Zombie Theories of Finance

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Welcome to the second part of EC2024

Admin

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- Office hours: Thursdays 9-11, S1-20, no appointment needed

Second part Outline

- Zombie Theories of Finance
- Finance, Innovation and growth: Schumpeter vs Romer. A case of technological change
- Finance and Development 1: Microfinance: holy grail of development finance?
- Finance and Development 2: Swaps and CDS as a good thing?
- Algorithmic trading, high frequency finance: the case of the flash-crash
- Ethical Finance: doing good and making money at the same time? (SK)

Today

1. 'Theories' of finance
2. Portfolio Selection Theory
3. Capital Asset Pricing Model
4. Efficient Market Hypothesis

Outline

History, 1

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- 1964. Sharpe. Single-Factor Asset Pricing Risk/Return Model

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- 1990s. Dot com boom.
- 2007-20??. International financial crisis.

Outline

Risk, Return, Portfolios, and Diversification: Assumptions

1. Agents prefer more to less
2. Agents are risk averse

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4. Individuals are too small to affect the distribution of the security held
5. Portfolio theory only concerns existing assets, not those contracted for in the future.
6. Full information abounds.

Risk/Return

1. Risk can be defined as the chance of financial loss or gain. More formally, risk can be considered as the variability of returns associated with a given asset.
2. The total return (R) on an asset is the ration of the amount received X_1 to the amount invested,X_0, so $R = X_1/X_0$.

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5. $r = 100 - 97/97 = 0.0309$.

Expected Returns

- Suppose X is a random quantity that can take on a number of values discretely, $x_1, x_2, \ldots x_n$, and these values occur with frequency probabilities $p_1, p_2, \ldots p_n$. The expected value of X is

$$E(X) = \sum_{i=1}^{n} p_i x_i \tag{1}$$

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In class example

1 asset, 3 outcomes A, B, C. $R_A = 10\%$, $R_B = 4\%$, $R_C = -7\%$. Prob$R_A = 0.2$, Prob$R_B = 0.7$, Prob$R_C = 0.1$. Calculate overall $E(r)$

Standard deviation of the rate of return

- The variance of return is the weighted sum of squared deviations from the expected return.

$$\sigma_i^2 = P_1[r_1 - E(r_1)^2)] + P_2[r_2 - E(r_2)^2] + \ldots + P_n[r_n + E(r_n)^2] \quad (2)$$

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Covariance/Correlation

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Absolute measure of the degree of association between the returns for a pair of securities. EG: Seasonal Demand for Ice Cream & Chocolate.

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Correlation

Causal relationship–positive or negative. If positively correlated, say, series move in the same direction.

Portfolios

Definition

Portfolio is just a collection of assets. People normally hold more than one risky asset, and we can look at the returns to each asset individually, or as the weighted sum of these assets times their risk. Each weight w of each asset i gives the fraction of your wealth you spend on maintaining asset is in your portfolio.

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Let the total risk of the portfolio be given by r_p. Then

$$r_p = w_1 r_1 + w_2 r_2 + \ldots + w_n r_n = \sum_{i=1}^{n} w_i r_i. \tag{3}$$

(These weights must sum to one.)

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Idiosyncratic Risk

- specific to firm/sector
- eg. Steve Jobs/Apple

Systematic risk

- can't be eliminated through diversification
- Factors affecting all assets– energy prices, interest rates, inflation, business cycles, etc

Risk with N assets

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5. This will form the basis for CAPM.

Outline

CAPM

Idea

CAPM quantifies tradeoff between risk and expected return. Look for the minimum standard deviation or risk that can be obtained at each level of expected return. 'Best' combination of risk and return is called the Efficient Frontier.

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Put another way

Expected return on any asset is a positive linear function of its beta and that beta is the only measure of risk needed to explain the cross-section of expected returns.

More formally

Recall:

$$r = \frac{\text{Change in asset value} + \text{Income}}{\text{Initial Value}} \tag{4}$$

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EG. Hold bill, 1 month holding period, buy for \$9488, sell for \$9528, 1 month $r = \frac{9528-9488}{9488} = .0042 = 0.42\%$.
Annualised at $(1.0042)12 - 1 = .052 = 5.2\%$

Variance of Portfolio

See mathematica demonstration, excel demonstration

For two assets, A and B, the expression for the variance of a portfolio is given by

$$\sigma_p^2 = w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2W_A W_B \sigma_A \sigma_B P_{AB} \quad (5)$$

Efficiency Frontier

See mathematica demonstration

- The whole idea of portfolio analysis is to create a set of rules, through which a risk averse investor might minimise the level of risk they are exposed to, for a given level of expected return. The profile we are interested in generating is a comparison space of difference bundles of differentially risky portfolios.
- For different levels of risk (as measured by σ), different weights of assets on A and B, and differing levels of correlation between different assets, the investor can generate a mean-standard deviation profile. The edge of this profile is called the efficiency frontier.

Idea behind CAPM

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1. The risk associated with that asset given
2. Investors own a combination of The risk free asset and The market portfolio.
3. A risky asset has no effect on the risk free rate, but effects the portfolio through its covariance with it.

Assumptions (on top of diversification assumptions)

- No transactions costs
- No taxes
- Infinitely divisible assets
- Perfect competition
- No individual can affect prices
- Only expected returns and variances matter
- Quadratic utility or
- Normally distributed returns
- Unlimited short sales and borrowing and lending at the risk free rate of return
- Homogeneous expectations

CAPM

Please see handout.

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CAPM:

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So what?

Once each investor holds proportional amounts of risky assets, the only thing they need to know is the covariance of their portfolio with the market portfolio. CAPM allows the investor to split risk into diversifiable risk and fundamental risk, with only the fundamental risk playing a part in the pricing of a stock. β is a measure of risk for diversified investors.

Using CAPM

Example

Find the β of a risky asset with return 2%, with risk free rate of 4%, and a market portfolio return of 12%.

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In Perold (2004), we are given a treatment of diversification, correlation, and risk, from a historical and theoretical point of view. Perold is required reading for this lecture.

Why learn this?

1. CAPM is a model of what expected returns should be if everyone solves the same passive portfolio problem
2. CAPM serves as a benchmark against which actual returns are compared, and against which other asset pricing models are compared.

Summary

1. CAPM shows division of risk into idiosyncratic and systematic.
2. CAPM is a highly flawed but benchmark-level model you've got to learn.

Outline

EMH and Modigliani-Miller

Let's assume that the rate of return to holding a unit of an asset (like housing) is the ratio of its rent to its value. For a share, the rule is

$$Return = \frac{CapitalGain + Dividend}{Price} \tag{9}$$

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Strong EMH

Even if a trader uses all available information, she still cannot beat the averages, because prices follow a random walk.

MM Theorem

Modigliani (1980, p. xiii):

> *with well-functioning markets (and neutral taxes) and rational investors, who can 'undo' the corporate financial structure by holding positive or negative amounts of debt, the market value of the firm debt plus equity depends only on the income stream generated by its assets. It follows, in particular, that the value of the firm should not be affected by the share of debt in its financial structure or by what will be done with the returns paid out as dividends or reinvested (profitably).*

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Four results

- Firm's debt/equity ratio has no effect on market value
- Firm's leverage has no effect on weighted average cost of capital
- Firm's market value is independent from dividend policy
- Equity holders are independent from firm's financial policy

MM Theorem II

Idea

Suppose you buy a car for 25,000. You have to put a deposit down. If you didn't have it, price may as well be infinite. If you had 25,000 in cash, you could walk away with it now. Between the two extremes lies debt. Say you put down 2500. Your leverage is 25000/2500=10. The debt *doesn't matter* relative to the equity because of resale.

More formally

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Let r_B be the real interest rate on bonds, r_E the interest rate on equity. Returns are paid out of profit flows according to

$$P = r_B B + r_E E \tag{12}$$

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- No capital market frictions
- Symetric access to credit market
- Firm's financial policy reveals no information

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Essentially

No arbitrage assumptions

The debate

What assumption to refute or amend?

- Taxes? US tax system favour debt over equity, Miller (1977) shows that total value of firm could be unchanged and increase dividends by changing debt structure. Higher tax on interest payments would remove that effect.

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  - Dividend policy: is the policy offering any signal?
  - Method of capital finance: lease or buy?

Conclusion

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