Deviations from Covered and Uncovered Interest Parity

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Abstract

The idea of IRP dates back to the twentieth century and was first postulated by Maynard Keynes in 1923. Deviation from covered and uncovered interest rate parity has gained prominence in the literature in the past decades; the study is filled with mixed findings. However, covered and uncovered interest rate parity is a major theory in finance and economics. It is widely agreed that one of the bedrocks of international finance is interest rate parity (IRP), as it provides information on the existing relationship between interest rate and foreign exchange rate prices. This paper seeks to review several literatures on deviation from covered and uncovered interest parity. The major findings of the literature are full of conflicting results. The reason for conflicting results is not farfetched, as the research was conducted under different monetary policy regimes, as well as different economic situations. In almost all the major continents of the world, this theory has been found to hold true for a period of time, and deviation occurred after certain period of time. The most significant factors responsible for failure of the theory are the great financial crisis and bankruptcy of Lehman Brother in United Sates of America. The lesson also learnt is that large deviation from CIP and UIP does not necessarily reflect the inefficiency of the foreign exchange market of emerging markets; the only difference is the time frame.

Keywords: Interest Rate Parity (IRP), Covered Interest Rate Parity (CIP) and Uncovered Interest Rate Parity (UIP).

JEL classification: B17, D53 and G1.

1.0 Introduction

The world economy is full of diverse races, resources, genders, economies, currencies and even leaderships. Almost every economy in the world has access to natural resources as well as human capital. Yet, resources are not equally distributed among countries and most regions have surplus supplies of one resource while having a deficit of another resource. The trade of goods and services allows countries to gain from their distinct competencies and helps satisfy the world's economy wants. However, for this trade to occur there is a need for price finding of currency exchange rate, thus leading to exchange rate theory and policy in international finance.

According to Lemke (2020), interest rate parity (IRP) explains a relationship between currency movements and the interest rates of countries using those currencies. In its most extreme form, IRP claims that future spot exchange rates between two currencies can be accurately forecasted using only the interest rates in the respective countries. Other papers, such as Suranovic (2012), claim that IRP provides one of the strongest frameworks to predict exchange rate movements, making it one of the most important theories in international finance. Since a majority of international currency exchanges are driven by investments, there is a strong motivation to understand the international investment market.

The idea of IRP dates back to the twentieth century and was first postulated by Maynard Keynes in 1923. As more reliable data has been gathered over the past century, much research has been done on IRP and its sub-theories, often with different results.

From IRP, two new theories have emerged: uncovered interest rate parity (UIP) and covered interest rate parity (CIP). Uncovered interest rate parity holds that an investor who invests money domestically should receive the same return as an investor who invests in an identical asset internationally and then reconverts their currency into the domestic currency. Covered interest rate parity makes a similar claim; however, the investor hedges their interest rate exposure through the use of a forward contract to reconvert the investment return and principle into the home currency, i.e., the investor covers their risk of exchange rate fluctuations. Lemke (2020) explains that there should not be any differences between CIP and UIP and that the forward rate should equal the future spot rate.

Without doubt or debate, economic and financial freedom otherwise referred to as openness survive when residents regardless of territorial boundaries are at liberty to trade assets with other residents in another country under some specific regulations (policies) which are not

harsh or stringent. As the whole world becomes a global village with the help of advanced technological prowess, the roles of economic variables are vital in the sustenance of meaningful growth and development. This era is indeed getting closer to the globalization stage of mankind although other factors are impediments. Bhatt and Virmani (2005) affirm that the free and unrestricted flow of capital in and out of countries and the ever-increasing integration of world capital markets can be attributed to the process of globalization. The benefits of such integration are numerous on one hand and the risk diversification on both of which are instrumental in making markets more efficient and also facilitate smooth transfer of funds between businesses. While we streamline this article to Interest rate parity, we intend to examine the deviation of covered and uncovered interest rate parity. This paper intends to review several literatures on deviation from covered and uncovered interest parity, and then highlight lessons learned from the literature

2.0 Conceptual Review

2.1 Covered Interest Parity (CIP)

In this section, we first define some of the concepts that are going to be discussed throughout this paper. Then, we summarize the theoretical framework used in evaluating interest parity and finally, we summarize the relevant literature.

Covered Interest Rate Parity otherwise referred to as Covered Interest Parity is a major theory in finance and economics. Although some argue that the negligence of CIP has severe policy impacts on the economy, others negate such consequences, saying its impacts are negligible. The proposition or concept of CIP as stated by Keynes in the early 20th century during the unsettled exchange rate pricing after WW1 is a bedrock of global finance and economic adjustment. CIP is generally defined as a non-arbitrage condition that could be used in the foreign exchange markets to determine the forward foreign exchange rate. The condition further states that investors could hedge foreign exchange risk or unforeseen fluctuations in exchange rates with forward contracts.

2.2 Uncovered Interest Parity (UIP)

The uncovered interest parity principle states that differences between interest rates across countries can be explained by expected changes in currencies. In this sense, UIP is just an expression of the law of one price, an economic principle which suggests that the price of the same goods in different markets or regions must be equal in a free market with no economic

trade restrictions. In essence, if interest rates in two countries are different, then exchange rates are expected to shift in order to make the return of investing in either country equal.

Despite common understanding of interest parity, different trading strategies have developed that take advantage of mispricing of currencies. One such strategy is the carry trade, in which in investor chooses to loan funds from a lender in a low interest rate currency. The investor then exchanges this currency for one of a high interest-bearing market. If the return is higher than the interest on the loan and if the investments are at the same risk level, then the investor makes a risk-free profit. Laux and Zhang (2014) explain covered and uncovered carry trade using an example. Assume American investors borrows Euros (EUR) at low interest rates and investors those funds at a higher rate in the United States. The proceeds gained from this investment can be used to pay the interest and principal of the loan. If there is no risk associated with the American investment, then the investor made a credit risk-free return. Yet, the investor is still subject to exchange rate risk. If the investor chooses to hedge against the risk using a forward contract, then the trade follows a covered interest rate strategy.

3.0 Theoretical Framework

We first present an overview over Covered Interest Parity (CIP). Second, we discuss the implication of CIP and its assumptions. Next, we summarize uncovered interest parity and present its implications and assumptions.

3.1. Covered Interest Parity (CIP)

Covered Interest Rate Parity (CIP) is a no-arbitrage condition. It states that the real interest rate of two identical assets in two different countries should be equal. Suppose a set of well-functioning economies with liquid currency markets. $y^{D}_{t,t+n}$ represents the interest rate an investor could achieve by investing money in period t for n periods domestically at the risk-free rate.$y^{F}_{t,t+n}$ in contrast is the risk-free interest rate the investor could get by investing the money abroad. S_t represents the current spot exchange rate. It measures the amount of foreign currency that could be bought with one U.S. Dollar. Hence, if the dollar appreciates, the spot exchange rate rises. $F_{t,t+n}$ is also represented in foreign currency per one U.S. Dollar. It measures the forward rate at time t for time t+n.

Given these constraints, an investor holding U.S. Dollars has two choices. The investor can either invest the money domestically in the U.S. risk-free security, or could convert the

money into a foreign currency and then invest it at the foreign interest rate, and hedge currency risk using a forward contract to sell foreign currency for U.S. Dollars. To illustrate this process, consider the following example. Assume that the investor holds $100. This money can be invested domestically and would earn $100 \cdot \left(1 + y_{t,t+n}^{D}\right)^{n}$ U.S. Dollars over n periods. However, she could also convert her money to $S_t \cdot 100$ foreign currencies and invest that money risk-free abroad to earn a return of $100S_t\left(1 + y_{t,t+n}^{F}\right)^{n}$ foreign currency at time n. Then, she would have to reconvert this foreign currency into U.S. Dollars using a forward hedge. Her overall return would hence be $100\left(1 + y_{t,t+n}^{F}\right)^{n} \frac{S_t}{F_{t,t+n}}$. Because both of these investments are risk-free, if you assume that there is no counterparty risk in the forward hedge and no credit risk in both the risk-free investments domestically and abroad, then the overall return should be the same, lest there be an arbitrage opportunity.

$$\left(1 + y_{t,t+n}^{D}\right)^{n} = \left(1 + y_{t,t+n}^{F}\right)^{n} \cdot \frac{S_t}{F_{t,t+n}}$$

If the implicit forward rate is different from the actual forward rate, then an arbitrage opportunity occurs that allows an investor to make a risk-free profit. This wedge in returns is referred to as the cross-currency basis. It can be interpreted as a change in the foreign required yield that offsets the 'mispricing' of the currency forward rate.

$$\left(1 + y_{t,t+n}^{D}\right)^{n} = \left(1 + y_{t_1 t+n}^{F} + X_{t,t+n}\right)^{n} \cdot \left(\frac{S_t}{F_{t,t+n}}\right)$$

We can reasonably estimate the compounded returns using and then solve the above equation for x.

$$X_{t,t+n} = y_{t,t+n}^{D} - y_{t,t+n}^{F} + \rho_{t,t+n}$$

If rho is defined as:

$$\rho_{(t,t+n)} \equiv \left(\left(F_{(t,t+n)} - S_t\right)/S_t\right)^{\frac{1}{n}}$$

$\rho_{t,t+n}$ represents the market implied forward rate. The cross-currency basis measures the difference between the direct U.S. dollar interest rate, and the synthetic dollar interest rate, $y_{t,t+n} - \rho_{t,t+n}$obtained by converting the foreign currency interest rate in U.S. dollars using currency forward contracts. A negative currency basis suggests that the direct U.S. dollar

interest rate is lower than the synthetic dollar interest rate by swapping the foreign currency interest rate into dollars. For covered interest parity to hold, the cross-currency basis must be zero. If it is not, an arbitrage opportunity, in theory, exists and should be exploited to make the basis zero. In the case of a negative basis, $x < 0$, the dollar arbitrageur can earn risk-free profits equal to an annualized $|x|$ percent of the trade notional by borrowing at the direct dollar risk-free rate, investing at the foreign currency risk-free rate, and signing a forward contract to convert back the foreign currency into U.S dollars. In the case of a positive basis, the opposite arbitrage strategy of funding in the synthetic dollar risk-free rate and investing in the direct dollar risk-free rate would also yield an annualized risk-free profit equal to x percent of the trade notional. This relies on the assumption that capital exchange between the countries is possible and free of charge. Furthermore, both investment securities must have the same risk-level. Otherwise, the investor would bear a risk that she should be compensated for (Du, Tepper &Verdelhan 2017).

3.2. Uncovered Interest Parity

Uncovered Interest Rate Parity relies on a very similar idea. However, instead of hedging the currency risk in the forward market, uncovered interest parity claims that the future spot price must adjust so that the return in both countries is equal.

$$S_t\left(1 + y^D_{t,t+n}\right)^n = E(S_{t+n})\left(1 + y^F_{t,t+n}\right)^n$$

The expected spot rate E(S) in theory should equal the forward premium of the currency. Again, the assumption of free capital flow must be met for UIP just as it is a requirement for CIP. Second, UIIP follows a no-arbitrage condition under which an investor should not be able to make a risk-free return on these exchange rate movements (CFI, 2020). With these definitions in mind, we turn now to a preliminary look at the date.

4.0 Empirical Review and Methodology

The literature on covered and uncovered interest parity is filled with extensive publications and reviews. Many such studies back the effectiveness of interest rate parity during certain periods of time, while during different timeframes the theory seems to not have held (Isard, 1991). This study seeks to review some of the literature on deviation from covered and uncovered interest parity.

4.1 Determinants of CIP and UIP Deviations

Harvey (2005) elaborated on factors that interfere with the textbook UIP operations and make it unlikely for UIP to ever truly hold in the real world. He shows that it is not necessary for risk to exist to create deviations from UIP. He finds that share prices and currency prices can explain large parts of the deviations from UIP.

Skinner and Mason (2007) seek to test how other factors, such as transactions costs, economy size, or credit risk volatility, can impact CIP deviations. They use data for Brazil, Chile, Russia, South Korea, Norway, and the United Kingdom. They find that CIP hold for any triple A rated economy, but it does not hold for long maturities in developing countries.

Jauregui and Natraj (2017) argue that during the great recession, initial rises in IRP deviations were attributable to counter party risk created through the uncertainty of financial viability during the crisis. Yet, the cross-currency basis for Yen, Euro, and Swiss Franc with respect to the U.S. Dollar has been persistently negative even since 2014 – long after the crisis. They find three forces that prevent arbitrage from closing those deviations. The first are limits to arbitrage through capital constraints. Second, monetary shocks by domestic and U.S. central banks limit the ability of arbitrageurs to capitalize on these opportunities. The last limiting factor is the inclusion of central bank swap lines. They furthermore find that expansionary monetary policies as those set in motion by the ECB and BOJ often lead to increases in the cross-currency basis. Using an event study methodology, they show there is a positive effect of central bank swap lines issued by the Federal Reserve on dampening CIP deviations in the 2008-2011 periods.

Du et al. (2017) present deviations from the CIP condition even after the great recession. They show that the CIP condition does not show in the LIBOR, RePo, and KfW bond markets. In both the RePo and KfW markets the lack of arbitrage can be explained by interaction between costly financial intermediation and imbalances in the supply and demand of investments. In addition, they find four CIP deviation characteristics. First, deviations are larger during quarter-end. Second, balance sheet costs can account for 67 percent of the deviations from CIP. Third, there exists a co-movement tendency between CIP deviations and other fixed income securities. Lastly, they find that deviations from CIP and nominal interest rates are strongly correlated.

Lida, Kimura, and Sudo (2018) study the determinants of movements away from CIP and investigate how environmental changes surrounding the foreign exchange swap market affect the U.S. dollar funding of banks. They hold that this funding may have explanatory power over the deviations from CIP. They conclude that global interest rate differentials, which indicate divergent monetary policies among major economies, supplant the role of creditworthiness of global banks as determinants of cross currency bases.

Liao (2016) further tries to examine reasons for the deviations from CIP. Specifically, he seeks to examine the connection between deviations from CIP and price discrepancy of credit risk for bonds denominated in different currencies. In his analysis, he finds that the two variable display persistent discrepancies in pricing, which indicates a violation of the Law of one price. Hence, this is aligned with the fact that there seem to be violations in CIP.

Ibhagui (2019a) provides evidence for the performance of one of the riskiest ass classes – stock – in response to the wider deviations from covered interest parity deviations in the Eurozone. The research documents a positive relationship between stock return and deviation from CIP, especially during a crisis. This means that larger CIP deviations result in a decline in stock returns.

Using a panel data econometric technique, Ibhagui (2018) investigates the long-run relationship between monetary fundamentals and CIP deviations for a basket of currencies. For all the considered currencies, one variable – relative money supply – exhibited the most consistent long-run with cross-currency basis swap spreads. Other variables considered such as spot exchange rate and relative real output also exhibited not only mixed results in their long run relationship with CIP deviations for the basket of currencies observed. He also carried out a comparative analysis of these results between the European and non-European currencies. The results show that the relationship between money supply and cross-currency basis swaps is largely sustained for European currencies, while it loses its relevance for non-European currencies. An especially revealing result is that of the consistent positive links between relative real output and the cross-currency basis swap spreads for non-European currencies. Largely, these results imply that the effect of monetary fundamentals in the long run on the currency basis swap is mixed across currencies, which calls for divergent policy implications.

A more specific analysis of the relationship between real output and deviations from CIP are found in Ibhagui (2019b). The research seeks to explain whether a stronger real output in the Eurozone can reduce the deviation from CIP. The empirical result indicates that real output in the Eurozone has a pronounced effect on the euro basis, implying that an increase in the Eurozone real output relative to US real output will tighten the euro basis, thereby reducing the deviation from CIP. The research is revealing as only a few works have sought to explain the reduction in the deviation from CIP from the lens of macroeconomic variables such as real output. Further evidence is needed from countries with increasing real output, especially a country like China, and its relationship with deviations from CIP.

Cerutti, Obstfeld, and Zhou (2019) discuss not only the increase in CIP deviations since the Great Financial Crisis, but also potential macro financial drivers of the variations in CIP that have become more significant. They confirm that the magnitude of cross-currency bases depends on multiple factors, not only on the regulatory environment. Some of these factors, such as for example asynchronous monetary policy may be time specific and other factors may be currency specific. Hence, deviations from CIP can sometimes be explained individually by external factors that block the efficient arbitrage process.

Franz and Valentiny (2020), in crypto covered Interest parity deviations, studying deviations from covered interest rate parity (CIP) in the Bitcoin/US-Dollar (BTC/USD) market, they find large CIP deviations of up to 15% until Q1/2018. Afterwards, CIP deviations have been subdued, which they attribute to the market entry of high-frequency traders (HFTs).

Hoffmann and Suter (2010) test for deviations from UIP using the Swiss Franc exchange rate. They use a linear factor model to test for UIP deviations in relation to the US Dollar and the Canadian Dollar, as well as the British pound. They find that since 1990, the Swiss Franc has displaced safe haven characteristics in its behavior in relation to the other currencies.

Liu and Otani (2005), in their article titled capital control and interest rate parity: evidence from China, 1999-2004, they believe deviations estimated from the uncovered interest rate parity condition present strong un-stationarity and persistence thus indicating China's capital controls is still effective in driving a wedge between onshore and offshore returns. Similar results are also obtained from covered interest rate parity conditions. The findings also demonstrate that there is no evidence of money market integration with Hong Kong.

However, the deviation also shows signs of moderation over time because of increased pace of capital account liberalization.

Thou and Kossa (2020), in his book the impact of macro financial variables on covered interest parity violations after the 2008 global financial crisis "on the 5-year horizon, the estimated effect of relative money supply on the deviations is mixed. On the other hand, there is a negative relationship between real GDP and the deviations observed. For longer-term horizons (10-20 years), both money supply and real output have a negative effect on the deviations. Yet, that of real GDP is stronger. In addition, the inclusion of VIX volatility index in the model was significant in most cases.

McBrady (2005) in his work titled: How integrated are global bond markets? Estimating the limits of covered interest arbitrage concluded by saying both in theory and in the data, that large deviation from covered interest parity can persist in equilibrium. Furthermore, from his empirical results, he stated that (i) the limits of covered interest arbitrage appear currency-specific, (not surprisingly, for yen-denominated securities, deviations from parity are largest and most persistent). (ii) for all currencies, they also tend to increase with maturity and decrease with credit quality. Curiously, this latter trend does not extend to risk-free government bonds.

Kim and Kang (2014) on analysis on recent changes in the covered interest rate parity condition based on their results concluded that deviation from the covered interest rate parity has decreased after the global financial crisis. It seems to be associated with the more active interaction between the short-term bond market and the foreign exchange market than before. The tightened relation of these two financial markets is caused by the arbitrage transaction of foreign investors.

Bush and de Mexico (2019) in the paper titled bank FX hedging needs and the impact on covered interest parity, an emerging market perspective stated that hedging demand directly influenced CIP deviations in the EM panel and the case of Mexico, while interaction effects varied across hedging measures. In addition, the Mexico analysis yields evidence that changes in banks FX liquid assets and foreign currency interbank funding affect changes in the CIP deviations. In sum, the results validate a key mechanism in the theoretical literature (i.e. that higher bank FX hedging demands- particularly from global banks, can indeed directly increase the cost of hedging).

Peslak (2011) analyzed four international exchange rate formulas. Using data from 1990 to 2010, he tested CIP, UIP, PPP, and IRP and found that for the most part over this timeframe the formulas held true. He found that the greatest deviations were found in the calculation of uncovered interest arbitrage. According to Paslek (2011), this was to be expected since uncovered arbitrage is subject to currency risk and hence more volatile than its covered counterparts. He furthermore finds that these differences magnify in emerging economies such as those of Mexico and Thailand.

Chen (2011) aims to investigate how capital controls in China from 2003 to 2010 impacted China's economy, specifically with attention to the period of financial turbulence that erupted in the summer of 2007. In this study, he calculates the Renminbi yield differential between onshore interest rates and its non-deliverable NDF-implied offshore interest rate using a two-regime threshold autoregressive model. He finds that as the intensity of capital control has increased over time, so has the threshold of arbitrage, even during times of financial turmoil.

4.2 CIP, Interest Rate and External Debt

Khor and Rojas-Suarez (1991) explored the dynamics between Mexico's domestic interest rate environment and perceptions about the default risk of Mexico's external debt. They tested for covered and uncovered interest rate parity with two identical asset classes denominated in different currencies. They find that, with some minor exceptions, usually both CIP and UIP conditions held.

Tola, Koomen, and Repele (2020) test the relationship between CIP deviations and Swiss capital outflows since the market crash in 2007/2008. In accordance with previous studies, they find that while CIP held tightly before the financial crisis, it has deviated from its long-run equilibrium significantly ever since the crisis. Their findings prove that as cross-currency bases increase, Swiss portfolio investment debt outflows decrease significantly. This reduction in outflows could have major implications for the demand of domestic currency investments.

4.3 UIP and PPP Linkages

Wang (2000) re-examines the long-run PPP and UIP relationships. Using data from 1973 to 1999 for many of the major economies in the world, he employs standard cointegration tests; however, adjust the critical values to be appropriate given infinite variance errors. The

unrestricted cointegration results point to a strong long-run relationship of UIP with the United States under the assumption of stable errors. However, he also finds that there are periodic deviations from uncovered interest parity.

A value at risk (VAR) analysis for UIP and PPP was done by (Macchiarelly, 2011). His study revisits the relationship between UIP, ex-ante PPP and the real interest parity the British Pound, Japanese Yen, and U.S. Dollar. Using the VAR model, he finds a forward premium in both the UIP and the EXPPP.

4.4 CIP, UIP and Counterparty Risks

Coffey, Hrung, and Sarkar (2009) provide evidence that proof deviations from CIP since the beginning of the Great Recession in 2007. Their results illustrate that the margin conditions as well as the cost of capital can determine the magnitude of CIP deviations, especially during times of crisis. They also emphasize, that following some of the large bankruptcies, the credit risk increases and what once was deemed risk free may not be a risk-free security anymore. They also conclude that central bank interventions mitigated the magnitude of the deviations from CIP. The study suggests that counterparty risk has become significant determinant of CIP deviation following Lehman Brothers bankruptcy on September 15, 2008.

Pippenger (2012) asserts that much of the literature assumed that, UIP fails to hold because investors are risk averse and hence prefer to trade with a cover. Yet, covered interest parity implies that the theory can fail even when investors are risk neutral and hold when investors are risk averse 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. He further shows empirically that UIP routinely fails, particularly in the short run, at short maturities and between developed countries.

4.5 Evidence in Support/Against CIP and UIP

CIP preaches the existence of a steady state between the interest rate differential of two countries under a zero-arbitrage condition in neither of the countries. UIP holds that the interest rate difference of two countries' currencies should be a perfect predictor of variation in the expected spot exchange rate (Hilde, 2009).

Researchers have over time questioned the empirical validity of the UIP. Pippenger (2013) identifies three puzzles associated with the failure of UIP: 1) short-term maturities violate the UIP theory than long-term maturities; 2) developing countries have larger forward bias than developed economies; 3) lack of systematic forward bias in commodity markets. CIP, although not entirely devoid of criticism, has largely been supported empirically. Bacchetta (2013) seeks to solve the puzzle why these theories do not hold in practice. He concludes that it is simple to design a model that generates deviations from UIP as observed in the Fama regression. However, what is more complex is finding models that are robust to external shocks and that can match the various aspects of the data, such as for example high exchange rate volatility.

The emergence of the global financial crisis (GFC) reshaped the institutional structure of the financial market, giving rise to larger non-zero arbitrage transactions. The strain as a result of the GFC, in the global interbank markets was initially thought to be the reason for the failure of CIP (Borio, McCauley, McGuire and Sushko, 2016). However, after the strain subsided, the non-zero arbitrage condition persisted with widening currency basis. This condition has renewed the interest of researchers in this area.

Gurvich, Sokolov, and Ulyukaev (2009) provide a robust analysis of the deviation in the CIP since inception of the GFC. Their result indicates that cost of capital and margin conditions are important determinants of CIP deviation. This is largely due to the dramatic surge in currency basis during the GFC, following the bankruptcy of the Lehman Brothers. Kim and Kang (2014) examine the nature and the extent of change of the CIP dynamics after the GFC. Using the Bayesian MCMC method, they estimate a multiple-state Markov regime switching model. They find that the deviation from CIP has decreased overtime after the GFC.

Borio et al (2016) present a framework that revolves around two components - FX hedging demand and constraints on arbitrage. They argue that the continued violation of CIP is reflective of the combination of the FX hedging demand and constraints on arbitrage, resulting from the limited balance sheet capacity.

Bhargava, Dania and Malhotra (2010) argued that the bulk of researches on CIP are on developed markets. Therefore, they examine the extent to which CIP is prominent in the BRIC nations. In their result, they find the efficacy of CIP in the capital markets of the BRIC

nations varies overtime. This means that sometimes, the CIP hypothesis is violated and other times, it holds true.

Im (2020) explains the violation of CIP from the lens of foreign sovereign credit risk. He finds that the profitability of both CIP and UIP is explained by foreign sovereign credit risk. Also, he finds that moderate credit risk is capable of producing the persistent underpricing of carry trades by standard CIP for Mexico and the G10 countries. Bräuning and Puria (2017) explore the role of bank regulations and monetary policy in lowering the deviation from CIP. In their work, they explain that the recent deviation from CIP is better explained by stringent post-crisis bank regulations, which have increased the cost of supplying dollars in the FX swap market, resulting in a restrained CIP arbitrage between the dollar cash market and the swap market.

Stefan, Du, Koch, Shin (2018) provide empirical evidence in support of the role of broad dollar exchange rate as a risk factor in pricing the cross-section of CIP deviations. They further document a triangular relationship between the value of the dollar, cross-currency basis, and dollar-denominated cross-border bank lending. This implies that a currency with higher exposure to the dollar will exhibit larger CIP deviations, a great platform for traders who have larger balance sheet capacity to exploit the potential arbitrage benefits.

Rime, Schrimpf, and Syrstad (2019) argue that a new viewpoint is needed to understand the CIP mystery. They show that the law of one price hold true for a majority of market participants when considering financing costs that truly reflect those of banks such as money market lending rates instead of government risk free rates. However, they also find that CIP arbitrage opportunities do exist, but are confined to a few highly rated global banks that have the necessary capital and low borrowing costs to take advantage of them.

Wong and Zhang (2018) use basic matrixes and OLS regressions in their analysis. They test for CIP on seven distinct currency pairs and find that even after adjusting for exchange rate risk, the return on investing in different currencies deviate from each other – a break of IRP.

Kim (2009) in his market structure, bargaining, and covered interest rate parity affirm that covered interest rate parity does not hold in either monopolistic or oligopolistic environment because foreign banks, exercising their market power, maximize their surplus by limiting the supply of foreign currency in emerging swap market.

Eaton and Turnovsky (1982) in their working paper with titled covered interest parity, uncovered interest parity and exchange rate dynamics, assert the following: first, the exchange rate and interest rate cannot be in steady state unless both the government deficit and current account equal zero, not simply their sum as would otherwise be the case. Secondly, even in steady state the domestic interest rate can deviate from the foreign interest rate by an amount which depends upon relative domestic asset supplies.

Bhatt and Virmani (2005): global integration of India's money market: interest rate parity in India said covered interest parity is found to hold for while uncovered interest parity fails to hold. The difference between the two can be attributed to the existence of an exchange risk premium over and above the expected depreciation of the currency.

Lily, Kogida, Muloka and Asid (2012) provide empirical evidence for UIP in an emerging economy (Malaysia) in relation to Japan, Singapore and Thailand, using the bound test approach. They found that UIP is violated in Malaysia largely due to the weaker financial liberalization, fundamentals of macroeconomics and exchange rate control. In the same vein, Dharmadasa (2010) examines the nexus between interest rates and exchange rates in Sri Lanka under the UIP framework, using the GMM econometric technique. She finds that the UIP theory does not hold true in Sri Lanka, a result which is consistent with previous findings. Nirmali and Rajapakse (2017) compare the Sri Lankan Rupee against the US Dollar, which show a particularly different result. They find no evidence to support the existence of UIP both in the short and long horizon. Furthermore, UIP is also proven to be violated in Africa (Nwiado and Torbira, 2016) and Asia (Adrangi, Raffiee and Shank, 2007). Omer et al. (2012a) tested the UIP theory using LIBOR interest rates, which presents a rare empirical evidence in support of UIP. They find that in fact, UIP holds true for short-run maturities when particular dynamics in the market are controlled for. Similarly, Ismailov and Rossi (2017) conjecture that there is a great likelihood that UIP will hold under a rather certain environment. In their defense, they develop a new exchange rate uncertainty index that measures the predictive nature of the exchange rate based on historical data. They find that UIP holds in five industrialized countries in the short-horizon period of low uncertainty and otherwise during periods of high uncertainty. In the bid to resolve the wide empirical rejections of UIP, Christensen (2000) examined more closely the policy behavior introduced by McCallum (1994). Sadly, his efforts were futile and UIP was violated yet again.

Contrary to some previous studies which have discredited the UIP empirically. Chinn and Meredith (2004) claim that the UIP theory holds true under the long horizon. In their research, they utilized the long-maturity bond interest rate for the G-7 countries. Surprisingly, their empirical result is consistent with the theoretical foundation of UIP. In the short run, they attribute the failure of UIP to the interplay between the random works inherent in exchange market shocks and the reactions of endogenous monetary policies. However, in the long run, the drivers of exchange rate are “fundamentals" which lead to a more consistent interplay between interest rate and exchange rate with UIP. Lothian (2016) examines the UIP in 17 countries using their historical time series data at its longest – for the US/UK country pair, for a period of 217 years. He finds that over the long term, bond yields expressed in common currency in most of the countries under study have a direct relationship with one another based on the prediction of UIP. His result is consistent with the theoretical foundation of UIP. Ubi and Nyiputen (2020) investigate, comparatively, the validity of the UIP theory between Nigeria and the US and Nigeria and China, using the ARDL Bound Test approach. They find that the UIP theory holds for between Nigeria and the US, while it is violated between Nigeria and China.

Alper, Ardic and Fendoglu (2007) argue that the methodology used in testing for UIP in emerging economies should be different from that of developed economies. Hence, emerging markets are deserving of some special treatment by recognizing the existence of additional risk premia, high inflation episodes, financial contagion, peso problem, simultaneity problem, asymmetricity, and the determination of de facto structural breaks. He also submits that the large deviation from UIP does not necessarily reflect the inefficiency of the foreign exchange market of emerging markets.

Albertsson (2018) examines UIP between Sweden and the United Kingdom and confirms the role of carry-trade strategy in explaining the long-standing failure of UIP, often called UIP puzzle. He finds that the carry-trade strategy can, to an extent, explain the UIP puzzle. Additionally, the empirical results show that a positive rate differential will cause the interest rate to rise, leading to a violation of the UIP.

Mark and Wu (1998) investigate the theoretical basis of an asset pricing anomaly in international finance known as the forward premium bias. The forward premium bias as an anomaly that suggests that forward premiums do have explanatory power on the magnitude of future currency depreciation, but not with the sign implied by UIP. They use data for the

US, Great Britain, Germany, and Japan ranging from 1976 to 1994 to test for the persistence of this anomaly. They estimate the risk premia using a vector error correction model and compare those to the expected premia implied by IRP. They find that the model fails to predict the premia with the current sign.

Cincibuch and Vávra (2003) also test for UIP but include potential non-restricted expectation distributions in their models. Hence, they test for UIP using options that imply information on currency movements. Specifically, they focused on the dollar-yen currency pair, for which they found UIP to hold.

Lothian and Wu (2005) took a different approach to studying UIP by employing a time series data set that spans over 200 years. They find that almost over the entire period, the forward-premiums are positive and only become negative during the 1980s, a period known for its extraordinary high inflation. Furthermore, they show that the explanatory power of interest rate differentials largely depends on the magnitude of those differences, i.e., minor interest rate differences may not make an arbitrage carry trade feasible and hence do not result in corrected exchange rates. Although large deviations do and can occur, on average the basis is found to be zero. Concluding, they find that over the long run, UIP seems to hold although large fluctuations can occur in the short run.

Westman and Tafazoli (2011), examine whether UIP holds over a 10-year period between Japan and Australia, Norway, and the U.S. They use data between 2001 and 2010 and used both a correlation analysis as well as a standard regression to see whether the UIP hypothesis holds. Additionally, they simulated a carry trade portfolio and showed this strategy could have been exercised and that investors could achieve profits employing a carry trade strategy. They furthermore find that UIP seems not to hold and then room for arbitrage exists.

Cuestas, Filipozzi and Staehr (2015) try to test the empirical validity of general UIP. To do so, he uses data from five European countries with floating exchange rates over the 10-year period from 2003 to 2013. In his analysis he allows for different types of structural breaks and includes forward looking as well as static expectations. His results show the importance of satisfying all assumptions to test the UIP hypothesis.

Meredith and Chinn (1998) in long-horizon uncovered interest rate parity conclude that in contrast to previous studies, which have used relatively short-horizon data, they test UIP using interest rates on longer-maturity bonds for the G-7 countries and these long-horizon

regressions yield much more support for UIP- all the coefficients on interest differentials are of the correct sign and almost all are closer to the UIP value of unity than zero coefficient implied by the random walk hypothesis. These results confirm the earlier conjectures of Mussa (1979) and Froot (1990) that UIP may work better at longer horizons.

Karahan and Çolak (2012) use a regular Ordinary Least Squares (OLS) regression model as well as a Generalized Autoregressive Heteroskedasticity (GARCH) analysis to test whether IRP holds in Turkey. In accordance with some of the previous studies, they find that neither UIP nor CIP seems to hold in their market. Furthermore, they argue that UIP does not seem to hold for most developed markets.

Brouwer (1997) examines covered, uncovered, and real interest parity for money market instruments in Australia, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand. He tests for integration with the world markets using standard regressions, cointegration analysis and error decompositions and finds that UIP has a strong explanatory power for financial openness.

Kotzé (2014) employs the use of common statistical methods that are widely applied in research on investment returns in all asset markets. This method enables him to test the "unbiasedness hypothesis". He finds that in general, over a one-to-six-month timeframe, there is constituent evidence proving deviations from IRP and the existence of forward premiums. In these cases, the average value of $ø_2$ is -0.88 Froot and Thaler (1990). It has also been shown that the magnitude of $ø_2$ is time varying and is also possibly regime specific. However, in the long-run, there seems to be a constant return to IRP and the theory seems to hold over those timeframes.

Brauning and Puria (2017) uncovering covered interest parity: the role of bank regulation and monetary policy in their paper said deviations can be explained by tighter post-crisis bank capital regulations that made the provision of foreign exchange swaps costlier. Moreover, the recent monetary policy and related interest rate divergence between USA and other foreign countries have led to a surge in demand for swapping low interest rate currencies into the US dollars. However, the current conditions that govern the provision of dollars funding through central banks are not favorable enough to reduce deviations from interest parity to zero.

5.0 Conclusions

It is widely agreed that one of the bedrocks of international finance is interest rate parity (IRP), as it provides information on the existing relationship between interest rate and foreign exchange rate prices. Essentially, the interest rate parity is categorized into two - Covered Interest Parity (CIP) and Uncovered Interest Parity (UIP). This paper seeks to review literature on deviation from covered and uncovered interest parity, and then highlight lessons learned from the literature.

Thousands of works have been executed for or against CIP and UIP that is covered interest parity and uncovered interest parity. Researchers have studied literature in Asia, Europe, America, and Africa. The indication of the above is that, literally, all developing, developed and underdeveloped economies of the world have been studied and many conflicting results have been found. The reason for conflicting results is not farfetched, as the research was conducted under different monetary policy regimes, as well as different economic situations. This study reveals the most common findings of authors at different points in time, some actually contradict one another, while supporting another.

5.1 Highlights of Most Common Findings in Literature

Some of the revelations are as follow:

- Covered and uncovered during the period under study in Mexico holds for a short term.
- Covered and uncovered interest parity does not hold in Australia, Thailand other Asian economies like Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan and.
- Empirical study between January 1973 to December 1999 for Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden and the United Kingdom against the United States UIP hypothesis. The results show long-run UIP relationship with the United States under the assumption of stable errors while the restrictions for strict UIP relationships do not hold.
- Uncovered interest parity holds for exchange between dollar and yen.
- Interest rate parity holds for large and small triple A rated economies, it holds for emerging markets only for a three-month maturity.
- In the long run, IRP does not hold for Brazil, Chile, Russia and South Korea but for the UK and Norway it holds for short and long-term capital
- Evidences are showing that CIP deviation has been since in the inception of financial crisis in 2007.

- A study carried out between Japan and Australia/Norway/USA shows that uncovered interest rate parity over a period of 10 years (2001 to 2010) does not hold in the long term.
- UIP has been found consequently to fail in short run between developed countries.
- A study carried out in Turkey lacks empirical evidence to support the validity of UIP in the economy.
- Over 1 to 6 months horizons, there is consistent evidence of the forward premium anomaly over many currencies. That is the interest parity does not hold in the short run.
- Uncovered interest parity does not in central and Eastern Europe.
- There were systemic failures of the CIP condition even after the great recession. CIP condition does not hold in the LIBOR, repo, and KfW bond markets. Deviations in CIP and nominal interest rates are strongly correlated.
- A negative relationship is revealed between CIP deviations and Swiss portfolio investment debt outflows.
- A large CIP deviation of up to 15% in the Bitcoin/US-Dollar (BTC/USD) market was found.
- CIP hypothesis is violated and other times it holds in Brazil, Russia, India, and China.
- UIP is violated in Malaysia largely due to the weaker financial liberalization, fundamentals of macroeconomics and exchange rate control.
- There was no evidence to support the existence of UIP both in the short and long horizon in Sri Lanka.
- UIP is also proven to be violated in Africa
- UIP holds in five industrialized countries in the short-horizon period of low uncertainty and otherwise during periods of high uncertainty.
- There is a claim that the UIP theory holds true under the long horizon.
- Utilization of the long-maturity bond interest rate for the G-7 countries shows empirically that the theoretical foundation of UIP holds consistently.
- Over the long term, bond yields expressed in common currency in most of the countries have a direct relationship with one another based on the prediction of UIP
- UIP theory holds for between Nigeria and the US, while it is violated between Nigeria and China
- There is affirmation that covered interest rate parity does not hold in either monopolistic or oligopolistic environments because foreign banks, exercising their

market power, maximize their surplus by limiting the supply of foreign currency in emerging swap markets.

- Deviation from the covered interest rate parity has decreased after the global financial crisis.
- In India, covered interest parity is found to hold for while uncovered interest parity fails to hold.
- UIP test using interest rates on longer-maturity bonds for the G-7 countries support UIP theory.

Based on the above analysis, the CIP and UIP deviations contain diverse mixed of findings, of which many of them are controversial.

5.2. Factors Responsible for CIP and UIP Deviations

The anomaly that is revealed above can be as a result of the following factors according to the literature. The factors responsible for possible deviation in UIP and CIP deviation contain the following:

- Changes in money and share prices are capable of explaining the majority of deviations from UIRP.
- The supply of dollars by the Federal Reserve to foreign central banks via reciprocal currency arrangements (swap lines) reduced CIP deviations.
- Some of the factors have been attributed to the bankruptcy of Lehman Brothers in United Sates.
- Literature assumes that the theory of uncovered interest parity fails because investing without cover is risky and investors are risk averse.
- Expansionary monetary policies decision by the European Central Bank, Swiss National Bank and Bank of Japan has contributed to increase in CIP deviations.
- Lack of systematic forward bias in commodity markets.
- In the short-run, UIP failure has been attributed to the interplay between the random works inherent in exchange market shocks and the reactions of endogenous monetary policies.
- An increase in the Eurozone real output relative to US real output will tighten the euro basis, thereby reducing the deviation from CIP.

6.0 Lessons Learnt and suggestion for further studies

Large deviation from CIP and UIP does not necessarily reflect the inefficiency of the foreign exchange market of emerging markets. Interest rate parity is like a sun that shines to one part of the world while it leaves the other in darkness, and later shines on the darkness and turns light to darkness. Every region may not experience the light at the same but all regions will get the light and darkness at their own time.

UIP and CIP theory holds true in certain economies, while it remains ineffective in others. The only difference here is time. Before the global financial crisis, the theory held true but after that time, it has been rejected in many literature. It held true during certain monetary tightening and became ineffective after loosening of monetary policies.

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