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Accounting for real exchange rate changes at long time horizons☆

Lein-Lein Chen[a,*], Seungmook Choi[b,1], John Devereux[c,2]

[a] Department of Economics, University of Nevada, Las Vegas, NV 89154-6005, United States
[b] Department of Finance, University of Nevada, Las Vegas, NV 89154-6008, United States
[c] Department of Economics, Queens College, CUNY, Flushing, New York, NY 11367-1597, United States

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ABSTRACT

Engel (1999) introduced real exchange rate accounting to determine the importance of nontradables for real exchange rate movements. We extend his approach in two directions. First, we identify a potential bias in the mean squared error (MSE) measure used in previous work. Second, using the corrected MSE measure we provide new empirical evidence that nontradables explain real exchange rate movements but only at really long horizons – over decades not years.

1. Introduction

Experience with floating exchange rates since the early 1970s shows that real exchange rates are volatile and that deviations from Purchasing Power Parity (PPP) are large and persistent.[3] What explains the deviations from PPP? The consensus in the literature is that tradable prices explain short run deviations from PPP. What about deviations over longer horizons? The traditional models of open economy macroeconomics and the growth literature arising from Balassa (1964) and Samuelson (1964) assume that purchasing power parity holds for traded goods over the long run. This ensures that long run movements in real exchange rates are caused by changes in the relative price of nontradables.[4]

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* Corresponding author. Tel.: +1 702 895 3776/702 895 3950; fax: +1 702 895 1354.
E-mail addresses: lein-lein.chen@unlv.edu (L.-L. Chen), seungmook.choi@unlv.edu (S. Choi), john.devereux@qc.cuny.edu (J. Devereux).
[1] Tel.: +1 702 895 4668.
[2] Tel.: +1 718 997 5441.

[3] Cassel (1916, 1918, 1922) is usually given the credit for the modern formulation of purchasing power parity. See Taylor and Taylor (2004) and Rogoff (1996) for literature surveys.

[4] Balassa (1964) and Samuelson (1964) argued that differences in rates of productivity growth in the traded and nontraded sectors drive differences in the relative price of nontradables and hence overall price levels. The subsequent literature provides many additional mechanisms. Bhagwati (1984), for example, emphasized differences in factor proportions. Asea and Corden (1994) summarize the early literature. More recent work studies the causes of price level differences using models with trade costs, heterogeneous firms and imperfect competition, see Bergin, Glick and Taylor (2006) and Ghironi and Melitz (2005).

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Engel (1999) transformed the empirical debate on the importance of nontradables for real exchange rate movements. Using CPI data from Canada, France, Germany, Italy, Japan, and the United States, he found no support for traditional theories as traded goods prices explained real exchange rate movements at all horizons. Subsequent work using Engel's framework have largely confirmed his findings. These results have proved highly influential leading some to suggest that the tradable/nontradable distinction has little relevance for open economy macroeconomics.

This paper extends real exchange rate accounting in two directions. Our first contribution is methodological. We show, analytically and numerically, that the mean squared error (MSE) measure used by Engel (1999) is biased. This potential bias does not appear to have attracted previous attention. We also show that the bias is positive and large for relative tradable price levels derived from CPI data. This, in turn, suggests that real exchange rate accounting as previously applied will understate the importance of nontradables. Finally, we use an alternative MSE measure that does not suffer from bias.

Our second contribution is to provide new empirical evidence on the relative importance of nontradables over longer time horizons. Engel's (1999) CPI data spans 1973 to 1995 – a little over two decades. As he recognized, two decades are not sufficient to determine the role of nontradables over the very long run. We re-examine the importance of nontradables for the floating period by extending Engel's (1999) price indices to the present. This doubles the span of his data. We also correct for the bias in his MSE measures. Using the longer span data and a corrected MSE measure, we obtain results similar to Engel (1999) that the relative price of tradables dominates the short and medium run. Indeed, they account for 95% of real exchange rate changes over a 10 year horizon for all countries with the exception of Canada. For Canada, the relative price of tradables accounts for 85%. However, we find that the importance of tradables falls at very long horizons – from 30–40 years. At a horizon of 35 years, tradables explain just 24% of real exchange rate changes for Canada and 47% for Germany. They explain 60% for France and 83% for Italy. The results that nontradables matter in the very long run also hold when we use price indices derived from GDP deflators. Our findings contrast with Engel (1999) who found no role for nontradables at long horizons with the exception of Canada. The differences arise from the longer span of our data and the corrected MSE measure. We conclude that, while Engel (1999) is correct over the short and medium run, there is an important role for nontradables over the very long run.

2. Real exchange rate accounting

This section outlines real exchange rate accounting. The approach aims to determine the contribution of relative traded and non-traded price levels to real exchange rate movements.

Let us assume that the overall price index is a geometrically weighted average of tradable and nontradable prices:

$$p_t = (1-\alpha)p_t^T + \alpha p_t^N \tag{1}$$

where p_t is the log of the overall price index, the super-scripts T and N refer to tradables and nontradables respectively and α is the share of nontradables in the price index of the base economy. For convenience, we take the US as the base economy.

Engel (1999) suggests that we decompose the real exchange rate as follows:

$$q_t = x_t + y_t \tag{2}$$

where

$$\begin{aligned} q_t &= s_t + p_t^* - p_t \\ x_t &= s_t + p_t^{T*} - p_t^T \\ y_t &= \beta(p_t^{N*} - p_t^{T*}) - \alpha(p_t^N - p_t^T). \end{aligned}$$

The asterisks represent the foreign country, β denotes the nontradable share in the foreign price index and s_t denotes the log of the nominal exchange rate. Eq. (2) divides the log of the real exchange rate (q_t) into two parts. The first term is the relative price of tradables in terms of the US denoted by x_t. The second term, y_t, is the cross-country relative nontradable-tradable price ratio weighted by the expenditure shares of nontradables.

There is a wide agreement that price levels respond slowly to nominal exchange rate changes over short time horizons. From Eq. (2), note that changes in the nominal exchange rate will change the x_t term but not the y_t term when prices are fixed in the domestic currency. Thus, tradables will explain most of real exchange rate movements over short horizons for floating exchange rates.

What explains real exchange rate changes at longer horizons? Engel (1999) proposed the following mean squared error (MSE) ratio to determine the importance of nontradables at different time horizons.[5]

$$B1(k) = \frac{\mathrm{MSE}(x_t - x_{t-k})}{\mathrm{MSE}(x_t - x_{t-k}) + \mathrm{MSE}(y_t - y_{t-k})} \tag{3}$$

Note that $B1(k)$ measures the importance of tradables for real exchange rate movements at a time horizon, k. If the ratio decreases as k increases, we may say that the importance of the relative price of tradables for real exchange rate changes falls over time.[6] Recall that the traditional approach assumes that relative purchasing power parity holds for tradables over longer time

[5] Eq. (3) assumes that there is a zero correlation between x and y which holds for our data in this paper. When the correlation between x and y is positive, $B1$ will understate the relative importance of tradables. With a negative correlation, it will overstate the importance of tradables.

[6] If x_t follows a stationary process and y_t is nonstationary this is sufficient for $B1(k)$ to decrease as k increases.