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HOME BIAS AND PURCHASING POWER PARITY: EVIDENCE FROM THE G-7 COUNTRIES

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ABSTRACT

Recent studies in the international economics literature emphasize the role of home bias in explaining a number of empirical puzzles. In the present study, we test for the following hypotheses: (i) that a home bias effect, which is nevertheless falling over time as traded goods markets become more integrated and consumption preferences become more similar across developed countries, influences the relationship among nominal exchange rates, domestic prices and foreign prices, and (ii) that incorporation of the home bias effect in the empirical specification of PPP enhances the robustness of the theory. We perform a panel data analysis using quarterly observations for the G-7 economies in the post-Bretton Woods era. The results confirm our hypotheses.

Keywords: PPP; Home bias; Panel data.

JEL classification: F31; C33.

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1. Introduction

Purchasing power parity (PPP) states that the exchange rate between two currencies is determined by the change in the relative prices of the two countries. The notion underlying it is that deviations from the parity represent profitable commodity arbitrage opportunities which, if exploited, will tend to bring the exchange rate towards the parity.

PPP is one of the most extensively analysed relationships in the international finance literature (see e.g. the recent survey studies by Taylor, 2006; Taylor and Taylor, 2004). Recent empirical studies on PPP make use of the concepts of stationarity and cointegration to test for the validity of the doctrine. They use advanced time series and panel methods and advocate extending the span of data in either a time series (see, *inter alia*, Hegwood and Papell, 1998) or a cross sectional dimension (see, *inter alia*, Wu and Chen, 1999). A number of recent empirical studies produce evidence which is favourable to the validity of PPP as an equilibrium relationship but report slow adjustment of the real exchange rate to its equilibrium value (the half-life to equilibrium is often estimated to be three to four years).

One strand of the literature on PPP focuses on economic explanations for the deviations from the doctrine and the slow adjustment of the real exchange rate to equilibrium. A number of authors emphasize the role of supply-side determinants of the real exchange rates as suggested by the popular Balassa-Samuelson model (see, *inter alia*, Lothian and Taylor, 2004). Other authors consider the effects of demand shocks such as unexpected increases in government spending (Chinn, 1999), whereas a number of studies develop and test the “pricing to market” theories (Knetter, 1993). Market frictions that impede commodity trade may be a source of slow reversion to parity (Sercu *et al.*, 1995), whereas transaction costs may produce “bands of inaction” within which deviations from PPP are not arbitrated away by market forces (Taylor and Peel, 2000). Exchange rate targeting and interventions in the foreign exchange markets may also affect the adjustment to PPP and the ability to uncover PPP empirically (Brissimis *et al.*, 2005; Sideris, 2006; Taylor, 2004).

In a recent paper, Warnock (2003) provides an alternative economic explanation for the observed deviations of the real exchange rates from PPP. He argues that home-product bias in consumption spending causes deviations of the real

exchange rate from its equilibrium value.¹ To analyze exchange rate dynamics, he develops a two-country sticky-price dynamic model which allows for home bias in consumption patterns and indicates that asymmetric changes in money supplies produce large short-run and small long-run deviations of the real exchange rate from PPP.

The issue of consumption home bias is well-established in the international trade literature. A key relationship for model analysis is the degree of substitution between imported and domestic goods due to changes in the relative price of those two goods, commonly known as the Armington elasticity (after Armington, 1969). A key feature of the Armington approach to demand is the assumption that consumers distinguish products by their source. The product-differentiation model is now widely used in empirical international trade studies, in which consumers are assumed to differentiate between domestic goods and their imported substitutes (see, for example, Blonigen and Wilson, 1999).

Obstfeld and Rogoff (2000) argue that home bias, associated with international trade costs in goods markets, may explain a number of empirical puzzles in international macroeconomics. These trade costs may include transportation and information costs, border costs such as tariffs and non-tariff barriers and possibly other broader factors that impede trade. As such, trade costs tend to decrease through time –especially during the last three decades or so– as a result of diminishing transportation costs and the abolition of a number of tariffs, as goods markets become more integrated.

The latter argument provides the impetus for the present paper. More specifically, we conduct simple tests for the following hypotheses: (i) that there exists a home bias effect which influences the relationship among nominal exchange rates, domestic and foreign prices, and that this effect is falling over time as traded goods markets become more integrated and consumption preferences become more similar across developed countries, and (ii) that incorporating the time pattern of home bias in the empirical specification of PPP enhances the robustness of the theory.² We use

¹ The importance of home bias in consumer spending in international macroeconomic models can be traced back in Flemming (1962) and Mundell (1963).

² In the present study, *home bias* is used as a generic term capturing both international trade costs and differences in consumption preferences.

quarterly data for the US dollar exchange rate against the currencies of the rest of the G-7 economies for the post-Bretton Woods period 1973:1-2006:1.

The rest of the paper is organised as follows: Section 2 briefly describes the theoretical background and presents the specifications of the theoretical arguments of the present study. Section 3 reports the empirical analysis and results, whereas the final section summarises and concludes.

2. The theoretical background

Recent empirical work on PPP has concentrated on the estimation of the following *long-run* relationship:

$$s_t = \beta_0 + \beta_1 p_t + \beta_2 p_t^* + u_t \quad (1)$$

where s_t indicates the log of the nominal exchange rate denominated in the currency of the domestic economy, p_t and p_t^* are the logs of the price levels of the domestic and foreign economy, respectively and u_t is the error term. Strong PPP is implied by the proportionality hypothesis H_1 ($\beta_1=1$, $\beta_2=-1$), i.e.,

$$s_t = \beta_0 + p_t - p_t^* + u_t \quad (2)$$

However, strong PPP cannot be expected to hold always as an empirical proposition -because of the effects of transportation and information costs and measurement error problems- and is more likely to have the weak form implied by the symmetry hypothesis H_2 ($\beta_1=-\beta_2$):

$$s_t = \beta_0 + \beta_1(p_t - p_t^*) + u_t \quad (3)$$

The panel version of (1) is written as follows:

$$s_{it} = \beta_0 + \beta_1 p_{it} + \beta_2 p_{it}^* + v_i + u_{it} \quad (4)$$

where the subscript i indicates countries in the sample, subscript t is the time period and u_{it} is a white-noise error term. The country-specific effect v_i takes a different value for each country and it accounts for the unobservable characteristics of the i^{th} country which are assumed to be time-invariant, e.g., country size effects.

In the present study, we assume that there exists a home bias effect, which influences, among other parameters, the formation of the prices of the domestic products and the consequent influence that domestic prices exert on nominal exchange rates. In the framework of (4), the home bias effect is incorporated in the effect of the domestic prices, as measured by β_1 . To investigate the pattern of the home bias effect through time, we extend (4) as follows:

$$s_{it} = \beta_0 + \beta_1 p_{it} + \beta_2 p_{it}^* + \delta(p_{it}t) + v_i + u_{it} \quad (5)$$

where t is a time trend.³ The time pattern of the home bias is now captured by the interaction term $p_{it}t$. Assuming that the home bias effect diminishes through time, *ceteris paribus*, we expect δ to be negative ($\delta < 0$).

We further investigate the role of the home bias on the estimated equilibrium relationship between the nominal exchange rate and relative prices. To this end, we examine whether the incorporation of home bias effects in the empirical specification, leads to different results with respect to the estimated PPP-type long-run relationship. We thus test for the hypotheses of symmetry and proportionality in the framework of (4) and in the framework of (5) and compare the results.

3. The empirical analysis

3.1 The data set

PPP is tested between the USA and the economies of Germany, Japan, France, Italy, Canada and the UK. Quarterly seasonally unadjusted data for the post-Bretton Woods period 1973:1 – 2006:1 are used.⁴ The six bilateral nominal exchange rates against the US dollar and the producer price indices (PPI) of the seven countries are taken from the *International Financial Statistics* (IFS) database.⁵ All variables are expressed in logs.

³ Georgopoulos and Hejazi (2005) use a similar specification to test for the existence of home bias effects in the framework of the Feldstein-Horioka puzzle.

⁴ Data on PPI for France and Italy are not available prior to 1980:Q1 and to 1981:Q1, respectively, hence resulting in an unbalanced panel data set.

3.2 Unit root tests

In order to choose the appropriate method to estimate (4) and (5), a number of assumptions regarding the time-series properties of the individual series are evaluated empirically. First, we apply the t -bar test developed by Im, Pesaran and Shin (1997) in order to test for the order of integration (stationarity) of the s_{it} and p_{it} series. According to this test, the panel unit root hypothesis for s_{it} and p_{it} is rejected at the conventional 5% significance level. Similarly, the ADF test indicates that the US price index (the foreign producer price index) is stationary in levels. The unit root test results are reported in Table 1.

3.3 The country-specific effects

In order to test for the significance of country-specific effects, we test for the null hypothesis that all the individual cross-section dummies (v_i) are jointly equal to zero, with the aid of F - tests. The results are reported in Table 2. The respective F -statistics take the value of 1468.767 for (4) and 1490.231 for (5). We thus reject the hypothesis at the 1% level of significance (CV 1.32) for both cases. The results validate the country-specific effect specifications given in (4) and (5).

We then examine whether v_i is a random variable, i.e. test the hypothesis that fixed effects do not exist. This is done using the Breusch-Pagan (BP thereafter) test, which is distributed as χ^2_1 . We calculate BP=68514.93 and BP=68353.14 for the specifications of (4) and (5) respectively, which are highly significant. The test results reject the null hypothesis in favor of the random effects model.

Nevertheless, the BP results should be interpreted with caution, given that a fixed effects specification might induce similar results. Hence, we apply the Hausman test to specify whether v_i are fixed or random. Hausman's test is distributed as χ^2_h , where the number of the degrees of freedom, h , equals the number of the regressors (excluding the constant). The test results indicate that v_i is a random variable in (4) and a fixed variable in (5).

⁵ For the period 1998:1 – 2006:1 the mark/dollar, French franc/dollar and Italian lira/dollar rates are calculated using the rates by which the mark, French franc and Italian lira were converted to euro and the euro/dollar rate.

3.4 Panel estimates

We proceed to the estimation of (4) and (5). The results are presented in Table 3. A heteroskedasticity consistent matrix estimator of the covariance matrix, based on White (1980), is used to generate unbiased standard errors for inferencing procedures. The results indicate that all estimated coefficients are correctly signed and highly significant. Furthermore, the negative sign of the statistically significant estimated coefficient of p_{it} ($\delta=-0.0002$) in (5) indicates that the home bias effect is marginally falling over time, thus verifying our *a priori* expectations. It is obvious that both the linearity and monotonicity of this effect is the outcome of our estimating procedure. Nevertheless, since we are interested in making the simple point that the home bias should be falling through time, we deliberately avoid running numerous regressions with different functional forms.

The estimated residuals are stationary in levels in both specifications, hence providing some evidence in favor of PPP –actually in favor of a long-run relationship linking the nominal exchange rate with domestic and foreign prices. However, further testing is required in order to validate PPP in the alternative specifications (4) and (5). Table 3 presents the outcomes of the likelihood ratio test statistics for alternative hypotheses concerning the specification of the estimated long-run relationships. We test for hypotheses H_1 and H_2 which imply the validity of strong and weak PPP, respectively. H_1 and H_2 result in test statistics that are asymptotically χ^2 distributed with two and one degrees of freedom, respectively. According to the test results, neither H_1 nor H_2 is accepted when specification (4) is used. However, both H_1 and H_2 are accepted when testing is performed using the specification in (5). The findings indicate that, when the effects of the home bias are included explicitly in the modelling, the PPP doctrine -in both the strong and weak form- is accepted by the data.

4. Conclusions

Recent studies in the international economics literature emphasize the role of home bias effects, expressed either in terms of international trade costs, or in terms of consumer spending, in explaining a number of empirical puzzles (see *inter alia*,

Obstfeld and Rogoff, 2000; Warnock, 2003). Warnock, (2003), in particular, argues that home bias is a source of real exchange rate deviations away from its PPP equilibrium, in the long run. In the present paper, we test for this hypothesis assuming that the home bias effect falls over time, as goods markets become more integrated and consumer preferences become more similar across countries. We use quarterly observations for the US dollar against the currencies of the rest of the G-7 economies, for the period 1973:1-2006:1. The empirical findings support this hypothesis. In addition, when the time pattern of the home bias effect is accounted for in the empirical modeling we are able to accept long-run PPP in both the weak and strong form.

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Table 1: Unit root test results

<i>IPS panel unit root tests at levels</i>		
	Statistic	ρ-value
Exchange rate	-1.71865	0.0428
PPI	-7.57043	0.0000
<i>ADF unit root test at levels</i>		
USA PPI	-4.2260	0.0009

Notes: The lag selection for the unit root tests is based on Schwartz Bayesian Criterion (SBC). IPS test includes individual effects. ADF test includes a constant.

Table 2. Tests for the presence of country-specific effects

	Eq. (4)	Eq. (5)
<i>F</i> -statistic	1468.767*	1490.231*
Breusch-Pagan test	68514.93*	68353.14*
Hausman test	2.618	667.169*

* denotes statistical significance at the 1% significance level.

Table 3. Panel estimates (1973:1 – 2006:1)

	β_1	β_2	δ	IPS (u_{it})	H₂	H₁
eq.(4)	0.9508*	-1.0805*		-2.0734	55.782	56.185
	(0.0283)	(0.0309)		[0.0191]	[0.000]	[0.000]
eq.(5)	0.9577*	-0.9612*	-0.0002*	-1.7776	0.006	2.281
	(0.0284)	(0.0467)	(<.00001)	[0.0377]	[0.936]	[0.316]

Notes: White robust standard errors in parentheses. Marginal significance values in brackets. The lag selection for the panel unit root test is based on Schwartz Bayesian Criterion (SBC). The IPS test includes individual effects. * denotes statistical significance at the 1% significance level.

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