The Choice of Direct Dealing or Electronic Brokerage in Foreign Exchange Trading

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MARKET PARTICIPANTS: Customers

- **End-users**
  - **Multinational firms**
  - **Central banks**
  - **Hedge funds.....**
- **Traditionally trade with dealers, not each other**
- **Trades private info to dealers**

MARKET PARTICIPANTS: Dealers

- **Trade with customers**
- **Low transparency**
- **Trade with each other—interbank market**
  - **Multiple of customer trades**
    - **Passing “hot potato” positions**

INTERBANK TRADING

- **Since 1930s, direct telephone trading**
- **Since 1960s voice brokers speaker boxes**
- **1987, Reuters Dealing 2000-1**
- **Until early 1990s, trade split almost in half between direct dealing and voice brokers**

ELECTRONIC BROKERS

- **1992, Reuters Dealing 2000-2**
- **1993, Minex and EBS**
- **1995, EBS/Minex merger**

ELECTRONIC BROKERS

- **Market and Limit orders**
  - **price/time priority**
  - **Anonymous prior to trade**
  - **Lower costs**
  - **Greater transparency**
  - **Continuous multilateral interaction**

CUSTOMER INTERNET TRADING

- **Nonbank sites**
  - **Take prices from interbank market**
  - **Not elect. Brokers, site is counterparty to trades**
  - **May 1996, Deal4Free (CMC Group)**
  - **March 2001, OANDA**

- **Bank sites**
  - **Request quotes from several banks**
  - **August 1996, FX Connect (State Street)**
  - **April 2000, Currenex**
    - **Multiple bank quotes and crossing network**

- **Increases competition and lowers costs**

ELECTRONIC BROKERS

- Start from a base of zero in 1992

	April 2001	April 1998
FRB of NY	**54%**	**32%**
Bank of England	**66%**	**30%**
Bank of Japan	**48%**	**37%**

Question: How would a trader choose when facing two competing trading venues?

- Theoretical model
  - Choice of trading venue for large and small traders
- Empirical Analysis
  - Tests hypotheses
- Summary & Discussion

Trading Venues

- Direct Dealing (DD)
  - Immediacy of transaction
  - Transaction cost *s* (dealer's bid-ask spread)
- Electronic Brokerage (EB)
  - Waiting time discount factor δ
  - Transaction cost *c* *c*<*s*

Theoretical Model

- Players
  - One large trader who trades a large amount
  - Many small traders who trade 1 unit
- Strategies
  - Go to DD
  - Go to EB
  - Don’t trade

Theoretical Model

- Asset (Currency)
  - a random future value *v*
  - Expectation $E(v) = u$
  - Variance σ_v
- Payoff
  - DM: $u_i - s$
  - CN: $\delta(u_i - c)$

Effective Discount Rate

- Effective Discount Rate:
  - For a small trader: $\delta_s = E\beta^{t_s}$
  - For a large trader: $\delta_l = E\beta^{t_l}$
  - : discount factor, β $0 < \beta < 1$
  - : number of periods it takes for a small trader to find a match t_s
  - : number of periods it takes for a large trader to find a match t_l

$F_l(t) \le F_s(t)$ $Et_l \ge Et_s, E\beta^{t_l} \le E\beta^{t_s}$

Optimal Decision Rules

– Trade with DD

if $u - s > \delta(u - c)$, and $u - s > 0$

– Trade with EB

if $u - s < \delta(u - c)$, $\delta(u - c) > 0$

– Indifferent

if $u - s = \delta(u - c) > 0$

– No trade

if $\delta(u - c) < 0$, $u - s < 0$

Optimal Outcome

- $u<c$ nobody would trade
- $c<u<s$ exclusive EB trading
- $u>s$ two possible equilibria when DD & EB coexist
  - *The large trader trades with DD and small traders go to the EB.*

    $(s-\delta_l c)/(1-\delta_l) < u < (s-\delta_s c)/(1-\delta_s), \delta_s > \delta_{l;}$
  - *The large trader trades on EB and small traders trade with DD.* (ruled out)

Empirical Analysis

- Data Description
  - Reuters D2000-2 electronic brokerage
  - Mark/Dollar
  - Oct 6-10, 1997, 130,535 orders
  - Available Information: order type, order entry time, removal time, removal code, price, quantity ordered and quantity dealt

Duration time of orders

- Average duration for limit orders is longer than that for market orders
- Mean waiting time is longer for unsuccessful limit orders than filled limit orders
- Time of day effect
- Clustering in the duration data

Descriptive Statistics for Duration

	Filled Limit Orders	Failed Limit Orders	Filled Market Orders	All sample
Number of Orders	38239	70453	21783	130475
Mean (min)	1.7886	3.4331	0.0012	2.3782
Std Deviation	10.8107	18.6327	0.0008	14.9453
Range	398.394	802.6677	0.0503	802.6702
Skewness	19.2068	14.4837	14.2692	17.4444
Kurtosis	494.4853	308.2410	689.0021	446.8854

Table 3

Intradaily Pattern of Duration

Time of Day	Average Duration	Number of Orders	Percentage
0	10.2146	477	0.37%
1	6.7147	692	0.53%
2	10.8359	317	0.24%
3	35.8062	64	0.05%
4	9.0134	200	0.15%
5	5.5536	891	0.68%
6	2.6893	5595	4.29%
7	2.3079	14491	11.10%
8	2.3178	15097	11.57%
9	3.0254	9696	7.43%
10	3.2417	7360	5.64%
11	2.1809	13006	9.96%
12	1.5406	16790	12.86%
13	1.4885	18976	14.54%
14	1.5596	14518	11.12%
15	2.391	6416	4.92%
16	4.7557	2139	1.64%
17	4.8778	1570	1.20%
18	3.1406	1510	1.16%
19	4.6772	446	0.34%
20	6.0416	143	0.11%
21	36.8439	43	0.03%
22	43.329	29	0.02%
23	44.7129	69	0.05%

Estimation of duration model

Three Hypotheses

- Size Effect
- Price Impact
- Liquidity Effect

ACD model

- ACD Model
  - Duration x_i $x_i = \psi_i \varepsilon_i$
  - Conditional duration ψ_i
  - ε_i is an IID error sequence
- EACD (flat hazard function)
- Weibull ACD (monotone hazard function)

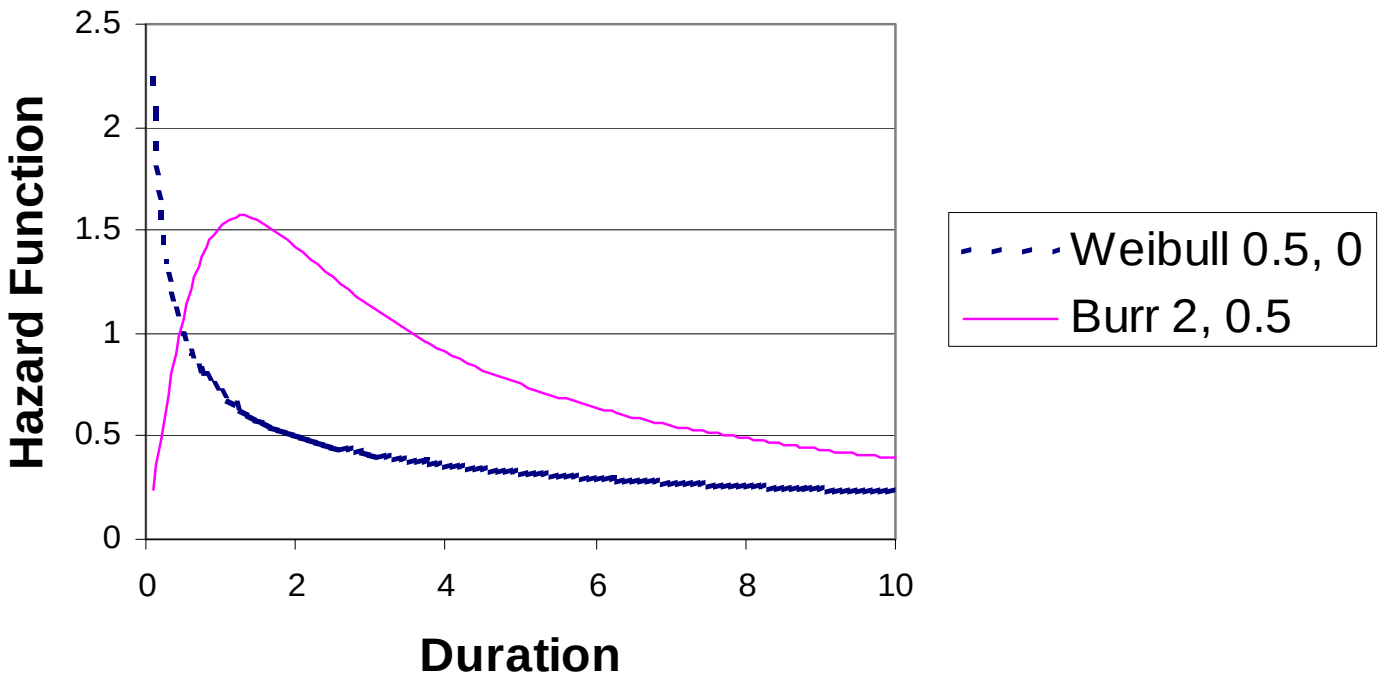
ACD model

- Burr ACD model
  - Inverted U-shaped Hazard function
  - Hazard function increasing for small duration and decreasing for long duration
  - Nests EACD and WACD model as special cases

Burr-ACD

- Burr-Distribution:
  - Density Function: $$f(\psi_i) = \psi_i \cdot \frac{(\sigma^2)^{(1+\frac{1}{\kappa})} \cdot \Gamma(\frac{1}{\sigma^2}+1)}{\Gamma(1+\frac{1}{\kappa}) \cdot \Gamma(\frac{1}{\sigma^2}-\frac{1}{\kappa})}$$
  - Hazard Function $$h(x_i \mid x_{i-1},..., x_1; \theta) = \frac{\kappa \cdot \xi_i^{-\kappa} \cdot x_i^{\kappa-1}}{1+\sigma^2 \cdot \xi_i^{-\kappa} \cdot x_i^{\kappa}}$$
- EACD $$h(x_i \mid x_{i-1},..., x_1) = \frac{1}{\psi_i}$$
- WACD $$h(x_i \mid x_{i-1},..., x_1) = x_i^{\gamma-1}\gamma$$

Representative Hazard Functions



ACD model

Concerns:

- Dependent Variable: Conditional duration
- Right hand side of estimation equation needs to be positive
- Non-negativity constraints on the coefficients of exogenous variables

Log ACD Model

- Log-ACD Model
  - Duration $x_i = \exp(\psi_i)\varepsilon_i$
  - ψ_i: Logarithm of conditional duration
  - ε_i is an IID sequence as in ACD model.
- Log-ACD(1,1) specification

$$\psi_i = \omega + \alpha \ln(x_{i-1}) + \beta\psi_{i-1}$$

Censoring

- Potential bias from ignoring unfilled orders or partial fills
- Estimate joint likelihood

$$\prod_{i=1}^{n} f(x_i; X_i)^{c_i} g(x_i; X_i)^{1-c_i} = \prod_{F} f(x_i; X_i) \prod_{C} g(x_i; X_i)$$

Model Estimation

- Over peak European business hours 8:00am –5:00 pm GMT
- Variables
  - SIZE: Quantity submitted in millions of dollars
  - PRICEDIF: submission price - last transaction price
  - DEPTH: depth of order book

Model Estimation

- Dummy variables
  - DummyBP
    - 1 for buy orders with pricedif>0; 0 otherwise
  - DummyBN
    - 1 for buy orders with pricedif<0; 0 otherwise
  - DummySP
    - 1 for sell orders with pricedif>0; 0 otherwise
  - DummySN
    - 1 for sell orders with pricedif<0; 0 otherwise

Model Estimation

- Burr Log-ACD (1,1) model

$$\psi_i = \omega + \alpha \ln(x_{i-1}) + \beta\psi_{i-1} + \delta_1 SIZE_i$$
$$+ \delta_2 DummyBP_i + \delta_3 DummyBN_i$$
$$+ \delta_3 DummySP_i + \delta_4 DummySN_i + \delta_5 DEPTH_i$$

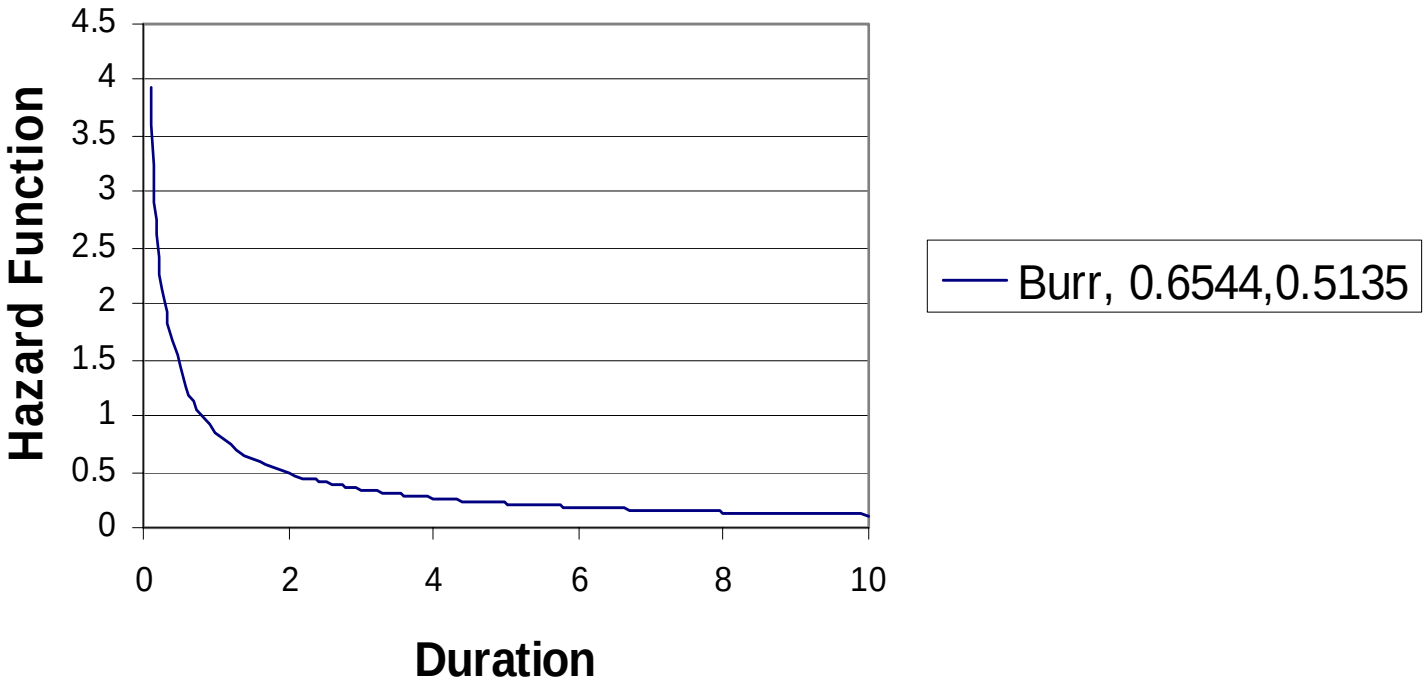
Model Estimates (filled orders)

	Coefficient	Std. Error	T-Stat	Prob
SIZE	0.0197	0.0085	2.33	0.0197
$DummyBP_i$	-1.2171	0.0402	-30.31	0.0000
$DummyBN_i$	1.7880	0.0368	48.59	0.0000
$DummySP_i$	1.7140	0.0355	48.31	0.0000
$DummySN_i$	-1.2902	0.0389	-33.17	0.0000
LDEPTH	-0.0084	0.0003	-30.20	0.0000
MDEPTH	-0.0101	0.0004	-25.22	0.0000

Model Estimates (censored orders)

	Coefficient	Std. Error	T-Stat	Prob
SIZE	-0.0484	0.0007	-64.78	0.0000
$DummyBP_i$	-0.2920	0.0295	-9.89	0.0000
$DummyBN_i$	1.5238	0.0308	49.47	0.0000
$DummySP_i$	1.4583	0.0313	46.60	0.0000
$DummySN_i$	-0.3193	0.0304	-10.49	0.0000
LDEPTH	0.0155	0.0060	2.60	0.0000
MDEPTH	-0.0052	0.0004	-14.19	0.0000

Estimated Hazard Function



Conclusions

- Explain choice of trading venues
  - Large traders prefer direct dealing while small traders utilize the electronic brokerage
- Empirical results consistent with hypotheses from theory.
  - Large orders wait longer on EB given the depth of the market and price competitiveness.