



---

## Covered interest arbitrage profits: The role of liquidity and credit risk

Wai-Ming Fong <sup>a</sup> ✉, Giorgio Valente <sup>b</sup>  ✉, Joseph K.W. Fung <sup>c</sup> ✉

Show more 

 Share  Cite

---

<https://doi.org/10.1016/j.jbankfin.2009.11.008>

[Get rights and content](#)

---

### Abstract

We study the profitability of Covered Interest Parity (CIP) arbitrage violations and their relationship with market liquidity and credit risk using a novel and unique dataset of tick-by-tick firm quotes for all financial instruments involved in the arbitrage strategy. The empirical analysis shows that positive CIP arbitrage deviations include a compensation for liquidity and credit risk. Once these risk premia are taken into account, small arbitrage profits only accrue to traders who are able to negotiate low trading costs. The results are robust to stale pricing and the nonsynchronous trading occurring in the markets involved in the arbitrage strategy.

---

### Introduction

The Covered Interest Parity (henceforth CIP) theorem states that the covered interest rate differential between two identical risk-free securities denominated in two different currencies should be equal to zero. Since Keynes, 1923, Einzig, 1937 a vast body of empirical and theoretical literature investigated the joint behavior of foreign exchange (henceforth FX) and money markets and the occurrence of arbitrage opportunities. The general consensus is that “CIP is a reasonably mild assumption, given the extensive empirical evidence suggesting that CIP holds” (Sarno, 2005, p. 675) especially when transaction costs are taken into account.<sup>1</sup>

However, some studies pointed out that currency markets were and still are characterized by a substantial number of instances in which CIP deviations exceed the transaction cost band, implying profitable arbitrage opportunities (see, *inter alia*, Balke and Wohar, 1998, Peel and Taylor, 2002, Akram et al., 2008, Akram et al., 2009, Marshall et al., 2008, Mancini Griffoli and Ranaldo, 2009 and the references therein). Although these findings could be explained by means of slow and infrequent communications between London and New York banks in the early 1920s (Einzig, 1937, Peel and Taylor, 2002), it is more difficult to

rationalize them in presence of modern FX dealing rooms, where prices can be obtained within seconds and orders can be carried out in an automated and synchronized fashion.

CIP arbitrage profits are generally assumed to be riskless<sup>2</sup> and attainable without capital outlay. However, real-world arbitrage activities are subject to impediments which prevent arbitrageurs to fully exploit arbitrage opportunities and move asset prices to their equilibrium no-arbitrage values (see, *inter alia*, Shleifer and Vishny, 1997 and the references therein). Two of these impediments are particularly important in the context of CIP arbitrage: market liquidity and credit risk.

It is well known that the Law of One Price (LOP) holds when markets have few frictions associated with transacting, especially illiquidity indicators such as the bid–ask spread. In these cases, few arbitrage opportunities arise in real time and the violations of LOP are generally not profitable if all transaction costs are taken into account. However, LOP does not hold when markets are illiquid. Several studies have documented that aspects of the market microstructure may cause the temporary deviation of prices from their no-arbitrage values (Stoll, 1978, O’Hara and Oldfield, 1986, Gârleanu and Pedersen, 2009) and financial market liquidity plays a key role in moving prices to eliminate arbitrage opportunities (Kumar and Seppi, 1994, Roll et al., 2007 and the references therein).

The other important aspect that has been surprisingly neglected in the literature on CIP is the fact that CIP arbitrage opportunities are generally computed using interbank deposit rates which are not risk-free since they are subject to different levels of credit risk. Arbitrage activities can eliminate the market risk associated with the movements of exchange rates and interest rates, but they cannot eliminate the credit risk associated with the interbank deposits and the counterparty risk in the forward contracts.

Furthermore, when interbank markets are highly concentrated, the banks that have an extensive retail deposit-taking network have also a high degree of market power that is exercised by means of a very selective assessment of counterparty credit-worthiness and the imposition of tight credit limits (i.e. trading volumes).

All of these arguments suggest that some of the arbitrage profits recorded in recent studies may reflect premia demanded by market participants as compensation for the liquidity and credit risk faced during arbitrage transactions.<sup>3</sup> In this paper we test this conjecture by investigating CIP arbitrage profits for a single currency market (i.e. Hong Kong dollar, henceforth HKD) which is among the 10 largest currency markets in terms of daily average turnover (Bank for International Settlement, BIS 2007) but its overall liquidity is poorer than in major currency markets and its banking market is highly concentrated. Using a novel and unique dataset of tick-by-tick tradable (firm) spot and forward quotes for HK dollar *vis-à-vis* US dollar (USD), as well as tradable HKD- and USD-denominated deposit rates over different short-term maturity tenors, we carry out an extensive analysis of CIP deviations and their relationship with market liquidity and credit risk.

Our main findings are as follows. First, we find that HKD/USD FX market is characterized by a large number of CIP deviations and most of these deviations exceed the transaction cost band implied by the bid–ask spreads of the individual financial instruments. Second, positive CIP deviations are clustered at the bid side of the market and their economic value is sizable across the maturity spectrum. Third, positive CIP deviations are associated with market illiquidity at very short maturities and with differences in credit risk between the Hong Kong and US financial institutions across the full maturity spectrum. Fourth, small residual arbitrage profits are still present even after taking into account liquidity and credit risk. However, since additional trading costs (i.e. brokerage fees and settlement costs) are generally not included in quoted prices, their explicit consideration is likely to offset any profits that

arise from arbitrage activities. Given the existence of heterogeneous additional trading costs (Mavrides, 1992), only the traders who are able to negotiate low trading costs will be able to reap genuine arbitrage profits as compensation for their activity (Deardorff, 1979, Grossman and Stiglitz, 1980).

This study differs and improves upon previous contributions in several respects. The dataset employed in this study, to the best of our knowledge, is the first to record tradable quotes at tick-by-tick frequency for all financial instruments involved in the CIP arbitrage over a period of eight months. Taylor (1987), a landmark study in the literature on CIP arbitrage, employed interest rates and exchange rates data that are recorded by phoning several London brokers at 10 min frequency during the most active hours (9:00–16:30 GMT) over three days in 1985. Other studies re-examining Taylor's results, employ datasets which exhibit various limitations. One of the most relevant limitations is that all or some of the prices used to compute arbitrage deviations are purely indicative, hence evidence of arbitrage opportunities recorded using these datasets may not necessarily imply glaring profitable opportunities. The dataset employed in this paper is therefore unique and allows us to carry out a thorough economic assessment of CIP arbitrage since contemporaneous tradable quotes of domestic and foreign deposit rates and spot and forward exchange rates are crucial to establish whether an apparent deviation from the no-arbitrage conditions in the FX market represents a genuine profitable arbitrage opportunity.

Our work builds on Cheung and Chan, 1994, Akram et al., 2008, Akram et al., 2009 who investigate CIP arbitrage violations in both round-trip and one-way arbitrage in the Hong Kong market and for the major currencies respectively. Our work differs from theirs in several important ways. First, Cheung and Chan (1994) employ daily indicative quotes over a shorter period of time (3 months) recorded over an interval of 30 min (between 10:45 am and 11:15 am Hong Kong time) while Akram et al., 2008, Akram et al., 2009 employ a tick-by-tick dataset comprising tradable quotes for spot FX rates and indicative quotes of FX swaps and currency deposit rates. Second, Cheung and Chan (1994) data are collected from only two commercial banks (i.e. Tokyo Forex and Tullett and Hua Chiao Commercial Bank Limited), while our tradable quotes are provided by ICAP, the world's largest voice and electronic interdealer broker which exhibits a substantial market share of the spot and forward FX trading in Hong Kong (ICAP, 2007).<sup>4</sup> Third, both Cheung and Chan, 1994, Akram et al., 2008, Akram et al., 2009, along the lines of earlier studies, do not consider the role of market liquidity and credit risk in affecting CIP arbitrage profits, which is the main goal of our paper.

Other related papers are Baba and Packer, 2009, Genberg et al., 2009, Mancini Griffoli and Ranaldo, 2009, McAndrews and Sarkar, 2009 who investigate the spillover effects of the money market turbulence in 2007–2008 on short-term CIP deviations between the US dollar and the major currencies and the effects of the Federal Reserve's responses to the crisis on credit and liquidity risk. Our work differs from theirs in that we do not focus on the behavior of the FX and money markets during turbulent periods, such as the recent 2007–2008 financial crisis, but we try to understand the role of market liquidity and credit risk on arbitrage activities under normal market conditions. Furthermore, we assess the impact of market liquidity and credit risk on CIP arbitrage profits computed by taking into account features which reflect very closely realistic conditions faced by arbitrageurs, while most of the other studies look at CIP deviations computed without taking into account transaction costs or use interest rate spreads.<sup>5</sup>

The remainder of this paper is organized as follows. In Section 2 we discuss the theoretical underpinnings, our dataset and the main institutional features of the HKD FX market. Section 3 reports preliminary summary statistics and in Section 4 the results of empirical analysis are discussed. Section 5 contains some robustness checks and a final section concludes.

## Section snippets

### CIP deviations

Deviations from CIP are routinely expressed as  $\frac{(1+i_{d,k})}{(1+i_{f,k})} \frac{F_k}{S}$  where  $i_d$  and  $i_f$  are the domestic and foreign interest rates on similar assets of a certain maturity tenor  $k$ ,  $S$  is the prevailing spot exchange rate and  $F_k$  is the forward exchange rate with maturity tenor  $k$ .

Any deviations from Eq. (1) would represent a risk-free arbitrage opportunity in a frictionless world. If we introduce bid and ask prices to Eq. (1), any deviations from CIP are profitable if either of the following inequalities ...

### Preliminary analysis

In this section measures of market liquidity and credit risk are computed. For each trading day, the measures described below are computed using daily or intraday data. In the latter case, as in previous empirical studies a daily average is used as input for the subsequent estimations (see Roll et al., 2007 and the references therein).

Market liquidity has many aspects (immediacy, costs, depth and resiliency) and no empirical measure is able to reflect them all. Our dataset only comprises best...

### CIP arbitrage profits

In this section, we compute positive CIP arbitrage opportunities that satisfy Eq. (3) and associate them with the measures of liquidity and credit risk discussed in the previous section.

Table 2 shows the percentage of positive CIP deviations out of all of the observations obtained at intraday level. Across maturity tenors, we find that the average percentage of positive arbitrage deviations ranges between 8% and 84%. Furthermore, arbitrage at the bid price of CIP is much more frequent (73% on...

### Robustness

In this section we report some robustness checks carried out to assess the sensitivity of our baseline results discussed in Section 4. Our first check relates to the possible bias induced by the synchronization rule applied to intraday data discussed in Section 3. More in particular we assess how the percentage share of positive CIP deviations, their average and the parameter estimates of Eq. (4) change when CIP deviations are computed using a different, and more stringent, synchronization rule...

### Conclusions

In this paper we study the profitability of CIP arbitrage violations and their relationship with market liquidity and credit risk. This analysis is motivated by the growing evidence documenting that FX markets are often characterized by a substantial number of instances in which CIP deviations exceed the

transaction cost band coupled with the assumption that such arbitrage deviations are risk-free profits. We take explicitly into account that real-world arbitrage activities are subject to...

## Acknowledgments

The authors are grateful to Ike Mathur (Editor) and an anonymous referee for constructive comments. They also would like to thank Bruno Biais, John Cotter, Andrew Filardo, Hans Genberg, Leo Goodstadt, Jacob Gyntelberg, Mico Loretan, Anthony Neuberger, Richard Payne, Eli Remolona, Mark Salmon, Lucio Sarno, Alex Stremme, Andy Rose, Dagfinn Rime, Mark Taylor for useful conversations on an earlier draft of this paper and to the participants in presentation to the 5th Conference of the Asia-Pacific...

---

## References (44)

V. Kotomin *et al.*

**Preferred habitat for liquidity in international short term interest rates**

Journal of Banking and Finance (2008)

T.C. Johnson

**Volume, liquidity and liquidity risk**

Journal of Financial Economics (2008)

R. Goyenko *et al.*

**Do liquidity measures measure liquidity?**

Journal of Financial Economics (2009)

Z. Darvas

**Leveraged carry trade portfolios**

Journal of Banking and Finance (2009)

N. Baba *et al.*

**Interpreting deviations from Covered Interest Parity during the financial market turmoil of 2007–2008**

Journal of Banking and Finance (2009)

F.Q. Akram *et al.*

**Arbitrage in the foreign exchange market: Turning on the microscope**

Journal of International Economics (2008)

F.Q. Akram *et al.*

**Does the Law of One Price hold in international financial markets? Evidence from tick data**

Journal of Banking and Finance (2009)


N.S. Balke *et al.*

**Nonlinear dynamics and Covered Interest Parity**

Empirical Economics (1998)

Bank for International Settlements, 2007. Triennial central bank survey of foreign exchange and derivatives market...

G.H. Bjørnes *et al.*

 [View more references](#)

---

## Cited by (44)

### [Does the swap-covered interest parity still hold in long-term capital markets after the financial crisis? Evidence from cross-currency basis swaps](#)

2022, International Review of Economics and Finance

[Show abstract](#) 

### [Variance disparity and market frictions](#)

2020, Journal of Econometrics

*Citation Excerpt :*

...This paper contributes to the finance literature in several ways. First, it is related to the extensive literature studying no-arbitrage violations in various financial markets, including papers on interest rate parity violations (Coffey et al., 2009; Baba and Packer, 2009; Fong et al., 2010; Mancini Griffoli and Ranaldo, 2012); American Depository Receipt (ADR) parity violations (Gagnon and Karolyi, 2010; Pasquariello, 2014); credit default swap (CDS)–bond parity violations (Gârleanu and Pedersen, 2011; Bai and Collin-Dufresne, 2013); and TIPS (Treasury Inflation-Protected Securities)–Treasury bond parity violations (Fleckenstein et al., 2014). Some of these existing papers focus on identifying important impediments to arbitrage, similar to this paper....

[Show abstract](#) 

### [Out-of-sample exchange rate predictability in emerging markets: Fundamentals versus technical analysis](#)

2019, Journal of International Financial Markets, Institutions and Money

[Show abstract](#) 

### [Predicting foreign investors' carry trade activity in the Israeli FX market using a time-varying currency risk premium approach](#)

2019, International Review of Economics and Finance

[Show abstract](#) 

### [What is new about covered interest parity condition in the European Union? Evidence from fractal cross-correlation regressions](#)

2017, Physica A: Statistical Mechanics and its Applications

[Show abstract](#) 

### [Monetary policy and covered interest parity in the post GFC period: Evidence from the Australian dollar and the NZ dollar](#)

*Citation Excerpt :*

...Baba and Packer (2009) find that CIP deviations were negatively associated with the creditworthiness of European and US financial institutions. The authors such as Fong et al. (2010) and Coffey et al. (2009) show that in addition to credit risk, liquidity and market risk played important roles in explaining the deviations. Grioli and Ranaldo (2010) find that the results were essentially the same even if we used secured rates such as OIS....

[Show abstract](#) ✓



[View all citing articles on Scopus](#)

---

## Recommended articles (6)

Research article

### [Liquidity, innovation and growth](#)

Journal of Monetary Economics, Volume 59, Issue 8, 2012, pp. 721-737

[Show abstract](#) ✓

Research article

### [Exchange rate regimes and the international transmission of business cycles: Capital account openness matters](#)

Journal of International Money and Finance, Volume 87, 2018, pp. 44-61

[Show abstract](#) ✓

Research article

### [Cross-listings and liquidity commonality around the world](#)

Journal of Financial Markets, Volume 22, 2015, pp. 1-26

[Show abstract](#) ✓

Research article

### [The fundamentals of safe assets](#)

Journal of International Money and Finance, Volume 102, 2020, Article 102119

[Show abstract](#) ✓

Research article

### [Assessing the degree of international consumption risk sharing](#)

Journal of Development Economics, Volume 134, 2018, pp. 176-190

[Show abstract](#) ✓

Research article

# The macroeconomic impact of unconventional monetary policy shocks

Journal of Macroeconomics, Volume 47, Part A, 2016, pp. 58-67

[Show abstract](#) 

---

[View full text](#)

Copyright © 2009 Elsevier B.V. All rights reserved.



Copyright © 2022 Elsevier B.V. or its licensors or contributors.  
ScienceDirect® is a registered trademark of Elsevier B.V.

The RELX logo features a stylized orange "R" followed by the word "RELX" in a bold, black, sans-serif font, with a trademark symbol (TM) to the right.