

# The Financial Facts of Life

(Welch, Chapter 07)

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Did you bring your calculator? Did you read these notes and the chapter ahead of time?

# Maintained Assumptions

In this part (consisting of three chapters), we maintain the assumptions of the previous chapter:

- ▶ We assume **perfect markets**, so we assume four market features:
  1. No differences in opinion.
  2. No taxes.
  3. No transaction costs.
  4. No big sellers/buyers—infinately many clones that can buy or sell.
- ▶ We already allow for unequal rates of returns in each period.
- ▶ We already allow for uncertainty. So, we do *not* know in advance what the rates of return on every project are.
- ▶ **But we no longer assume risk-neutrality. We will henceforth allow for risk aversion.**

## First Part: A “Tour”

- ▶ The intent of this part of the course is to summarize the basics of an investments course within the context of our corporate finance course. We only have a few lectures available, in which we will have to cover a great deal of material:
  1. Basic historical return patterns.
  2. What risk aversion does.
  3. How to measure risk and reward.
  4. The CAPM formula and its inputs. How to use it.

The most important part of investments in our corporate finance perspective is the determination of  $E(r)$  in the NPV formula. Of course, to become a real financier, you really should take a full investments course, and not just live with this summary. However, even if you have already taken an investments course, seeing the material here again could still be a useful reminder for you.

## Asset Classes

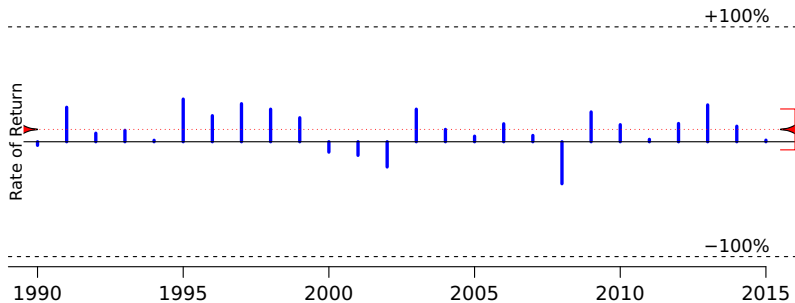
Asset classes are convenient portfolios that try to represent a swath of investment types—though inaccurately so. Examples are:

- ▶ Stocks: Large-firm stocks, Small-firm stocks, Foreign stocks, Value stocks, ...
- ▶ Bonds: Long-term bonds, Risky bonds, Foreign bonds, Mortgage bonds, ...
- ▶ Short-Term: Cash, Foreign Currency, Short-term bonds, ...
- ▶ Real Estate: Commercial, Retail, West-Coast, Russian, ...
- ▶ Art: Paintings, Renaissance sculpture, Rare Books, ...
- ▶ Commodities: Eggs, Bacon, Crude, ... Precious Metals: Gold, Silver, Platinum, ... Agricultural: Land, Grain, ...

## The S&P500 (with dividends), 1970-2015

Decade 2nd Part	Year				
	0 5	1 6	2 7	3 8	4 9
1970	3.5%	14.1%	18.7%	-14.5%	-26.0%
1975	36.9%	23.6%	-7.2%	6.4%	18.2%
1980	31.5%	-4.8%	20.4%	22.3%	6.0%
1985	31.1%	18.5%	5.7%	16.3%	31.2%
1990	-3.1%	30.0%	7.4%	9.9%	1.3%
1995	37.1%	22.7%	33.1%	28.3%	20.9%
2000	-9.0%	-11.9%	-22.0%	28.4%	10.7%
2005	4.8%	15.6%	5.5%	-36.6%	25.9%
2010	14.8%	2.1%	16.0%	32.5%	13.5%
2015	1.5%	?			

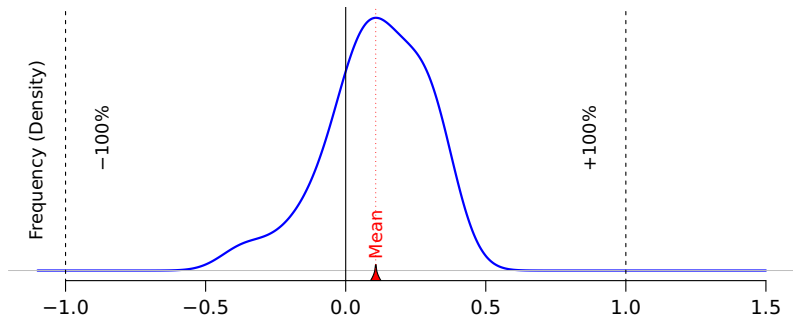
# Time-Series Plot, 1990-2015



Average Rate of Return = 10.7% per year.

Annualized = 9.2% per year.

## Histogram Plot, 1990-2015



Average Rate of Return = 10.7% per year.

Annualized = 9.2% per year.

Standard Deviation = 12.6% per year.

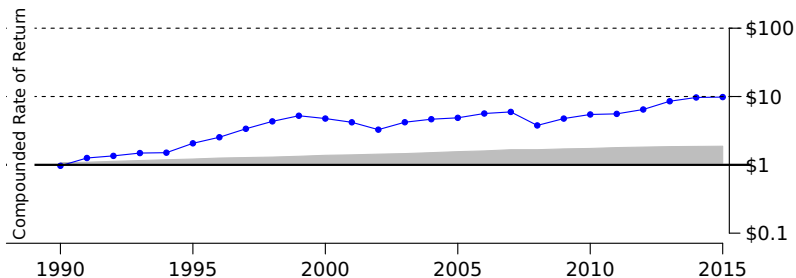
Is the **average** rate of return on an investment a good representation of the long-run rate of return that a buy-and-hold investor receives?



Compare two assets, A and B. They had equal average rates of return. However, A had a higher standard deviation than B. You are not risk-averse. Which investment would have earned you more money?

Is it possible to lose all your money on a buy-and-hold portfolio that had a positive average rate of return?

# Cumulative Performance Plot for Stocks, 1990-2015



End Result: \$1 in Jan 1990 became  $\approx$ \$10 in Dec 2015.

(More accuracy is senseless, because different market portfolios come out with slightly different results.)

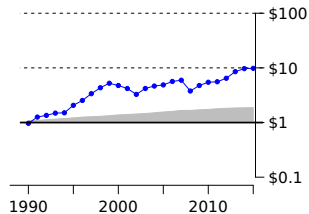
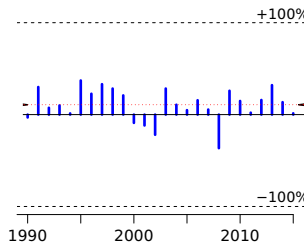
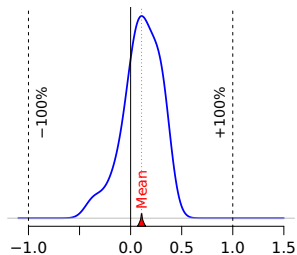
# Stocks

\$1 → \$9.82

Geo: 9.2%/yr.

Ari: 10.7%/yr.

SD=18%/yr



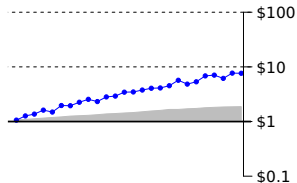
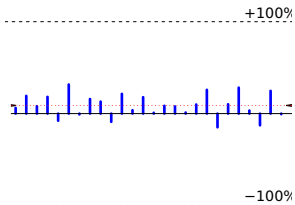
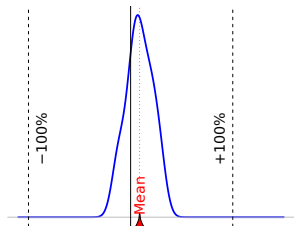
# Bonds

\$1 → \$7.64

Geo: %/yr.

Ari: 8.1%/yr.

SD=13%/yr



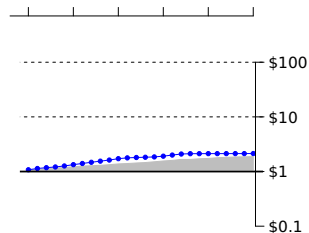
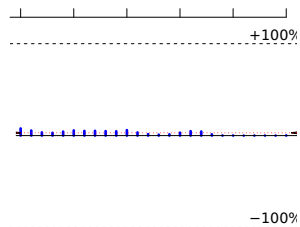
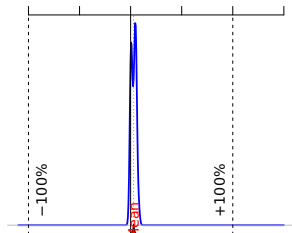
# Cash

\$1 → \$2.14

Geo: %/yr.

Ari: 3.0%/yr.

SD=2.4%/yr



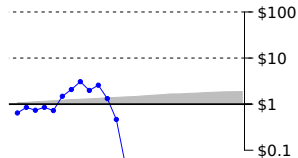
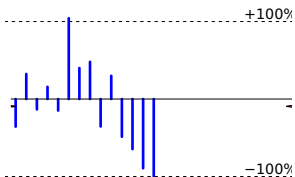
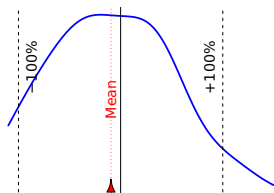
# Stock UAL

\$1→\$0

Geo: %/yr.

Ari:  $-9.4\%/yr.$

SD= $8\%/yr$



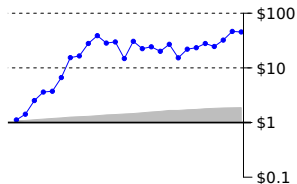
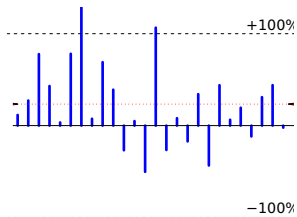
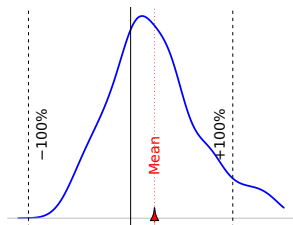
# Stock INTC

\$1→\$45

Geo: %/yr.

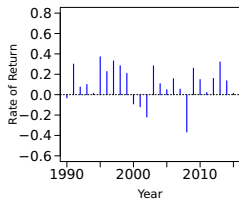
Ari: 23%/yr.

SD=18%/yr

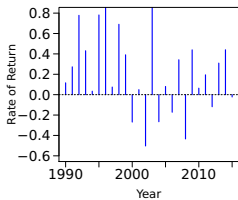




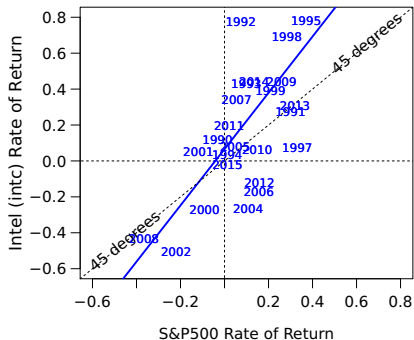
# Correlation and (Market-) Beta



**S&P500**



**Intel**



Which asset classes generally offer higher average rates of returns?

Which asset classes (and stocks) were riskier?

Could you have lost your shirt?

Is there a risk-return relationship?

Do assets with a positive average rate of return always make you money?

Do stocks move together? Intuitively, can we exploit any non-synchronicity?

Is there anything special to multiple-stock investments?



Can you trust history?

## History vs. Future — AGAIN

- ▶ Finance has one huge advantage relative to other fields of economics—we have lots of data!—not clear how useful it is, but we have it!
- ▶ Statisticians often pretend historical distribution (means, standard deviations, betas, etc.) are representative of the future distribution. That is, one should not pretend that we can judge a powerball gamble's outcome by how it did last week, but that we can judge a a powerball risk and reward by how it did over the last many thousands of weeks.
  - ▶ if we know the physics of ball drawing, we don't even need any history. we can then work out the expected risk and expected reward mathematically. alas, we do *not* know the underlying physics of financial investments, so we work with historical data.
- ▶ Historical data is helpful—but it can also mislead if it is not used carefully.
- ▶ Correlations and variances are more “stable” (“reliable”) than historical average rates of returns. Tail risk is tough.
- ▶ **The only reason why we use historical data is because the alternative is no data and this would be way worse.**

## Geometric and Arithmetic Returns: How To Extrapolate Over 20 Years?

- ▶ How do you “roughly” translate geo to ari returns and vice-versa?
  - ▶ **If** rates of returns are approximately normally distributed, then the ari mean is higher than the geo mean by about half the variance.
  - ▶ Stocks here:  $10.7\% - 18\%^2/2 \approx 9.1\%$ . Correct  $\approx 9.2\%$ .
- ▶ There are some not-so-obscure issues how to think about historical rates of returns for predicting future geometric and arithmetic rates of return. Explained in the book. Often neglected. Tricky statistical problem.

# Causality vs. Correlation

- ▶ This is one of the most important questions in finance, economics, and business. Does correlation mean causation?
- ▶ 80% of consultant reports get this wrong — often deliberately to fool their clients.
- ▶ Regression Discontinuity is unusually good at empirical evidence, but not all questions can be addressed by it.

## Market Institutions — Read the book

- ▶ Brokers: Retail B vs. Prime B. (Execution and Margin.)
- ▶ Market vs. Limit orders.
- ▶ Various modifications: Fill-or-kill, Good for the day, etc.
- ▶ Exchanges and non-Exchanges. In-person or computerized, batched auction or continuous, electronic crossing. OTC. (Pink sheets.)
- ▶ Regulation: Congress, SEC, Exchanges(?!).
- ▶ Seeing the order book is huge advantage. (Tell Anand Madhavan's experience on the trading floor.)
- ▶ Mutual Funds (more funds than stocks today!)
- ▶ Open-end vs. closed-end distinction.
- ▶ Investment companies under the 1940 Act: UITs, open-end=mutual fund in the US, closed-end.
- ▶ Many other investment vehicles, e.g., hedge funds, private equity funds, venture capital funds, ADRs, trust funds, etc. (Talk about trust accounts and churning.)
- ▶ Entry of corporate securities into the financial markets: IPOs, underwriters, reverse mergers, SEOs.
- ▶ Exit of corporate funds from the financial markets: Dividends, repurchases, delisting, limited liability, financial distress.

# The Egg Approach to Investing

and the egg-ilibrium .

## Egg Merchandise

- ▶ The insights of investments apply to business products, just as they apply to financial investments.
- ▶ Your problem: Choose a portfolio of products (eggs) to bring to the market for sale.
  - ▶ You do not know before you stock your basket which eggs will sell—but you have a good idea which eggs tend to sell better than others on average.
  - ▶ Some products have higher likelihood of selling, others have lower likelihood of selling.
  - ▶ For your customers, egg products have a fashion aspect—some types will be highly desirable, others less so.
  - ▶ (They could be imperfect substitutes for one another.)
- ▶ We assume perfect markets: there are a large number of sellers and buyers.
- ▶ Let's presume you care about your overall risk and reward.

Do you care about overall basket risk and reward, or do you care about the risk and reward of each egg in your basket individually?



Should you purchase just the most likely egg to sell?

Should you go out of the business entirely?

Should you purchase a mix of different products?

Consider a completely different type of product, which is very risky in itself. That is, you do not think it will sell. If you have purchased just the most likely product seller, what is your risk of having one completely different product in your basket?

(Equilibrium:) How much would you be willing to pay for the completely different type of product on the margin?

# Eggs and Markets

- ▶ First, you have to understand portfolio selection. Given the prices and probabilities of when what eggs will sell, how would you optimally stock your basket?
  - ▶ If an asset is very different from all other assets (it pays off when other assets do not pay off), then you are willing to buy this asset for a higher price (expecting a lower return) than you would otherwise.

In the context of investment theory, you should like assets that (a) pay off often; and (b) pay off big when other assets do not. This topic is called **optimal portfolio choice** and is the subject of the Chapter 8. If you are only an investor, you are done.

- ▶ Then, after you have understood what everyone wants, you have to understand how the prices of eggs will adjust to the many people that want to stock baskets.
  - ▶ If every seller wants the rare purple egg because it is so different from all the other eggs, then its price will be bid up.

The CAPM is the model that tells us how risk and reward are related to

- ▶ how individual products are expected to perform
- ▶ how individual products are different from others.

This is the subject of the Chapter 10. If you are a corporate CEO, you must think about what eggs you want to make—i.e., what projects you want to offer to investors that like eggs that (a) pay off often and (b) pay off when other eggs do not.