Predatory Trading

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Motivation

- Forced liquidation of large position:
  - is often associated with low liquidity
  - can be very costly
  - cross-correlation structure goes wild
  - is a key concern in risk management
- This paper: predatory trading,
  - trading that induces and/or exploits other traders' need to reduce their positions
- Wall Street conventional wisdom:
  - "They'll let you in, but they won't let you out."

Examples

- Amaranth
- Long-Term Capital Management (LTCM)

> *"If lenders know that a hedge fund needs to sell something quickly, they will sell the same asset - driving the price down even faster. Goldman Sachs and counterparties to LTCM did exactly that in 1998. Goldman admits it was a seller but says it acted honorably and had no confidential information."*

Examples

- Amaranth
- Long-Term Capital Management (LTCM)
- UBS Warburg and Enron

> *"UBS Warburg's proposal to take over Enron's traders without taking over the trading book was opposed on the ground that "it would present a 'predatory trading risk', as Enron traders effectively know the contents of the trading book."*

Examples

- Amaranth
- Long-Term Capital Management (LTCM)
- UBS Warburg and Enron
- 1987 Crash, Brady Report:

> *"several 'triggers' ... ignited mechanical, price-insensitive selling by a number of institution following portfolio insurance strategies ... The selling by these investors, and the prospect of further selling by them, encouraged a number of aggressive trading-oriented institutions to sell in anticipation of further declines. "*

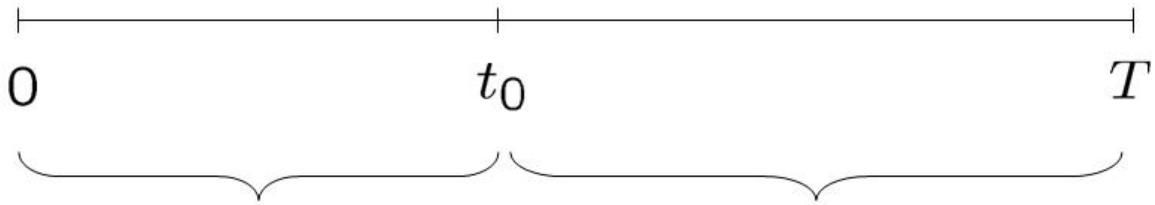
Examples

- Amaranth
- Long-Term Capital Management (LTCM)
- UBS Warburg and Enron
- 1987 Crash
- Askin/ Granite vs. Merrill Lynch
- Metallgesellschaft (MG)

Results

- Under which circumstances occurs predatory trading
- Price overshooting
- Systemic risk
- Time-varying liquidity - dries up when it is needed the most
- "Distress" value $<$ orderly liquidation value $<$ paper value
- Contagion
- Risk management, disclosure

Timeline



Investment Phase

Predatory Phase

exogenous default

- single predator
- multiple predator

endogenous default

systemic risk

Model

- Time is continuous $t \in [0, T]$
- Large strategic traders — "big players" $i \in \{1, 2, ..., I\}$:
  - trading intensity/speed: , $a^i(t)$
    aggregate speed constraint: $\sum_i a^i \leq A$
  - position at time t:
    $x^i(t) = x^i(0) + \int_0^t a^i(\tau) d\tau$
    individual position limits: $x \leq \bar{x}$ and $x \geq -\bar{x}$.
  - aggregate holding

$$X(t) = \sum_{j=1}^{I} x^j(t)$$

- Long-term traders — many small investors:
  - aggregate demand: $Y(p) = \frac{1}{\lambda}(\mu - p)$
- Price: $p(t) = \mu - \lambda(S - X(t))$

Price

- Price

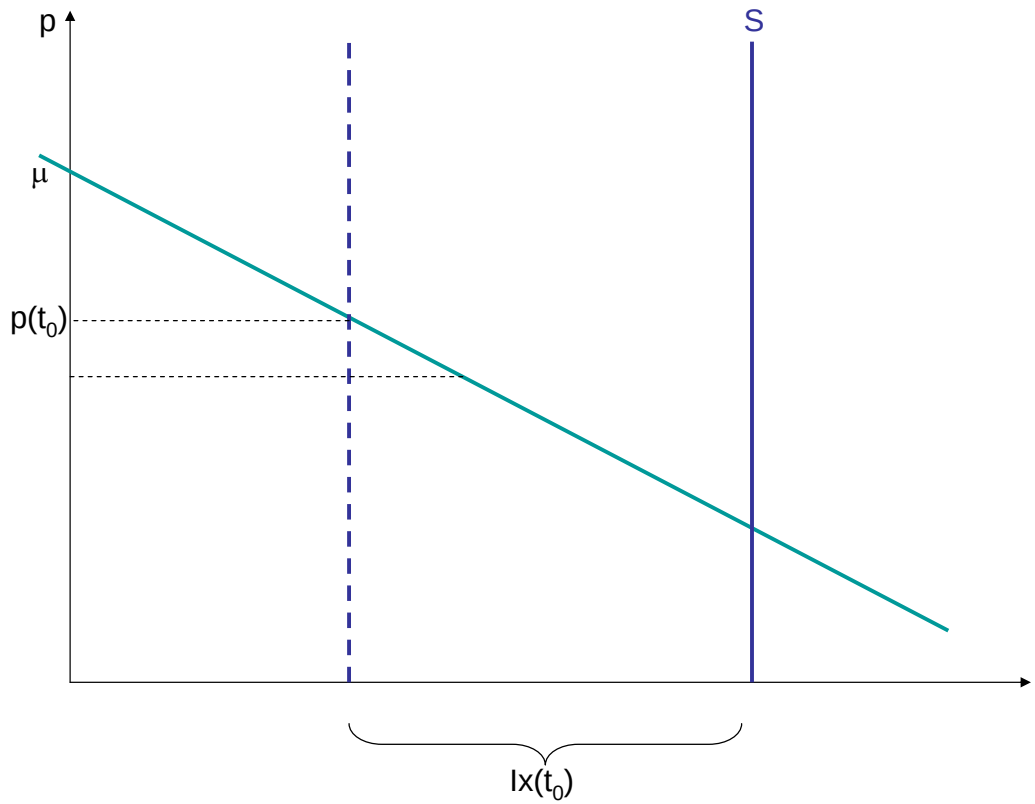
$$p(t) = \mu - \lambda (S - X(t))$$

  where supply $S \geq I\bar{x}$, hence, $p(t) \leq \mu$.

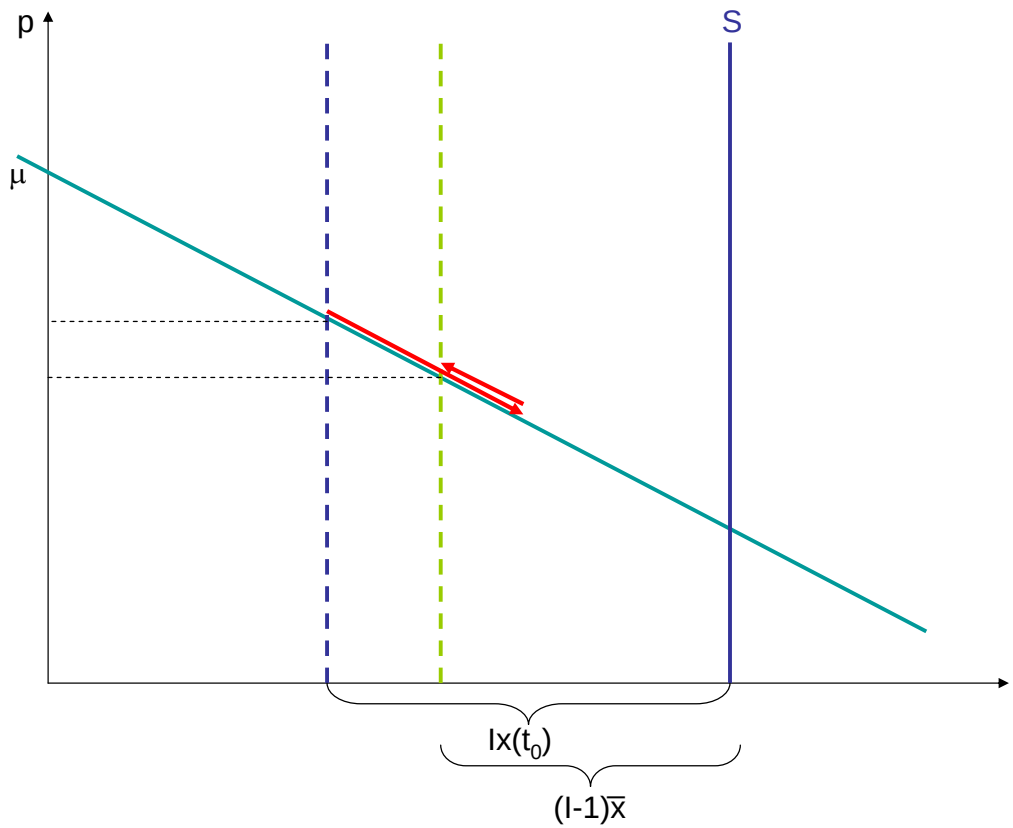
- Price impact of order flow
  - "permanent": $\lambda \sum_i a^i$
  - "temporary": $\gamma \left(\left| \sum_i a^i \right| - A \right)$ if $\left| \sum_i a^i \right| > A$
    equal order priority:
    - no temporary price impact for first $\bar{a}$ buy- ($\underline{a}$ sell-) orders
    - trader i's temporary price impact cost:

$$G := \gamma \max \left\{ 0, a^i - \bar{a}, \underline{a} - a^i \right\}$$

Equilibrium Price at t_0



Long-Run Price Shift



Financial Crisis

- A trader in crisis/default must liquidate:
  $\Rightarrow$ forced to sell at a minimum speed of A/I
- What triggers default?
  - Part 1: bad luck: i is in crisis at time t_0
  - Part 2: wealth fall below critical level: $W^i(t) \leq \underline{W}$

Objective Function and Equilibrium

Strategic trader i's objective is to maximize his expected wealth

$$\max_{a^i(\cdot)\in\mathcal{A}^i} E\left(x^i(T)\mu - \int_0^T [a^i(t)p(t) + G\left(a^i(t), a^{-i}(t)\right)]dt\right) \quad (*)$$

Definition

An equilibrium is a set of processes $(a^1, \ldots, a^I)$ such that, for each i, a^i solves *(*)*, taking $a^{-i} = (a^1, \ldots, a^{i-1}, a^{i+1}, \ldots, a^I)$ as given.

Preliminary Analysis

Agent minimizes trading costs as if his own trades do not affect the price.

Lemma

A trader's problem can be written as

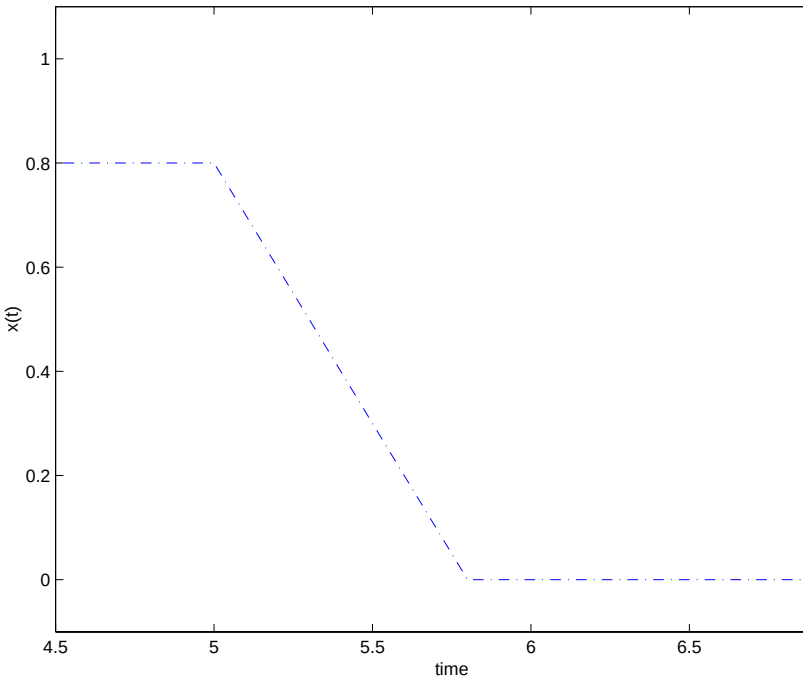
$$\min_{a^i(\cdot)\in\mathcal{A}^i} E\int_0^T a^i(t)\,X^{-i}(t)\,dt$$

$$\text{s.t.} \qquad x^i(T) = x^i(0) + \int_0^T a^i(t)\,dt = \bar{x} \quad \text{if } i \in \mathcal{I}^p$$

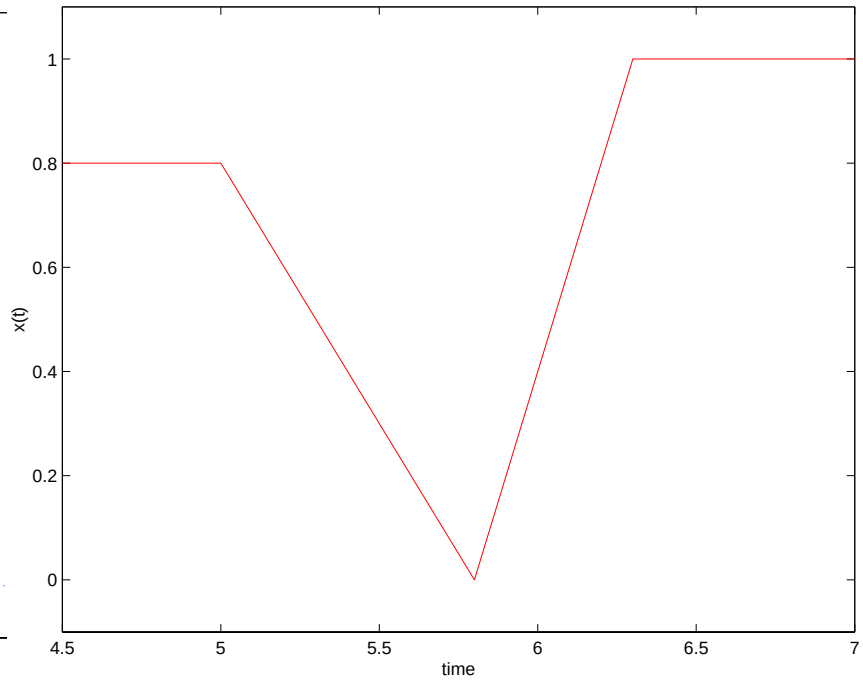
$$a^i(t) \in \left[\underline{a}\left(a^{-i}(t)\right),\, \overline{a}\left(a^{-i}(t)\right)\right].$$

Predatory Phase I: Exogenous default

I	I^p	λ	μ	S	A	$x(t_0)$	$\bar{x}$
2	1	1	140	40	20	8	10

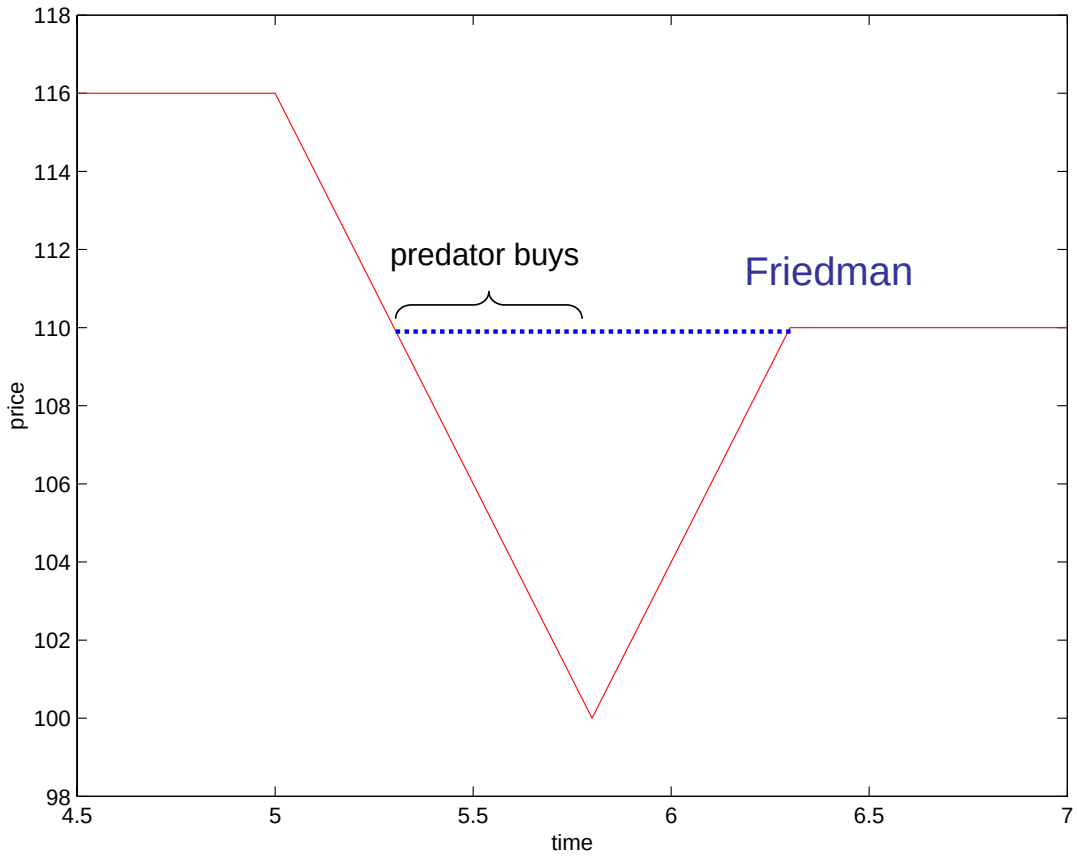


Distressed trader



Single Predator

Price Overshooting



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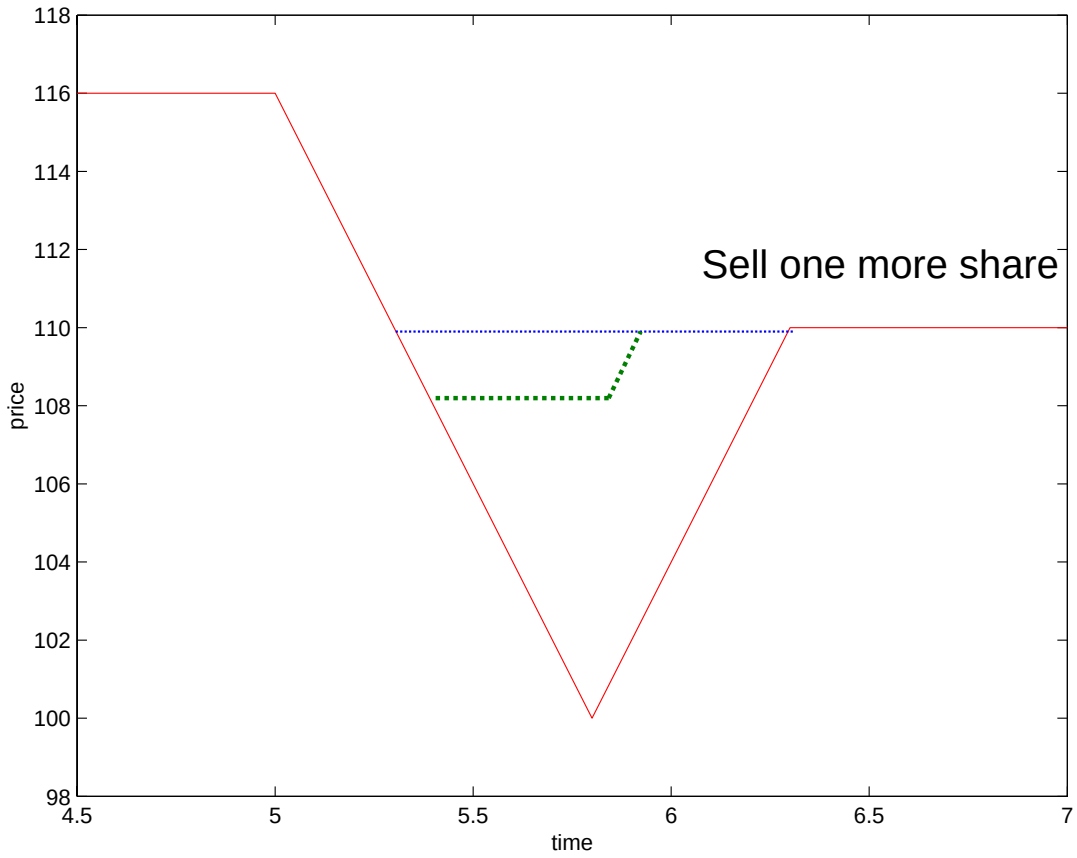
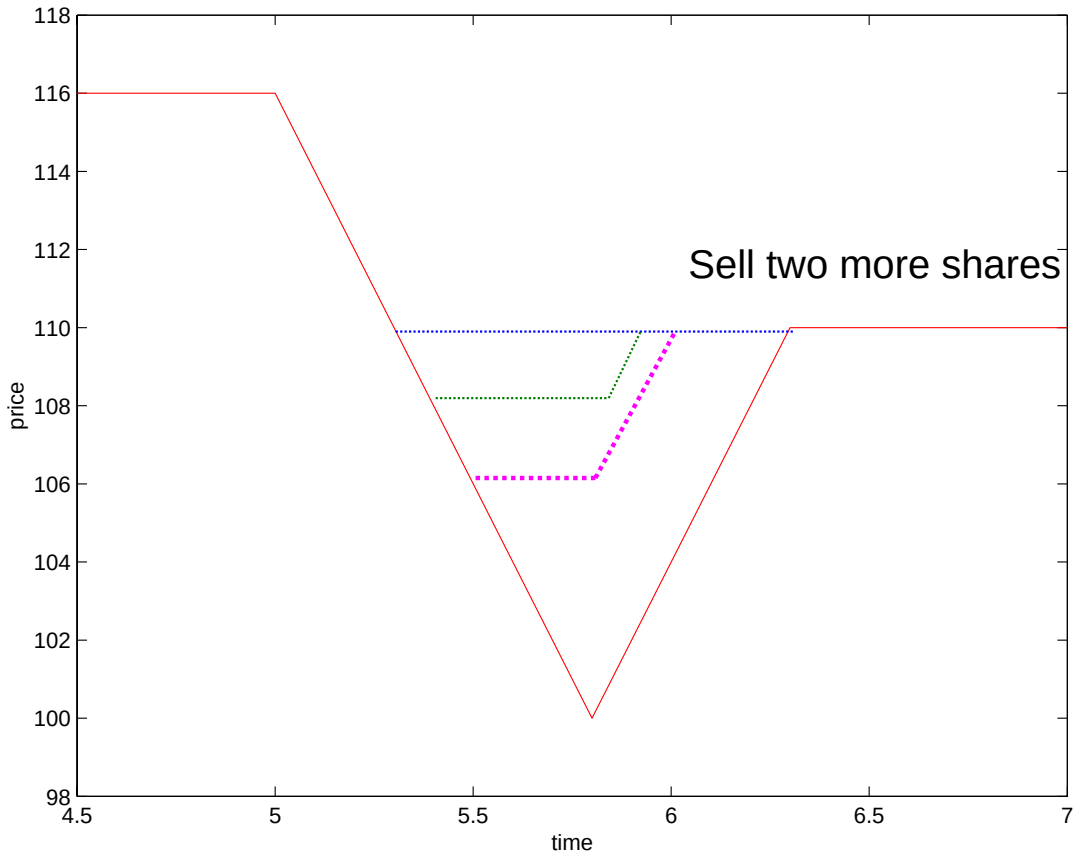
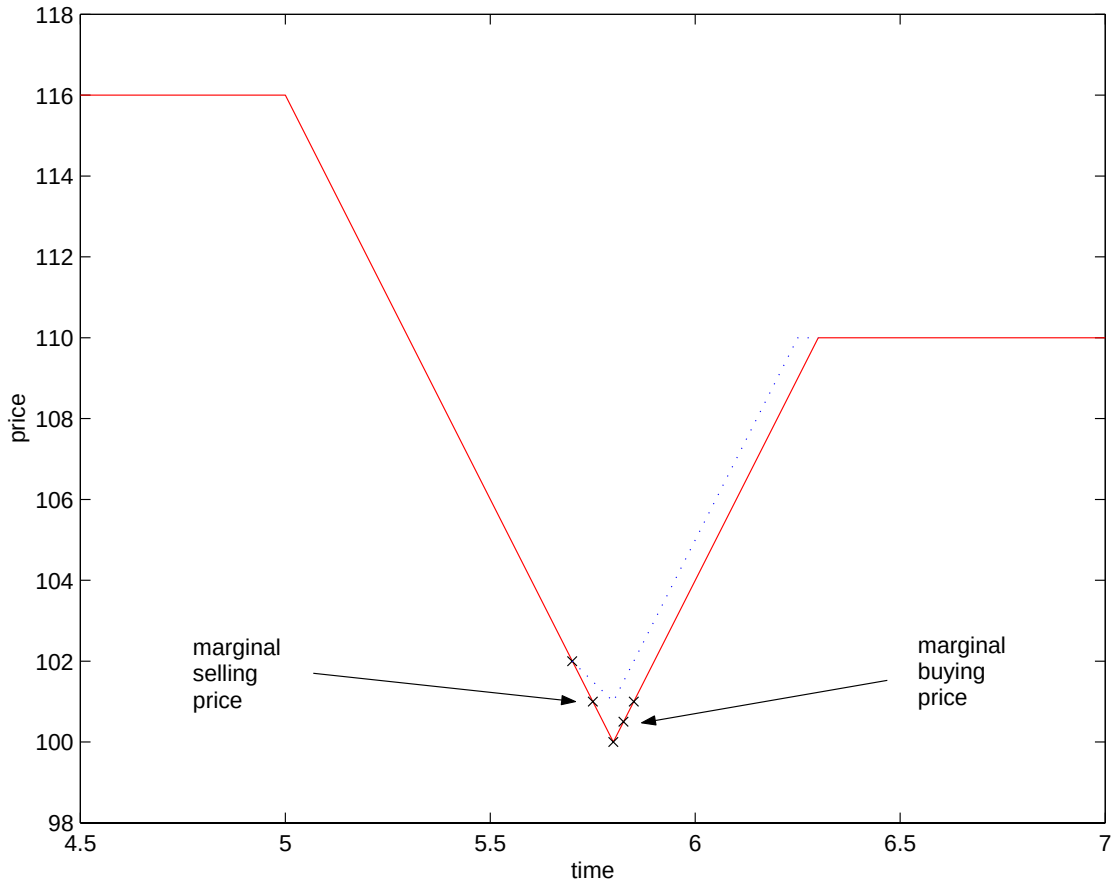


Price Overshooting



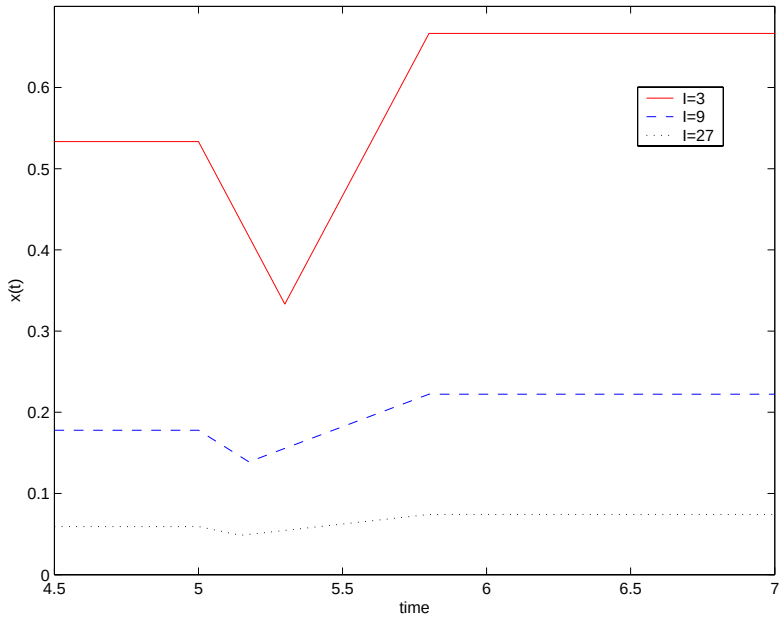
Why does the predator keep selling?

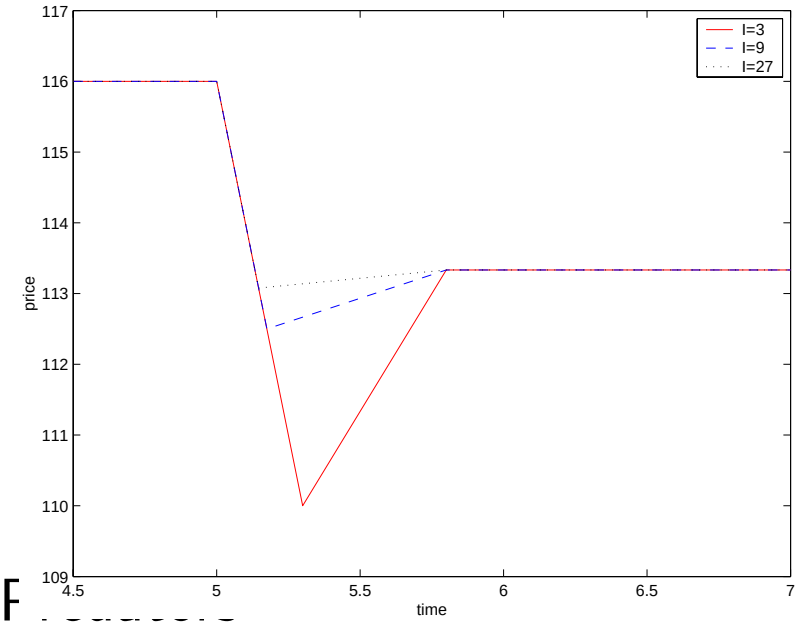


Competing Predators Spoil the Prey!

Three examples: $I = 3$, 9, and 27.

I^d/I	λ	μ	S	A	$x(t_0) \cdot I$	$\bar{x} \cdot I$
$\frac{1}{3}$	1	140	40	20	16	20





F Price

Price Overshooting

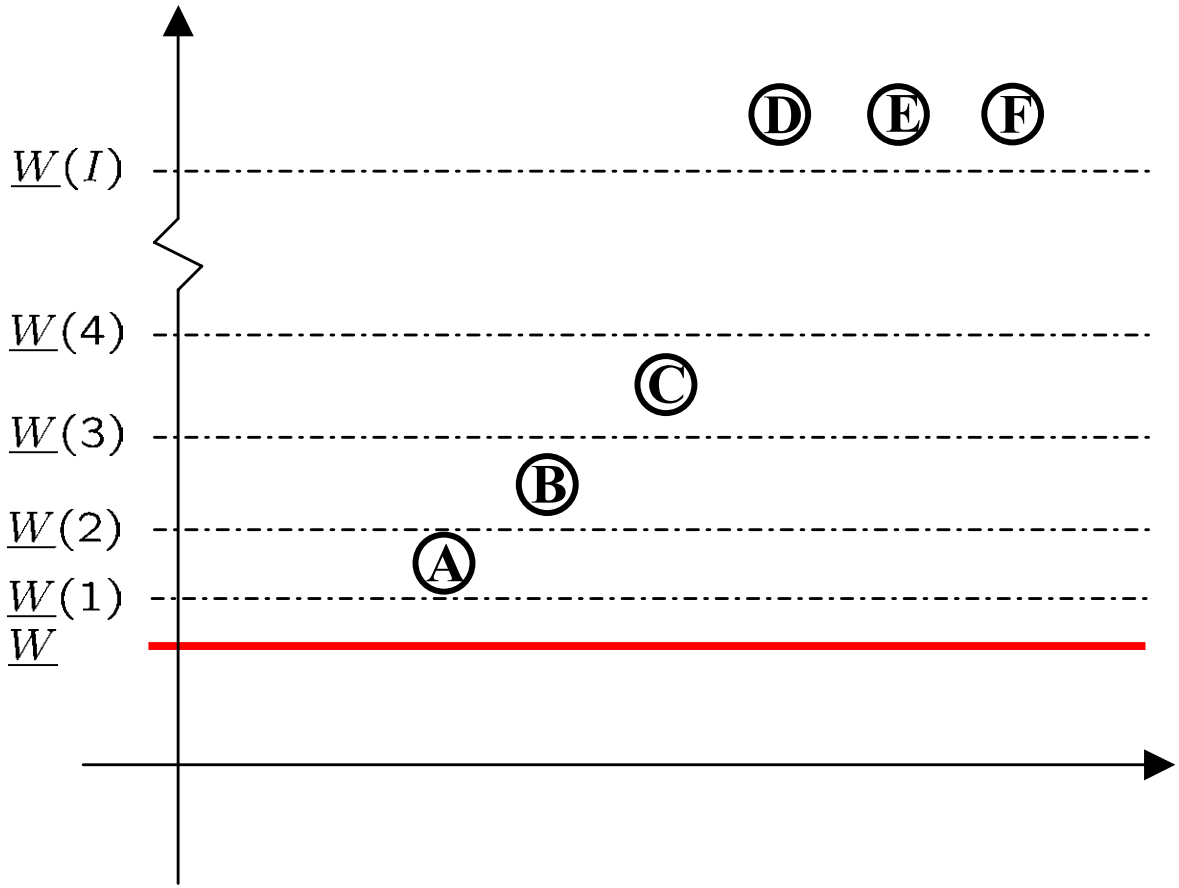
Summary

1. *If "money on the sideline", $\bar{x} - x(t_0)$, is small, then*
   $\Rightarrow$ *Predatory Trading and*
   $\Rightarrow$ *Price overshooting*
2. *Competition among predators reduces price overshooting.*
3. *If "money on the sideline" is large, there is no predatory trading or price overshooting.*

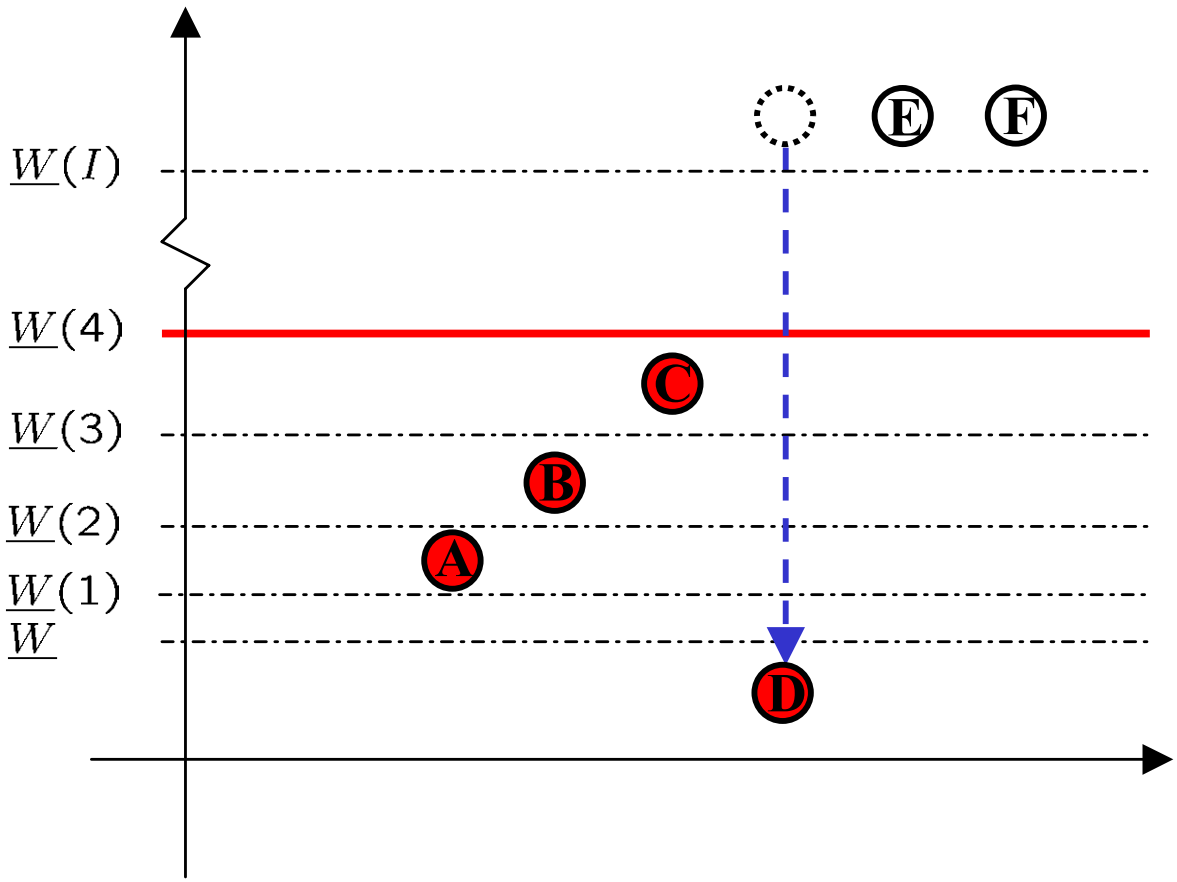
Predatory Phase II: Endogenous Default

- trader defaults if his marked-to-market wealth drops below $\underline{W}$
- Others' selling lowers price and erodes trader's wealth even further
  $\Rightarrow$ trader's wealth can drop below $\underline{W}$ after t_0
- survival hurdle, $\underline{W}(\cdot)$, is even higher
  $\Rightarrow$ better to start selling now if wealth is lower than survival hurdle
- the more traders are expected to default, the higher is the survival hurdle $\underline{W}(I^d)$ since
  - predation is more fierce
  - more traders have to fully liquidate their position

Endogenous Default



Systemic Risk



Alan Greenspan

In testimony to the House of Representatives, 10/1/98:

"...the act of unwinding LTCM's portfolio in a forced liquidation would not only have a significant distorting impact on market prices but also in the process could produce large losses, or worse, for a number of creditors and counterparties, and for other market participants who were not directly involved with LTCM."

Risk Management

- Risk management should take into account that in times of crisis
  - predatory trading lowers liquidity
  - predatory trading affects correlation structure of assets
  - other large traders' positions matter: "dealer exit stress test" (Risk Magazine Nov. 2003)
  - rigid risk management strategies can be exploited by predators
- These effects are more severe because $\underline{W}(I^d)$ is higher
  - in markets that are typically less liquid (higher λ)
  - for open-end funds which may suffer fund outflows

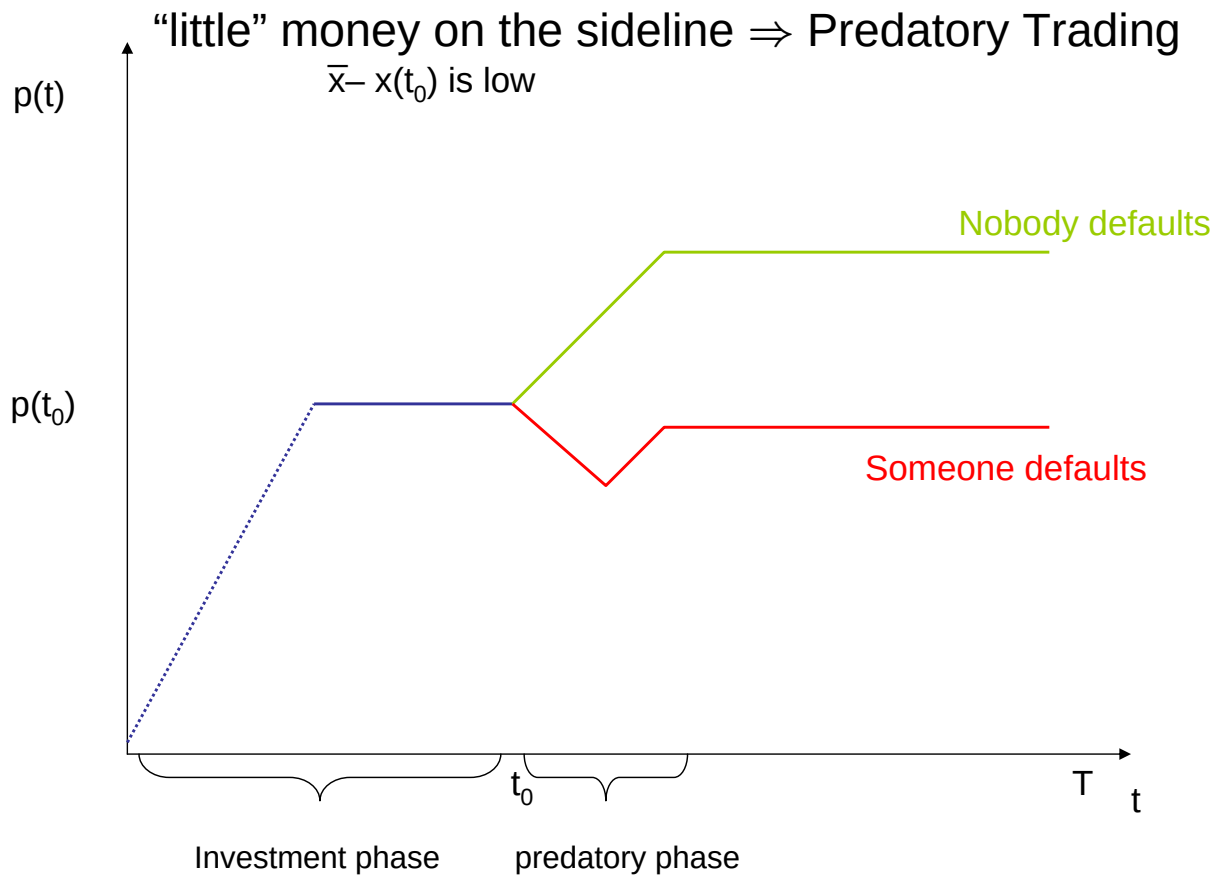
Valuation with Endogenous Liquidity

Three levels of valuation:

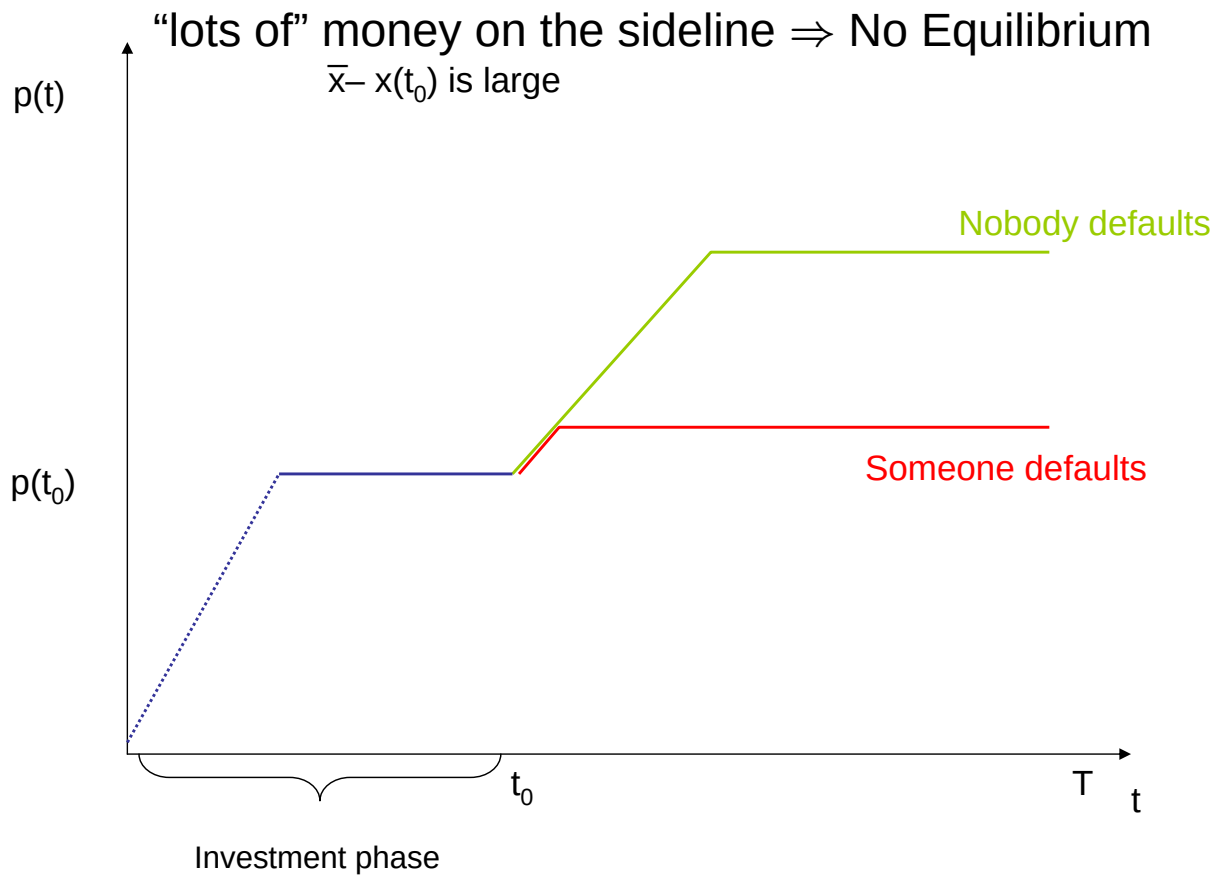
1. "paper value":
2. "orderly liquidation value":
3. "distressed liquidation value":

$$V^{paper} > V^{orderly} > V^{distressed}$$

Predatory Trading HAS TO Occur in Equilibrium



Predatory Trading HAS TO Occur in Equilibrium



Further Implications of Predatory Trading

- Front-running
  - predators sell first and buy when distressed traders sell
- Batch Auctions, Trading Halts, Circuit Breakers
  - uniform price execution lowers price overshooting
- Bear Raids and the Uptick Rule
- Contagion
- Collusion

Collusion

- Predators have an incentive to collude:
  - to trigger many defaults
  - to exploit fully the defaults
- Collusive and non-collusive outcomes qualitatively different

Related Literature

- Cai (2002)
- Hradsky and Long (1989)
- Friedman (1953); DeLong, Shleifer, Summers, and Waldmann (1990a)
- Attari, Mello, and Ruckes (2002);
- Bernardo and Welch (2002)

Conclusion

- Predatory trading important
  - for large traders
  - in illiquid markets
- Predatory trading can lead to
  - price overshooting
  - low distressed liquidation values (time-varying liquidity)
  - systemic risk
  - different cross-correlation across assets
  - contagion