
Exchange Traded Contracts for Difference: Design, Pricing and Effects

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Outline

- Motivation
- What are CFDs, how are they priced?
- Market evolution, regulatory issues
- The ASX exchange traded CFD contract
 - Details and Market implications
 - Potential Research Issues
- Prior Literature and Hypotheses
- Results
- Conclusion



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Motivation

- CFDs - a significant financial derivative and no prior academic research
- ASX exchange traded CFD
 - Study optimality of contract design, trading platforms
 - London Stock Exchange proposals (shelved early 2009)
 - Database enables research
 - Implications for financial market development
- Regulatory/public policy interest
- Research the linkages between derivative and underlying market – pricing and spreads



What are CFDs

- Close substitute for individual share futures (ISF) – also available on indices and exchange rates
- Buyer of CFD on Co. X at price P_0
 - Has no cash flow at $t=0$ (ignoring margin account)
 - Receives amount equal to any dividend D_t paid by X at time t
 - Pays contract interest amount rS_{t-1} on each day t , where S_{t-1} is price of Co. X shares at $t-1$
 - Receives/Pays $(P_T - P_0)$ at time T when she chooses to close contract
 - Ideally $P_t = S_t$ such that CFD is highly levered stock position
- Seller of CFD has opposite cash flows



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CFD Pricing

- For hypothetical CFD with fixed expiry date T and $S_T = P_T$ arbitrage proof of $P_t = S_t$ is straightforward (by induction)

	Date T-1	Date T
Short sell stock at date T-1	+ S_{T-1}	
Invest proceeds of short sale	- S_{T-1}	+ $S_{T-1} (1+r)$
Pay any dividend D_T		- D_T
Buy and deliver stock at date T		- S_T
Buy CFD at date T-1		
Pay contract interest		- rS_{T-1}
Receive dividend		+ D_T
CFD settlement		+ $(S_T - P_{T-1})$
Net Cash Flow	0	$S_{T-1} - P_{T-1}$

- Induction proof – substitute in Table the closing out at date $t-i$ of arbitrage portfolio established at $t-i-1$, and sale of CFD (rather than settlement) at $P_{t-i} = S_{t-i}$

CFD Pricing

- Arbitrage proof for finite maturity case
- Equivalently, compare to ISF price (F)
 - Basis $(S - F) = \text{cost of carry (interest)} - \text{dividends}$
- Long CFD involves paying interest and receiving dividends
 - Hence $P = F + \text{interest} - \text{dividends} = S$
- BUT
 - CFDs have no maturity – no explicit link of $P_T = S_T$
 - Trader closes position with provider in OTC market or sells in exchange traded market
 - No risk free arbitrage pricing relationship
 - How do market/contract arrangements ensure $P_t \simeq S_t$?
 - Reputation, risk management, DMA



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CFD Market Development

- UK, OTC market London, early 1990s
 - Institutional investors, stamp duty avoidance
 - Trading volume around 35% of London Stock Exchange in 2007
 - Major providers (worldwide) CMC and IG Markets
- Australia, OTC market – retail investors
 - ASX exchange traded CFDs, Nov 2007
- USA – prohibited
 - But institutional investors can use equity swaps

CFD Markets – Some Issues

- Investor Protection
 - Understanding of risks
 - Exposure to CFD Provider pricing in OTC markets
- Non-disclosed economic interests
 - FSA 2007 report and 2009 disclosure requirements
- Short Selling
- Margin Lending



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The ASX CFD Contracts

- Began Nov 2007, replaced ISFs
- CFDs on 49 stocks, indices, currencies
- Limit order book, Designated Price Maker, electronic trading, novation of positions
- Structure very similar to OTC CFDs
 - No maturity, margin requirements
 - Interest rate = RBA target cash rate
 - ASX fee (Open Interest Charge) of 1.5% p.a (but not for DPMs).
 - Wide bid-ask spread compatible with trader participation
 - Does DPM competition, risk arbitrage keep spreads low and generate “parity pricing”
 - Dividend tax credit complication for design



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The ASX CFD Contracts

- Trader's positions novated to exchange
- Buyer/Seller post initial margins
- Pay/receive Contract Interest $=rNS_{t-1}$
 - r = Reserve Bank cash rate target
- Both pay Open Interest Charge $=r^*NS_{t-1}$
 - r^* = 1.5% p.a. (effectively an ASX fee)
- Receive/Pay dividend equivalent
- Receive/Pay dividend franking (tax) credit amount
 - But net DPM short positions (D_s) don't pay this
 - Buyers receive $T_s/(T_s+D_s)\%$ of tax credit amount (where T_s is short positions of traders)

“Arbitrage” Pricing?

- No risk-free arbitrage possible
- Contract features which may give “near-arbitrage” pricing
 - Daily settlement price
 - DPM hedging/arbitrage
 - Competition with other levered products
 - Cash flow characteristics
- Does pricing conform to no-arbitrage relationship?
- Does market operate efficiently (low transactions costs – bid/ask spreads)?



Literature Review

- None for CFDs
- Papers on ISF
 - Arbitrage violations
 - Effect on volatility of underlying
 - Settlement practices and implications for underlying and other derivatives
 - Explanations for low trading volume
- Papers on bid-ask spreads
 - Focus generally on physical market
 - Few studies relating spreads in physical and derivatives markets



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Hypotheses

- H1: The Open Interest in the CFD market will fall significantly at the ex-div date (less for unfranked divs).
 - Contract design and ex-div netting of DPM positions.
- H2A: Bid-Ask spreads in CFDs will be significantly greater than in the underlying stock
 - Hedging costs (funding, spreads) and risks, imperfect competition by DPMs (exploiting retail customers' higher cost of other levered strategies)
- H2B: Spreads in the CFD market will be directly related to spreads in the stock market

$$CFDS_{i,t} = b_0 + b_1 SS_{it} + b_2 \ln(M_{i,t}) + b_3 (1/P_{i,t}) + b_4 S_{s,t} + b_5 S_{m,t} + b_6 \ln(1+V_{i,t}) + b_7 IS_t + b_8 D_t$$

+ - + + + - + +

- H3: “Parity pricing”: no difference in price of contemporaneous trades of CFDs and underlying stock, beyond that attributable to transactions costs.



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Data and Market Characteristics

- Transactions and quote data (from SIRCA) for Nov 11, 2007 – Dec 31, 2008 for 49 CFDs / underlying stocks
 - 180 mill (or so) data points
 - Matching of CFD and underlying stock trades
 - Calculation of average spreads for each day
 - End of day data for Open Interest also used

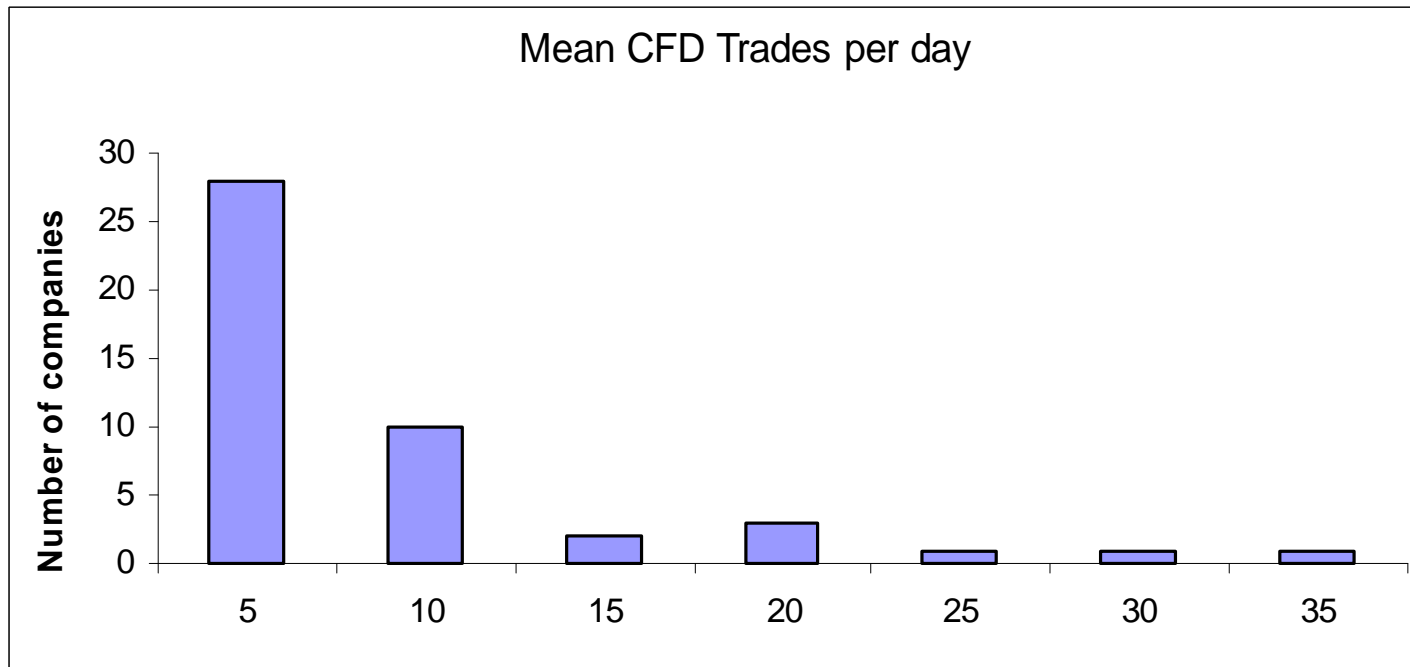


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A Thin Market



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Concentration of Interest

Statistic	Percentage of CFD's traded	Share of total value traded of		
		Largest CFD traded	Second largest CFD traded	Third largest CFD traded
Average	60.5%	28.0%	15.9%	10.8%
Minimum	29.8%	11.2%	3.7%	2.6%
Maximum	80.9%	87.0%	31.1%	21.0%

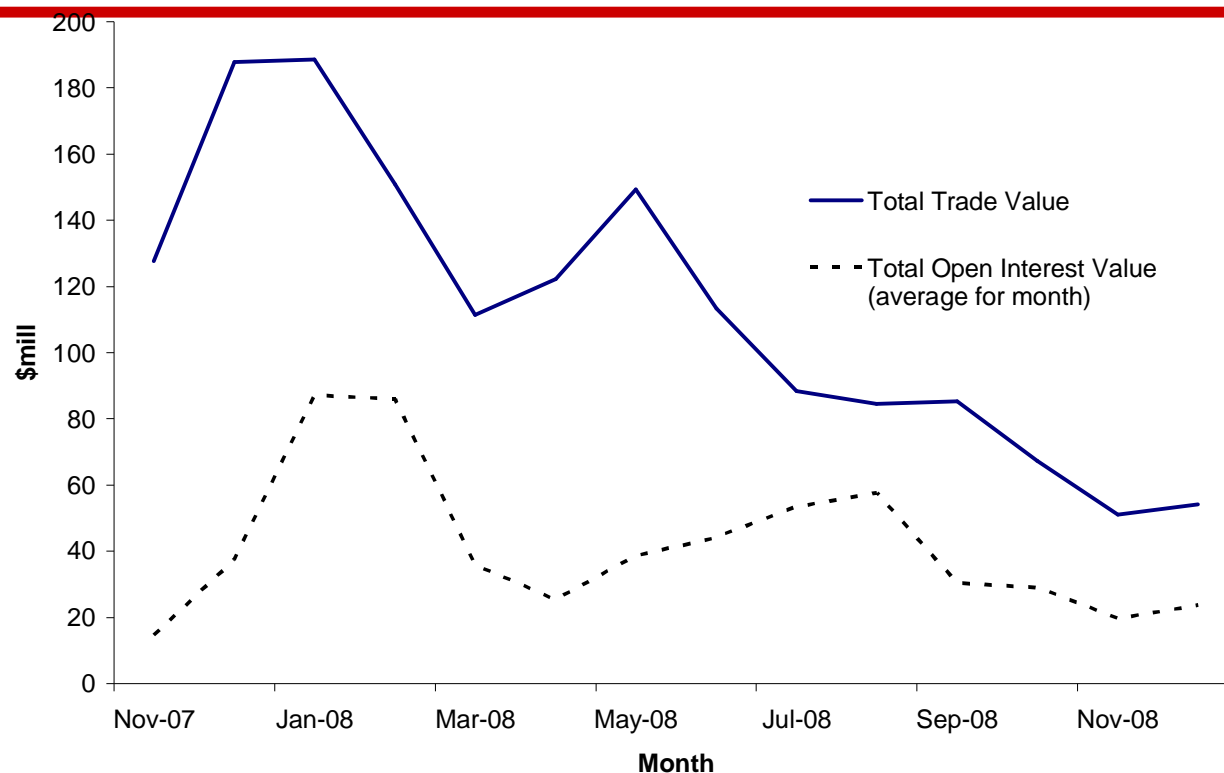


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Limited Success



But stock market collapse exaggerates decline
Short selling ban from Sept 22, 2008
Pick up of activity in 2009

Hypothesis 1:

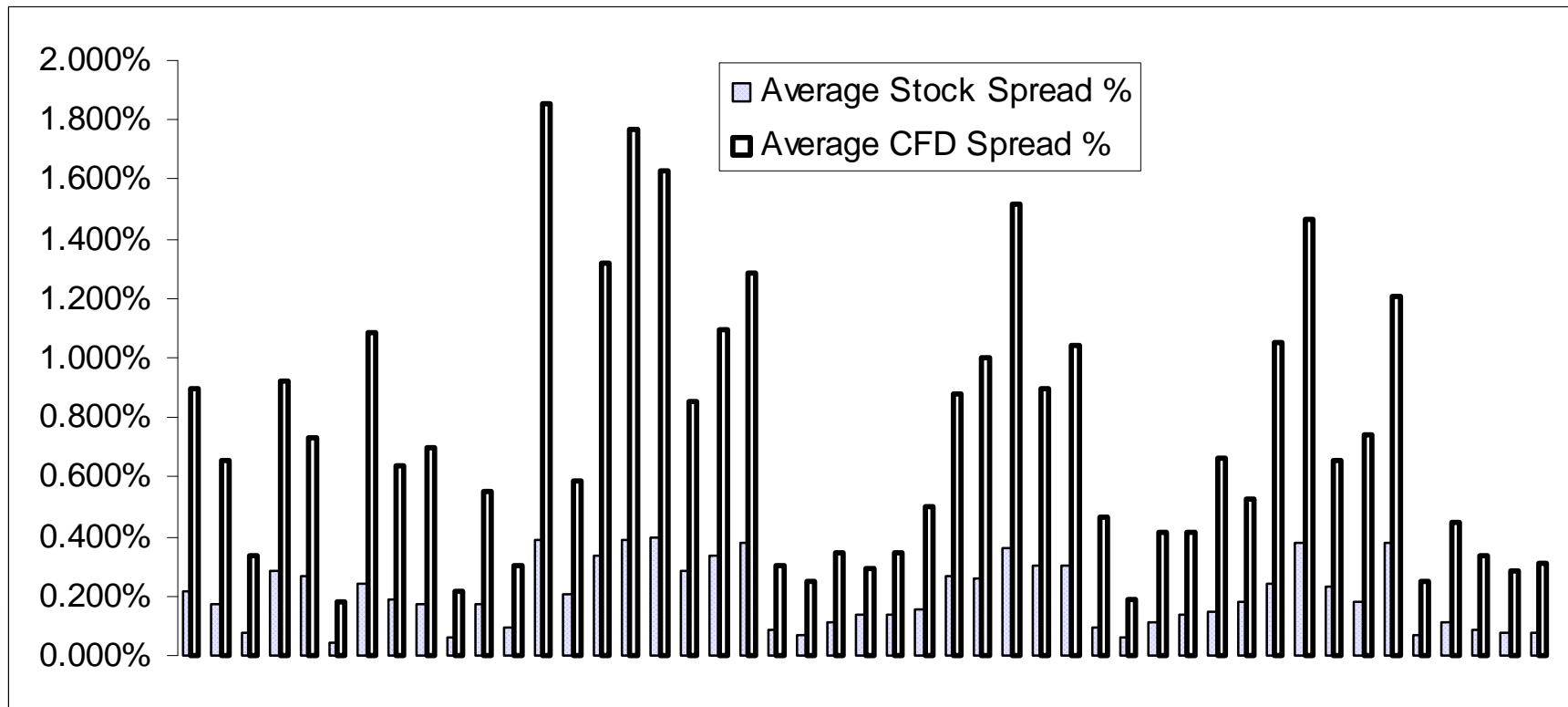
Percentage fall in the average open interest for six days after the ex-div date compared to the six days prior.

Statistic	Unfranked dividends	Franked dividends
Number of observations	31	69
Mean	-0.39	-0.72
Std deviation	1.08	0.34
t test	-1.99**	-17.81***
Median	-0.69	-0.83
Wilcoxon test	-3.61***	-6.77***
Proportion <0	90%	94%

***, **, *, Denotes statistical significance at 1%, 5% and 10%

Netting of DPM open positions complicates interpretation, but dividend arrangements a problem for contract design and maintenance of market liquidity.

Average Stock v CFD Spreads:cross - section

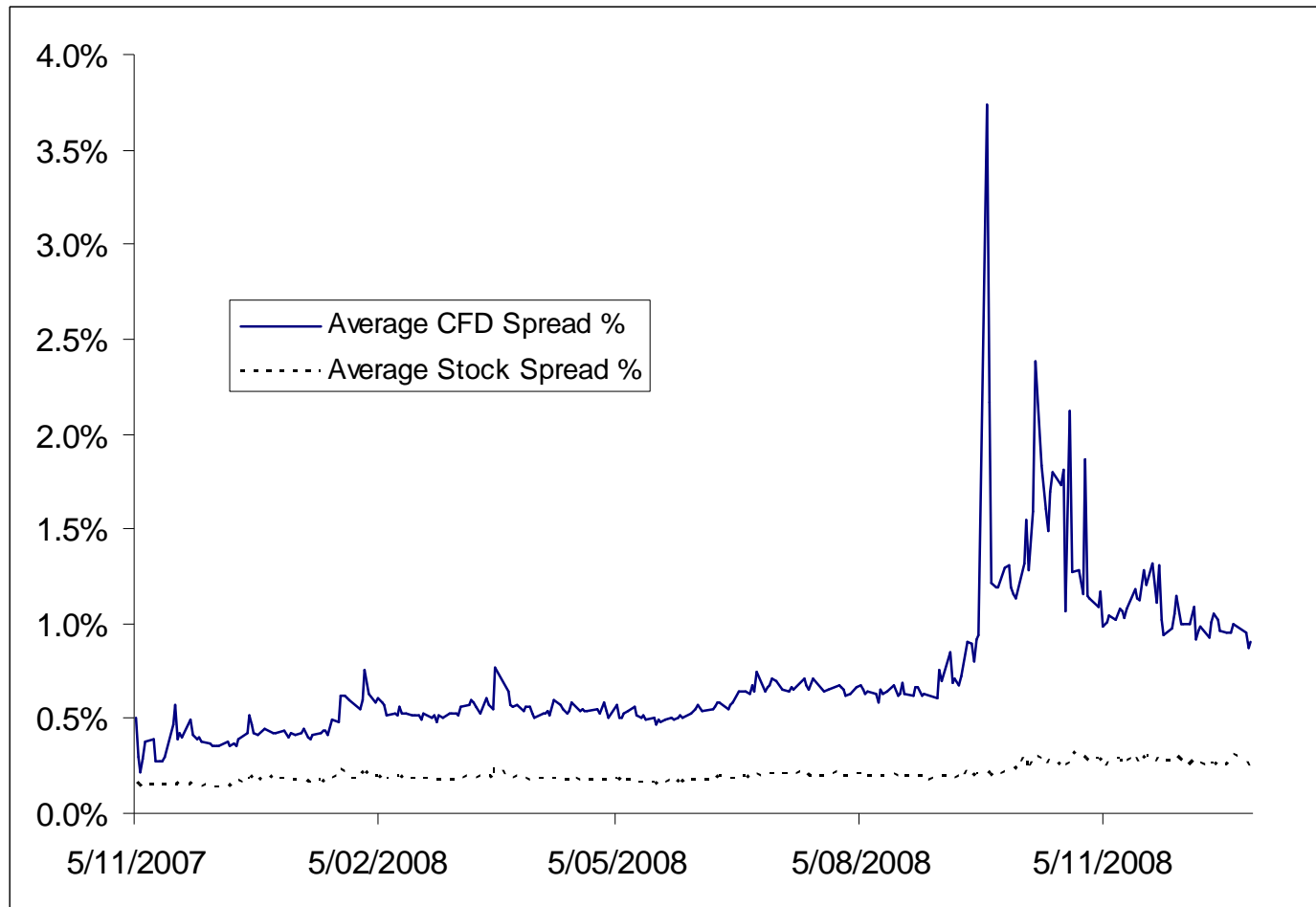


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Average Stock v CFD Spreads: time-series



Hypothesis 2: Spreads

- Panel data with large T (approx 250 days) and N (approx 49 CFDs)
 - What is best approach: some evidence of non-stationarity in some variables for some CFDs; cross-sectional correlation ?



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Univariate Unit Root Tests

This table displays the number of times that the test supported an I(1) variable using a 5% (10%) level of significance

	Lag length/ Bandwidth	CFD Spread	Stock Spread	Stock value	Price Inverse	Stock Volatility	CFD Volume
ADF	SIC	18 (15)	32 (27)	3 (1)	39 (37)	4 (3)	0 (0)
	AIC	27 (23)	41 (37)	9 (7)	40 (38)	18 (17)	7 (5)
KPSS	N-West	40 (44)	44 (45)	27 (34)	38 (40)	43 (45)	28 (29)
	Andrews	32 (42)	37 (44)	24 (35)	12 (33)	45 (46)	29 (30)



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Cross-sectional dependence

Residual is the OLS residual from Equation 4. \bar{r}_{ij} denotes the average cross section correlation, %V_p denotes the proportion of variability explained by the pth principal component (p = 1,2) from the relevant correlation matrix.

	CFD Spread	Stock Spread	Stock Value	Price inverse	Stock Volatility	CFD volume	OLS Residual
\bar{r}_{ij}	0.47	0.50	0.35	0.50	0.34	0.07	0.19
%V ₁	0.52	0.50	0.36	0.60	0.35	0.11	0.27
%V ₂	0.10	0.12	0.06	0.17	0.05	0.05	0.13



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Estimation Alternatives

- Pooled OLS (POLS) as suggested by (Phillips and Moon, 1999),
- an OLS estimator of a cross-section regression (CS) as suggested by (Pesaran and Smith, 1995),
- Two way fixed effects (2FE),
- the Mean Group (MG) estimator of (Pesaran and Smith, 1995) and
- the Common correlated effects mean group (CCMG) estimator of (Pesaran, 2004).
- Results robust to choice of technique – focus on POLS



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Pooled OLS Results

Period	Constant	Stock Spread	Stock value	Price inverse	Stock Volatility	Market Volatility	CFD volume	Interest spread	Sept dummy
Full	-0.313* (-1.81)	2.094*** (17.86)	-0.002 (-0.23)	14.350*** (22.13)	3.376*** (9.83)	6.495*** (10.01)	-0.008*** (-4.27)	0.006*** (9.51)	1.755*** (19.41)
	Adj R square	0.423	F statistic (p value)	1021.06 (0.000)					
2.1.08 19.9.08	0.351*** (5.51)	0.902*** (12.10)	-0.015*** (-4.39)	16.434*** (28.05)	1.891*** (12.09)	1.794*** (6.51)	-0.010*** (-13.88)	0.002*** (6.38)	n.a
	Adj R square	0.690	F statistic (p value)	2529.48 (0.000)					
22.9.08 31.12.08	-1.623*** (-2.76)	3.850*** (12.79)	0.070** (2.18)	10.841*** (8.59)	2.522*** (2.90)	9.281*** (4.53)	-0.008 (-1.12)	-0.002 (-1.00)	1.856*** (11.50)
	Adj R square	0.337	F statistic (p value)	199.73 (0.000)					
	t test of difference in coefficient estimates [#]	-543.6***	-	238.87***	-40.56***	-204.80***	-	-	-



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Interpretation

- Structural break from time of short selling ban (Sept 22)
- Pre Sept
 - CFD spread sensitivity to stock spread approx unity
 - But significant pos intercept (suggestive of imperfect DPM competition (since other variables should capture hedging risks))
 - Stock and market vol have similar positive effects
 - Stock and CFD trade value/volume have negative effect
 - Interest spread significant
- Post Sept
 - CFD spread sensitivity to stock spread =3.85
 - Intercept negative
 - Increased sensitivity to stock and, much more so, market volatility
 - Sept 22-23 were days of marked disruption
- Positive Coeff for inverse of stock price (larger % spread for low priced stocks), but lower sensitivity post Sept.



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Hypothesis 3: “Parity Pricing”

- Variety of tests
 - Examination of synchronous CFD and stock price differences exceeding 0.5 and 1.0%
 - Relatively few, but larger than perfect competition between DPMs would predict, but
 - Consistent with wide spreads
 - Problem for DPMs of hedging
 - » Different platforms, latency and risk of “legging”
 - Pricing errors inversely related to size of that CFD trade, and
 - Less pricing errors for stocks with larger average CFD volumes



Hypothesis 3

Violations of CFD – Stock Price Parity:
assuming 0.5% transactions cost

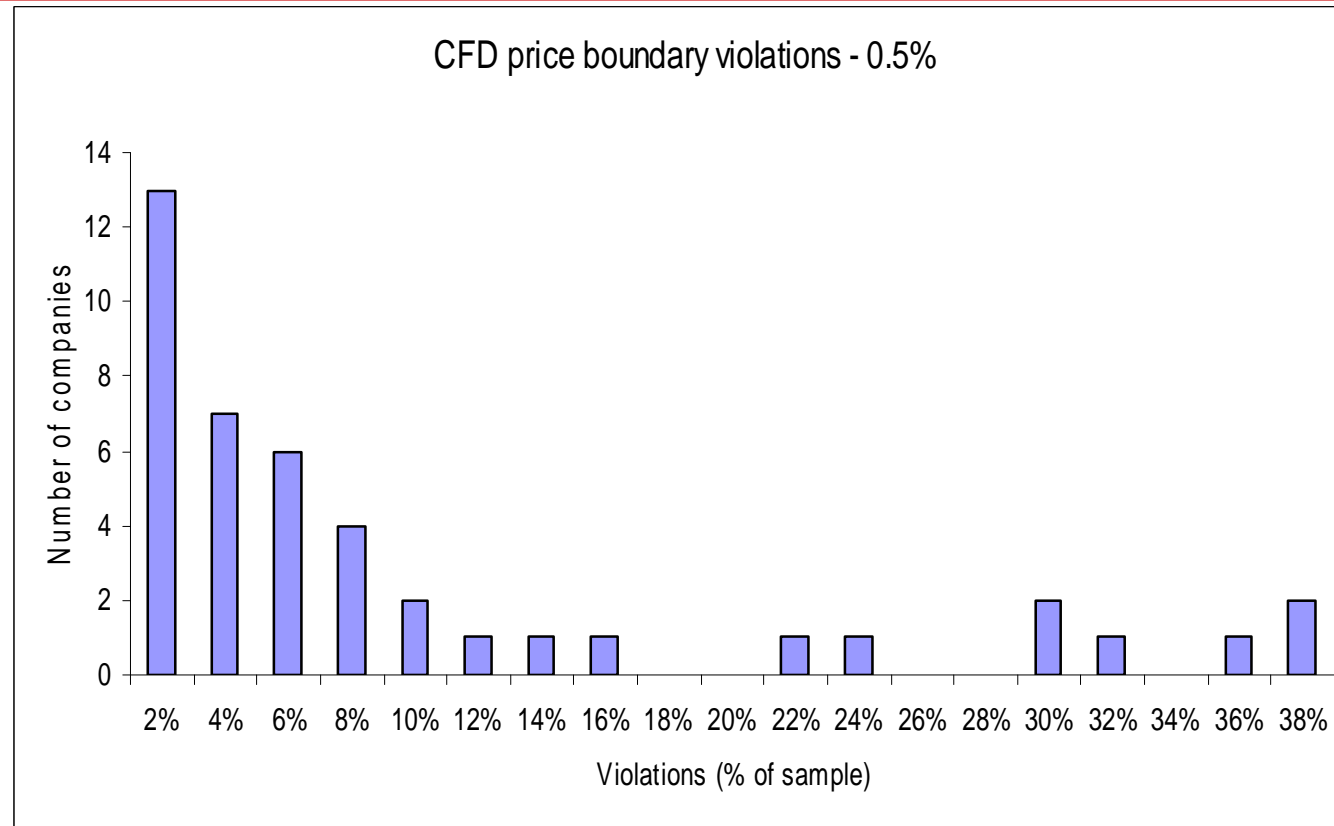
CFD	No of violations (% of sample)	No of negative violations (% of sample)	W-W runs test (p value)	Descriptive statistics of % difference between CFD and subsequent spot price for cases of violations					Time between CFD and subsequent spot price (minutes)	
				Avg (t test)	Median (Wilcoxon test)	Std dev	Min	Max	Avg	Median
All	1757 (2.97%)	931 (1.57%)		-0.10% (-2.13)**	-0.51% (-2.41)**	1.94%	-31.30%	29.70%	0.164	0.014



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Wald-Wolfowitz runs test on individual CFDs indicates clusters of violations

Hypothesis 3



60% of companies have 6% or less of CFD trades violating “transactions cost – arbitrage” boundaries.

A few companies with large percentage of violations

Hypothesis 3

$$|e_t| = a + b_1 D_{start,t} + b_2 D_{sept,t} + b_3 Vol_t + b_4 D_{sept,t} Vol_t + b_5 |e_{t-1}| + e_t$$

e_t is $P_t - S_t$ for all trade pairs (mispricing error), Vol_t is number of contracts for trade at t , $Start_t$ is dummy variable for first month of trading, $D_{sept} = 1$ post Sept 22, 2008

- Regressions done for individual stocks (Table 10)

CFD	a	b_1	b_2	b_3	b_4	b_5	Adj R squared	F stat (p value)
BHP	1.362*** (20.83)	-0.142 (-1.61)	0.921*** (4.67)	-3.4e-05 (-1.62)	-1.5e-04 (-1.00)	0.285*** (9.02)	0.802	4538.17*** (0.000)



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Hypothesis 3

$$V_i = I_0 + I_1 Trade_i + e_i$$

- Where V_i is the percentage of mispricing for the CFD of stock i , and $Trade$ is the average number of trades per day for the CFD of stock i .

Transaction costs	I_0 (p value)	I_1 (p value)	Adj R squared	F statistic (p value)
1%	0.031*** (0.000)	-0.002*** (0.002)	0.136	7.76*** (0.008)
0.5%	0.155*** (0.000)	-0.008*** (0.001)	0.200	10.74*** (0.002)

estimated via OLS with Newey West standard errors

*** Denotes statistical significance at the 1% level of significance



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Conclusions & Questions

- **Market Efficiency**
 - Limited deviations from CFD/Stock Parity Pricing
 - Wide bid-ask spreads
- **Contact Design and Trading**
 - Why infinite maturity?
 - Why franking credit cash flow complication?
 - Importance of trading platform arrangements
 - Possibility of direct integration of CFD and underlying order books (London Stock Exchange 2008 initiative (since deferred))
- **Regulation/Public Policy**
 - Future of ISFs
 - Implications for short selling
 - Competition with margin lenders
 - Retail Investor Protection

