IMF WORKING PAPER

WP/91/51

INTERNATIONAL MONETARY FUND

Research Department

Uncovered Interest Parity

Prepared by Peter Isard *

May 1991

Abstract

This note provides an overview of the uncovered interest parity assumption. It traces the history of the interest parity concept, summarizes evidence on the empirical validity of uncovered interest parity, and discusses the implications for macroeconomic analysis. The uncovered interest parity assumption has been an important building block in multiperiod and continuous time models of open economies, and although its validity is strongly challenged by the empirical evidence, its retention in macroeconomic models is supported on pragmatic grounds, at least for the time being, by the lack of much empirical support for existing models of the exchange risk premium.

JEL Classification Numbers:
F31, F41

---

* This note has been prepared as a contribution to The New Palgrave Dictionary of Money and Finance.

Contents

Summary

This note briefly assesses the assumption of uncovered interest parity, which postulates that market forces drive the expected rate of change in the spot exchange rate between any two currencies into equality with the difference between the interest rates on comparable assets denominated in the two currencies. Because uncovered interest parity hypothesizes a simple relationship between the values of exchange rates and interest rates currently observed and the value of the exchange rate that market participants expect to prevail in the future, it has played a central role in multiperiod and continuous time models of open economies.

After tracing the history of the interest parity concept, the note reviews the empirical evidence on the validity of the uncovered interest parity assumption and discusses the implications for macroeconomic analysis. Although the validity of uncovered interest parity is strongly challenged by the empirical evidence, its retention in macroeconomic models is supported on pragmatic grounds, at least for the time being, by the lack of much empirical support for existing models of the exchange risk premium (that is, the deviation from uncovered interest parity). It is emphasized, however, that even if the uncovered interest parity assumption is valid, which depends on whether there is bias in its implicit forecasts of changes in spot exchange rates, it provides a very inaccurate framework for pre-dicting the total (expected plus unexpected) change in exchange rates.

I. Introduction

The assumption of uncovered interest parity (UIP) is an important building block for macroeconomic analysis of open economies. It provides a simple relationship between the interest rate on an asset denominated in any one country's currency unit, the interest rate on a similar asset denominated in another country's currency, and the expected rate of change in the spot exchange rate between the two currencies.

The theory of interest parity received prominence from expositions by Keynes (e.g., 1923: pp. 115-39), whose attention had been captured by the rapid expansion of organized trading in forward exchange following World War I (Einzig, 1962: pp. 239-41 and p. 275). Although an understanding of the forward exchange market must have developed within various banking circles during the second half of the nineteenth century, apart from an isolated exposition by a German economist, Walther Lotz (1889: pp. 34-5), the nineteenth century literature on foreign exchange theory apparently dealt only with spot exchange rates (Einzig, 1962: pp. 214-15). Forward exchange trading gave rise to the notion of covered interest parity (CIP), which related the differential between domestic and foreign interest rates to the percentage difference between forward and spot exchange rates. Since it was clear that forward rates also reflected perceptions about future spot rates, it was a short step to the assumption of UIP, which builds on the theory of CIP by essentially postulating that market forces drive the forward exchange rate into equality with the expected future spot exchange rate.

II. Basic Concepts

The concept of interest parity recognizes that portfolio investors at any time t have the choice of holding assets denominated in domestic currency, offering the own rate of interest $r_{d,t}$ between times t and t+1, or assets denominated in foreign currency, offering the own rate of interest $r_{f,t}$. Thus, an investor starting with one unit of domestic currency should compare the option of accumulating $1+r_{d,t}$ units with the option of converting at the spot exchange rate into s_t units of foreign currency, investing in foreign assets to accumulate $s_t(1+r_{f,t})$ units of foreign currency at time t+1, and then reconverting into domestic currency. If the domestic and foreign assets differ only in their currencies of denomination, and if investors have the opportunity to cover against exchange rate uncertainty by arranging at time t to reconvert from foreign to domestic currency one period later at the forward exchange rate f_t (in units of foreign currency per unit of domestic currency), then market equilibrium requires the condition of CIP:

$$(1) \quad 1+r_{d,t} = s_t(1+r_{f,t})/f_t.$$

If condition (1) did not hold, profitable market arbitrage opportunities could be exploited without incurring any risks.

Investors also have the opportunity to leave their foreign currency positions uncovered at time t and to wait until time t+1 to make arrangements to reconvert into domestic currency at the spot exchange rate s_{t+1}. Unlike f_t, the value of s_{t+1} is unknown at time t, so the attractiveness of holding an uncovered position must be assessed in terms of the probabilities of different outcomes for s_{t+1}. The assumption of UIP postulates that markets will equilibrate the return on the domestic currency asset with the expected value at time t (E_t) of the yield on an uncovered position in foreign currency:

$$(2) \quad 1+r_{d,t} = E_t[s_t(1+r_{f,t})/s_{t+1}] = s_t(1+r_{f,t})E_t(1/s_{t+1}).$$

This is essentially equivalent to combining the CIP condition with the assumption that exchange rates are driven, at the margin, by risk neutral market participants who stand ready to take uncovered spot or forward positions whenever the forward rate deviates from the expected future spot rate.

By manipulating condition (1), it is easily seen that CIP implies

$$(3) \quad \frac{f_t - s_t}{s_t} = \frac{1+r_{f,t}}{1+r_{d,t}} - 1.$$

Hence, as a first approximation (for values of $1+r_{d,t}$ in the vicinity of 1):

$$(4) \quad r_{f,t} - r_{d,t} \approx (f_t - s_t)/s_t$$

In addition, when Jensen's inequality (i.e., the difference between $E_t(1/s_{t+1})$ and $1/E_t(s_{t+1})$) is ignored, the assumption of UIP can be approximated as

$$(5) \quad r_{f,t} - r_{d,t} \approx E_t[(s_{t+1} - s_t)/s_t] = (E_t s_{t+1} - s_t)/s_t.$$

The assumption of UIP adds an element of dynamics to the CIP condition by hypothesizing a relationship between the observed values of variables at time t and the value of the spot exchange rate that market participants expect at time t to prevail at time t+1. As such, UIP has been embedded in many multiperiod and continuous time models of open economies. The CIP and UIP conditions can be written for any duration of the time period between t and t+1. Thus, if the UIP assumption was valid at all horizons, the observed values of the spot exchange rate and the term structures of domestic and foreign interest rates could be used to infer the expected future time path of the spot exchange rate (Porter, 1971).

III. Empirical Validity

The theory leading to the CIP condition--and hence also to the UIP assumption--abstracts entirely from any credit risks, capital controls, or explicit taxes on the domestic and foreign currency investments. Keynes (1923: pp. 126-7) was well aware that investor choices between foreign and domestic assets do not depend on interest rates and exchange rates alone:

> ...the various uncertainties of financial and political risk...introduce a further element which sometimes quite transcends the factor of relative interest. The possibility of financial trouble or political disturbance, and the quite appreciable probability of a moratorium in the event of any difficulties arising, or of the sudden introduction of exchange regulations which would interfere with the movement of balances out of the country, and even sometimes the contingency of a drastic demonetisation,--all these factors deter...[market participants], even when the exchange risk proper is eliminated, from maintaining large...balances at certain foreign centres.

In those circumstances where it is clearly valid to abstract from such considerations, the CIP condition has been unambiguously confirmed. Indeed, interviews at large banks have established that the CIP condition is used as a formula for determining the exchange rates and interest rates at which trading is actually conducted. Foreign exchange traders use Eurocurrency interest rate differentials to determine the forward exchange rates (in relation to spot rates) that they quote to customers, while traders in Eurocurrency deposits use the spreads between forward and spot exchange rates to set the spreads between the interest rates that their banks offer on domestic and foreign currency deposits (Herring and Marston, 1976; Levich, 1985). Consistently, empirical research has confirmed that deviations from CIP can be related systematically to the effective taxes imposed by capital controls and to non-currency-specific risk premiums associated with prospective controls (Dooley and Isard, 1980).

The UIP assumption has played a much more central role than the CIP condition by itself in the development of multiperiod and continuous time models of open economies. Accordingly, considerable effort has been made to test the empirical validity of UIP. Some of the stimulus for such testing has been policy related. In particular, the validity of UIP has been a central issue in the policy debate over the effectiveness of official intervention in exchange markets (Henderson and Sampson, 1983). To the extent that UIP was valid, official intervention could not succeed in changing the spot exchange rate relative to the expected future spot rate unless the authorities chose to allow interest rates to change. In this sense, exchange market intervention could not be viewed as providing the authorities with an effective policy instrument in addition to interest rates. Thus, the case for intervention has been considered by some to depend on whether the empirical evidence rejects UIP.

In the absence of recorded data on expected future exchange rates, UIP can be tested empirically only as part of a joint hypothesis. A common approach has been to test UIP jointly with the assumption that exchange rate expectations are unbiased. Together the two assumptions imply that forward exchange rates should be unbiased predictors of future spot exchange rates.

The proposition that forward rates are unbiased predictors of future spot rates has been rejected by most of the econometric studies that have tested it (see, for example, Cumby and Obstfeld, 1984). Such evidence can only be consistent with UIP if exchange rate expectations have exhibited the same bias as forward rates. This finding has focused attention on the possibility that exchange rate expectations have been biased by the presence of "peso problems" (Krasker, 1980). In particular, even if UIP were valid, the forward rate would be a biased predictor of the future spot rate, in finite data samples, whenever market participants repeatedly expected the spot rate to be affected by a policy action or some other event that failed to materialize over a long sequence of observations.

Another approach to testing the UIP assumption has been based on survey data. Survey data on exchange rate expectations provide direct evidence on whether the UIP assumption is valid. Such data, which have been collected by several different sources since the early 1980s, reveal that exchange rate expectations, measured by the average forecasts of sample respondents, deviate considerably from prevailing forward exchange rates (Frankel and Froot, 1987; Takagi, 1991). To the extent that the survey measures of average expectations are meaningful, this is strong evidence against UIP.

IV. Implications for Macroeconomic Analysis

The empirical evidence against UIP challenges the appropriateness of retaining the UIP assumption in macroeconomic analysis. On pragmatic grounds, however, the case for abandoning UIP depends on the confidence that can be placed in behavioral models of the deviation from UIP. Until this deviation can be shown to behave systematically relative to other economic variables in practice, and in a manner that makes sense in theory, there will be no apparent way to replace the UIP assumption with something more appealing.

The deviation from UIP--the difference between the expected future spot rate and the forward rate, measured as a percent of the current spot rate--is generally called the exchange risk premium. Thus, the expected percentage change in the spot exchange rate can be viewed, by definition, as the sum of the observable (percentage) forward premium and the unobservable exchange risk premium.

Behavioral hypotheses about the exchange risk premium can be tested by embedding them in models of observable exchange rates. The first conceptual models of the exchange risk premium were based on a portfolio balance

framework in which financial claims are distinguished by currencies of denomination but not by the countries obligated to meet the claims (see, for example, Dooley and Isard, 1983). Empirical tests of this class of portfolio balance models have explained at most a small portion of the variation over time in the exchange risk premium (Tryon, 1983; Boughton, 1987). More sophisticated behavioral hypotheses have recognized--in the spirit of the above citation from Keynes--that exchange risks and credit risks are interrelated, and that the magnitudes of these risks reflect the relative macroeconomic and political conditions, prospects, and uncertainties of the countries that have issued the portfolio claims (Dooley and Isard, 1983; Isard, 1988). While casual evidence suggests that this type of hypothesis is broadly capable of explaining the empirical behavior of exchange rates (Dooley and Isard, 1991), it has not yet received careful empirical testing or provided a well specified replacement for the UIP assumption. Accordingly, many macroeconometric models continue to embody either the UIP assumption or a slight modification that incorporates a constant exchange risk premium.

Quite apart from the validity of the UIP assumption, which turns on the issue of unbiasedness, it is clear that predictions of future exchange rates based on UIP tend to be highly inaccurate. Even if the UIP assumption were valid, the empirical evidence reveals that forward exchange rates have been able to explain very little of the variance in future spot exchange rates (Isard, 1978; Frenkel, 1981). The average absolute value of forward premiums for one-month or three-month horizons, for example, has been much smaller than the average absolute value of observed changes in spot exchange rates over comparable intervals. Consistently, a predominant part of the change in the spot exchange rate between times t and t+1 often appears to be triggered by "news" received after time t. Such news may take the form of unexpected policy changes, surprising new statistical information, or other unanticipated events that have macroeconomic implications. Accordingly, insofar as the change in the spot rate that is expected ex ante is generally dominated by the unexpected change, UIP by itself provides a very inaccurate framework for predicting the total (expected plus unexpected) change in exchange rates.

References

Boughton, J.M., "Tests of the Performance of Reduced-Form Exchange Rate Models, Journal of International Economics, Vol. 23 (1987), pp. 41-56.

Cumby, R.E., and Obstfeld, M., "International Interest Rate and Price Level Linkages Under Flexible Exchange Rates: A Review of Recent Evidence." In J.F.O. Bilson and R.C. Marston (eds.), Exchange Rate Theory and Practice (Chicago: University of Chicago Press, 1984).

Dooley, M.P., and Isard, P., "Capital Controls, Political Risk and Deviations from Interest-Rate Parity," Journal of Political Economy, Vol. 88 (1980), pp. 370-84.

_____ and _____, "The Portfolio-Balance Model of Exchange Rates and Some Structural Estimates of the Risk Premium," International Monetary Fund, Staff Papers, Vol. 30 (1983), pp. 683-702.

_____ and _____, "A Note on Fiscal Policy, Investment Location Decisions, and Exchange Rates," Journal of International Money and Finance, Vol. 10 (forthcoming 1991).

Einzig, P., The History of Foreign Exchange (London: Macmillan, 1962).

Frankel, J.A., and Froot, K.A., "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations," American Economic Review, Vol. 77 (1987), pp. 133-53.

Frenkel, J.A., "Flexible Exchange Rates, Prices and the Role of 'News': Lessons From the 1970s," Journal of Political Economy, Vol. 89 (1981), pp. 665-705.

Henderson, D.W., and Sampson S., "Intervention in Foreign Exchange Markets: A Summary of Ten Staff Studies," Federal Reserve Bulletin (November 1983), pp. 830-6.

Herring, R.J., and Marston, R.C., "The Forward Market and Interest Rates in the Eurocurrency and National Money Markets." In C.H. Stern, J.H. Makin, and D.E. Logue (eds.), Eurocurrencies and the International Monetary System (Washington: American Enterprise Institute, 1976).

Isard, P., "Exchange-Rate Determination: A Survey of Popular Views and Recent Models," Princeton Studies in International Finance, No. 42 (Princeton: International Finance Section, Department of Economics, Princeton University, 1978).

_____, "Exchange Rate Modeling: An Assessment of Alternative Approaches." In R.C. Bryant, D.W. Henderson, G. Holtham, P. Hooper, and S.A. Symansky (eds.), Empirical Macroeconomics for Interdependent Economies (Washington: The Brookings Institution, 1988).

Keynes, J.M., A Tract on Monetary Reform (London: Macmillan, 1923).

Krasker, W.S., "The Peso Problem in Testing the Efficiency of Forward Exchange Markets," Journal of Monetary Economics, Vol. 6 (1980), pp. 269-76.

Levich, R.M., "Empirical Studies of Exchange Rates: Price Behavior, Rate Determination and Market Efficiency." In R.W. Jones and P.B. Kenen (eds.), Handbook of International Economics, Vol. 2 (Amsterdam: North Holland, 1985).

Lotz, W., "Die Währungsfrage in Österreich-Ungarn," Schmollers Jahrbuch, Vol. 13 (1889), pp. 34-5.

Porter, M.G., "A Theoretical and Empirical Framework for Analyzing the Term Structure of Exchange Rate Expectations," International Monetary Fund, Staff Papers, Vol. 18 (1971), pp. 613-42.

Takagi, S., "Exchange Rate Expectations: A Survey of Survey Studies," International Monetary Fund, Staff Papers, Vol. 38 (1991), pp. 156-83.

Tryon, R.W., "Small Empirical Models of Exchange Market Intervention: A Review of the Literature," Staff Studies 134 (Washington: Board of Governors of the Federal Reserve System, 1983).