Leverage and Margin

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BUSI 448: Investments

Where are we?

Last time:

- Adverse Selection
- Market structure
- Liquidity

Today:

- Leverage
- Margin
- Repurchase agreements

Leverage

Leverage

Leverage is investing borrowed money.

- The return, good or bad, on every $1 of your own money is amplified.

Example

- Initial capital to invest of $100,000 + borrow $50,000
- Buy $150,000 of stocks

Assets		**Liab/Eq**	
Stocks	150,000	Debt	50,000
		Equity	100,000
Total	150,000	Total	150,000

- Leverage ratio $= \frac{\text{Assets}}{\text{Equity}}$
- Example is levered 1.5 to 1
- More jargon: 50% leverage

One possible future

Suppose the stocks go up 10% and you're charged 2% interest on the loan (rolled into the debt balance)

Assets		**Liab/Eq**	
Stocks	165,000	Debt	51,000
		Equity	114,000
Total	165,000	Total	165,000

- The return is 14% (114,000/100,000-1).
- You made 10% plus one half of (10% minus 2%) $= 0.10 + 0.5(0.10 - 0.02) = 0.14$
- "one-half" because you borrowed 50%.

Levered return

Let $w = \frac{\text{Debt}}{\text{Initial Equity}}$.

Levered portfolio return is:

$$-w \cdot r_{\text{borrow}} + (1 + w) \cdot r_{\text{stock}}$$

We can rewrite this as:

$$r_{\text{stock}} + w \cdot (r_{\text{stock}} - r_{\text{borrow}}) .$$

The return in the example is:

$$0.10 + 0.5(0.10 - 0.02) = 0.14$$

Another possible future

- Suppose the stocks fell by 10%.
- You lose 10% plus one half of (− 10% − 2%).
- So, your loss is 16% on your $100,000 investment.

Assets		**Liab/Eq**	
Stocks	135,000	Debt	51,000
		Equity	84,000
Total	135,000	Total	135,000

- Check: 84,000/100,000 -1 = -16%.

The good and the bad

- You always make the stock return plus the fraction borrowed times (stock return minus borrowing rate).
- With 50% leverage and a 2% interest charge,

$$+10\% \to +14\%$$

$$-10\% \to -16\%$$

Levered S&P Returns

- SPY with leverage in today's notebook

Margin

Margin

Margin: borrowing from your broker to purchase securities

- Percent margin = $\frac{\text{Equity}}{\text{Total Asset Value}}$
- **Initial margin** requirement set by the Fed's Reg T: 50%
  - Broker may set a higher initial margin requirement
- **Maintenance margin** requirement set by broker
  - Protects broker agains default by borrower if asset values drop.

Example with margin

Initial balance sheet

Assets		**Liab/Eq**	
Stocks	150,000	Margin loan	50,000
		Equity	100,000
Total	150,000	Total	150,000

$$\begin{aligned}\text{Percent Margin} &= \frac{\text{Equity}}{\text{Total Asset Value}} \\ &= \frac{100,000}{150,000} \\ &= 66.67\%\end{aligned}$$

Example with price drop of 10%

Balance sheet after stocks drop by 10% (and margin interest of 2% rolled into loan)

Assets		**Liab/Eq**	
Stocks	135,000	Margin loan	51,000
		Equity	84,000
Total	135,000	Total	135,000

$$\begin{aligned}\text{Percent Margin} &= \frac{\text{Equity}}{\text{Total Asset Value}} \\ &= \frac{84,000}{135,000} \\ &= 62.22\%\end{aligned}$$

Margin Calls

A **margin call** occurs when the percent margin falls below the maintenance margin set by the broker.

- Suppose the maintenance margin on the account in our example is 35%.
- How much could the stock value drop before a margin call occurs? (Ignore the interest expense on the margin loan.)

A margin call occurs when:

$$\frac{\text{Equity}}{\text{Total Asset Value}} < \text{Maintenance Margin}.$$

Margin Calls

- S_0 = initial stock value
- L = margin loan amount
- MM = maintenance margin percentage
- r = stock return

A margin call occurs when:

$$\frac{S_0(1+r) - L}{S_0(1+r)} < MM\,.$$

Solving for r:

$$r < \frac{L}{S_0(1-MM)} - 1.$$

Example

Margin call occurs if stock return is less than:

$$r < \frac{50,000}{150,000(1-0.35)} - 1 = -48.7\%$$

Balance sheet with -50% return

Assets		**Liab/Eq**	
Stocks	75,000	Margin loan Equity	50,000
			25,000
Total	75,000	Total	75,000

$$\text{Percent Margin} = \frac{25,000}{75,000} = 33.3\%$$

Margin Loan Rates

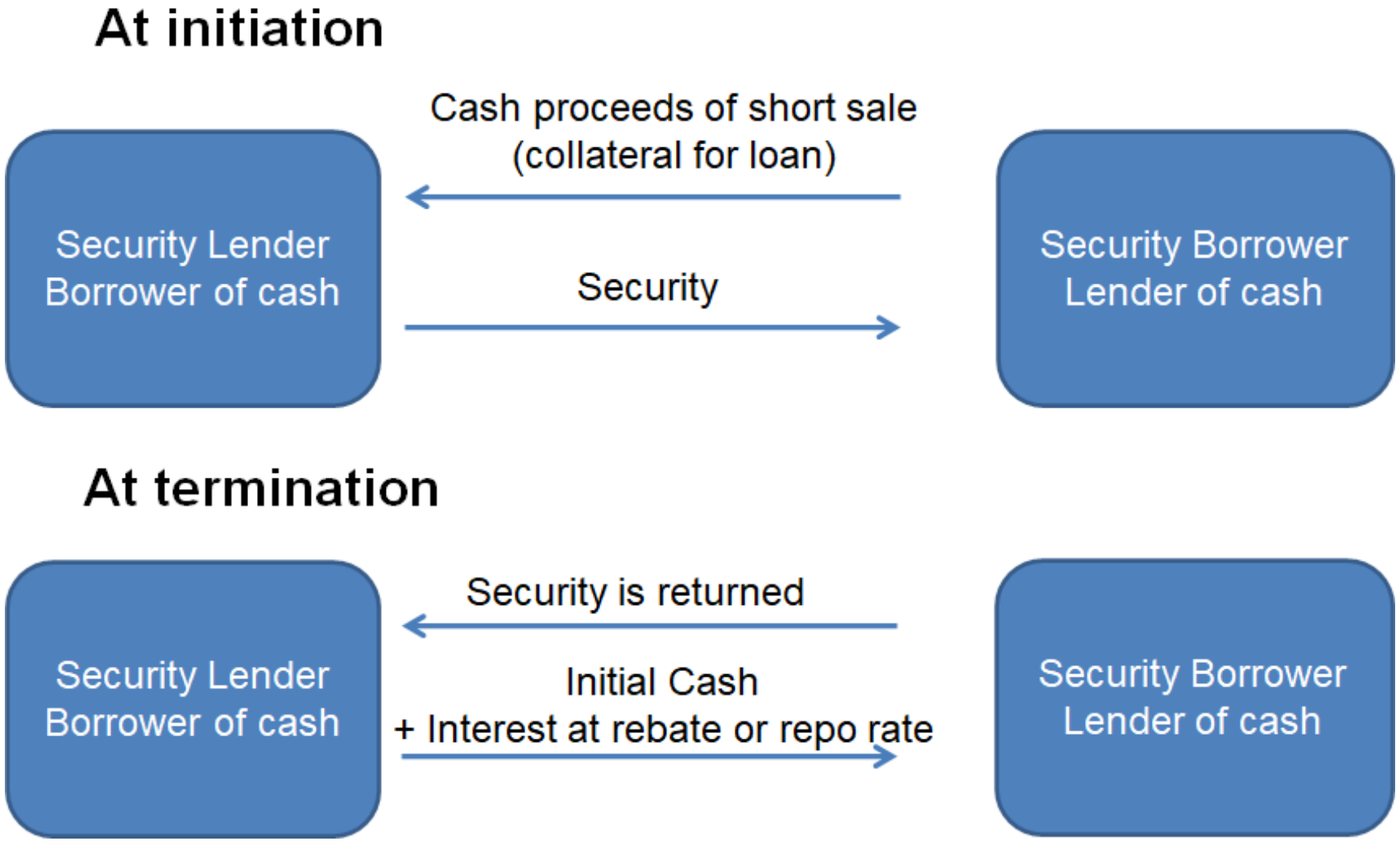
- It pays to shop around.
- Interactive Brokers charges
  - Fed Funds rate plus 1.5% on the first $100,000.
  - and falling further after that.
- Fidelity rate schedule

Repurchase agreements

Repurchase agreements (repos)

- Simultaneously sell a security and agree to repurchase the same, or similar, asset at a later date at an agreed price.
- A repo can be thought of as a collateralized loan
  - cash borrower pays the lender interest at the repo rate.
- Initial collateral is usually greater than the notional loan amount.
  - difference is a haircut or repo margin.

Repo transaction



Repo rates

$$\text{Repo rate} = \text{short-term rate} - \text{collateral-specific fee}$$

- **General collateral**: repo rates slightly below federal funds rate
- **Special collateral**: repo rates lower because cash lender (security borrower) wants a particular security
- Repo rates are lower:
  - higher credit quality bonds
  - more liquid bonds
  - harder to find bonds

Term of repos

- Repos are short-term
- Majority are overnight

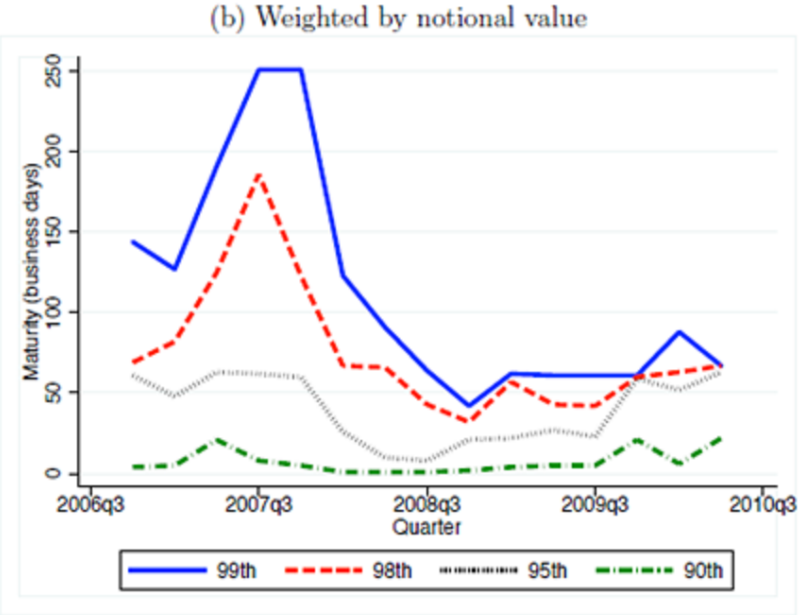


Figure 5: Percentiles of Repo Maturities

Source: Krishnamurthy, Nagel, Orlov

Numerical example

- A dealer needs to finance $20 million par value of 10-year Treasury notes for 1 day. The current market value of the securities is $19,576,026.65. A corporation is willing to take the other side of the repo at a repo rate of 6% with a 1% haircut.
- At initiation, the dealer surrenders the notes and receives $19,380,266.39 ($19,576,026.65*99%) in cash.
- In 1 day, the corporation returns the notes and is paid $19,383,496.43 in cash. The interest on the cash loan is calculated as 3,230.04 (19,380,266.39 · 6% · (1/360).

Credit risk and repos

- Both parties are exposed to credit risk.
- The cash lender is exposed to the possibility of default on the cash borrower's part.
  - If the market value of the collateral declines, the lender may have a loss.
- The cash borrower is exposed to the possibility that the cash lender cannot return the collateral (if the market value of the collateral increases)

Mitigating credit risks

- The haircut is designed to protect the cash lender. If the collateral market value declines, the lender may still be made whole if the drop is less than the haircut.
- Higher haircuts for riskier borrowers and/or less liquid collateral.
- Marking-to-market
  - if collateral MV declines, cash borrower can send cash or additional securities to the cash lender.
  - if collateral MV increases, cash lender can send cash or the collateral securities to the cash borrower

Empirical evidence on haircuts

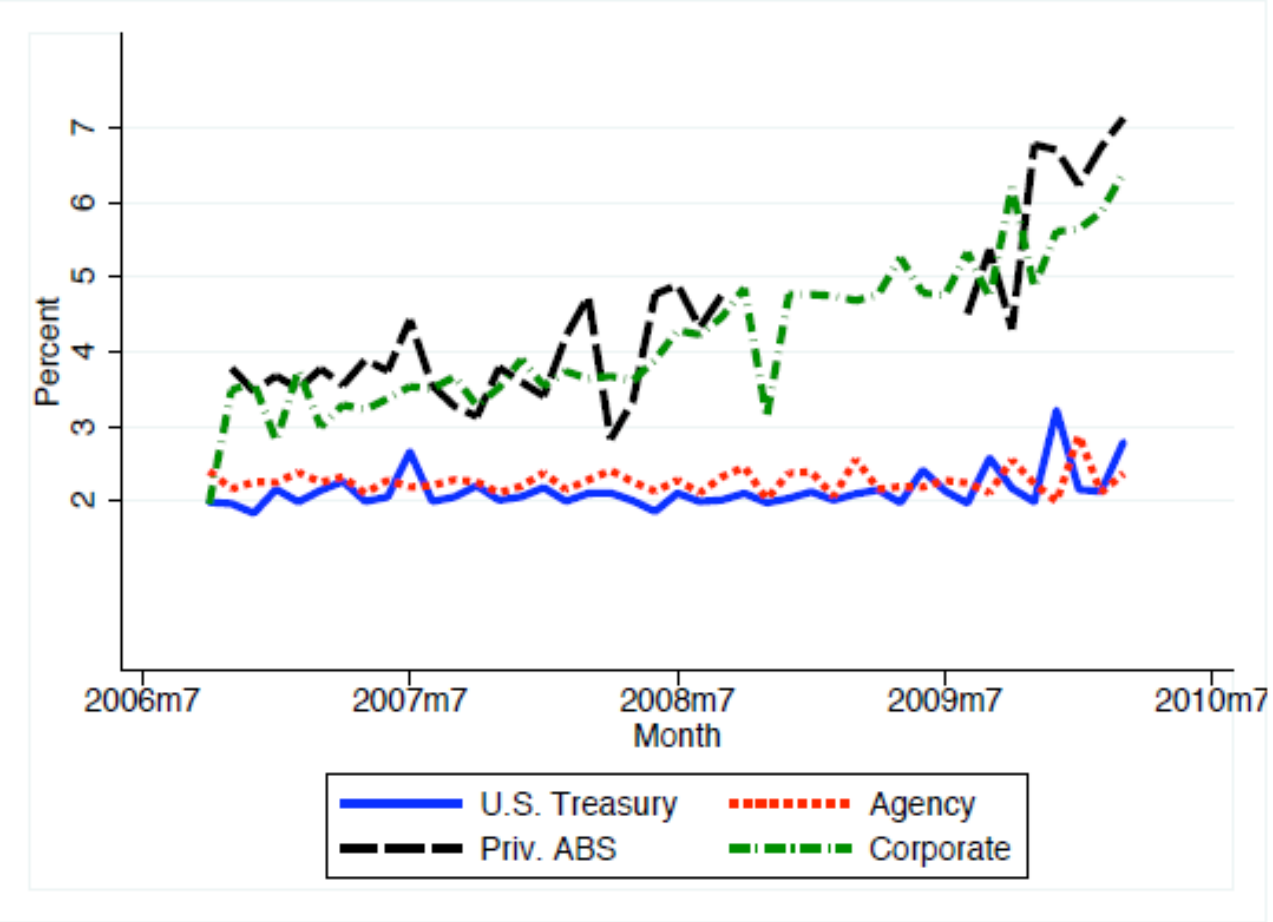


Figure 6: Haircuts by Collateral Type (weighted by notional value)

Source: Krishnamurthy, Nagel, Orlov

For next time: Short-selling + Limits to arbitrage