Predatory Trading in a Rational Market

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ESEM
Aug 22, 2022

Predatory Trading

- Exploiting or inducing the need of other traders to unwind positions (Brunnermeier and Pedersen, 2005)
  - E.g. move prices to trigger a margin call or redemptions
  - Evidence: Cai (2009), Chen, Hanson, Hong, and Stein (2008), Liu (2015), Takahashi and Xu (2016), Barbon et al. (2019)
- How does the rest of the market affect predatory trading? Cushioning or exacerbating role?
  - Predators temporarily push prices away from fundamental to induce distress
  - Should the rest of the market buy or sell?
  - Literature (Brunnermeier et al., 2005, Carlin et al., 2007, etc.): rest of the market does not optimize → predators' price impact is exogenous
  - This paper: rational hedgers understand the possibility of firesales and adjust their demand accordingly → predators' price impact is endogenous

Main results and mechanisms

1. High risk-bearing capacity: no predatory trading
   (a) High price, low liquidity premium
   (b) Same price impact for predators and prey
2. Low risk-bearing capacity: hedgers do not cushion the predators' price impact
   (a) Price adjustment today in anticipation of tomorrow's firesale
   $\rightarrow$ tightens the prey's price-based constraint
   (b) Trader-specific depth: predators' price impact $\uparrow$, prey's $\downarrow$
   Cheaper for predators to move prices, vice-versa for the prey
3. Initial ownership distribution matters: certain structures are more prone to predatory trading
4. Short-selling bans may not be effective
   (a) Hedgers unwind their holdings in anticipation of firesales
   (b) Predators stay on the sideline: no need to short-sell

Empirical implications

For a large enough drop in risk-bearing capacity or in prey's wealth (starting from a 'normal' situation)

- 'Rich' traders' price impact increases, 'poor' traders' decreases (in % terms)
- Price drops (higher liquidity premium)
- Firesales

Literature

- Exogenous price impact & (mostly) exogenous distress: Brunnermeier and Pedersen (2005), Carlin et al. (2007), Attari, Mello, and Ruckes (2005), La'o (2010), Brunnermeier and Oehmke (2014), etc.
- Endogenous price impact & exogenous distress: Pritsker (2005)
- This paper: endogenous price impact & endogenous distress
  1. Links prey's wealth and price impact ($\neq$ limits of arbitrage literature)
  2. Links endogenous price impact and probability of predatory trading

Model

- $t = 0, 1, 2$: two trading rounds + consumption
- Risky asset
  - Net supply $S \geq 0$
  - Liquidation value: $D_2 = D + \epsilon_1 + \epsilon_2$, $\epsilon_t \sim \mathcal{N}(0, \sigma^2)$ iid, public
- Risk-free asset in perfectly elastic supply, $r_f = 0$
- Competitive hedgers
  - Unit mass
  - CARA (risk aversion α)
  - Holdings: X^0_{-1}
- n risk-neutral strategic traders
  - 1 financially constrained prey, holding $X^1_{-1} > 0$
  - $n - 1$ 'cash-rich' predators ($i = 2, \ldots, n$)
  - Compete in quantities (Cournot)
- Complete information

Prey's financial constraint

- A low marked-to-market value at $t = 0$ leads to portfolio liquidation (firesale) at $t = 1$

$$B_0^1 + X_0^1 p_0 \leq \underline{V} \quad \Rightarrow X_1^1 = 0 \tag{1}$$

- Maximum position (substitutes for risk aversion)

$$X_0^1 \leq \bar{X} \tag{2}$$

- Price-based constraint must be sufficiently backward-looking
- Constraint (1) yields a distress threshold $\bar{p}_0$

$$\bar{p}_0 = \frac{\underline{V} - B_{-1}^1}{X_{-1}^1}$$

- Hedgers' problem

$$\max_{X_0^0, X_1^0} -\mathbb{E}_0\left[\exp\left(-\alpha C_2^0\right)\right]$$
$$s.t.\ W_t^0 = W_{t-1}^0 + X_{t-1}^0(p_t - p_{t-1})$$

- Hedgers' demand

$$X_t^0 = \frac{\mathbb{E}_t(p_{t+1}) - p_t}{\beta}, \quad \text{where } \beta = \alpha\sigma^2 \tag{3}$$

- Predators/prey:

$$\max_{x_0^i, x_1^i} \mathbb{E}_0\left[W_2^i\right]$$
$$s.t.\ W_2^i = B_{-1}^i - x_0^i p_0\left(\sum_{j=2}^{n} x_0^j, x_0^1\right) - x_1^i p_1\left(\sum_{j=2}^{n} x_1^j, x_1^1\right) + X_1^i D_2$$

Prey's constraints (1) & (2)

Equilibrium definition

Definition

An equilibrium consists of trades x_t^i and prices p_t such that

(i) Hedgers' holdings are optimal given rationally anticipated prices;

(ii) given other predators' trades, the prey's trades, the prey's constraints, and the price schedules, predator i's trades maximize his expected wealth;

(iii) given the predators' trades, her constraints, and the price schedules, the prey's trades maximize her expected wealth.

Two cases

- Hedgers have no initial holdings: no risk-sharing motive
  - Price drop and trader-specific price impact in anticipation of firesales
- Hedgers have positive initial holdings
  - Similar price and liquidity effects (stronger for price)
  - Asset ownership distribution and probability of predatory trading
  - Effectiveness of short-selling bans

No risk-sharing motive

Proposition

- *There is an equilibrium without trade, in which the prey remains solvent, iff* $\beta < \underline{\beta}_{nd}$
$$p_t = \mathbb{E}_t(D_2), \quad t = 0, 1$$
- *There is a predatory trading equilibrium iff* $\beta \in \left[\min(\underline{\beta}_d, \beta_F), \beta_F\right)$
- *In the predatory trading equilibrium:*
  - *The prey maxes out her position at time 0:* $X_0^1 = \bar{X}$
  - *Predators sell until* $p_0 = \bar{p}_0 < \mathbb{E}_0(D_2)$
- *Equilibria may coexist for some* β

$\Rightarrow$ The prey's constraint generates predatory trading

Price impact

- In the no-trading equilibrium: all traders have the same price impact

$$p_0^{nd}\left(\sum_{j=2}^{n} x_0^j, x_0^1\right) = D + \beta \frac{n+2}{n+1} \sum_{j=1}^{n} x_0^j$$

- In the predatory trading equilibrium: trade-specific price impact

$$p_0^{d}\left(\sum_{j=2}^{n} x_0^j, x_0^1\right) = D - \beta \frac{1}{n} X_{-1}^1 + \beta \frac{n+1}{n} \sum_{j=2}^{n} x_0^j + \beta x_0^1$$

  - Price discount: tightens the prey's constraint
    - Hedgers will have to clear the market at $t = 1$, thus require a compensation at $t = 0$
  - Predators' price impact increases, prey's price impact decreases
    - Marginal value of trading with predators is higher for hedgers

Empirical implication

- A positive shock to β (e.g. higher risk aversion) can increase the price impact of cash-rich traders and decrease that of cash-poor traders (in % terms)
- Also increases liquidity premium and triggers firesales

With risk-sharing motive

Hedgers start with non-zero (e.g. positive) endowments X^0_{-1}

Proposition

1. *Equilibrium with limited risk-sharing for β low enough provided $\frac{\bar{X}}{X^1_{-1}}$ large enough*

$$x^i_t = c_{t,n} X^0_{-1}$$
$$p_t = \mathbb{E}_t(D_2) - \beta \rho_{t,n} X^0_{-1}$$

2. *Predatory trading equilibrium exists for β intermediate*
   - *Same characteristics as before*
   - *Interval for β depends on the position of a vs θ*
     - $a = \frac{\bar{X}}{X^1_{-1}}$*: prey's leverage capacity*
     - $\theta = \frac{X^0_{-1}}{X^1_{-1}}$*: risk-sharing vs firesale*

Price impact

- Price schedule

$$p_0^{nd}\left(\sum_{j=2}^{n} x_0^j, x_0^1\right) = D - \beta\frac{n+2}{n+1}X_{-1}^0 + \beta\frac{n+2}{n+1}\sum_{j=2}^{n} x_0^j + \beta x_0^1$$

$$p_0^{d}\left(\sum_{j=2}^{n} x_0^j, x_0^1\right) = D - \beta\frac{n+1}{n}X_{-1}^0 - \beta\frac{1}{n}X_{-1}^1 + \beta\frac{n+1}{n}\sum_{j=2}^{n} x_0^j + \beta x_0^1$$

  - Same effect on price impact
  - Larger price discount

- Hedgers' valuation for the asset drops more since they are already exposed to it

Initial distribution of asset ownership

- Probability of predatory trading increases with θ if the leverage capacity is large, and decreases with it otherwise
- Two effects: large hedgers' endowment
  - Large benefit to predators from sharing risk
  - But large liquidity premium, so the price is close to the distress threshold $\rightarrow$ cheaper predation

Short-selling bans

- If $\bar{X} > \frac{n+1}{n} S$ (strong prey), predators *must* go short to trigger distress
- If $\bar{X} \leq \frac{n+1}{n} S$ (weaker prey), predators need not short-sell for β large enough: only hedgers unwind their position $\Rightarrow$ Short-selling ban ineffective

Consequences:

- Short-selling bans widespread in 2007-2009 (Beber and Pagano, 2012), but may be ineffective
- Under-identification of predatory trading in the data, since 'predators' are indentified as seling or short-selling funds (not the rest of the market)

Main points

- Theory of predation where all investors are rational
- Endogenous price impact and distress
- New predictions:
  - Trader-specific price impact and market risk-bearing capacity/ tightness of constraint
  - Asset ownership distribution and probability of predatory trading
  - When short-selling bans are effective