NON-LINEARITY IN THE REACTION OF THE FOREIGN EXCHANGE MARKET TO INTEREST RATE DIFFERENTIALS:

EVIDENCE FROM A SMALL OPEN ECONOMY WITH A LONG-TERM PEG

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Rationale

❖ Global financial crisis

❖ Change in currency value & interest rates

❖ Affect volume & value of FX activity

❖ More efficient & centralised Treasury management - locally

❖ More regionally oriented FX operations

Non-linearity in Reaction of FX Trades to Interest Rate Spread

❖ Did FX traders respond to differences in interest rates?

  ❖ SOE with a long-term peg

  ❖ Impact of crisis

❖ Monetary policy considerations to interest rate changes

❖ Did UIP hold?
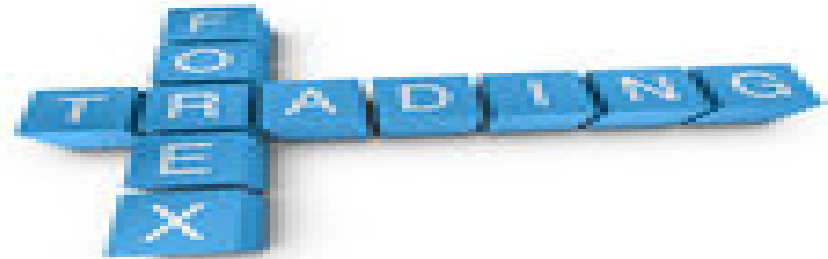
Uncovered Interest Rate Parity (UIP)

❖ The UIP hypothesis - cornerstone of international finance

Under a floating exchange rate regime, the UIP suggests that in the absence of opportunities for arbitrage, the expected change in the exchange rate between two currencies equals the interest rate differential between those two currencies

❖ Traditonal Tests of the UIP:

   ❖ Regress $\Delta spot = \beta\left(i_{domestic} - i^*_{foreign}\right)$

   ❖ Hypothesis to be tested: $\beta = 1$

…but empirical tests to date often find contrary results

Researchers often find:

- $\beta = 0$
- $\beta < 0$

the forward bias puzzle

Why???

Several theories have been proposed to the contrary results, but the most prominent view is that the puzzle may be due to specification error:

the reaction to the spread may be non-linear e.g. restrictions to trade

…what about the case of fixed exchange rate regimes?

Very few studies investigate the implications of the UIP hypothesis under a pegged rate.

Under a fixed regime, the market expectation in the spot rate is virtually zero. Thus, in the absence of exchange rate uncertainty, inflows and outflows of foreign exchange should respond to interest differentials, in a way that maintains UIP (Worrell et al, 2008).

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…tests of UIP under a fixed exchange rate regime

❖ Worell (2008) found that once allowance is made for market frictions and large discrete events, foreign exchange flows responded to interest differentials in a way that is consistent with the UIP condition.

❖ The work of Worrell et al (2008) aided in filling part of the gap on research dealing with the UIP, but we need to go further:

    ❖ Is it possible that there are non-linearities present in the reaction of FX flows to interest rate differentials ?

Objective of Study

❖ The objective of this paper is to test for the presence of non-linearities in the reaction of FX flows to interest rate differentials

❖ To carry out the task, the paper incorporates the Castle and Hendry (2010) test for non-linearity, into an E-GARCH-M Model

❖ The dataset runs from 1999 to July 2011, which allows for an evaluation of how the crisis may have impacted the FX market

The Empirical Model

❖ According to Worrell et al (2008), for fixed exchange rate economies, it is the inflows and outflows of FX which react to the differential

❖ The central bank in this economy is the last resort for sales and purchases of foreign exchange

 ❖ FX transactions on the central bank's books are a reflection of the daily balance of supply and demand on the FX market, hence the behavior of the market can be analyzed solely on the basis of central bank activity

❖ So, the model becomes

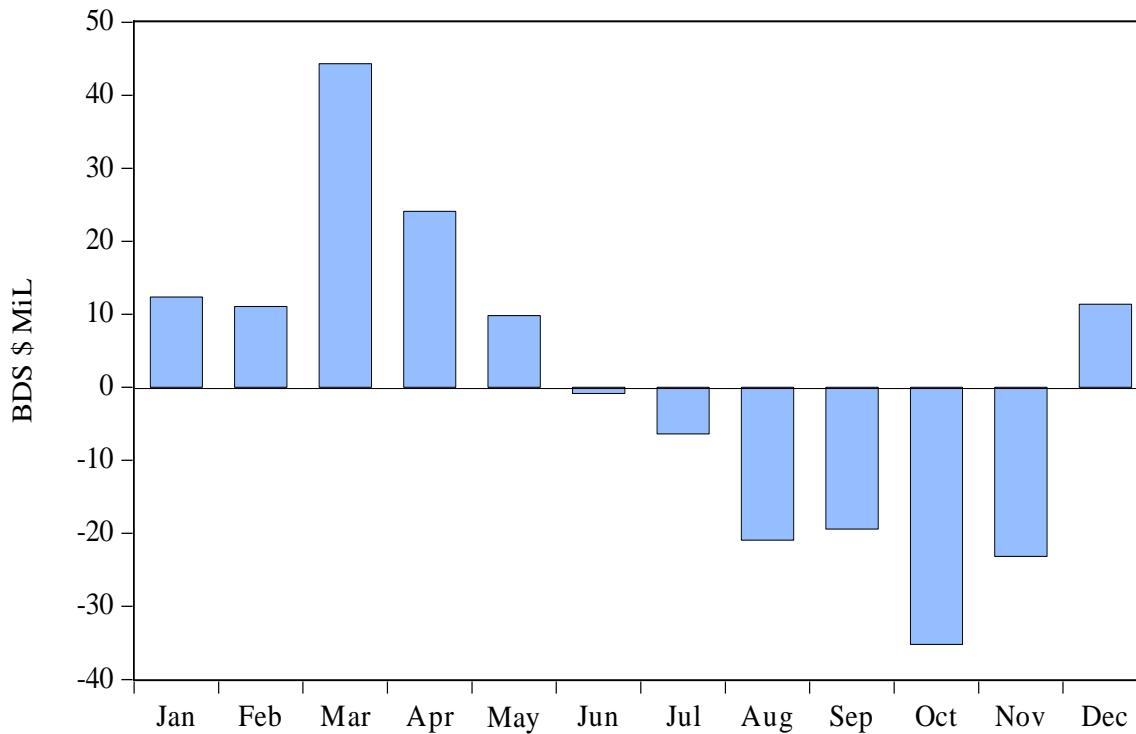$$Net\ Purchases_t = f\left[ARMA(p, q), g\left(i_{t,k} - i_{t,k}^*\right)\right]$$

where $g\left(i_{t,k} - i_{t,k}^*\right)$ is assumed to be non-linear.

❖ But in Barbados, FX flows are influenced by other variables besides the interest rate differential

…Other Factors Impacting Net Purchases

Average Monthly Net Purchases of Foreign Exchange

> **B**uoyancy of inflows is highly seasonal. reflecting the fact that the majority of the island's FX earnings come from tourism)

…Other Factors Impacting Net Purchases

Other features determining the fluctuations in net purchases are:

❖ Exceptional FX trades – for instance, for debt service or purchase of real estate

❖ Market Frictions, *h*

❖ Taking these into consideration, the empirical model is defined as:

$$(6)\ Net\ Purchases_t = f\left[ARMA(p, q), g\left(i_{t,k} - i_{t,k}^*\right),\ Exceptional\ FX\ Trades, Tourist\ Season_t, h_t\right]$$

Data

❖ The paper uses data on net purchases of US dollars by the Central Bank of Barbados

❖ The interest rate differential is defined as the spread between plus the local and U.S. treasury bill interest rates

❖ "*Exceptional FX Trades*" and "*Tourist Season*" are discrete variables

❖ The "*Market Frictions*" indicator h_t is represented by the volatility of net demand.

❖ The frequency of the data is daily spanning the period January 1999 to July 2011

Estimation Approach

❖ The empirical model is estimated using an E-GARCH-M model

❖ To test for non-linearity in the FX reaction to interest-rate differentials, the Castle and Hendry (2010) portmanteau test into the E-GARCH-M specification is used

Results

❖As a preliminary step to the estimation process, the temporal properties of the variables was checked.

  ❖ Net Purchases is I(0) stationary, with a drift

  ❖ Interest Rate Differential is also I(0) stationary but with drift and a linear deterministic trend.

  ❖ Hence, the interest rate differential is detrended

…the variance equation

	Full Sample (05-Jan-99 to 27-July-11)	Pre-Crisis Sample (05-Jan-99 to 29-Jun-07)
	E-GARCH (1,2)	E-GARCH (1,1)
$\dfrac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$	-0.027*** [0.000]	-0.019* [0.081]

…the control variables

	Full Sample (05-Jan-99 to 27-July-11)	Pre-Crisis Sample (05-Jan-99 to 29-Jun-07)
Market Frictions	0.020*** [0.000]	-0.012*** [0.000]
Net Purchases (-1)	0.998*** [0.000]	0.997 [0.000]
MA(10)	-0.992*** [0.000]	-0.983*** [0.000]
Exceptional FX Trades	7.404*** [0.000]	14.477*** [0.000]
Tourist Season	4.555*** [0.000]	3.839*** [0.000]

…relationship between interest differential and FX trades

	Full Sample (05-Jan-99 to 27-July-11)	Pre-Crisis Sample (05-Jan-99 to 29-Jun-07)
$\left(i_{t,k} - i_{t,k}^*\right)$	18.917*** [0.000]	20.637*** [0.000]
$\left(i_{t,k} - i_{t,k}^*\right)^2$	-0.181*** [0.000]	-0.860*** [0.000]
$\left(i_{t,k} - i_{t,k}^*\right)^3$	-4.298*** [0.000]	-5.275*** [0.000]
$\left(i_{t,k} - i_{t,k}^*\right)e^{-\left|i_{t,k} - i_{t,k}^*\right|}$	-35.077*** [0.000]	-34.659*** [0.000]

Concluding Remarks

❖ This paper investigated the possibilities of non-linearities in the behavior of the foreign exchange market of Barbados

❖ The empirical evidence suggest that when allowance is made for market frictions, tourism seasonality and large discrete events, capital flows have a general non-linear reaction to the interest spread

❖ The linear term is positive, which is consistent with the UIP condition; however, the remaining non-linear terms are all negative

❖ The crisis, though affecting the control variables, did not have a substantial impact on the FX-interest spread relation

❖ Policy implication: FX reaction to interest rate differentials is much more complicated than initial work suggests

THANK YOU