A. Portfolio Shifts Model and the Role of Order Flow

Portfolio shifts by public cause exchange rate change

not common knowledge when they occur
large enough that market clearing requires exchange rate to change

There are T periods & 2 assets: riskless & fx with stochastic payoff F

\[
F = \sum_{t=1}^{T} r_t \quad \text{where innovations are iid } \sim N(\theta, \Sigma_r)
\]

\( r_t \) observed before trading each period (public info.)

Decentralized market with N dealers i and continuum of non-dealer customers
all have identical neg. exponential util. defined over wealth at \( T \)

3 trading rounds each day \( t \)
TRADING ROUND 1

a) observe $r_t$ at beginning of period

b) all dealers simultaneously & independently quote a scalar price $P_{il}$

at which any amount may be bought or sold

c) customer orders $c_{il}$ at $P_{il}$

$c_{il} < 0$ is customer sale (dealer buy)

$c_{il} \sim N(0, \Sigma_{cil})$ for each of $N$ orders

orders are indep. across dealers

orders are distributed indep. of public info. $r_t$

these are the portfolio shifts that are not publicly observable

TRADING ROUND 2

a) each dealer simultaneously & indep. quotes a scalar price to other dealers $P_{i2}$

at which any amount may be bought & sold

interdealer quotes observable & available to all dealers

b) dealers trade on other's quotes

at any given $P$, orders evenly split across any dealers quoting that $P$

$$\Delta x = \sum_{i=1}^{N} T_{i2}$$ is net interdealer order flow

interdealer trade transparent to all dealers (no noise)
TRADING ROUND 3

a) dealers quote scalar price $P_{i3}$

$P_{i3}$ conditioned on interdealer order flow
(dealers know amount public must absorb)

any amount may be traded

observable & available to public at large

public absorbs dealer unwanted inventory

each dealer ends day with 0 net position

b) public trades at $P_{i3}$

$$c_3 = \gamma(E[P_{3,t+1} | \Omega_3] - P_{3,t})$$

so public's total demand is function of expected return

$\gamma$ captures agg. risk-bearing capacity of public
EQUILIBRIUM

Dealer's problem is:

\[ \text{max } E[\exp(-\theta w_{i3}) | \Omega_i] \]

s.t.

\[ w_{i3} = w_{i0} + c_{i1}(P_{i1} - P_{i2}^\prime) + (D_{i2} + E[T_{i2} \mid \Omega_{i2}](P_{i3} - P_{i2}^\prime)) - T_{i2}'(P_{i3} - P_{i2}) \]

' denotes interdealer quote or trade

yields price equation:

\[ \Delta P_t = r_t + \lambda \Delta x_t \]

for \( r \) use \( \Delta(i - i^\star) \)

estimate:

\[ \Delta P_t = \beta_1 \Delta(i_t - i_t^\star) + \beta_2 \Delta x_t + \eta_t \]
ESTIMATION

Data: Reuters Dealing 2000-1

* time, price, and signed trade (+ buy, - sell)

* no quantity, no quotes

* take price from 4pm to 4pm GMT

*(i-i*) overnight rates from Datastream (4pm GMT)

Sig. & pos. order flow effect

* high R²

* estimates indicate that day with 1000 more purchases than sales ↑DM/$ by 2.1%

If order flow drives prices, what drives order flow?

References

ASYMMETRIC INFORMATION AND PRICE DISCOVERY IN THE FX MARKET: Does Tokyo Know More About the Yen?

Vicentiu Covrig and Michael Melvin
I. INTRODUCTION

Microstructure theory ⇒ informed trader presence affects market dynamics

Empirical problem:
identifying informed

Suggested experiment:

Tokyo pre- and post-Dec. 22, 1994


*Informed trader concentration in pre-lunch BEFORE period
Some initial stylized facts:

U-shaped volatility for Japan BEFORE

no U-shape for non-Japan BEFORE

no U-shape for either AFTER

What kind of private information?

customer order flow

eyear knowledge of government action

inventory positions

GOAL: Test implications of microstructure theories regarding market dynamics with many informed traders present
II. IMPLICATIONS OF INFORMED TRADER CONCENTRATION

A. A Representative Theory

(1) \( F = F + \delta \).

(2) \( P = F + \lambda \omega \),

Informed trader demand: \( \beta(\delta + u) \)

(3) \( \beta = 1/\{(1 + \phi)\lambda(k + 1) + A[\phi + \lambda^2 \sigma_Z^2(1 + \phi)]\} \).

(4) \( \lambda[k^2(1 + \phi) + \sigma_Z^2 \alpha^2] = k\alpha \).

\[ \alpha = \beta^{-1} = A[\phi + \lambda^2(1 + \phi)\sigma_Z^2] + (k + 1)\lambda(1 + \phi). \]

Informational efficiency, \( Q = [\text{var}(\delta | \omega)]^{-1} \)

(5) \( Q = 1 + \{1/[\phi + (\sigma_Z^2 / k^2 \beta^2)]\} \).

**IMPLICATION:** Prices are more informative and converge more quickly to full information levels when there are many informed traders in the market.
B. **Estimating Speed of Adjustment**

Sample

*10:30-12noon Tokyo

*20 days BEFORE and AFTER

*Reuters quotes on yen/dollar

*1-minute returns

MA(1)-GARCH(1,1)

\( r_t = \alpha_0 + \varepsilon_t + \alpha_1 \varepsilon_{t-1} \)

\( h_t = \gamma_0 + \gamma_1 h_{t-1} + \gamma_2 \varepsilon_{t-1}^2 + \gamma_3 \text{dum}^* h_{t-1} + \gamma_4 \text{dum}^* \varepsilon_{t-1}^2 \)

---

**Estimated half-life of shock to volatility:**

_2 \frac{1}{2} minutes BEFORE_

_14 minutes AFTER_
III. JAPANESE AND NON-JAPANESE BANK DYNAMICS

If Tokyo knows more, then Japanese quotes should lead non-Japanese?

Causality tests:

\[ (9) r_t^d = a + b r_{t-1}^d + c r_{t-1} + e_t \]

Sample:
* 20 days BEFORE and AFTER
* early-morning, late-morning, and afternoon
* filter tick-by-tick \( r^i \) returns \( \geq 2.5 \) basis points
* construct \( r^d \) returns around \( r^i \)

FINDINGS:
* 2-way causality in all periods but one
* Japan causes non-Japan in late-morning BEFORE
Nonsynchronous Quoting and Cross Correlations

Difference between 2 observed quotes equals sums of returns of underlying unobserved quote process

(i) \[ q_{t+1} - q_t = \sum_{t=t+1}^{t+1} \Delta q_t \]

(ii) \[ E(y_{ij}) = E[(q_{t+1}^J - q_t^J)(q_{t+1}^N - q_t^N)] = E \left[ \sum_{t=t+1}^{t+1} \Delta q_t^J \cdot \sum_{k=k+1}^{k+1} \Delta q_s^N \right] = \sum_{t=t+1}^{t+1} \sum_{k=t+1}^{k+1} \gamma_{t-k} \]

(iii) \[ \gamma_k = Cov(\Delta r_t^J, \Delta r_{t-k}^N), r_t = q_t - q_{t-1} \]

(iv) \[ E(y_{ij} | \chi_{ij}) = \sum_{k=-k}^k \chi_{ij}(l_c)\gamma_k \]

(v) \[ y_{ij} = \chi_{ij}\gamma + e_{ij} \]

for \( k = 5 \), Wald test for lead/lag:

<table>
<thead>
<tr>
<th>( q^J ) lead ( q^N )</th>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.2</td>
<td>12.6</td>
<td></td>
</tr>
<tr>
<td>( q^N ) lead ( q^J )</td>
<td>8.3</td>
<td>15.7</td>
</tr>
</tbody>
</table>

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IV. Price Discovery in Japan and Elsewhere

Follow Hasbrouck (1995) to estimate contribution of Japanese and non-Japanese quotes to price discovery

\( r_t = \Psi(L)e_t \) (10)

\( r_t = \alpha(\beta'q_{t-1} - E\beta'q_t) + \Gamma_1r_{t-1} + \Gamma_2r_{t-2} + ... + \Gamma_{k-1}r_{t-k+1} + e_t \) (11)

\[ e_t = Fz_t, \; Ez_t = 0, \; \text{Var}(z_t) = I \]

\( S_j = ([\psi F]_j)^2 / (\psi \Omega \psi') \) (12)

Japanese/non-Japanese info. share:
   BEFORE   96%
   AFTER    89%

Japanese/Hong Kong info. share:
   BEFORE   128%
   AFTER    111%

Japanese contribution to price discovery
higher BEFORE than AFTER
V. CONCLUSIONS

Market dynamics differ depending upon the presence of informed traders

*greater the number of informed traders the faster price adjusts to full-information value

*informed-trader quotes lead the rest of the market when high concentration of informed traders

*informed traders’ contribution to price discovery peaks when informed cluster

“Does Tokyo Know More About the Yen?”

*qualified yes ..........

Reference: http://www.public.asu.edu/~mmelvin/
Figure 1: Variance of Yen/Dollar Quotes in Asian Morning -- BEFORE

Figure 2: Variance of Yen/Dollar Quotes in Asian Morning -- AFTER