UC Santa Barbara
Departmental Working Papers

Title
What Covered Interest Parity Implies about the Theory of Uncovered Interest Parity.

Permalink
https://escholarship.org/uc/item/0zk6t2hj

Author
Pippenger, John

Publication Date
2012-05-30

WHAT COVERED INTEREST PARITY IMPLIES ABOUT THE

THEORY OF UNCOVERED INTEREST PARITY AND RISK PRMIUMS

John Pippenger

Department of Economics

University of California

Santa Barbara, California 93106

The literature assumes that the *theory* of uncovered interest parity fails because investing

without cover is risky and investors are risk adverse. But covered interest parity implies

that the theory can fail even when investors are risk neutral and hold when investors are

risk adverse and there is a risk premium. The failure to fully appreciate the relation

between uncovered interest parity and risk premiums has probably contributed to our

failure to understand why UIP fails empirically.

1.0 Introduction

Although this paper has implications about testing uncovered interest parity (UIP) it is not primarily about testing. It is primarily about the theory of uncovered interest parity.[1] The literature assumes that the *theory* of uncovered interest parity fails because investing without cover is risky and investors are risk adverse. But covered interest parity (CIP) implies that the theory can fail even when investors are risk neutral and hold when investors are risk adverse and there is a risk premium. The failure to fully appreciate the relation between uncovered interest parity and risk premiums almost certainly has contributed to our failure to understand why UIP fails empirically.

Section 2 briefly reviews the theory of uncovered interest parity. Section 3 describes what covered CIP implies about UIP. Section 4 describes the role of risk premiums when CIP holds. Section 5 uses Sarno et al (forthcoming) to illustrate how ignoring the relation between the theory of UIP and risk developed in Sections 3 and 4 can affect empirical research.

2. Uncovered Interest Parity

The theory of uncovered interest parity has produced a large literature. See Aslan and Korap (2010) for a recent compact review of that literature. For a more extensive review see Chinn (2006). Additional recent work includes Faust and Rogers (2003), Chinn and Meredith (2004), Han (2004), Chaboud and Wright (2005), Baillie and Kiliç (2006), Sarantis (2006), Sarno et al (2006), Sercu et al (2008), Mehl and Cappiello (2009), Bacchetta and van Wincoop (2010), Frankel and Poonawala (2010), Hochradl and Wagner (2010) and Paya, Peel, Spiru (2010), Baillie (2011) and Sarno et al (forthcoming).

---

[1] Testing the theory requires additional assumptions such as rational expectations, capital mobility and the absence of taxes.

As this literature shows, empirically UIP routinely fails, particularly in the short run, at short maturities and between developed countries.

For reasons that will become clear shortly, I express the theory of uncovered interest parity as follows:

$$[E(s_{t+1}/\Phi_t) - s_t] - (i_t - i_t^*) = E(R_{t+1}/\Phi_t) = 0.0 \qquad (1)$$

Following the usual notation, s_t is the log of the spot domestic price of foreign exchange, i_t is a risk free domestic interest rate and i_t^* is a risk free foreign interest rate. The maturity of the interest rates should match the maturity of the expected change in spot rates. $E(x_{t+1}/\Phi_t)$ is the expectation of x_{t+1} taken at time t based on the information Φ_t available at time t. So $E(s_{t+1}/\Phi_t)$ is the expected future spot rate.

Ignoring any relevant transaction costs, the theory of uncovered interest parity holds when $E(R_{t+1}/\Phi_t)$ is zero. The UIP literature usually interprets $E(R_{t+1}/\Phi_t)$ as a risk premium. See for example Chinn (2006). If investors were risk neutral, presumably the theory of UIP would hold.

3.0 What CIP Implies about the Theory of UIP

Covered interest parity suggests that the theory of uncovered interest parity fails, not because investors are risk adverse, but because there is an expected excess return. That expected excess return may or may not equal some risk premium. The next section discusses the relationship between expected excess returns and risk premiums. This section concentrates on expected excess returns.

Some of the more recent articles on CIP include Felmingham and Leong (2005), Akram et al (2008), Baba and Packer (2009), Fong et al (2010) and Paya et al (2010).

As that literature points out, covered interest parity is the equilibrium, or what is often called the no-arbitrage, condition associated with covered interest arbitrage. Effective arbitrage appears to quickly eliminate any potential profit from covered interest rate arbitrage. As Akram et al (2008) points out, "It seems generally accepted that financial markets do not offer risk-free arbitrage opportunities, at least when allowance is made for transaction costs." Akram et al (2008) goes on to say that one "can safely assume arbitrage-free prices in FX markets when working with daily or lower frequency data". From this point on I assume that covered interest parity holds empirically.

Ignoring the relevant transaction costs, eq. (2) describes the theory of covered interest parity where f_t is the log of the forward exchange rate with the same maturity as the interest rates.

$$(f_t - s_t) - (i_t - i_t^*) = 0.0 \tag{2}$$

When CIP holds for all t, eq. (2) implies eq. (3).

$$s_{t+1} = f_{t+1} - (i_{t+1} - i_{t+1}^*) \tag{3}$$

The actual excess return from investing without cover is s_{t+1} minus f_t, which I denote as R_{t+1}. When s_{t+1} equals f_t, the actual return from an uncovered investment is the same as the return from a covered investment. When s_{t+1} is greater than f_t, borrowing dollars and investing in sterling without cover produces a higher return than the same investment with cover. When s_{t+1} is less than f_t, borrowing sterling and investing in dollars produces a higher return than the same investment with cover.

Subtracting f_t from both sides of eq.(3) produces eq. (4) .

$$R_{t+1} \equiv s_{t+1} - f_t = \Delta f_{t+1} - (i_{t+1} - i_{t+1}^*) \tag{4}$$

Note that R_{t+1} equals $s_{t+1} - f_t$ by definition while the equality between R_{t+1} and Δf_{t+1}

minus $(i_{t+1} - i_{t+1}^*)$ is an implication of the theory of covered interest parity.

Taking the first difference of eq. (3) and doing a little rearranging produces eq. (5).

$$\Delta s_{t+1} = (i_t - i_t^*) + \Delta f_{t+1} - (i_{t+1} - i_{t+1}^*) \tag{5}$$

Using eq. 4, eq. (5) can be rewritten as eq. (6).

$$\Delta s_{t+1} = (i_t - i_t^*) + \Delta f_{t+1} - (i_{t+1} - i_{t+1}^*) = (i_t - i_t^*) + R_{t+1} \tag{6}$$

Since R_{t+1} is the actual excess return to investing without cover, it follows that the

expected excess return is $E(R_{t+1}/\Phi_t)$. Rearranging eq. (6) and taking expectations

produces eq. (7).

$$[E(s_{t+1}/\Phi_t) - s_t] - (i_t - i_t^*) = E(\Delta f_{t+1}/\Phi_t) - E(i_{t+1} - i_{t+1}^*/\Phi_t) = E(R_{t+1}/\Phi_t) \tag{7}$$

Eq. (7) says that uncovered interest parity holds if and only if the expected excess

return is zero. This interpretation of the theory of uncovered interest parity does not

assume rational expectations, risk neutrality or anything about risk premiums. All it

assumes is that covered interest parity holds.

4.0 Expected Excess Returns and Risk premiums

When the UIP literature interprets $E(R_{t+1}/\Phi_t)$ in eq.(1) as a risk premium it

implicitly assumes stock equilibrium. That assumption may be reasonable for the long

run, but it is unlikely to hold in the very short run.[2] In either case, the assumption needs

to be explicit because it has important implications.

To make my point as simply as possible, let all uncovered investment involve

forward contracts. A_t represents the actual stock of uncovered forward claims on sterling

---

[2] The theory of covered interest parity also assumes stock equilibrium. But that stock equilibrium does not imply stock equilibrium for uncovered interest parity. Investors may be willing to move quickly to earn riskless returns and at the same time be slow to exploit risky profits even when they exceed risk premiums.

and A_t^D the desired stock of A_t. When A_t is positive investors hold contracts to buy

sterling forward that are not covered. When A_t is negative, investors hold contracts to

sell sterling forward that are not covered.

Buying sterling forward without cover is equivalent to borrowing in the U.S. and

lending in the U.K. without cover. In both cases the actual excess return is R_{t+1}.

When investors are risk neutral, desired changes in A_t presumably depend on only

the expected excess return $E(R_{t+1}/\Phi_t)$. When investors are risk adverse, desired changes

in A_t depend on risk adjusted expected excess returns where υ_t is the risk premium.[3]

$$A_t^D - A_t = a(E(R_{t+1}/\Phi_t) - \upsilon_t) \tag{8}$$

When $E(R_{t+1}/\Phi_t)$ is positive and greater than υ_t, risk adverse investors buy sterling

forward without cover. When $E(R_{t+1}/\Phi_t)$ is negative and less than υ_t, they sell sterling

forward without cover. When $E(R_{t+1}/\Phi_t) - \upsilon_t$ is zero they neither buy nor sell.

For simplicity, I assume that risk premiums depend on A_t and a vector of

exogenous variables Z_t.

$$\upsilon_t = \Psi(A_t, Z_t) \tag{9}$$

The larger A_t, the larger υ_t.

$E(R_{t+1}/\Phi_t)$ also depends on A_t and a different vector of exogenous variables z_t.

$$E(R_{t+1}/\Phi_t) = \Omega(A_t, z_t) \tag{10}$$

As A_t increases $E(R_{t+1}/\Phi_t)$ tends to decrease.

With only flow equilibrium, expected excess returns and risk premiums can diverge.

With only flow equilibrium, there is nothing preventing a risk neutral investor from

expecting an excess return.

---

[3] The relevant risk premium is positive when the expected excess return is positive and negative when the expected excess return is negative.

With stock equilibrium $(A_t^D - A_t)$ is zero. The standard assumption that risk

neutrality produces UIP depends on the implicit assumption of stock equilibrium. Stock

equilibrium and risk neutrality require that $E(R_{t+1}/\Phi_t)$ is zero. On the other hand, stock

equilibrium and risk aversion requires that, in general, risk premiums just offset expected

excess returns.

But when A_t is zero, risk adverse investors also do not want to buy sterling forward

without cover as long as υ_t is greater than $E(R_{t+1}/\Phi_t)$. Investors also do not want to sell

sterling forward without cover as long as υ_t is less than $E(R_{t+1}/\Phi_t)$. Therefore stock

equilibrium with risk aversion implies eq. (11).

$$E(R_{t+1}/\Phi_t) = \upsilon_t \qquad\qquad\qquad A_t \neq 0$$

$$E(R_{t+1}/\Phi_t) \leq \upsilon_t \qquad\qquad\qquad A_t = 0 \text{ and } E(R_{t+1}/\Phi_t) \geq 0$$

$$E(R_{t+1}/\Phi_t) \geq \upsilon_t \qquad\qquad\qquad A_t = 0 \text{ and } E(R_{t+1}/\Phi_t) \leq 0 \qquad (11)$$

Equilibria like the one described by eq. (11) are not the result of my simplifications.

When risk adverse investors do not hold uncovered assets or liabilities, they have no

incentive to acquire them as long as the risk of doing so equals or exceeds the expected

excess return. As a result, if both A_t and $E(R_{t+1}/\Phi_t)$ are zero, uncovered interest parity

holds even though there may be a risk premium.

With the addition of the equilibrium condition that A_t^D equals A_t, eqs. (9) to (11)

describe a system of four equations with four endogenous variables: A_t, A_t^D, $E(R_{t+1}/\Phi_t)$

and υ_t. The UIP literature consistently ignores what a system of equations like this

implies about the role of risk premiums in the theory of UIP. Sarno et al (forthcoming) is

an example of what can happen.

5. Sarno, Schneider and Wagner

Sarno et al (forthcoming) tries to estimate risk premiums using a model based on covered interest rate parity. Their model includes the assumption that $E(s_{t+1}/\Phi_t)$ equals f_t plus a risk premium υ_t. By including that assumption they implicitly assume that the expected excess return equals the risk premium. From there they go on to ignore the expected excess return and estimate a model of the risk premium.

What they do is equivalent to assuming that demand equals supply and then going on to estimate a demand schedule while ignoring the supply schedule. As a result, their estimates of the risk premium suffer from simultaneous equations bias.

6.0 Summary

CIP implies that the *theory* UIP fails if and only if expected excess returns are zero. The UIP literature routinely attributes that failure to risk premiums. But that attribution implicitly assumes a stock equilibrium in which actual and desired investments without cover are equal. Without that implicit assumption there is no theoretical reason to equate expected excess returns and risk premiums.

Failing to recognize the crucial role of stock equilibrium can lead to serious problems. Sarno et al (forthcoming) is an example.

References

Akram, Q., Rime, D., Sarno, L., 2008. Arbitrage in the Foreign Exchange Market: Turning on the Microscope. *Journal of International Economics,* 76, 237-253.

Aslan, Ő., Korap, H., 2010. Does the uncovered interest parity hold in short horizons?. *Applied Economic Letters,* 17, 361-365.

Baba, N., Packer, F., 2009. Interpreting deviations from covered interest parity during the financial market turmoil of 2007-08, *Journal of Banking and Finance,* 33, 1953-1962.

Bacchetta, P., van Wincoop, E., 2010. Infrequent Portfolio Decisions: A Solution to the Forward Discount Puzzle. *American Economic Review,* 100, 870-904.

Baillie, R., 2011. Possible solutions to the forward bias puzzle. *Journal of International Financial Markets, Institutions and Money,* 21, 617-622.

Baillie, R., Kiliç, R., 2006. Do asymmetric and nonlinear adjustments explain the forward premium anomaly?. *Journal of International Money and Finance,* 25, 22-47.

Chaboud, A., Wright, J., 2005. Uncovered interest parity: it works, but not for long. *Journal of International Economics,* 66, 439-362.

Chinn, M., 2006. The (partial) rehabilitation of interest rate parity in the floating era: Longer Horizons, alternative expectations, and emerging markets. *Journal of International Money and Finance,* 25, 7-21.

Chinn, M., Meredith, M., 2004. Monetary Policy and Long-Horizon Uncovered Interest Parity. *IMF Staff Papers,* 51, 409-430.

Felmingham, B., Leong, S., 2005. Parity Conditions and the efficiency of the Australian 90- and 180-day forward markets. *Review of Financial Economics,* 14, 127-145.

Fong, W-M., Valente, G., Fung, J. K. W., 2010. Covered interest arbitrage profits: The role of liquidity and credit risk. *Journal of Banking and Finance,* 34, 1098-1107.

Frankel, J., Poonawala, J., 2010. The forward market in emerging currencies: Less biased than in major currencies. *Journal of International Money and Finance,* 29, 585-598.

Han, B., 2004. Is the forward premium puzzle universal?. *Applied Economics Letters,* 11, 131-134.

Hochradl, M., Wagner, C., 2010. Trading the forward bias: Are there limits to speculation?. *Journal of International Money and Finance,* 29, 423-441.

Mehl, A., Cappiello, L., 2009, Uncovered Interest Parity at Long Horizons: Evidence from Emerging Economies. *Review of International Economics,* 17, 1019-1037.

Paya, I., Peel., D. A., Spiru, A., 2010. The forward premium puzzle in the interwar period and deviations from covered interest parity. *Economic Letters,* 108, 55-57.

Sarantis, N., 2006. Testing uncovered interest parity using traded volatility, a time-varying risk premium and heterogeneous expectations. *Journal of International Money and Finance,* 25, 1168-1186.

Sarno, L., Schneider, P., and Wagner, C., forthcoming. Properties of Foreign Exchange Risk Premiums, *Journal of Financial Economics,*.

Sarno, L., Valente, G., Leon, H., 2006. Nonlinearity in Deviations from Uncovered Interest Parity: An Explanation of the Forward Bias Puzzle. *Review of Finance*, 10, 443-482.

Sercu, P., Vandebroek, M., Wu, X., 2008. Is the forward bias economically Small? Evidence from European Rates. *Journal of International Money and Finance,* 27, 1284-1302.