Real Exchange Rates

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1. The Real Exchange Rate(s)

The real exchange rate plays a crucial role in models of the open economy. How should the real exchange rate be defined, how does it behave over time, and what determines it at various time horizons are all questions that have been posed over the years. They have taken on heightened importance in recent years, as the scope of international transactions has expanded and more and more economic activity is either directly or indirectly affected by economic activity in other countries.

The most common definition of the real rate is the nominal exchange rate adjusted by price levels.

$$q_t \equiv s_t - p_t + p_t^* \qquad (1)$$

where s is the log exchange rate defined in units of home currency per unit of foreign, and p and p^* are log price levels. If purchasing power parity (PPP) holds, then q is always unity (or a constant, if price indices are used). One should expect PPP to hold in a world where transportation and transactions costs were negligible, consumption baskets were identical, and no arbitrage profits existed. Absent these conditions, the real exchange rate will vary.

One way of thinking about the determinants of movements in the real exchange rate is to appeal to a decomposition. Suppose the price index is a geometric average of traded and nontraded good prices.

$$p_t = \alpha\, p_t^N + (1 - \alpha)\, p_t^T \qquad (2)$$

where the lowercase letters denote logged values. Then substituting (2) into (1) yields:

$$q_t \equiv (s_t - p_t^T + p_t^{T*}) + [-\alpha(p_t^N - p_t^T) + \alpha^*(p_t^{N*} - p_t^{T*})] \qquad (3)$$

$$q_t \equiv q_t^T + [\omega_t] \qquad (3')$$

Equation (3) indicates that the real exchange rate can be expressed as the sum of three components: (i) the relative price of tradables q^T, (ii) the intercountry relative price of nontradables in terms of tradables in the home country ω.

2. The Determinants of the Real Exchange Rate

If PPP holds only for tradable goods, then only the second term in equation (3') can be non-zero, and the relative tradables-nontradables price is the determining factor in the value of the real exchange rate. Another possibility is that all goods are tradable, but not perfectly substitutable; then the imperfect substitutes model results, and q^T is equivalent to q. More generally, both terms on the right hand side of equation (3') can take on non-zero values. In either of these cases, there are a large number of variables that could influence each relative price. And of course, there is nothing to rule out both relative price channels as being operative. In popular discussion, all three definitions of "the real exchange rate" are used, sometimes leading to considerable confusion.

Most models of the real exchange rate can be categorized according to which specific relative price serves as the object of focus. If the relative price of nontradables is key, then the resulting models – in a small country context – have been termed "dependent economy" (Salter, 1959, and Swan, 1960) or "Scandinavian" model. In the former case, demand side factors drive shifts in the relative price of nontradables. In the latter, productivity levels and the nominal exchange rate determine the nominal wage rate and hence the price level, and thence the relative price of nontradables. In this latter context, the real exchange rate is a function of productivity (Krueger, 1983: 157). Consequently, the two sets of models both focus on the relative nontradables price, but differ in their focus on the source of shifts in this relative price. Since the home economy is small relative to the world economy (hence, one is working with a one-country model), the tradable price is pinned down by the rest-of-the-world supply of traded goods. Hence, the "real exchange rate" in this case is $(p^N\text{-}p^T)$.

The relative price of tradables definition is most appropriate when considering the relative price that achieves external balance in trade in goods and services. This variable is also what macroeconomic policymakers refer to as price competitiveness; hence, anything that affects the markup of price over cost – including both the level of demand, input costs, and market structure – can determine the real exchange rate.

Notice the dichotomy between the relative price of tradables and the relative price of nontradables breaks down when countries specialize in the production of goods. Then the real exchange rate is the same as the terms of trade; purchasing power parity would occur only if the two goods were perfect substitutes (see Lucas, 1982; Stockman, 1980).

3. Empirical Modeling and Results

3.1 Real exchange rate dynamics

In one special case, there is no need to model the real exchange rate: If relative PPP is *assumed* to hold, then q is a constant. Empirically, this is clearly not true in the short run, but could be in the long run. Consequently, tremendous effort has been invested in investigating whether q is trend stationary or not, even though trend stationarity is not the same as purchasing power parity holding (the stronger condition of mean stationarity is required). Numerous studies have evaluated the trend stationarity of q directly by application of unit root tests, or indirectly, by assessing whether the component series of q exhibit common long term trends. Broadly speaking, the conclusions in this literature are mixed. Generally, panel methods, long time samples, and the use of producer or wholesale price indices provide more evidence in favor of a trend reverting q than do pure time series methods, short samples, and the use of consumer price indices (see Rogoff, 1996; Taylor and Taylor, 2004). These results leave open the possibility that economic variables affect the movement of exchange rates over the short as well as the long run.

3.2 Modeling real exchange rate movements as a function of economic variables

The modeling of the real exchange rate determinants can be broken up into two main categories. The first category includes models of the nominal exchange rate which, by virtue of the assumption of sticky prices, become models of the real exchange rate. First and foremost among these are sticky price monetary models that incorporate exchange rate overshooting, such as Dornbusch (1976) and Frankel (1979). In the long run, purchasing power parity holds, so that these models are only short run models.

The second category includes models that focus on the determinants of the long run real exchange rate. By far dominant in this category are those that center on the relative price of nontradables. These include the specifications based on the approaches of Balassa (1964) and Samuelson (1964) that model the relative price of nontradables as a function of sectoral productivity differentials, including Hsieh (1982), Canzoneri, Cumby and Diba (1999), and Chinn (1999, 2000). They also include those models that search more broadly and include demand side determinants of the relative price, such as DeGregorio and Wolf (1994). Engel (1999) has cast doubt upon the relevance of the relative nontradables price. He demonstrates that

for the G-7 economies, the variability of q^T as proxied by the tradable components of the CPI, is comparable to the variability of ω even at horizons of 15 years.

More recently, some version of the portfolio balance model has been resurrected. Lane and Milesi-Ferretti (2002) have forwarded a model wherein the real rate depends upon the net foreign assets. Early panel evidence in favor of the importance of this factor is to be found in Gagnon (1996).

Some methodological approaches do not fall neatly into one or the other category. The analysis by Mark and Choi (1997) is one instance. They compared the usefulness of monetary and real factors in predicting exchange rate changes over long horizons, and found – surprisingly – that monetary factors had persistent effects on the real exchange rate. Using a different methodology, namely a Structural VAR model, Clarida and Gali (1995) find that monetary and demand side factors dominate in the determination of exchange rates. Also relying upon a structural (permanent-transitory) decomposition involving the real exchange rate and the current account, Lee and Chinn (forthcoming) find that positive permanent shocks (interpreted as productivity innovations) tend to appreciate the currency and (at least for the U.S.) have an impact comparable in magnitude to those of temporary shocks.

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