Capital Allocation

Reference: Bodie et al, Ch 6

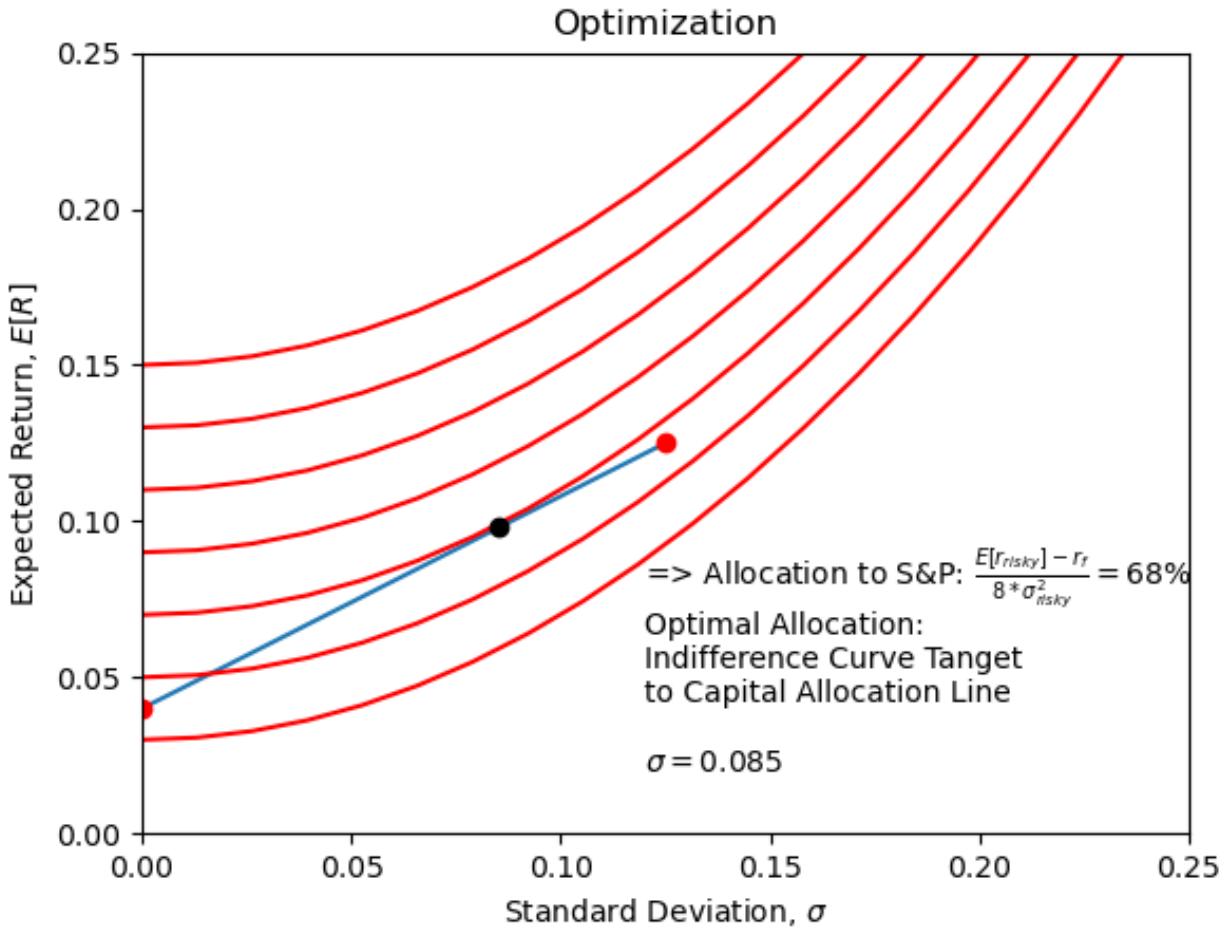
Econ 457

Week 3-b

Outline

1. Capital Allocation: Review
2. Capital Allocation: Practice
3. Leverage and Extending the CAL
4. Leverage in Practice
5. Margin Calls
6. LTCM 1998
7. Excel

1. Capital Allocation: Review



2. Capital Allocaiton: Practice

Practice Questions

You manage a risky portfolio with expected rate of return of 12% and a standard deviation of 28%. The T-Bill rate is 2%.

1. You clinet chooses to invest 70% of a portfolio in your fund and 30% in a risk-free money market fund. What are the expected return and standard deviation on her portfolio?
2. What is the reward-to-volatility (Sharpe) ratio of her portfolio? Of your risky portfolio? (Hint: draw the CAL, what is the slope? Where is your client's portfolio?)
3. Suppose your client instead chooses to invest a proportion y that maximizes the expected return, subject to the constraint that the complete portfolio standard deviation will not exeed 12%. What is in the invested proportion y? What is the expected return?
4. Your client's degree of risk aversion is $A = 3.5$. What proportion y should they invest in your fund?

2. Capital Allocaiton: Practice

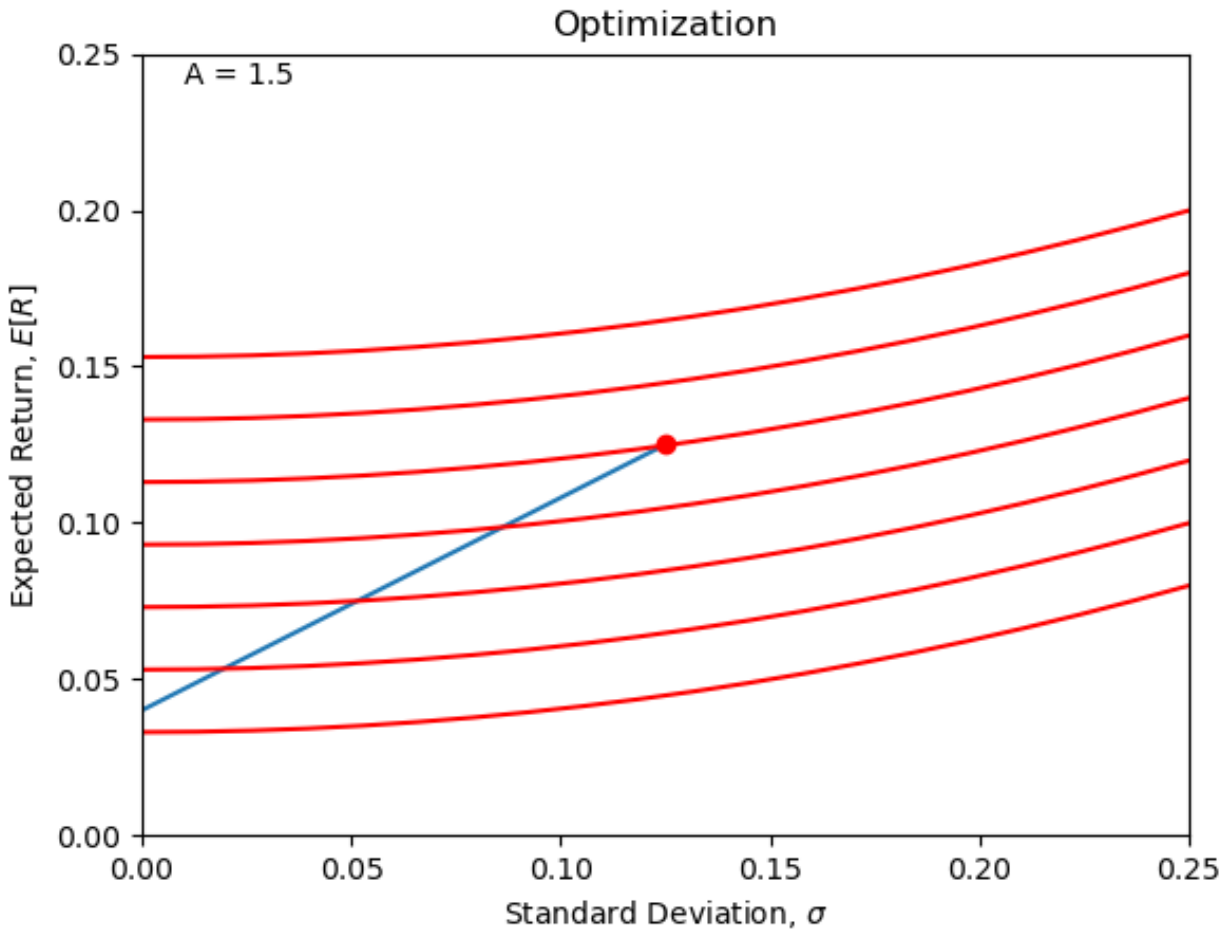
Practice Questions

Consider a risky portfolio with $\mathbb{E}[r_p] = 8\%$ and $\sigma_p = 15\%$. The risk free rate is 2%.

5. Your client wants to invest a proportion of her budget in this fund to get a a rate of return on her overall portfolio of 5%. What proportion of her total portfolio should she invest in the risky fund?
6. What will the standard deviation be on her total portfolio?
7. Another client wants the highest return possible, subject to the constraint that you limit the standard deviation to be no more than 12%. Which client is more risk averse?

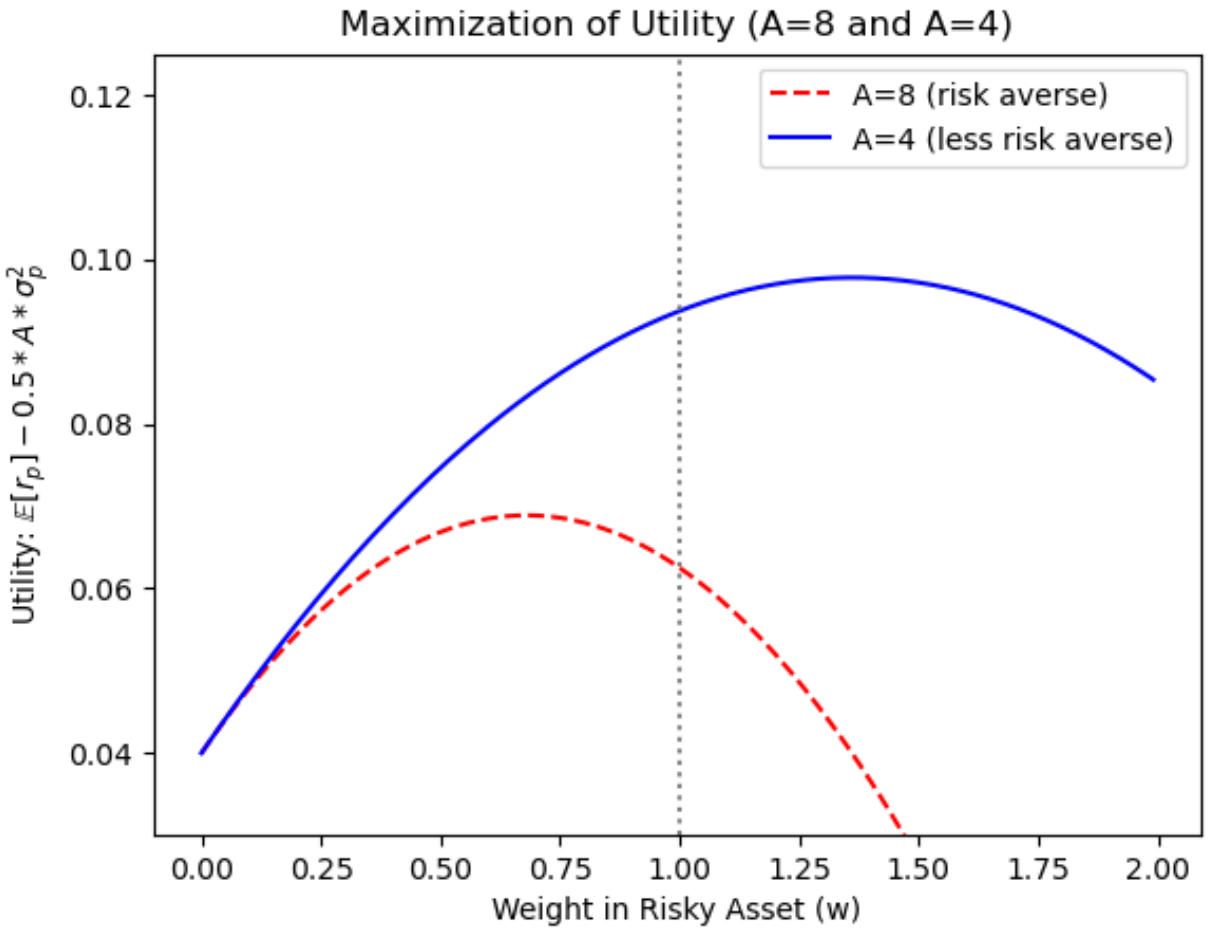
3. Leverage and Extending the CAL

Risk Lovers



3. Leverage and Extending the CAL

Risk Lovers



3. Leverage and Extending the CAL

Cost of Leverage

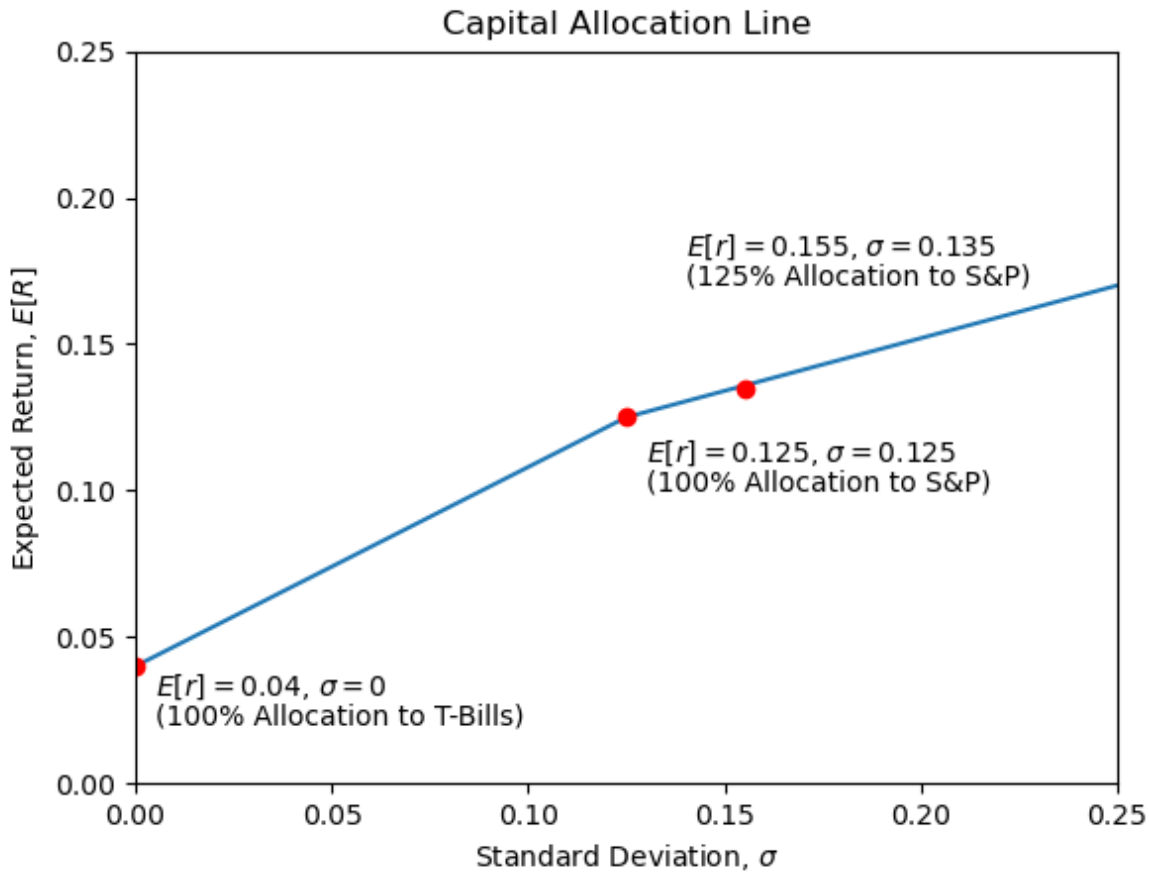
Leverage involves borrowing money in order purchase more assets. Leverage makes it possible to attain higher expected returns, with additional risk.

Typically borrowing has an associated cost. The cost depends on the riskiness of the assets being purchased (more on this below). For a broad basket of equities, the cost of borrowing is typically close to the risk-free rate.

3. Leverage and Extending the CAL

Cost of Leverage

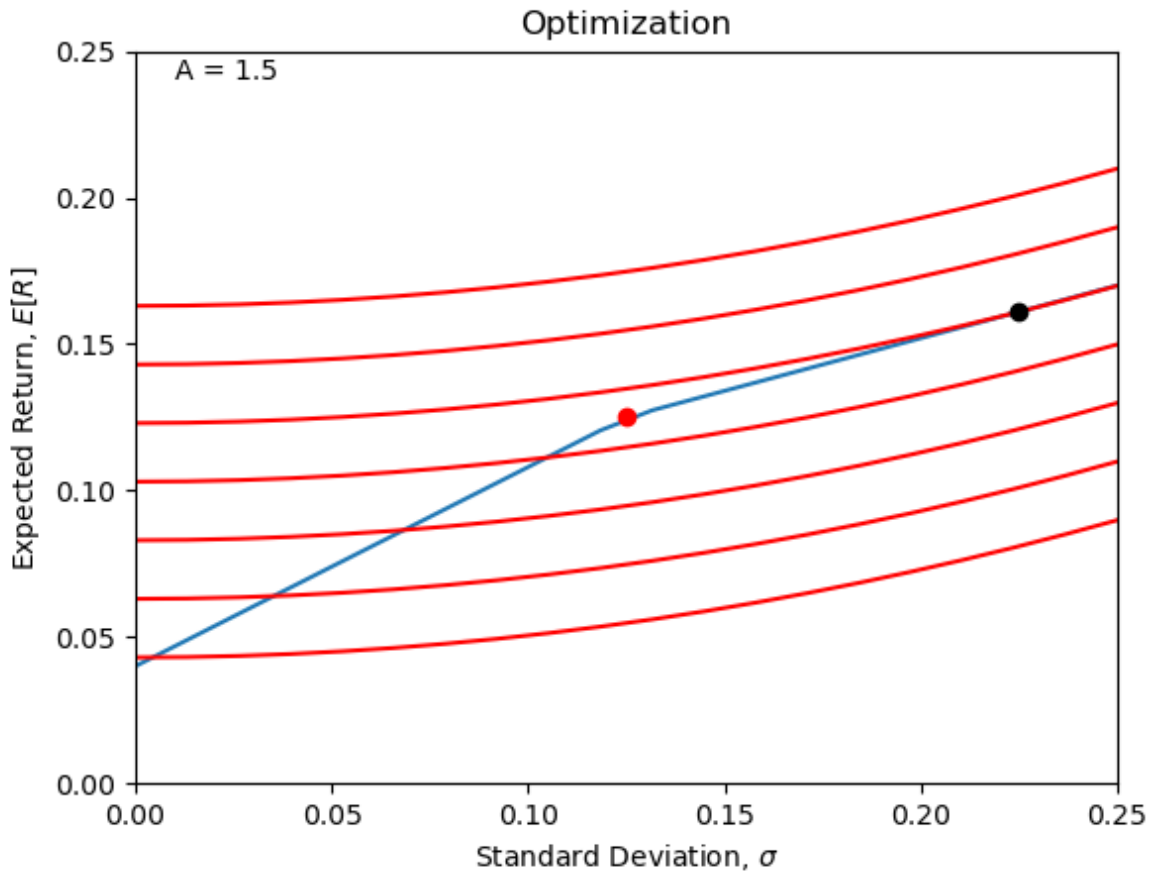
The slope of the line to the right of the CML is $\frac{E[r_{risky}]-2\cdot r_f}{\sigma_{risky}}$, in order to account for the cost of borrowing.



3. Leverage and Extending the CAL

Graphic Representation and Optimization

Extending the CAL matters for risk-loving prefernces (low A values). Can consider leverage in cases when $w^* = 100\%$.



3. Leverage and Extending the CAL

Caution

Assumptions in CAL Model

Be careful, the capital allocation process described so far makes two very strong assumptions, both of which are based, in part, on a assumption of normally distributed returns:

1. Investor preferences are determined by *only* the mean and variance of returns. Investors are ”mean-variance optimizers.”
2. The cost of leverage is *only* the cost of borrowing (here $2 * r_{rf}$).

In fact, investors probably also care about the probability of bankruptcy (probability in the tails). The true cost of leverage may be that it introduces a vulnerability that can exacerbate losses.

4. Leverage in Practice

Examples

Three prominent examples of leverage in practice:

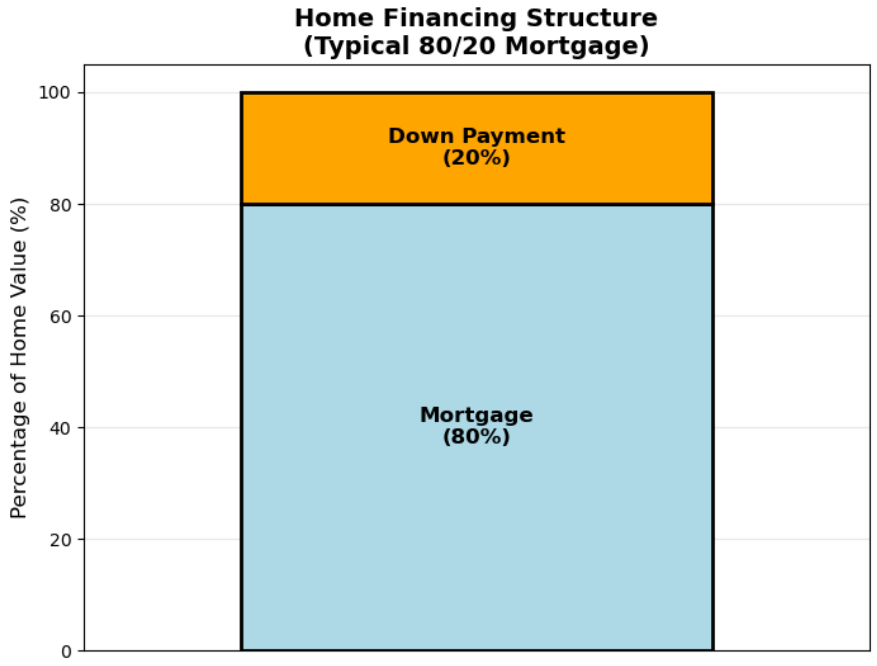
1. Housing
2. Banking
3. Buying Assets on Margin

4. Leverage in Practice

Housing

The typical mortgage requires a 20% downpayment. The remaining 80% of the cost of the house is borrowed.

The leverage ratio is 5:1 (total cost / amount of equity).



4. Leverage in Practice

Housing, cont'd

Example:

- You buy a house for $1,000,000.
- You make a 20% downpayment ($200,000)
- You finance the remainding $800,000 with a 7% mortgage.

Table: Example Home Ownership Returns

Scenario	Price Change	Interest Cost	Return on Equity
HPI +10%	$100,000	$56,000	22.0%
HPI +20%	$200,000	$56,000	72.0%
HPI -10%	-$100,000	$56,000	-78.0%

4. Leverage in Practice

Banking

Banks are required to be financed with $\sim$10% equity capital.

While it varies widely with the bank, the remainder is financed with a mix of deposits, which are really short term loans, and unsecured debt.

Banks are typically levered around 10:1 (total assets / equity capital)

4. Leverage in Practice

Banking, cont'd

The core business of banking is making loans to households and businesses. The rate on these loans is, say, around $r_f + 500bps$ (it varies widely with the credit quality, maturity, etc). If the bank finances these loans using unsecured debt, the cost of borrowing is, say, around $r_f + 200bps$ (again, varies widely). The banks' net interest margin on the loan is $300bps$. The bank must also account for charge-offs and costs associated with making loans. Let's say those are an additional $200bps$. The total return for the bank, after expenses, is $100bps$. *This is not a particularly high return.*

The banks return on equity, on the other hand, is much higher. Because the leverage ratio is 10:1, if the bank makes $100bps$, then the equity holder would make 10%!

While this example is purely for illustration, and reality is more complex, it does reflect the basics of the banking business model.

4. Leverage in Practice

Banking, cont'd

FDIC QUARTERLY

TABLE I-A. Selected Indicators, All FDIC-Insured Institutions*

	2025**	2024**	2024
Return on assets (%)	1.16	1.09	1.12
Return on equity (%)	11.58	11.23	11.37
Core capital (leverage) ratio (%)	9.38	9.18	9.28
Noncurrent assets plus other real estate owned to assets (%)	0.54	0.49	0.55
Net charge-offs to loans (%)	0.67	0.65	0.68
Asset growth rate (%)	2.42	1.02	1.84
Net interest margin (%)	3.25	3.18	3.22
Net operating income growth (%)	10.93	-20.18	2.25
Number of institutions reporting	4,462	4,568	4,487
Commercial banks	3,917	4,012	3,941
Savings institutions	545	556	546
Percentage of unprofitable institutions (%)	6.36	6.90	6.84
Number of problem institutions	63	63	66
Number of failed institutions	1	0	2

* Excludes insured branches of foreign banks (IBAs).
** Through March 31, ratios annualized where appropriate. Asset growth rates are for 12 months ending March 31.

5. Margin Calls

Buying Assets on Margin

When investors borrow money to purchase asssets, the lender (often a broker) typically requires them to post collateral or 'margin', which acts as surety for the lender.

The margin requirements may vary with the riskiness of the assets being purchased. For common stocks the requirements may be 50% initial margin and then 30% maintenance margin.

If the stocks that were purchased fall in price, the value of the posted margin declines as well. If the value falls below the maintenance margin, the investor is forced to post additional margin, or the broker will close the position. This is known as a "margin call".

5. Margin Calls

Buying Assets on Margin

Margin is calculated as the owners' equity divided by the value of the assets owned in the account.

If you have \$10,000 of equity to fund a margin account, assuming a 50% initial margin, you can buy \$20,000 worth of assets.

In order to see where the margin call would happen, note that maintenance margin requirement can be expressed as:

$$\frac{\$20,000 * (1 + r) - \$10,000}{\$20,000 * (1 + r)} > 30\%$$

If that requirement is violated, you must either deposit more equity or the positions will be closed at a loss.

5. Margin Calls

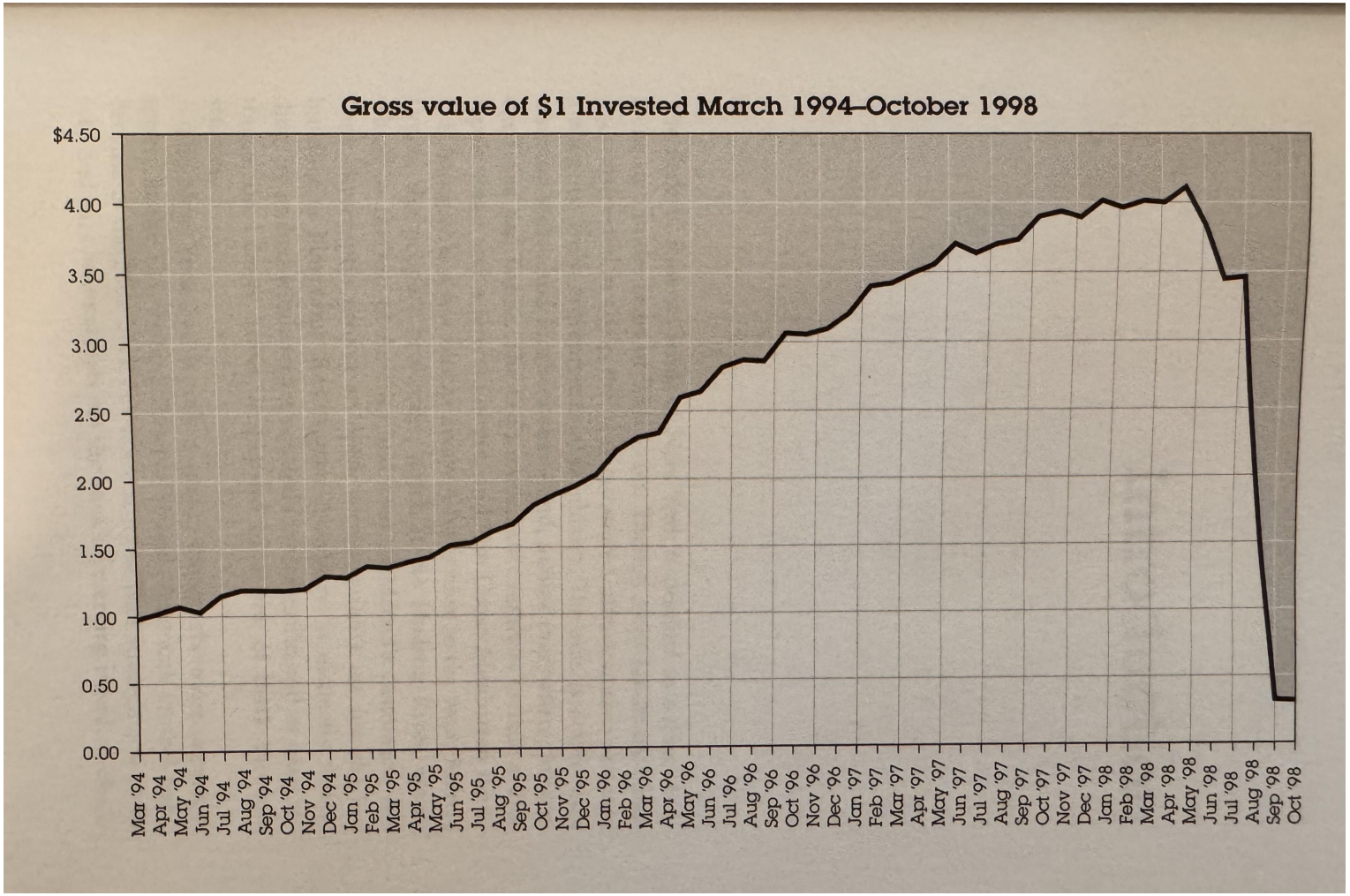
Buying Assets on Margin, example

You buy $100 of stock by borrowing $50 from your broker. The following table summarizes your results, ignorning interest costs for simplicity:

Table: Margin Trading Example: $100 Stock, $50 Equity, $50 Borrowed

Scenario	Stock Value	Equity Value	Return on Equity	Margin Call
Initial	$100	$50	–	NO
Stock +20%	$120	$70	40.0%	NO
Stock +10%	$110	$60	20.0%	NO
Stock -10%	$90	$40	-20.0%	NO
Stock -20%	$80	$30	-40.0%	NO
Stock -30%	$70	$20	-60.0%	YES
Stock -40%	$60	$10	-80.0%	YES

6. LTCM in 1998



Source: *When Genius Failed*, Roger Lowenstein, Random House, 2000

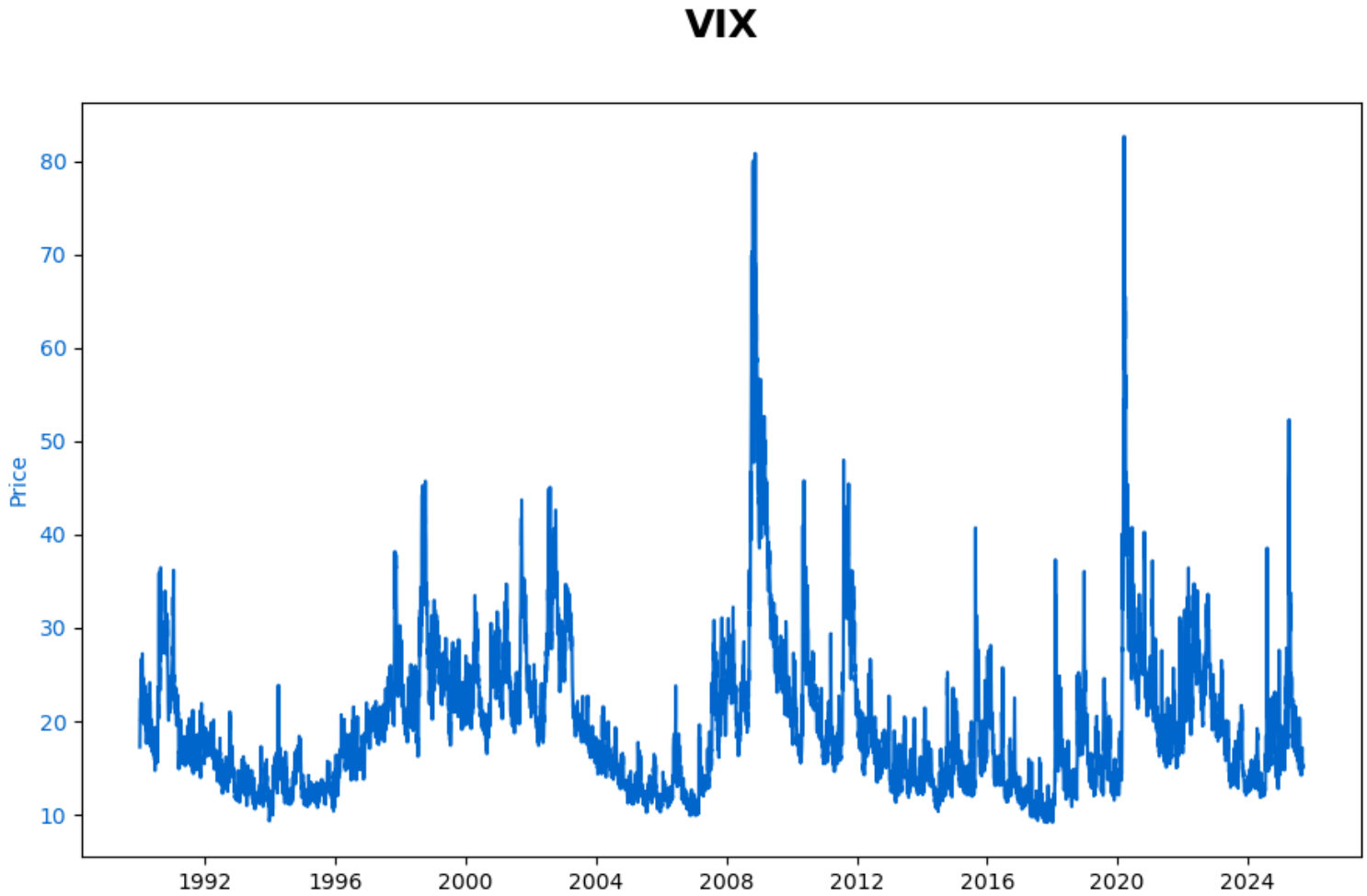
6. LTCM in 1998

Table: LTCM Losses by Position

Trade	Loss
Russia and Emerging Markets	$430 million
Directional Trades	$371 million
Equity Pairs	$286 million
Yield Curve	$215 million
S&P Stocks	$203 million
High Yield Bond Arbitrage	$100 million
Merger Arbitrage	roughly even
Swap Spreads	$1,600 million
Equity Volatility	$1,300 million

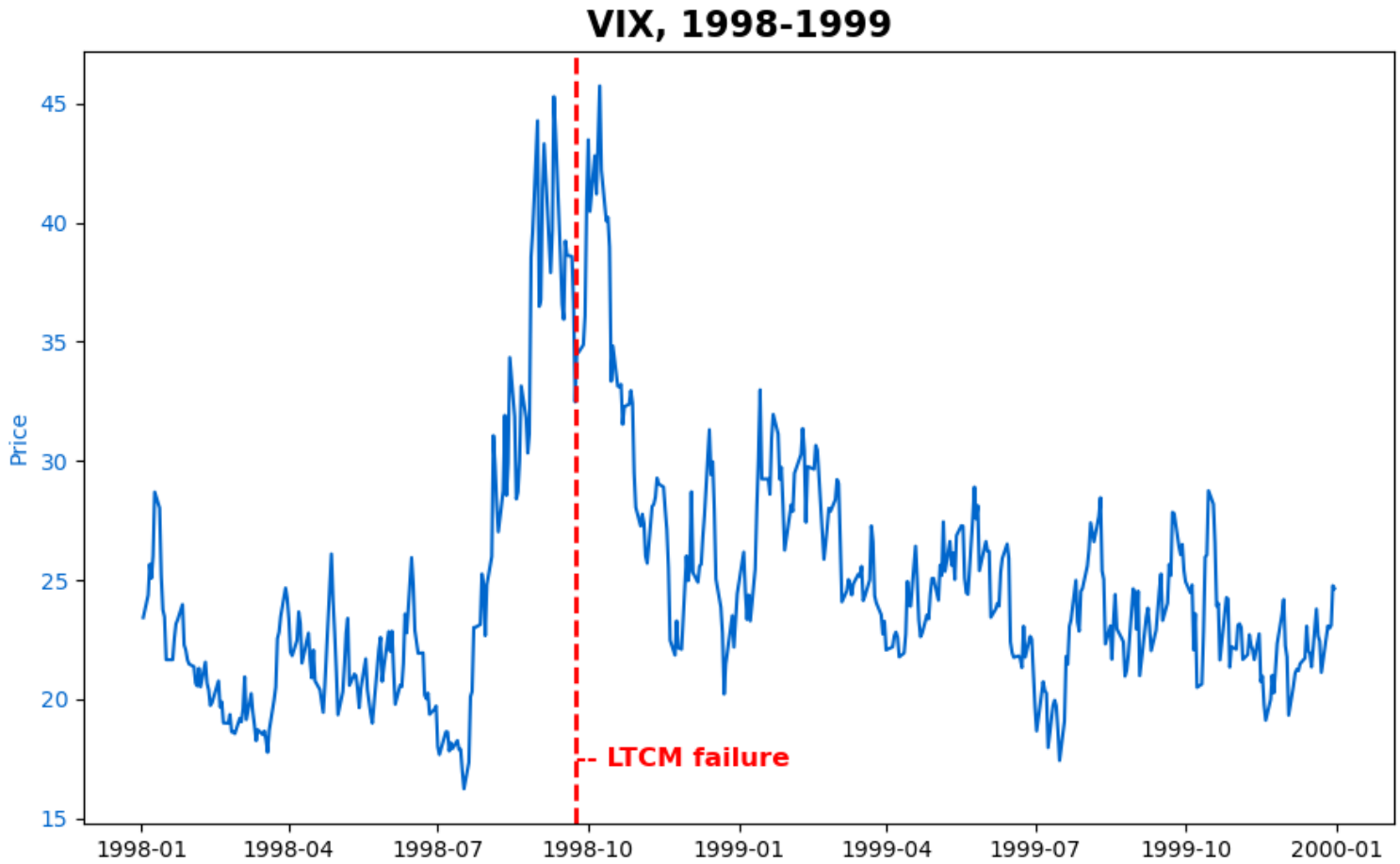
Source: *When Genius Failed*, Roger Lowenstein, Random House, 2000, page 235

6. LTCM in 1998



VIX Index is calculated by the CBOE. Data from Yahoo Finance

6. LTCM in 1998



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REVIEW: The Normal Distribution

Foundation Material

Empirical Estimates

Empirical mean:

$$\bar{x} = \frac{1}{T}\sum_{t=1}^{T} x_t$$

Empirical variance:

$$s^2 = \frac{1}{T-1}\sum_{t=1}^{T}(x_t - \bar{x})^2$$

Empirical standard deviation:

$$s = \sqrt{s^2} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(x_t - \bar{x})^2}$$

REVIEW: The Normal Distribution

Empirical Estimates

Empirical covariance:

$$\text{Cov}(x, y) = \frac{1}{T-1} \sum_{t=1}^{T} (x_t - \bar{x})(y_t - \bar{y})$$

7. Excel

- AVERAGE()
- STDEV()
- VAR.P()
- COVARIANCE.P()
- SUMPRODUCT()