The Covered Interest Parity Puzzle and the Evolution of the Japan Premium

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Abstract: A disturbance or breakdown of the first stage of the monetary transmission mechanism tends to be synonymous with high and volatile money market risk premia. Such market indicators include violations of the covered interest parity (CIP). This was not only evident during the financial crisis of 2007-08, but already during the Japanese banking crisis in the late 1990s, when it became referred to as the 'Japan Premium'. Despite extraordinary policy measures by central banks in recent years, however, deviations from the CIP indicate continuing or even elevated stress in the international monetary system. This paper examines a string of distinct, but closely interconnected, assumptions and perceptions regarding CIP arbitrage. By doing so, it not only sheds some fresh light on the recent 'CIP puzzle' but also on the era of the Japan Premium during the 1990s and its aftermath.

Keywords: arbitrage, covered interest parity, financial crisis, FX swap market, Japan Premium, money market

JEL Classification Numbers: E4, E52, F3, F65, G15

Benchmarks and indices are often used to construct, measure and decompose risk premia in financial markets. High and volatile money market risk premia are seen as symptomatic of a disturbance or breakdown of the first stage of the monetary transmission mechanism. This is the process by which central banks attempt to affect prices, interest rates, credit and ultimately agents' behaviour and decision-making in the wider economy. An important indicator of stress in the international financial system is the covered interest rate parity (CIP) – or, to be precise, a violation of it. This was not only evident during the financial crisis of 2007-08, but already during the Japanese banking crisis in the late 1990s.

'A Physical Law in International Finance'

The CIP is a fundamental equation, which, according to Claudio Borio et al. (2016) "verges on a physical law in international finance". Indeed, the significance of it in international economics and finance can hardly be overstated. According to the CIP, interest rate differentials between two currencies should be perfectly reflected in the foreign exchange (FX) forward market. Otherwise, *arbitrage* would be possible. For instance, in terms of Japanese yen against US dollars, this can be expressed as:

$$(1 + i_t^{¥}) = \frac{F_t^{\$/¥}}{S^{\$/¥}}\left(1 + i_t^{\$}\right), \qquad (1)$$

where $i_t^{\$}$ is the US interest rate, and $i_t^{¥}$ the yen interest rate for maturity *t*. $S^{\$/¥}$ and $F_t^{\$/¥}$ represent the FX spot and forward rates between the currencies respectively.

In practice, banks typically quote FX swaps, rather than FX forward prices to each other (an FX swap is a combination of an FX spot transaction plus an FX forward transaction done simultaneously but in the opposite direction). Consequently, the formula can be rewritten as:

$$(1 + i_t^{¥}) = \frac{S^{\$/¥} + SW_t^{\$/¥}}{S^{\$/¥}}\left(1 + i_t^{\$}\right), \qquad (2)$$

where $SW_t^{\$/¥}$ represents the FX swap price between US dollars and Japanese yen for maturity *t*.

Textbooks in Economics and Finance treat the CIP from the perspective of covered interest arbitrage. As stated by John Hull (2000, 14), "arbitrage involves locking in a profit by simultaneously entering into transactions in two or more markets." In other words, as soon as one variable in the equation is out of synch, traders rush to lock in "free money" – resulting in an immediate price adjustment of one or several of the variables in the equation. This particular kind of arbitrage, it is widely argued, ensured that the deviation from the CIP tended to be close to zero until August 2007. However, one major exception to this was the Japanese banking crisis, which resulted in the so-called 'Japan Premium'.

The Japanese Banking Crisis and the Japan Premium

The Japanese banking crisis in the 1990s resulted in increasing difficulties for Japanese banks to access unsecured funds from other commercial banks – particularly in foreign

currencies. Although banks, at the time, were offered ample liquidity in yen from domestic sources (notably the Bank of Japan), they needed foreign currency funding as a result of large-scale investments made abroad during previous boom years. Since the Bank of Japan could not offer US dollar reserves, and the interbank money markets dried up for the Japanese banks (being perceived as less creditworthy), they had to turn to the FX swap markets. In this way, they could use their yen liquidity to swap them into US dollars, which they required. When Japanese banks headed for this last funding avenue, the CIP deviations became more substantial, indicating that, for traders holding Japanese yen, swapping them to US dollars (or other foreign currencies through dollars) would be much more expensive than stated in the Eurodollar market. The Japan Premium emerged.

Figure 1 shows the 20-day moving average of the 3-month CIP deviation for Japanese yen against US dollars. As per Equation (2) and the market convention, mid-market quotes are used for FX spot and 3-month FX swap prices, and 3-month LIBOR (London Interbank Offered Rate) as the prevailing interest rates. LIBOR is, since its inception in 1986, the most widely used benchmark for the short-term interbank money market in which large banks state they can borrow from each other. The figure illustrates the difficulty of Japanese banks to access funding in US dollars in comparison to their peers in other countries during the banking crisis. For instance, a value of 40 indicates that Japanese banks needed to pay a premium of 40 basis points (0.40 percent) to borrow US dollars via the FX swap markets.

< Figure 1 here >

In response to the banking crisis (or put differently: to eliminate the Japan Premium), the Japanese government introduced a string of policy measures, including bank capital injections and wide-ranging reforms (Kanaya and Woo 2000). With the actions deemed successful, the CIP deviation disappeared towards the late 1990s. Then, after occasional turbulence, normality was rather quickly restored. The CIP for Japanese yen against US dollars, as for other currency pairs, more or less held up until August 2007.

Thus, the CIP deviation during the late 1990s came to play a significant role in the shaping of government policy towards the banking sector (Peek and Rosengreen 1999). The Japan Premium was directly affected by the financial strength of the borrowing Japanese banks. However, it was also influenced by the policy of the Bank of Japan (or ultimately the Ministry of Finance) through its ability or desire to act as Lender of Last Resort, and also its willingness (and ability) to shield unsecured creditors from losses (Spiegel 2001).

The Financial Crisis of 2007-08 and the Return of the CIP Deviation

The financial crisis of 2007-08 led to substantial, lasting and volatile deviations from the CIP that had held since 1999. This time, however, the equation was showing that the problems in the money markets were not only bank- or country-specific, but also currency-specific. To be more precise, a 'Dollar Premium' indicated that the relative demand for US dollar funding rose compared to other currencies.

As the international money markets froze, the Federal Reserve, the European Central Bank and other central banks reacted fast and subsequently introduced a range of extraordinary policy measures. However, domestic liquidity injections, like those of the Bank of Japan during the Japanese banking crisis, were not sufficient to dampen demand since only the Federal Reserve could provide US dollar reserves. Since the demand was particularly severe for banks outside the US, an international response was necessary to offer US dollar liquidity - in technical terms to reduce the CIP deviation. The systematic failure of the CIP, therefore, led to unprecedented co-ordinated international central bank action. The Federal Reserve established reciprocal currency arrangements in the form of FX swap lines with a range of central banks, including the Bank of Japan, to channel dollars to banks in other jurisdictions (Baba and Packer 2009; McGuire and von Peter 2009). The dollar liquidity swap lines were designed to improve liquidity conditions in the dollar and foreign financial markets by providing foreign central banks with the capacity to deliver US dollar funding to institutions in their jurisdictions during times of market stress. The initial response to the FX swap lines was positive in the sense that the CIP deviations were reduced reasonably quickly following the collapse of Lehman Brothers.

The CIP Puzzle

From the perspective of the CIP deviation, the Japanese banking sector was less affected by the financial crisis of 2007-08. Indeed, other risk premia and financial market indicators suggested that *non*-Japanese banks found it more difficult to fund themselves than their Japanese counterparts in the Japanese market. However, with the Eurozone

sovereign debt crisis during the spring of 2010, risk premia started to widen again. Rather than disappearing since, the CIP deviation indicates continuing (or even elevated) stress in the international, and particularly the Japanese, monetary system.

Figure 2 shows 1-year cross-currency basis swap (CRS) prices for selected currencies against the US dollar. The derivative instrument can be viewed as a market price for a string of 3-month CIP deviations for a specific maturity. Thus, the market essentially provides us with a yield curve, which includes expected future (negative) deviations from the CIP. For instance, a value of -40 represents a premium of 40 basis points (0.40 percent) to borrow US dollars via the CRS market for one year.

< Figure 2 here >

The persistent failure of the CIP since 2007 has received considerable attention from academics and policymakers alike. Whereas the consensus seems to have been that the deviation during the financial crisis stemmed from US dollar funding gaps by global banks, the latter period is puzzling – particularly considering the relative stability in international financial markets since the establishment of the central bank FX swap network. Different explanations have emerged. Tomoyuki Iida, Takeshi Kimura and Nao Sudo (2016) stress the importance of monetary policy divergence and the search for yield in a low-interest environment. Victoria Ivashina, David Scharfstein and Jeremy Stein (2015), on the other hand, point out the capital needed in exploiting arbitrage opportunities in international money markets. Vladyslav Sushko et al. (2016) highlight the relevance of balance sheet constraints and point to a combination of FX hedging

demand and tighter limits to arbitrage. Alfred Wong, David Leung and Calvin Ng (2016) argue that the traditional version of the CIP is inadequate in coping with counterparty and liquidity risks between countries that are typical during periods of stress. Thus, the emphasis has been put on market frictions causing violations of the CIP in terms of a 'rule' or a 'law', rather than the internal mechanisms of the equation itself. Perhaps most fundamentally, the equation continues to be treated *as if* each variable can be bought and sold - although this is impossible.

A No-Arbitrage Condition

Arbitrage involves buying, selling, borrowing or lending – and in the case of true CIP arbitrage, all of these activities at once. Following a long-standing convention, LIBOR, as a proxy for the money market interest rate, is used as the 'i' in the CIP-equation. However, LIBOR and its equivalent in other jurisdictions (such as EURIBOR and TIBOR) are benchmarks and not tradable instruments in themselves. Consequently, borrowing or lending at 'i' in terms of LIBOR is possible in theory but has never been possible in practice (Stenfors and Lindo 2018).

Arbitrage in theory, which is typically treated as a risk-free or nearly risk-free activity, often differs from arbitrage in practice (MacKenzie 2003). The difficulty of observing perfect and completely risk-free arbitrage opportunities leads Iain Hardie (2004) to state that most arbitrage activity is, in fact, similar to other trading and investment activity – in other words, a speculative activity involving assets perceived to be mispriced. Such strategies aim to exploit differences in 'similar', but not the 'same', assets (Beunza,

Hardie and MacKenzie 2006). Indeed, Dagfinn Rime, Andreas Schrimpf and Olav Syrstad (2017) find that the CIP deviations would be considerably smaller if other types of money market instruments were used.

Problematically, however, hardly any unsecured borrowing and lending takes place between banks for maturities of 3 months or longer (FCA 2017), which ought to serve not only as the calculation basis for LIBOR itself but also, fundamentally, as the 'i' in the CIP. That is not to say that the traditional money market is non-existent. It is still vast. However, virtually all activity relates to maturities of less than one week. Thus, the 'i' (when expressed as LIBOR) in the CIP-formula is not only impossible to trade. The variable has also evolved into a hypothetical rate, which is only tradable via similar, but not the same, financial instruments.

Instead, FX swaps have largely replaced interbank deposits as a short-term funding vehicle for banks. Importantly, FX swaps are considerably less credit risk intense than unsecured loans – and have received a more favourable regulatory treatment since the 1988 Basel Accord was put in place during the 1990s (Stenfors and Lindo 2018). Whereas other money markets were extremely illiquid, completely frozen or not tradable at all, FX swaps continued to function as a tradable funding instrument throughout both the Japanese banking crisis and the financial crisis of 2007-08. It is therefore not surprising that the FX swap market has seen phenomenal growth during the recent decades – with global daily turnover increasing from $190 billion in 1989 to $944 billion in 2004 and $2,378 billion in 2016 (BIS 2005; BIS 2016).

Indeed, the FX swap market has been considerably more liquid (as evidenced by, for instance, implied bid-ask spreads) than the corresponding unsecured money markets since well before the financial crisis of 2007-08. Figure 3 depicts *indicative* bid-ask spreads for 3-month FX swaps between US dollars and Japanese yen, as well as the corresponding deposit rates.

< Figure 3 here >

Despite this trend, however, FX swaps continue to be explained as being *derived* from interest rate differentials between two countries following the CIP – rather than vice versa.

From the analysis above, one might go on to conclude that developments in financial markets over the last two decades simply have rendered the CIP as obsolete. After all, why pay attention to a theoretical no-arbitrage condition when no arbitrage is possible in practice? That would, however, be the wrong approach. As Dick Bryan and Michael Rafferty (2014) point out, modern derivatives markets have enabled prices *in themselves* to evolve into tradable instruments. The list of such prices is constantly expanding, ranging from derivatives on non-tradable benchmarks and indices (such as LIBOR) to measurements conceptualised as 'prices' (such as volatility, temperature or inflation) (Stenfors and Lindo 2018). The established and relatively liquid CRS market belongs to this group, as it permits market participants to protect themselves against, or speculate on, future deviations of the CIP. In essence, then, the CIP deviation (or, indeed, the Japan Premium) has evolved into a price, which can be bought and sold.

Implications

The fact that the CIP continues to be treated *as if* each component can be bought and sold (which is impossible), whereas financial markets allow buying and selling *as if* it were possible, is important.

First, the vast notional amounts traded in FX swaps, CRSs and LIBOR-indexed derivatives create an illusion of intense activity of buying, selling, borrowing and lending – even though no such activity may be taking place (Stenfors and Lindo 2018; Stenfors and Susai 2018). Prices which "have stood at particular levels for some time acquire thereby some sanction and authority" (Shackle 1972, 227, quoted in Hodgson 1988, 184). At the same time, social norms and conventions play an essential role in the price determination process in money markets, which are rooted in relationships and trust (Stenfors 2018). Stickiness and clustering of prices around certain focal points are, therefore, natural outcomes of human coordination (Stenfors 2014a). This includes a price or value of 'zero'. Consequently, the long episode between the Japanese banking crisis and the 2007-08 financial crisis, when hardly any deviations from the CIP in major currencies were observed, should be seen in a different light. Rather than treating it as a period of relative stability in interbank money markets underpinned by continuous arbitrage activities, it was the absence of deviations that provided the CIP with further authority.

Second, the equation may both understate and overstate the actual stress in the domestic and international money markets – without necessarily deviating from any

kind of 'equilibrium' achieved via CIP arbitrage activities. Indeed, Tetsuro Hanajiri (1999) observed a 'CIP puzzle' already two decades ago, when analysing the Japan Premium during 1997 and 1998. The author's findings suggested that the Japan Premium appeared to be greater when studying tradable markets (e.g. FX swaps) than non-tradable markets (i.e. LIBOR). Takatoshi Ito and Kimie Harada (2004) also pointed out that interbank money market benchmarks did not serve as robust indicators of stress in the Japanese banking system during the early 2000s. Thus, similarly to what has been documented following the recent LIBOR manipulation controversies (Stenfors 2014b), the CIP deviation can be misleading and affect subsequent policy measures by central banks, governments and regulators aimed at restoring health in the banking system and overall financial stability.

The CIP was not originally constructed as a tool for monetary policy and financial stability. However, the attention to it during the era of the Japan Premium, and subsequent use of it by academics, market participants and policymakers made it into precisely that.

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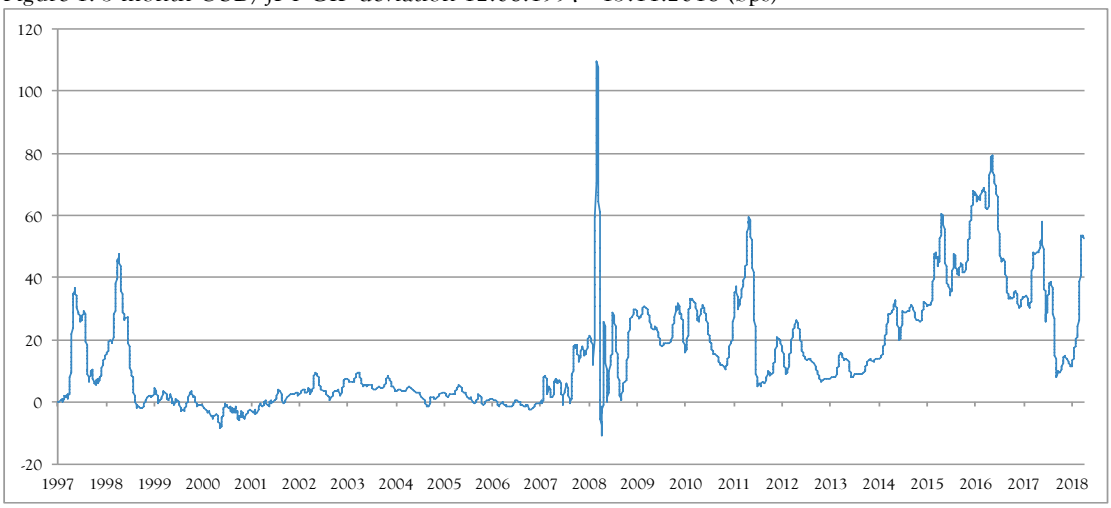
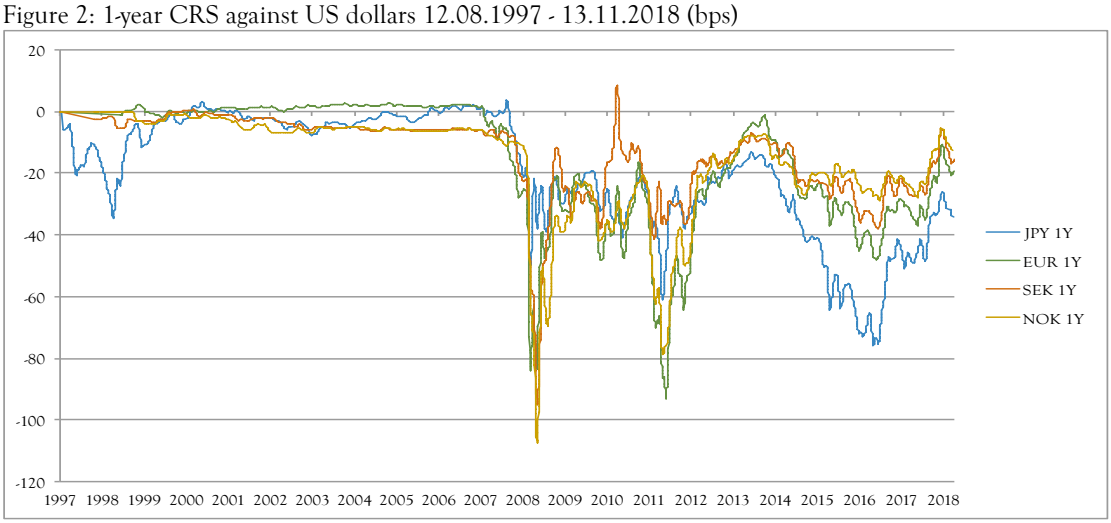
Figure 1: 3-month USD/JPY CIP deviation 12.08.1997 - 13.11.2018 (bps)



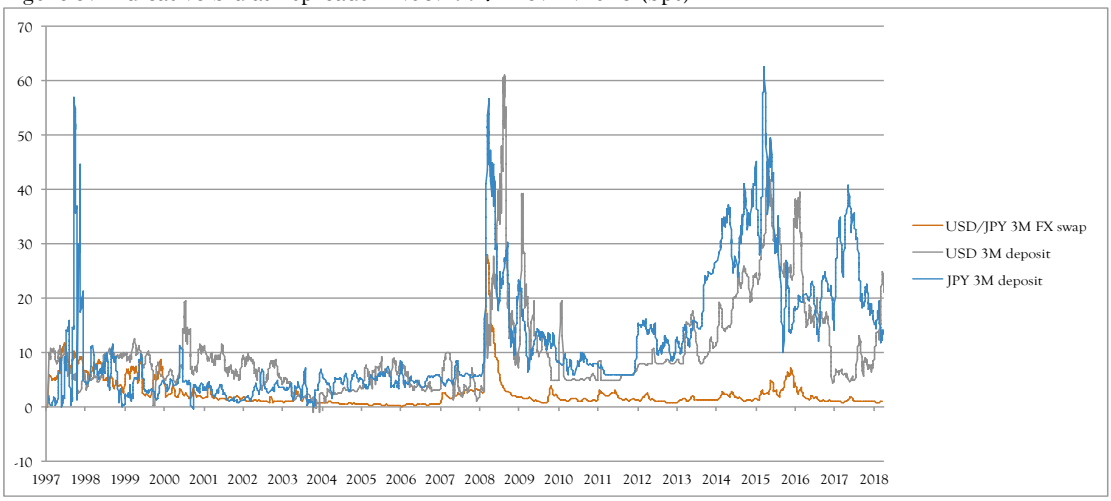
Sources: Bloomberg and author's calculation. Notes: 20-day moving average, USD = US dollar, JPY = Japanese yen.

Figure 2: 1-year CRS against US dollars 12.08.1997 - 13.11.2018 (bps)



Sources: Bloomberg and author's calculation. Notes: 20-day moving average, JPY = Japanese yen, EUR = euro, SEK = Swedish krona, NOK = Norwegian krone.

Figure 3: Indicative bid-ask spreads 12.08.1997 - 13.11.2018 (bps)



Sources: Bloomberg and author's calculations. Notes: 20-day moving average, USD = US dollar, JPY = Japanese yen.