Capital Constraints, Counterparty Risk and Deviations from Covered Interest Rate Parity[*]

by

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Comments by

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[*] f.k.a. "Credit Risk, Liquidity Risk and Deviations from Covered Interest Rate Parity"

Outline of Remarks

- **Overview of literature on covered interest parity**
  - » Limits to arbitrage; factors associated with CIP deviations
  - » The minimum covered differential needed to induce arbitrage, or how wide is the boundary?
  - » Data, methodology and empirical evidence in the 1960s, 1970s, and 1980s
- **CIP as conventional wisdom**
  - » CIP as benchmark for 'perfect capital mobility'
  - » CIP adopted for financial product design
  - » Testing for CIP deviations with high frequency, high quality data (Akram, Rime, and Sarno, 2008 and 2009)
- **Comments on the CHNS paper**
  - » Set up and methodology
  - » Strong elements of the paper – Research design, attributing deviations to risk factors versus arbitrage constraints
  - » Suggestions for the next revision

First Arbitrage, then Covered Interest Parity

■ **Early references to arbitrage and its impact on prices**

» Ricardo (1811), Cournot (1838), and Walras (1870)

"Whenever this state of general equilibrium is disturbed,
it will be restored by arbitrage operations in bills of
exchange exactly like arbitrage operations in commodities."

First Arbitrage, then Covered Interest Parity

■ Keynes (1923) popularized ideas about covered interest arbitrage, and provided a list of cautionary reasons why the forward premium and interest differential would not satisfy a simply mathematical relationship

◆ Credit risk: "Such risks prevent the business from being based, as it should be, on a mathematical calculation of interest rates; they obliterate by their possible magnitude the small 'turns' which can be earned out of differences between interest rates plus a normal bankers commission; and being incalculable, they may even deter conservative bankers from doing the business on a substantial scale at any reasonable rate at all." (p. 126-7)

◆ Limits to arbitrage: "the floating capital normally available, and ready to move from centre to centre for the purpose of taking advantage of moderate arbitrage profits between spot and forward exchange, is by no means unlimited in amount, and is not always adequate to the market's requirements." (p. 128-9)

1950s – Living with CIP Deviations

■ **Holmes (1959) in first FRBNY FX market monograph**

» Assumes, following Keynes, that deviations might have to 0.50% per annum to be worthwhile for arbitragers to move funds from one market to another

» Movements were restricted by exchange controls in place, possible future controls, sovereign risks, as well as bank credit risk, and limits to arbitrage.

» CIP deviations developed (between U.S. and foreign treasury bills) around periods of BOP, FX, and political crises.

◆ Domestic policies sometimes reacted to these CIP deviations and vice-versa
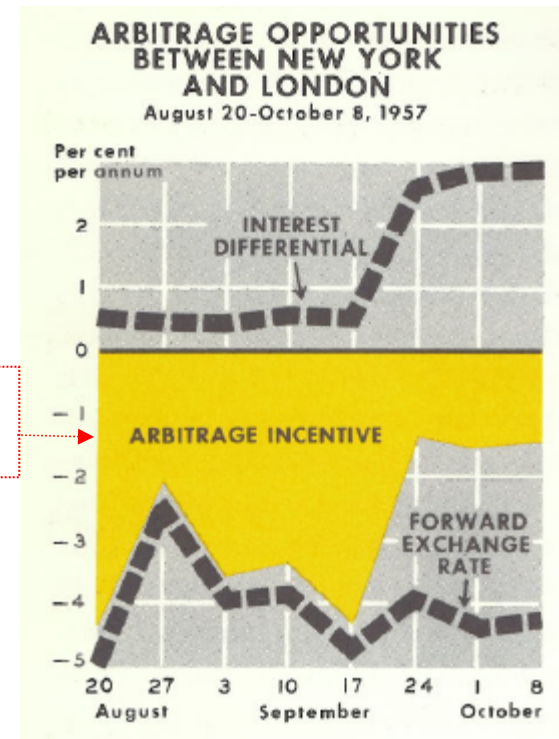
1950s – Living with CIP Deviations

Sterling and Suez Crisis, October 1956

Sterling Exchange Crisis, August 1957
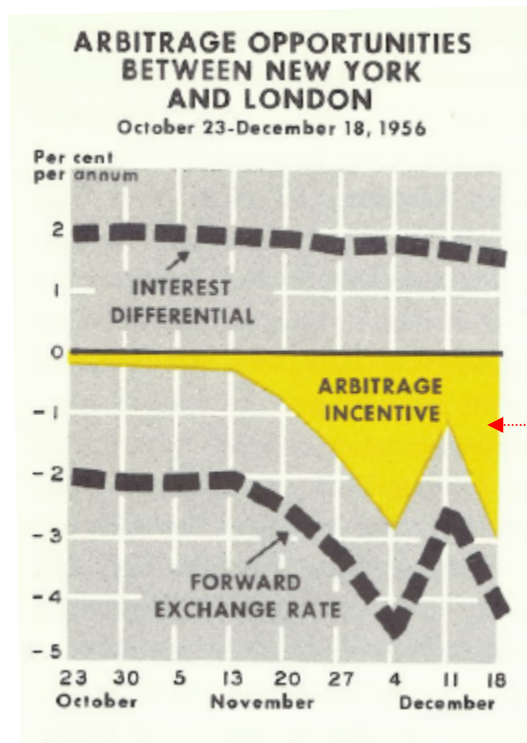
for covered arbitrage to New York (USD)

Source: Holmes (1959, p. 51-2)

1960s,70s,80s: Methodology and Evidence

- **Branson (1969)** – Estimates min. CIP differential
- **Frenkel (1973)** – Estimates min. elasticities to bound 95%
- **Aliber (1973)** – Estimates using offshore rates r/t gov't bills
- **Frenkel & Levich (1975, 1977)**
  - » Est. S and F transaction costs, elasticities & neutral band
  - » With trans costs, no arbitrage profits using offshore rates
  - » Impact of FX market turbulence on trans. costs and band
- **Deardorff (1979)** – "One-way arbitrage" lowers band width
- **Adler & Dumas (1979)** – Default risk in forward contracts
- **Dooley & Isard (1980)** – Costly FX controls, risk of more controls
- **Clinton (1988)** – F/S swap trans. costs lowers band width
- **M. Taylor (1989)** – Time synch data (no R-T, very few O-W profits)

CIP as conventional wisdom, until ?

- **CIP as benchmark for 'perfect capital mobility'**
  - » Frankel and MacArthur (1985)
- **CIP and design of financial products and strategies**
  - » Synthetic DM commercial paper: $(1+\hat{i}_{DM})=(1+i_{USD})\times S/F$
  - » Long-dated forward contracts: $\hat{F}=S(1+i_{USD})/(1+i_{NZD})$
  - » Synthetic USD funding: $(1+\hat{i}_{USD})=(1+i_{AUD})\times F/S$
    - ◆ McBrady & Schill (2007); McBrady, Mortal & Schill (2008)
- **Testing for CIP deviations with high frequency, high quality data** (Akram, Rime, and Sarno, 2008 and 2009)
  - » Tick data, 8 months in 2004, 3 currencies, 4 maturities; ~2mm observations
  - » CIP: Short-lived deviations (30 sec – 4 min); economically significant
  - » One-Way arbitrage: Opportunities for both owner's arb. and borrower's arb.
    - ◆ Numerous (10-50% of obs.) and economically significant (2-6 pips)
    - ◆ Opportunities decline with pace of market and increase with volatility
    - ◆ Overall, market is efficient, and brief opportunities promote efficiency
- **Things looking good for CIP until summer 2007**

Figure 2: CIP Deviations Based on US Dollar LIBOR and Euro-Dollar Exchange Rate January 2007 –March 2009
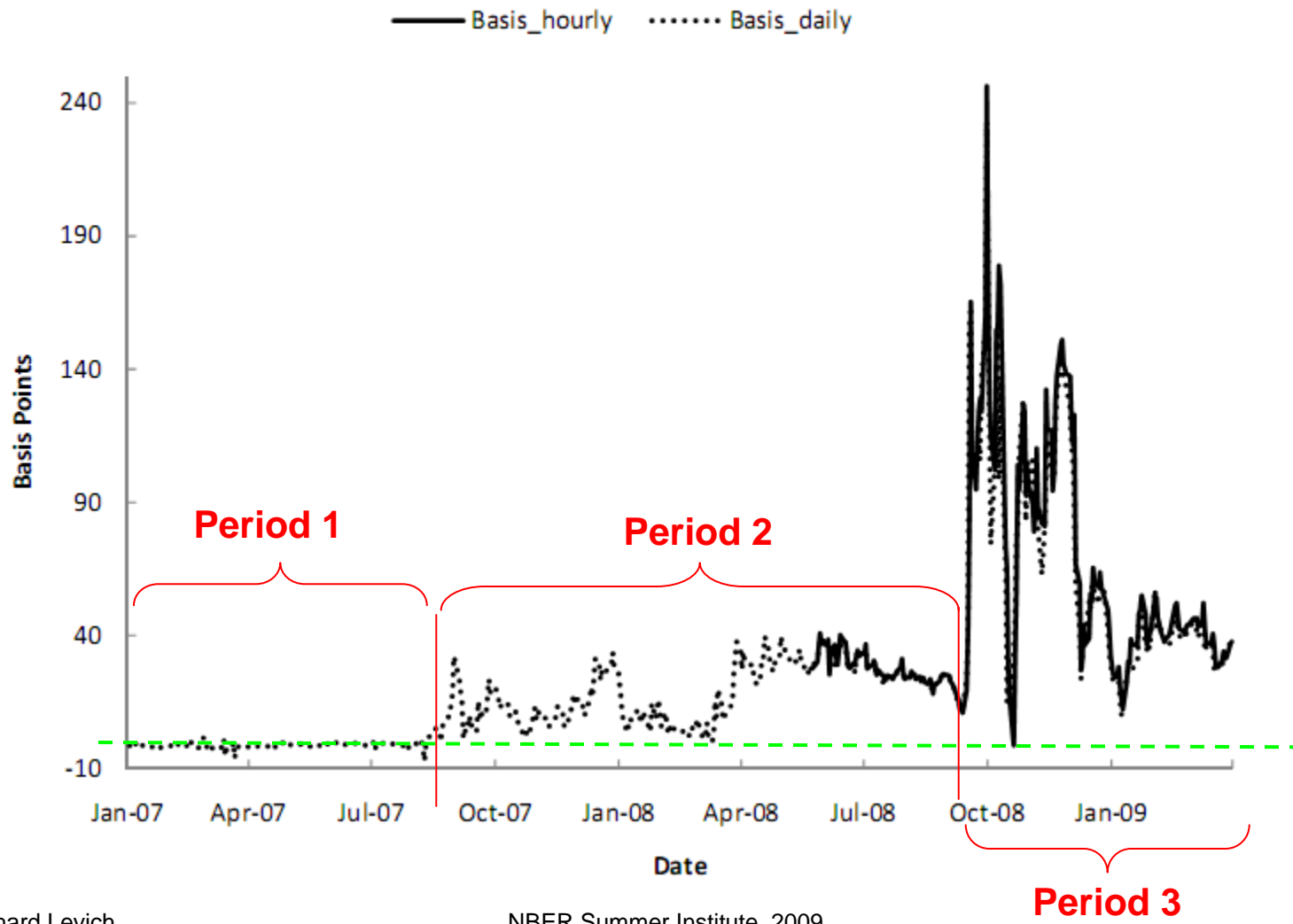
Setup for the CHNS paper (1)

- **Q: Why does CIP break down during the crisis?**
- **Database:**
  - » Daily, 1/1/07 – 3/31/09 for USD against EUR & 5 others
  - » 3-month maturity
  - » 3 sub-periods:
    - ◆ Tranquil pre-crisis: 1/1/07 – 7/31/08
    - ◆ Crisis pre-Lehman: 8/1/08 – 9/15/08
    - ◆ Crisis post-Lehman: 9/16/08 – 3/31/09
- **Regress CIP deviations** ("basis") **for EUR/USD against**
  - » Capital constraint proxies, credit risk proxies, swap dummies
  - » And lagged dependent variables

Setup for the CHNS paper (2)

- **Key findings:**
  - » CIP deviations develop in summer 2007;
    - ◆ explode after Lehman bankruptcy,
    - ◆ decay s.t. high volatility as credit and liquidity conditions improve, aided by new swap facilities
  - » Regression findings
    - ◆ Period 1 – Cost of capital proxies matter, deviations largely random
    - ◆ Period 2 – Capital constraints, liquidity risk proxies significant
    - ◆ Period 3 – Counterparty risk and credit risk proxies become significant
      - – Swap program significant impact on CIP deviations

Strong selling points for the paper

- **Sample and research design**
  - » Three periods permit analysis of parameter instability, changing impact of different drivers
    - ◆ e.g. relative credit risk (dispersion) versus CDX index
  - » Investigate impact of swap line announcements and dollar auctions; swap impact via FX market r/t interest rates
 - » Robustness checks
- **Helps us to interpret the basis**
  - » Are CIP deviations profit opportunities or not?
  - » If credit/counterparty risk, then pricing could be efficient reflection of differential risks
  - » If capital constrained, more like mkt. inefficiency, mkt. failure
- **Includes FX volatility** (for FX risk, given default)**; excludes OIS** (vs. earlier draft)

Suggestions for next revision (1)

- **Include transaction costs, bid & ask prices**
  - » Enumerate trades for US or non-US bank to undertake the arbitrage; enumerate costs and risks of the "arbitrage"
    - ◆ Figure 1 and mention of US T-Bills confuses the transaction
  - » Bid/Ask alters the effective basis (i.e. incentive for arbitrage)
  - » Trans costs and σ^2(FX) rose substantially during crisis

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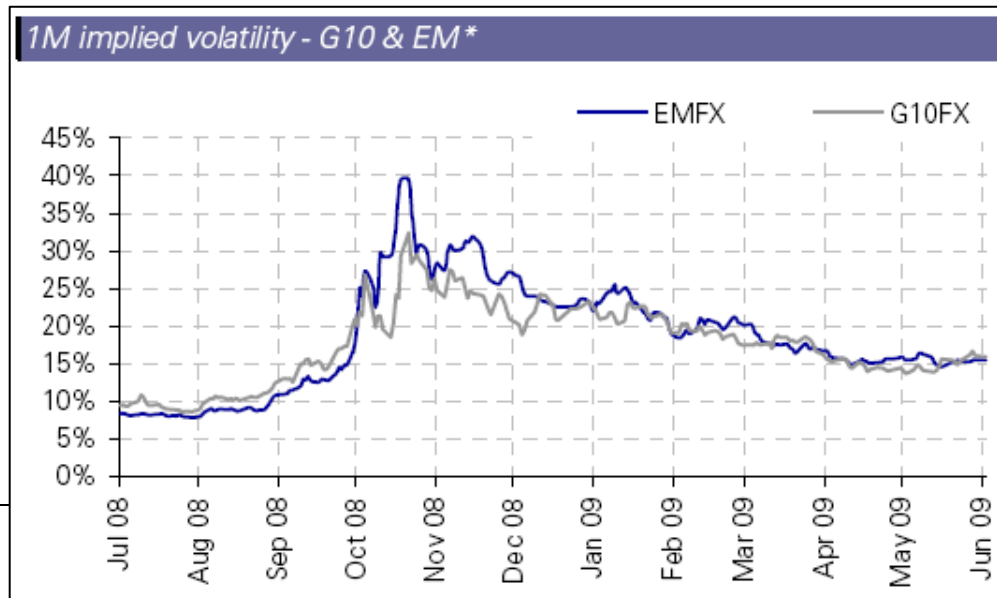
Numerical Example

Data for 9/23/08:		Notes:	
i(EUR) =	5.05%	Interest differential p.a.	-1.84%
i(USD) =	3.21%	Forward premium p.a.	-0.46%
Spot =	1.4676	CIP incentive	1.38%
Forward =	1.4659	Implied USD interest rate	4.59%

■ **Possible trades**

» RT arbitrage: Borrow USD at 3.21%, buy spot EUR and sell forward (loss 0.46%), invest EUR at 5.05%; profit 1.38%

» OW arbitrage: US bank borrows at 3.21% and lends USD to non-US bank at up to 4.59%; profit up to 1.38%

» Dual of above: non-US bank borrows EUR at 5.05%, sells EUR spot and buys EUR forward (gain of 0.46%) to create USD funding at 4.59%, overpaying by 1.38%

■ Cost and risk profile of above trades vary

Suggestions for next revision (2)

- **Express deviations on a per period basis** (divide by 4)
  - » No impact on regression results
  - » Substantial impact on magnitude of residuals and may alter impression, or sense of market disruption
- **Analyze residuals, and the "risk adjusted" basis**
  - » A measure of unexploited profit opportunities
  - » Serially correlated, sporadic, declining over time, extreme outliers?

Suggestions for next revision (3)

■ **Econometric quibbles and open questions**
- » Regression w/ and w/o lagged dependent variable
- » Magnitude of β coefficients. Is impact on basis of 1% move in RHS variable sensible?
- » Swap lines coefficient: 5 bps per event or in total?
  - ◆ Are early swap announcements more powerful than later?
- » Credit risk event could have catastrophic crash impact
  - ◆ Consider square of RHS risk proxy variables
- » End-of-quarter, end-of-year dummies
  - ◆ Cost of violating regulatory mandate or failing to perform on a commitment goes infinite at certain dates

Final Thoughts

- **Look at non-USD currency pairs** (Genberg, et al. 2009)
  - » CAD/HKD, SGD/JPY, or others with lower default risks
  - » Is breakdown of CIP a USD or USA phenomenon, or more universal?

- **CIP, int'l capital mobility, FX mkt efficiency are 'bedrock' themes**
  - » We've taken CIP for granted over most of last 20-30 years
  - » All CIP deviations are not necessarily efficient market violations
  - » This study aids our understanding of drivers of deviations
  - » Measure of when markets have returned to pre-crisis health