is that increasing the amount of information on real exchange rates typically increases the power of unit root tests, thereby overcoming the issue of the low power of early univariate unit root studies. See Wu (1996), Papell (1997) and Lothian (1998) for details. However, Taylor and Sarno (1998) issue an important warning related to the spurious interpretation of findings derived from panel data.

[2] Svensson (2000) provides theoretical evidence that IT lowers variability of real exchange rates. Under IT, the central bank is more precise in hitting its target than non-IT countries and provides credible forecast of future inflation rate to help practitioners determine the equilibrium exchange rate. That eventually results in smaller deviations from PPP and stabilizes real exchange rate to a significant amount in the long run. See Svensson (2000), and Mishkin and Schmidt-Hebbel (2007) for details.

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the persistent coefficient, implying that the parity condition is estimated spuriously to be less persistent than it actually is.[3]

To examine the influence of IT in this regard and to estimate the half-life, we use the bias-correction method proposed by So and Shin (1999) and Shin and So (2001). The computationally simple recursive mean adjustment (RMA)[4] is applied to the cross-sectionally augmented versions of the tests of Im et al. (2003) by Pesaran (2007) (CIPS) for panel data. The RMA method is used to test PPP and to estimate the convergence rates to PPP for IT and non-IT countries without bias. Moreover, in order to avoid possible aggregation bias because of heterogeneous dynamics in cross-sector aggregate prices,[5] we use sectoral consumption data by type and implicit deflators for durable goods' and service consumptions to construct the real exchange rates for traded and non-traded goods' prices, respectively among seven industrialized countries. Comparisons are made, together with traded and non-traded goods including PPI and CPI, between IT and non-IT, and with cross-sectional dependence.

2. Econometric model and estimation

Let p_t^T (p_t^{T*}) be the domestic (foreign) price of traded goods and s_t be the nominal exchange rate, all in natural logarithms. The real exchange rate is defined as $q_t = s_t - p_t^{T*} + p_t^T$. The form of PPP says that the nominal exchange rate is proportional to the relative price ratio so that the real exchange rate is constant over time.[6] To test the long-run relationship, first we consider the following regression,

$$q_t = \alpha + \beta q_{t-1} + e_t \tag{1}$$

where q_t is a real exchange rate at time, t, and e_t is a white noise error. As mentioned above, it has been provided by various literature that the potential downward bias exists in the LS estimator for β and the bias can become particularly severe as the true value of the parameter nears unity. To correct this bias, we employ a RMA estimator by So and Shin (1999) and Shin and So (2001). By defining the recursive mean, $\bar{q}_{t-1} = (t-1)^{-1}\sum_{k=1}^{t-1} q_k$ and rewriting Eq. (1) as:

$$q_t - \bar{q}_{t-1} = \beta_{\mathrm{RMA}}(q_{t-1} - \bar{q}_{t-1}) + e_t. \tag{2}$$

Extending the RMA estimation to panel data is straightforward. For a dynamic panel model, first we consider that e_t in Eq. (1) is allowed to be serially correlated for country i ($i = 1, 2, \ldots, N$) at time t and has a single common factor structure,

$$e_{it} = \gamma_i f_t + \varepsilon_{it} \tag{3}$$

where f_t is an unobserved common factor, γ_i is the individual factor loading, and ε_{it} is a white noise idiosyncratic error. The CIPS by Pesaran (2007) regressions are then employed together with RMA to test PPP and to estimate the half-life estimates of real exchange rates. The LS estimate of $\widehat{b}_i$ is considered in the following regression combined with RMA for each cross-sectional unit suggested by Pesaran (2007),

$$\Delta q_{it} = b_i(q_{it-1} - \mu_i) + c_i(\bar{q}_{t-1} - \mu_i) + \sum_{j=0}^{p_i} d_{ij}\Delta\bar{q}_{t-j} + \sum_{j=1}^{p_i} \delta_{ij}\Delta q_{i,t-j} + \eta_{it} \tag{4}$$

where $\Delta q_{it} = q_{it} - q_{i,t-1}$, $\mu_i = \bar{q}_{i,t-1} = (t-1)^{-1}\sum_{s=1}^{t-1} q_{is}$, $\bar{q}_t = \frac{1}{N}\sum_{i=1}^{N} q_{it}$, $\Delta\bar{q}_t = \frac{1}{N}\sum_{i=1}^{N}\Delta q_{it}$, p_i is the lag length determined by Hall's (1994) general-to-specific method and η_{it} is the idiosyncratic disturbance which is assumed to be cross-sectionally independent. According to Pesaran (2007), the cross-sectional averages of Δq_{it} and q_{it-1} are included into (4) as a proxy for the unobserved common factor f_t. The null hypothesis, $H_0 : \widehat{b}_i = 0$, for all i is tested against the heterogeneous alternative $H_1 : \widehat{b}_1 < 0, \ldots, \widehat{b}_{N_0} < 0, N_0 \leq N$ in the whole panel set. In line with the findings of Im et al. (2003), Pesaran (2007) proposes the CIPS test,

$$\mathrm{CIPS} = \frac{1}{N}\sum_{i=1}^{N} \mathrm{CADF}_i \tag{5}$$

where CADF_i is the CADF statistic for the ith cross-sectional unit in Eq. (4). The distribution of the CIPS statistic is shown to be non-standard even for large N.[7]

3. Empirical results and conclusion

We use quarterly data from 1974 Q1 to 2013 Q4. To measure inflation rates, in addition to the CPI and PPI, we use durable goods' and service consumption classified by type for the following countries: Canada, France, Japan, Italy, Sweden, the United Kingdom and the United States from the Data Stream.[8] We construct the inflation rate for traded and non-traded goods using implicit deflators for durable goods' consumption and service consumption, respectively. For the CPI and PPI as proxies for prices of non-traded goods and traded goods, nineteen OECD countries are employed.[9,10] To test the hypothesis, we classify countries based on if their central banks have adopted IT. The countries that engage in IT are nine countries such as New Zealand (1990), Canada (1991), Great Britain (1992), Sweden (1993), Finland (1993), Australia (1993), Spain (1994), Switzerland (2000), and Norway (2001). Furthermore, since many studies point out the problem of choosing the US dollar as the numeraire, real exchange rates are alternatively defined with respect to the US dollar, Deutsche mark, and French franc.[11]

Tables 1 and 2 report the results of the panel-based tests and the estimates of half-lives, namely the conventional CIPS regressions with or without RMA for the real exchange rates for traded and non-traded goods including CPI and PPI.[12] The p-values and 95% confidence intervals are taken from the non-parametric bootstraps in order to provide a precise inference.[13] To assess the convergence

[3] For details, see Andrews (1993), Andrews and Chen (1994) and Hansen (1999).

[4] See So and Shin (1999) and Shin and So (2001) for details.

[5] See Imbs et al. (2005) for details.

[6] Alternatively, if p_t^T, s_t, p_t^{T*} are first difference stationary and PPP holds in the long-run, the real exchange rate defined by $p_t^T - s_t - p_t^{T*}$ would be stationary.

[7] For details, see Pesaran (2007).

[8] The countries we selected are based on the availability of the data. The German data, for non-service and service consumptions, are not available.

[9] They are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States. This is determined by availability of data. For PPI panel, France is excluded from non-IT group and for CPI, the UK is excluded from IT group due to the availability of the data.

[10] Wu (1996) uses 19 OECD countries, Papell (1997) uses 21 industrial countries and Lothian (1998) uses 22 OECD countries. However, they do not consider any methods to correct cross-sectional dependence and downward bias.

[11] I appreciate the referee to point out this issue. Real exchange rates are also alternatively defined with respect to IT countries such as the UK, Sweden, and Switzerland but the results are similar. These results are available upon request from the author. To avoid any complications regarding real exchange rates between IT and non-IT countries, we consider the numeraire currencies from the non-IT countries only.

[12] A general diagnostic test proposed by Pesaran (2004) is employed here and the null of no cross-sectional dependence is strongly rejected for all cases. Further, the empirical results of IPS are also available upon request.

[13] We also used a parametric bootstrap for the CIPS tests. As the results do not depend on the normality assumption, only the nonparametric results are reported here.