Asymmetric Information and Inventory Concerns in Over-the-Counter Markets

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Over-the-counter (OTC) markets

- Decentralized trading
- Trade details negotiated in bilateral meetings
- Trading risks: timing, quantity, price
How does information about the trading needs of your counterparties affect an OTC market?

- Costs of trading
- Market participation
- Allocative efficiency and welfare
Regulators introduce post-trade transparency
   TRACE, Dodd-Frank Act, MiFID II

Benefits: Better valuation of asset

BESEMBINDER, MAXWELL, AND VENKATARAMAN (2006)
GOLDSTEIN, HOTCHKISS, AND SIRRI (2007)
EDWARDS, HARRIS, AND PIWOWAR (2007)

Costs: Reduced liquidity provision

Lobbying material by SIFMA, surveys
DUFFIE (2012)
ASQUITH, COVERT, AND PATHAK (2013)
Relevance

Transparency and commodity derivatives

- Risk magazine (January 16, 2015):
  “liquidity at the back-end of the futures curve has dried up”

- Southwest Airlines:
  Spread on long-term jet fuel swaps up by 35bps.

- Timothy Massad, CFTC chairman (February 12 2015):
  “In an illiquid market, real-time reporting can hurt that ability [the ability of commercial end-users to hedge]”
Reduced Liquidity Provision?

\[ V = 100 \]
\[ P = 95 \]

\[ V = 100 \]
\[ P = 90 \]

huge buy by a dealer
Main Findings

Transparency affects

- allocative efficiency (↗)
- inventory costs (↗)
- dispersion of transaction prices (↗)
- market participation (ambiguous and fragile)
- welfare (ambiguous and fragile)
Literature Review

- **OTC markets**
  - Duffie, Gărleanu, and Pedersen (2005, 2007)
  - Lagos and Rocheteau (2007, 2009)

- **OTC markets and asymmetric information**
  - Blouin and Serrano (2001)

- **Inventories**
  - Grossman and Miller (1988)

- **Formalism**
  - Diamond (1982)
  - Huang, Malhâmé, and Caines (2006), Lasry and Lions (2007)
Outline

Model

Market equilibrium

Market participation
1. Risk-free rate $r > 0$
2. Risky asset paying dividends at the rate

$$dD_d = m_d \, dt + \sigma_d \, dB_t$$
 Investors

- Continuum of agents
- Endowment at the rate
  \[ d\eta_t^a = Z_t^a \, dD_t \]
- Time-varying exposures
  \[ dZ_t^a = \sigma_a \, dB_t^a \]

see Lo, Mamaysky, and Wang (2004)
Risky asset traded on an illiquid over-the-counter (OTC) market

- Entry costs $\kappa$
- Expected search time is $\frac{1}{\Lambda \cdot (\# \text{ market participants})}$
- Bargaining over the transaction details

see Duffie, Gârleanu, and Pedersen (2005, 2007)
(i) $a$ asks $b$ for a quote.
(ii) If $b$ finds it optimal

- $b$ receives a signal

$$s_a = Xz_a + (1 - X)\zeta,$$

with $X \sim B(1, \tau), \zeta \sim \mu$

- $b$ quotes a price $p$
- $a$ chooses a quantity $q$

$\tau$ is the transparency of the market
(i) $a$ asks $b$ for a quote.
(ii) If $b$ finds it optimal
   ▶ $b$ receives a signal
     \[ s_a = Xz_a + (1 - X)\zeta, \]
     with $X \sim B(1, \tau)$, $\zeta \sim \mu$
   ▶ $b$ quotes a price $p$
   ▶ $a$ chooses a quantity $q$

$\tau$ is the transparency of the market.
Trading II/II: Bargaining

Signal $s$ about $a$

(i) quoted price $P(s)$

(ii) traded quantity $Q(P)$

Transparency is $P[\text{signal is correct}]$
Preferences

- Investors maximize expected CARA utility from consumption

\[ V_t = \sup_{(c_s)_{s \geq t}} E_t \left[ - \int_t^{\infty} e^{-\rho(s-t)} e^{-\gamma c_s} \, ds \right] \]
Timeline

Entry Decision
  ▶ initial exposures
  ▶ entry costs $\kappa$

Trading
  ▶ Endowment shocks
Market Equilibrium

Take as given the investors in the market trading by others

flow equation
distribution of exposures

HJB

my trading
\[ \rho V(w, z) = \sup_{\tilde{c}} \{ U(\tilde{c}_s) - V_w(w, z)\tilde{c} \} \]

\[ + V_w(w, z)(rw + zm_d) \]

\[ + \frac{1}{2} \left( V_{ww}(w, z)z^2\sigma^2 + V_{zz}(w, z)\sigma_z^2 \right) \]

\[ + \lambda \mathbb{E}^{\mathcal{L}(z_q,s_z)} \left[ \mathbf{1}_{\{z_q \in A\}} \left( \begin{array}{c} \sup_{\tilde{q}} V(w - \tilde{q}P(z_q, s_z), z + \tilde{q}) \\ -V(w, z) \end{array} \right) \right] \]

\[ + \lambda \mathbb{E}^{\mathcal{L}(z_a,s_a)} \left[ \sup_{\tilde{p}} \mathbb{E}^{\mathcal{L}(z_a,s_a)} \left[ V(w + Q(z_a, \tilde{p}) \tilde{p}, z - Q(z_a, \tilde{p})) | s_a \right] \right] \]
\[ dZ_t = \sigma_z \, dB_t \]
\[ + \left( \begin{array}{cc}
X_{r,t} & Q(Z_{t-}, P(\cdot, Z_{t-})) \\
(1 - X_{r,t}) & Q(Z_{t-}, P(\cdot, \zeta))
\end{array} \right) dN_t^r \]
\[ + \left( \begin{array}{cc}
X_{q,t} & -Q(Z_{t-}, P(\cdot, Z_{r})) \\
(1 - X_{q,t}) & -Q(Z_{t-}, P(\cdot, \zeta))
\end{array} \right) dN_t^q, \]

Market equilibrium
Market Equilibrium

Proposition

There exists an equilibrium for which the value functions have the form

\[ V(t, w, z) = -\exp \left( -r \gamma \left( v_0(t) + v_1 z + v_2 z^2 \right) \right). \]

- Exponential convergence at rate \( \frac{4}{9} \lambda(1 + \tau^2) \)
- Steady-state variance of exposures

\[ \text{Var}[\tilde{z}_\infty] = \frac{\sigma_a^2}{\frac{4}{9} \lambda(1 + \tau^2)}. \]
Transparency Makes Inventories Costly

\[ \log(\text{value function}) = v(z) \]

\[ \sigma(z_0) \quad \sigma(z_0) \]

\[ \tau = 0.87 \]
\[ \tau = 1 \]

stationary density of exposure

\[ \sigma(\tau=1) \quad \sigma(\tau=1) \]

\[ \tau = 0.87 \]
\[ \tau = 1 \]
Transparency Makes Inventories Costly

Corollary

When the transparency increases,

- Trades become smaller
- Cross-sectional dispersion of prices increases

* Consistent with Southwest Airlines’ complaints.
Outline

Model

Market equilibrium

Market participation
Endogenous Market Participation

Net benefits to joining the OTC market

\[ \beta(z) = a(z - E[\tilde{z}_0])^2 + b \text{Var}[\tilde{z}_0] + c \sigma_a^2 - \kappa \]

- **Liquidation**: \( a \) is \( \uparrow \) in \( \lambda \) \( \downarrow \) in \( \tau \)
- **Intermediation**: \( b \) is \( \downarrow 0 \) in \( \lambda \) \( \uparrow \) in \( \tau \) entrants are substitutes
- **Anticipated risk-sharing**: \( c \) is \( \uparrow \) in \( \lambda \) \( \uparrow \) in \( \tau \) entrants are complements
\[ \mathcal{E} = \{ \text{investors who enter the OTC market} \} \]

Solution Methods

1. Homogeneous initial exposure
2. Cases for which most investors enter the market
3. Numerics
Rational Market Participation

\[ \mathcal{E} = \{ \text{investors who enter the OTC market} \} \]

Solution Methods

1. Homogeneous initial exposure
2. Cases for which most investors enter the market
3. Numerics
Market Participation: Method 1

Homogeneous initial exposure

Proposition

If $\text{Var}[\tilde{z}_0] = 0$

- No participation is an equilibrium
- Full participation is an equilibrium if $\beta(1) \geq \kappa$
- Partial participation is an equilibrium if $\beta(p) = \kappa$, $p \in (0, 1)$

Participation and Welfare weakly decreasing in transparency.
Market Participation: Method 2

Solution available when there is full participation

Most investors enter the market

entry benefits $\beta(z)$

entry costs $\kappa$

exposure $z$

$\delta$

exposure $z$
Proposition

Around the full participation case, when \( \sigma_a \) is large enough,

- two equilibrium paths for \( \tau > \tau_{\text{full}} \)
- market participation and welfare can \( \downarrow \) in \( \tau \)
- discontinuous participation drop when \( \tau < \tau_{\text{full}} \)

- Ambiguous effect of transparency on market participation, trading delays, welfare
- Economy is fragile in the transparency \( \tau \)
Numerical solution: Assume strong enough complementarity
Transparency can Decrease liquidity

Market Participation

Trading Volume

Welfare

Transparency
Transparency can Decrease Liquidity

- Increased transparency
- Either
  - Increased trading costs
  - Reduced liquidity
  - Reduced market participation
- Increased intermediation revenues
- Improved liquidity
- Increased market participation

Or

Market participation
Transparency can Decrease Liquidity

- Consistent with Southwest Airlines’ claims.
- Consistent with CFTC’s view that trade dissemination can hurt hedgers.
- Not consistent with
  
  **Bessembinder, Maxwell, and Venkataraman (2006)**
  **Goldstein, Hotchkiss, and Sirri (2007)**
  **Edwards, Harris, and Piwowar (2007)**

  but common value effects drive these studies.
Transparency can Increase Market Participation

- Market Participation:
  - Transparency
  - Trading Volume
  - Welfare

- Transparency vs. Market Participation:
  - Increase

- Transparency vs. Trading Volume:
  - Decrease

- Transparency vs. Welfare:
  - Decrease
Transparency can Increase Market Participation

- Increased transparency
  - Increased trading costs
    - Reduced liquidity
    - Reduced market participation
  - Or
    - Increased intermediation revenues
    - Increased market participation
    - Improved liquidity
    - Increased market participation

Some swap execution facilities (SEF) have a “name give-up” on their order-book, and some do not.

Dealers favor SEF with name give-up.

Risk Magazine (February 11, 2015):
“Name give-up provides a vehicle for credit allocation”
Equilibrium is Fragile

Market Participation

Trading Volume

Welfare

Transparency

Market participation
Equilibrium is Fragile

- Increased transparency
- Increased trading costs
- Reduced liquidity
- Reduced market participation
- Increased market participation
- Increased intermediation revenues
- Improved liquidity

Either increased transparency or increased trading costs can lead to reduced liquidity and reduced market participation, which can then increase market participation and improved liquidity, or increased intermediation revenues. Conversely, either increased transparency or increased trading costs can lead to increased market participation, which can then increase intermediation revenues and improved liquidity, or increased transparency and reduced trading costs.
Equilibrium is Fragile

Empirical Evidence

Asquith, Covert, and Pathak (2013) document bond trading volumes being reduced by up to 40% after post-trade transparency was introduced.

- According to our model, this drop in trading volume was accompanied by a drop in welfare.
Subsidizing liquidity provision eliminates the low participation equilibria.

- Norwegian central bank ensures a liquid sovereign bond market with attractive interest rates for dealers.
Wrapping up

- Trading is more costly in a transparent market — but less trading in equilibrium
- Market participation ambiguous and fragile in transparency
- Welfare ambiguous and fragile in transparency
Thank you!
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<th>Notation</th>
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<td>$r$</td>
<td>interest rate</td>
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<td>risk-aversion</td>
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