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Understanding Trends in Foreign Exchange Rates

In 1983 Richard Meese and Kenneth Rogoff published a startling paper. Briefly stated, their paper provided convincing evidence that traditional exchange rate models had no ability whatsoever to predict exchange rates; in fact, they could not even explain exchange rate changes ex post, i.e., even after future explanatory variables, like money supplies and interest rates, became known. These results took the wind out of the sails of researchers in international finance. For more than ten years now, a demoralized and shrinking corps of international economists has been devising ever more esoteric models, ranging from chaos and catastrophe theory to neural networks and Markov switching, in a (thus far) fruitless effort to explain exchange rate movements. As a result, if you asked a random sample of economists to name the three most difficult questions confronting mankind, the answers would probably be: (1) What is the meaning of life? (2) What is the relationship between quantum mechanics and general relativity? and (3) What's going on in the foreign exchange market? (Not necessarily in that order.)

This is an unfortunate state of affairs, because whenever turbulence erupts in the foreign exchange market, as it has in the past few months, economists are naturally called on to explain it. Since economists cannot explain short-term movements in exchange rates, the door is left open to thousands of armchair economists who are happy to sell you their own pet theories (as long as you don't ask them about their track record). The resulting morass of contradictory stories then creates the impression that economists know *nothing* about foreign exchange rates.

This *Letter* will try to change that impression. I argue that the economics profession does have something useful to say about exchange rates, if only you are patient enough. In particular, this *Letter* shows that long-term *trends* in foreign exchange rates are pretty well accounted for by just two factors—inflation and productivity.

Exchange rates in the post-Bretton Woods era

In 1944, Western leaders began drafting plans for the post-War world. Part of these plans included a strategy to restore order to the world's financial system. Global financial markets had been chaotic during the inter-war years, as nations resorted to competitive currency devaluations in an ultimately unsuccessful effort to shift unemployment to other countries. To avoid a repetition of this experience, the world's financial leaders met in Bretton Woods, New Hampshire, to devise a system of fixed exchange rates. The basic idea of the plan was to set a fixed value of each currency against the dollar, and then to set a fixed price of the dollar in terms of gold. Effectively then, the world was on a gold standard, but with the important difference that the dollar, not gold, served as the international store of value.

This system worked remarkably well for more than 20 years. However, its success depended on the world's confidence in the value of the dollar. If other countries began to suspect that the dollar would lose its value relative to gold, they would want to convert their dollar reserves to gold in order to avoid a capital loss. As U.S. inflation accelerated in the late 1960s, such a lack of confidence did in fact occur, as a given, fixed stock of gold was being asked to support a larger and larger supply of circulating dollars.

The Bretton Woods system ultimately collapsed in the early 1970s. At the time, most economists endorsed the demise of the Bretton Woods system, thinking that it would free the world's economies from the straitjacket of coordinating monetary policies. Although everyone knew that exchange rates would now move around as economic conditions varied from country to country, no one thought that they would fluctuate much more than underlying macroeconomic conditions.

Of course, these expectations were wildly inaccurate. The past 25 years of floating exchange rates have been characterized by two unexpected

features. First, exchange rates have been much more volatile than macroeconomic variables. For example, exchange rates are about as volatile as stock prices, and as noted above, are extremely difficult to predict. In fact, it is easier to predict year-to-year changes in the stock market than it is to predict year-to-year changes in exchange rates. Second, many exchange rates have exhibited a persistent trend against the dollar. For example, Figures 1 and 2 plot the value of the dollar against the yen and the mark. (Ignore the dotted lines for now.) Note that except for a brief interlude between 1980 and 1985, the dollar has depreciated steadily during the past 25 years. In 1970, a dollar was worth 358 yen and 3.65 marks. By 1994, the dollar was worth only 102 yen and 1.62 marks. (During 1995, the dollar has declined an additional 15 percent.) While exchange rate volatility remains a mystery, I will argue that these trends can be mostly explained by two simple theories—the Purchasing Power Parity theory of nominal exchange rates, and the Balassa-Samuelson theory of real exchange rates.

Purchasing Power Parity

Purchasing Power Parity is one of the oldest theories in economics. It was formally stated by the philosopher David Hume in 1752, but has no doubt been around as long as currencies have been exchanged. The basic idea is simple—according to PPP the value of an exchange rate should equalize the prices of goods when expressed in a common currency. The underlying logic is based on commodity arbitrage. For example, if the current yen/dollar exchange rate is 100, and the price of U.S. cars is $10,000 while the price of Japanese cars is 1.2 million yen, then everyone will want to buy U.S. cars since they are $2,000 cheaper. This creates an excess demand for dollars, which eventually causes the dollar to appreciate to 120 yen. (Or, if the exchange rate is fixed, causes U.S. car prices to rise to $12,000, or Japanese car prices to fall to 1.0 million yen.)

Now, an operational problem with this theory is determining exactly *which goods* have their prices equalized. As a practical matter, economists use a price *index*, like the CPI, to summarize the level of prices in each country. With this definition, PPP says that the exchange rate should equal the ratio of national price indices. (Actually, since base periods and the commodity composition of price indices may differ across countries, PPP only predicts a proportional relationship between exchange rates and the ratio of price indices.)

The pattern of relative prices—the dotted lines in Figures 1 and 2—provide evidence on the validity of PPP. To deal with base period indeterminacy, I assume that in 1980 the exchange rate equaled the ratio of CPIs, in other words, that exchange rates were "in equilibrium" in 1980. Clearly, PPP provides a poor theory of year-to-year changes in the exchange rate. Still, there is definitely *some* sort of long-run relationship between exchange rates and relative price levels, particularly for the U.S. and Germany. Specifically, on average the dollar has depreciated 4.9 percent per year against the yen, and 3.2 percent

Figure 1
Japan

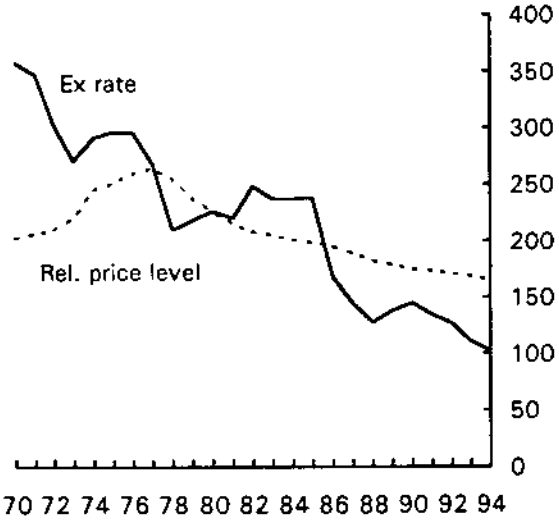
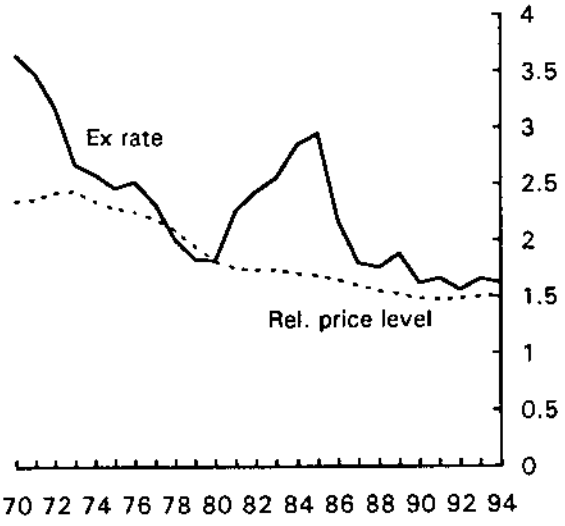


Figure 2
Germany



per year against the mark. At the same time, U.S. inflation has exceeded Japanese inflation by 0.9 percent on average, and exceeded German inflation by 1.9 percent on average. Thus, while PPP only accounts for 20 percent of the trend of the dollar/yen rate, it accounts for a more substantial 60 percent of the long-run trend in the dollar/mark rate. What about the remaining 80 and 40 percent? Discrepancies between observed exchange rates and their PPP levels are referred to as "real exchange rate" changes, and the leading theory of real exchange rate determination was first put forth in 1964 by Bela Balassa and Paul Samuelson.

The Balassa-Samuelson theory of real exchange rates

An important problem with the notion of PPP is that, either because of natural or government-imposed barriers, many goods are not traded between countries. For nontraded goods there is obviously no reason for the exchange rate to adjust to equalize prices, and therefore, to the extent that nontraded goods enter national price indices, no reason to expect changes in exchange rates to mirror changes in relative price levels. In fact, estimates suggest that more than 50 percent of most countries' output consists of nontraded goods. Specifically, products with a large service component, like housing and routine medical treatment, tend to be nontraded, while manufactured products, like cars and computers, tend to be traded.

Balassa and Samuelson examined the consequences of nontraded goods for the theory of PPP and the determination of real exchange rates. They were motivated by the empirical regularity that wealthy countries have higher price levels than poor countries, i.e., wealthy countries have "overvalued" exchange rates. Their explanation of this phenomenon was based on the tendency for productivity growth to be higher in the traded goods sector than in the nontraded goods sector. Because the prices of traded goods are determined in world markets, productivity growth in the traded goods sector doesn't lower prices; instead, it raises the returns to factors of production. However, since capital is relatively mobile across countries, its return is also fixed by world market conditions. Therefore, the primary effect of traded goods productivity growth is increased wages in the traded goods sector. Then, since labor tends to be mobile across sectors, wage increases in the traded goods sector bid up wages in the nontraded goods sector. Finally, an increase in wages in the nontraded goods sector gets passed along into higher prices of nontraded goods, and more generally, into a higher overall price level.

Does this theory explain departures from PPP? Note that the yen has experienced an annual trend *real* appreciation of 4.0 percent against the dollar, while the trend real appreciation of the mark has been a more modest 1.3 percent. At the same time, Japanese labor productivity growth in manufacturing, (a proxy for the traded goods sector), has been 2.1 percent higher on average than in the U.S., while German labor productivity growth has on average been 1.1 percent higher. Adding up the contributions of both PPP and productivity, the result is that about 60 percent of the trend in the yen can be accounted for, while nearly all of the trend in the mark can be accounted for.

Conclusion

Economists cannot explain short-run changes in exchange rates. Nor can they explain the volatility of exchange rates. However, if we focus on the long run—measured in *decades*, not months or even years—then something can be said about exchange rate determination. In particular, we can explain nearly all of the trend in the mark, and about 60 percent of the trend in the yen. For the mark, most of the explanation comes from inflation differentials (i.e, PPP), while for the yen most of the explanation comes from differential productivity growth (i.e., the Balassa-Samuelson effect).

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References

Balassa, Bela. 1964. "The Purchasing Power Parity Doctrine: A Reappraisal." *Journal of Political Economy* 72, pp. 584–596.

Meese, Richard A., and Kenneth Rogoff. 1983. "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?" *Journal of International Economics* 14, pp. 3–24.

Samuelson, Paul A. 1964. "Theoretical Notes on Trade Problems." *Review of Economics and Statistics* 46, pp. 145–154.