MFE 409 Lecture 8
Liquidity Risk

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Lecture Objectives

- Market liquidity
- Funding liquidity
- How to measure them?
- Liquidity crises

Liquidity

- Liquidity: ability to make payments when they are due
- Two dimensions to liquidity:
  1. **Market liquidity**, or trading liquidity
  2. **Funding liquidity**
- The two dimensions interact

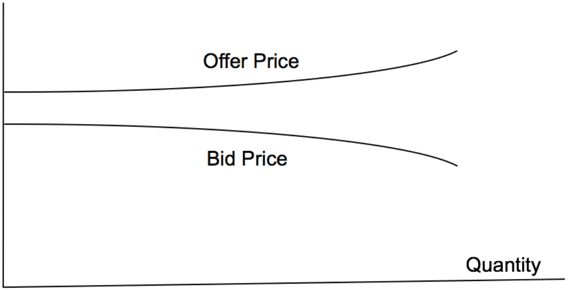
Outline

Market Liquidity

- **Market liquidity**: Ability to sell an asset on short notice
- Price received for an asset depends on:
  - Mid-market price
  - How much is to be sold
  - How quickly it is to be sold
  - The economic environment

Bid-Ask Spread

- Ask price (or offer price): price at which one can buy
- Bid price: price at which one can sell
- Role of *size*



Cost of Liquidation

- Proportional bid-ask spread:

$$s = \frac{\text{Ask Price} - \text{Bid Price}}{\text{Mid-market Price}}$$

- Cost of liquidating a portfolio with positions α_i right now:

$$\sum_{i=1}^{n} \frac{1}{2} |\alpha_i| s_i(\alpha_i)$$

- Stressed conditions: replace s_i by extreme historical value, e.g. 1% largest
- *Liquidity-adjusted VaR*: If portfolio is likely liquidated in extreme bad performance, add liquidation cost to VaR calculation

Role of Time

- Role of *time*
  - Example: selling a house tomorrow vs over the next month

- Trade-off for executing a trade:
  - Selling slowly avoids large trading costs
  - Selling slowly increases the risk of adverse price movement

Optimal Execution

- You want to sell S shares over the next n days
- The bid-ask difference is $p(q)$ where q is the quantity sold on that day
- The daily standard deviation of price changes is σ
- Formalize the problem of optimal execution

$$\min_{\{q_t\}} \lambda \sqrt{\sum_{t=1}^{n} \sigma^2 x_t^2} + \sum_{t=1}^{n} \frac{1}{2} |q_t| p(q_t)$$

$$\text{such that } \sum_{t=1}^{n} q_t = S$$

$$x_1 = S$$

$$x_t = x_{t-1} - q_{t-1}$$

- Solve it for $p(q) = 0.1 + 0.05 \exp(0.03 \times q)$, $S = 100$, $n = 5$, $\sigma = 0.1$

Fire Sales

- Bid-ask spread might be the tip of the iceberg for illiquidity
- **Fire sale**: In periods of deep market distress, many investors might want to sell, and few are ready to buy, so the whole price is lower
- Fire sales are difficult to tell apart from justified low prices
  - Chodorow-Reich, Ghent, Haddad (2020): *Asset insulators*: Valuation of institutions that sit out the fire sale should not respond to the drop in prices

Outline

Funding Liquidity

- **Funding liquidity**: Ability to maintain sources of funding for running the firm's activities
- Sources of funding liquidity:
  - Cash and Treasury holdings
  - Ability to borrow
  - Retail and wholesale deposits
  - Central bank borrowing

Quantifying Liquidity Risk

- Difficult to quantify liquidity risk

- Some measures from Basel III:
  - *Liquidity coverage ratio*: designed to make sure that the bank can survive a 30-day period of acute stress

  - *Net stable funding ratio*: a longer term measure designed to ensure that stability of funding sources is consistent with the permanence of the assets that have to be funded

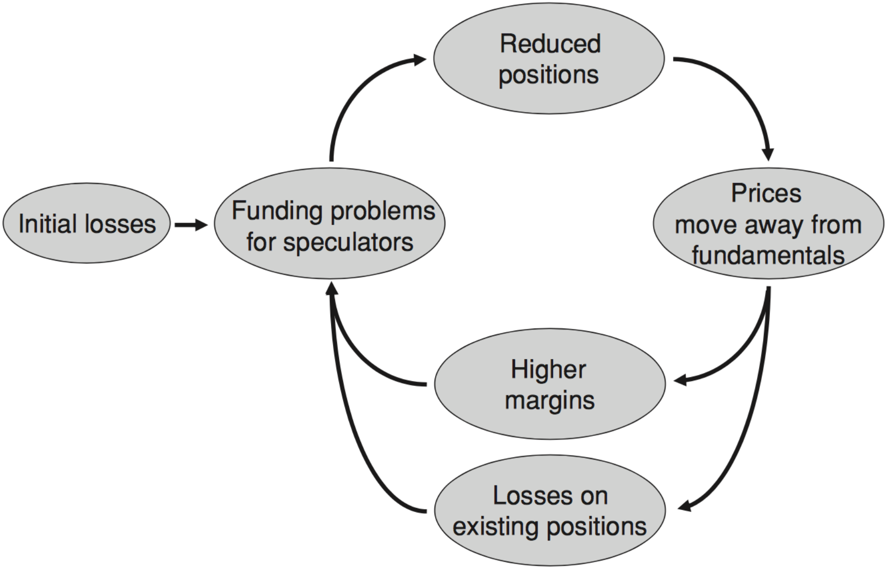
Outline

1. Market Liquidity
2. Funding Liquidity
3. Liquidity Crises

Liquidity Crises

- In a simple view of markets, trading stabilizes prices
  - If somebody gets in trouble and has to liquidate some assets ...
  - Somebody else sees this as a buying opportunity
  - *Negative feedback trading*: price drop creates buying, which pushes price up
- But market frictions can lead to unstable prices: positive feedback trading
  - Remember LTCM

Liquidity Spirals



Preparing for Liquidity Crises

- Fatalist view: when everything goes bad, there is nothing to do

- Some useful steps:
  - Plan for the lifetime of the strategy
  - Analyze correlation of strategy performance and funding conditions
  - Understand behavior of other participants in the markets: if everybody does the same thing, everybody will fall at the same time

- Even risk management regulations could generate liquidity crises!

Takeaways

- Liquidity problems can prevent ability to run a strategy or a business
- Stem from limited ability to:
  - Sell assets: market liquidity
  - Borrow to finance trade: funding liquidity
  - Both
- Liquidity risk is difficult to quantify ...
- But being aware of sources of liquidity and market environment can help