Modeling an Alternative Expression of Covered Interest Parity – in Inflation Targeting Economies of Emerging Asia

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Abstract: We establish an alternative form of expressing the covered interest parity model that incorporates the onshore and offshore foreign exchange forward market of inflation targeting economies of Emerging Asia, which provides the ability to identify if there is the occurrence of covered interest parity in foreign exchange forward markets.

Keywords: Capital Mobility Covered Interest Parity Model, Arbitragers, Speculators, Onshore and Offshore Foreign Exchange Forward Market, Arbitrage Profit and Loss, Emerging Asia.

1. INTRODUCTION

In Emerging Asia (EA) following the Asian Financial Crisis of 1997/1998, managing capital mobility is a key feature for central banks and financial regulators. The imposition of rules and regulations to capital mobility is part of Emerging Asia's macroeconomic policy framework. The uncertainty of these rules and regulation being imposed strictly or relaxed in managing capital flow created a parallel foreign exchange market beyond the regulatory parameters of central banks and financial regulators of Emerging Asia (EA). The creation of a segmented foreign exchange markets that consists of onshore and offshore is a result of these rules and regulations. The offshore foreign exchange market relies on the non-deliverable foreign exchange forward while the onshore foreign exchange market relies on the deliverable foreign exchange forward. In the context of offshore foreign exchange trading, the non-deliverable foreign exchange forward rate features as a significant foreign exchange trading instrument that circumvents barriers to capital mobility in Emerging Asia (EA). The instrument's attractiveness include the ability to settle foreign exchange trading transactions in US Dollar and does not require foreign investors to have an underlying financial trading asset in the onshore market.

In this paper, we model the foreign exchange forward markets in inflation targeting economies of Emerging Asia[1] (EA) (see Table **1**) by incorporating the onshore and offshore foreign exchange forward rate into the covered interest rate parity (CIP) model[2]. The approach we use is by re-specifying the original covered interest parity (CIP) equation into a more simplified specification that enables us to obtain a CIP equation that is adoptable for foreign exchange forward markets of Emerging Asia (EA).

2. THE MODEL

The covered interest parity model incorporates four important components. These include the forward exchange rate, spot exchange rate, domestic interest rate and foreign interest rate, computed as

$$F = S\frac{1+i}{1+i^*} \tag{1}$$

Where *F* is the forward exchange rate in the onshore foreign exchange market and in the offshore foreign exchange market, it is substituted with the non-deliverable forward exchange rate. *S* is the spot exchange rate of EA currency against the US Dollar, *i* is the onshore interest rate which is substituted by the implied yield derived from the forward exchange rate[3] in the onshore foreign exchange market, and as the implied yield derived from the non-deliverable forward

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[1]These economies include South Korea, Indonesia, Thailand and Philippines.

[2]When the no-arbitrage condition is satisfied with the use of a forward contract to hedge against exposure to exchange rate risk, interest rate parity is said to be covered. Investors will still be indifferent among the available interest rates in two countries because the forward exchange rate sustains equilibrium such that the dollar return on dollar deposits is equal to the dollar return on foreign deposit, thereby eliminating the potential for covered interest arbitrage profits.

[3]Where the implied yield is $i = \left[\frac{F}{S}(1+i^*)\right] - 1$, which is computed for the onshore foreign exchange forward market. In the offshore foreign exchange forward market, the computation is the same but the forward exchange rate is substituted with the non deliverable forward rate. The implied yield that is obtained from the computation provides two different implied yield based on the onshore and offshore foreign exchange forward market.

E-ISSN: 1929-7092/14 © 2014 Lifescience Global

Table 1: Accountability Framework of Inflation Targeting in Emerging Asia

Inflation Targeting countries	Target set by	Target Horizon	Open Letter	Parliament Hearings
S. Korea	Government and Central Bank	3 years	No	Yes
Indonesia	Government and Central Bank	Medium term	No	No
Thailand	Government and Central Bank	8 quarters	Yes	No
Philippines	Government and Central Bank	2012-2014	Yes	No

Source: Hammond (2012), HSBC Asian Central Bank Guide 2012.

exchange rate in the offshore foreign exchange market. The foreign interest rate i^* is the US Dollar London Interbank Offered interest rates (Libor), alternatively it is the proxy for cost of funding foreign exchange trading. The equilibrium condition from equation (1) indicates that gross domestic return is equal to gross covered foreign return at the forward exchange rate. It is gross because it includes the amount invested and the interest earned. The gross foreign return is covered because the foreign return is converted into the domestic currency at the forward exchange rate hence the covering of foreign exchange risk. The interchangeably of equation (1) can be specified in different forms as well, where further computation show

$$(1+i) = \frac{F}{S}(1+i^*) \tag{2}$$

The specification of equation (2) is still consistent with covered interest parity but provides the ability to distinguish between the actual forward exchange rate F which prevails whether or not covered interest parity holds and the equilibrium forward exchange rate $\dot{F}$, which can be considered as the no arbitrage condition foreign exchange forward rate. Therefore the covered interest parity equilibrium condition can be re-written as $\dot{F}=F$. Whereby

$$\dot{F} = S\left(\frac{1+i}{1+i^*}\right) \tag{3}$$

From equation (3), the specification shows that there is equality between the equilibrium forward exchange rate $\dot{F}$ and the actual forward exchange rate F, thus can be expressed as

$$i = \left[\frac{F}{S}(1+i^*)\right] - 1 \tag{4}$$

The derivation of equation (4) indicates i as the implied yield derived from the forward exchange rate in the onshore foreign exchange market, where else in the offshore foreign exchange market, the implied yield is derived from the non-deliverable forward exchange rate. The spread between the equilibrium forward exchange rate and the actual forward exchange rate is the forward gap which is denoted as $f = \dot{F} - F$. The spread is measured as the difference between the implied yield derived from the forward exchange rate in the onshore foreign exchange forward market and the implied yield derived from the non-deliverable forward rate in the offshore foreign exchange forward market.

The foreign interest rate, the US Dollar Libor and the difference against the implied yield derived from the foreign exchange forward rate can be considered as the carry return (which in the original form is also specified as the interest rate differential) and denoted as $i - i^*$. Therefore it can be written that

$$\dot{F} - F = i - i^* \tag{5}$$

Where equation (5) implies that in order for covered interest parity to be achieved, the condition

$\dot{F}-F = i - i^*$ must be fulfilled, which further suggest that the forward gap is equivalent to the carry return. Under conditions of $i - i^* > \dot{F}-F$, agents in the foreign exchange forward market would sell EA currencies to achieve covered interest parity equilibrium. Under conditions of $i - i^* < \dot{F}-F$, agents in the foreign exchange forward market would buy EA currencies to achieve covered interest parity equilibrium (see Figure **1**).

In estimating whether there is an occurrence of covered interest parity, based on the interchangeably of the original covered interest parity equation (1) to (5), we can formulate the equation for estimation purposes as

$$\dot{F} - F = a + b\{\left[\frac{F}{S}(1+i^*)\right] - 1)\} - i^* + \varepsilon \tag{6}$$

Equation (6) indicates that the difference between the equilibrium forward exchange rate and actual forward exchange rate, which is $\dot{F} - F$, is determined by the carry return given by the difference between implied yield derived from the forward exchange rate and the foreign interest rate, which is

$$\left[\frac{F}{S}(1+i^*)\right]-1)-i^*.$$

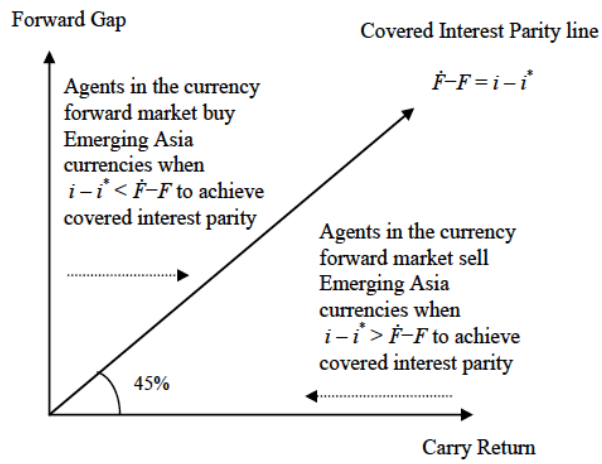

Figure 1: Covered Interest Parity and Adjustments towards Equilibrium.

The constant and error term is denoted as *a*. and ε_t while *b* is the coefficient that measures the covered interest parity. Where

$$b=i=\left[\frac{F}{S}(1+i^*)\right]-1 \tag{7}$$

Equation (7) is the covered interest parity model in the context of incorporating the onshore and offshore foreign exchange forward market of Emerging Asia. If there is an occurrence of covered interest parity, the *b* = 0, while deviation from covered interest parity will indicate the $b \neq 0$.

3. DATA

In modelling deviation from covered interest parity, daily data for Korean Won (KRW), Indonesia Rupiah (IDR), Thai Baht (THB), and the Philippines Peso (PHP) against the United States Dollar (USD) is used. These emerging Asian currencies use the spot exchange rate against the USD, the 3-month onshore and offshore forward rate, the 3-month US Dollar London Interbank offered rate and the 3-month implied yield for the onshore and offshore currency forward market and respective interbank rates. The period of analysis is between 2 June 2008 and 30 September 2011.

4. FINDINGS

All four currency pairs fail to achieve covered interest parity equilibrium in both the onshore and offshore foreign exchange forward markets (see Table **2**) but the positive coefficient of deviation from covered interest parity imply currencies as being inclined to appreciate against the US Dollar in the foreign exchange forward market. The appreciation tendency of currencies during the period of study show the carry return $i–i^*$ as below the forward gap $\dot{F}–F$ with agents in the foreign exchange markets inclined to buy these currencies in the foreign exchange forward market.

Table 2: Estimated Coefficient of Deviation from Covered Interest Parity

	Onshore		Offshore	
	b	Standard error of regression	*b*	Standard error of regression
KRW	0.9294	0.4147	0.7184	0.8471
IDR	0.6807	0.8304	0.4870	1.3889
THB	0.7231	0.1525	0.7096	0.1705
PHP	0.7373	0.2182	0.7096	0.6354

Source: Author's calculation.
Notes: The deviation from covered interest parity is based on equation (6), where $\dot{F}-F=a+b\left[\frac{F}{S}(1+i^*)\right]-1)-i^*+\varepsilon_t$.
The coefficient *b* is in % terms which reflects the magnitude of deviation from covered interest parity.
Significant at the 5% level of *t*-Stat for both onshore and offshore coefficient.

The largest deviation in covered interest parity occurs for the KRW. The deviation is larger in the onshore foreign exchange forward market due to the accessibility given by Bank of Korea (BoK) for onshore residents to engage in offshore non-deliverable foreign exchange forward market for currency risk hedge purposes. The regulation encourages deviation in covered interest parity to occur and in the same vein raises the risk of capital outflow by onshore residents. The Indonesia Rupiah (IDR) also shows a large deviation from covered interest parity in the onshore foreign exchange forward market due to tight regulations imposed by Bank Indonesia to deter speculative activity. Indonesia imposes regulation pertaining to purchase of foreign exchange forward against the IDR by non-residents for amounts exceeding USD 100,000 and making it mandatory to obtain written permission from the Bank of Indonesia (BI)[4]. This control limits the amount of foreign exchange that flows in and out of Indonesia's foreign exchange system.

[4]Tsuyuguchi, Y and Wooldridge, P, (2008) find that activity in Asian currencies is concentrated in the onshore foreign exchange markets. This indicates that foreign exchange controls are having the intended effect of stalling the internationalization of Asian currencies and therefore potentially hindering the integration of Asian financial markets with global markets. The authors also find foreign exchange controls act as a restraining factor in the development of Asian foreign exchange derivatives trading which segments foreign exchange activity between onshore and offshore markets.

5. CONCLUSIONS

Even with inflation targeting policy, the occurrence of deviation from covered interest parity occurs. The segmentation of onshore and offshore foreign exchange forward markets is a by-product of rules and regulation that has been imposed by monetary authorities in respective economies. The deviation from covered interest parity is larger in the onshore market compared to the offshore market. This is due to the volatility of capital flows that passes through between both markets. The fact that monetary authorities in these economies have inflation targets, the management of currency movements is not seen as the ultimate objective of policy making.

ACKNOWLEDGEMENTS

The authors are grateful to two anonymous referees for their very helpful comments and suggestions.

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Received on 29-04-2014 Accepted on 15-09-2014 Published on 24-10-2014

DOI: http://dx.doi.org/10.6000/1929-7092.2014.03.28

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