

The theory of portfolio choice

(1) Introduction

Suppose you have just inherited a certain amount of money.

- How will you decide what portfolio of assets you should hold to store your new-found wealth?
- What criteria should you use to decide among these various stores of wealth?
- Should you buy one type of asset or several different types?

The *theory of portfolio choice* helps us by:

- (a) outlining criteria that are important when deciding which assets are worth buying, and
- (b) gives us an idea as to why it is good to diversify and not to put all our eggs into one basket.

(2) Determinants of asset demand

An asset is a piece of property that is a store of value e.g. money, bonds, stocks, art, land, houses, manufacturing equipment etc....

Faced with the question of whether to buy and hold an asset or whether to buy and hold one asset rather than another, an individual must consider the following factors:

- (a) **Wealth**: the total resources owned by the individual, including all assets. Holding other things constant, an increase in wealth raises the quantity demanded of an asset.
- (b) **Expected return**: the return expected over the next period on one asset relative to alternative assets. e.g. bond, stock. An increase in an asset's expected return relative to that of an alternative asset, holding all other things constant, raises the quantity demanded of the asset. One can distinguish long run expected returns from temporary undervaluation. Over 1920-99 UK equities yielded 7% and bonds 4% for example, allowing for inflation.

(c) **Risk:** the degree of uncertainty associated with the return on one asset relative to alternative assets.

Asset A: has a return of 15% half the time and 5% the other half.

⇒ Expected return of asset A = 10%

Asset B: has a fixed return of 10% for sure.

⇒ Asset A has uncertainty associated with its returns and so has a greater risk than asset B, whose return is certain.

A *risk-averse* person prefers asset B (the riskless asset) to asset A (the riskier asset), even though the assets have the same expected return.

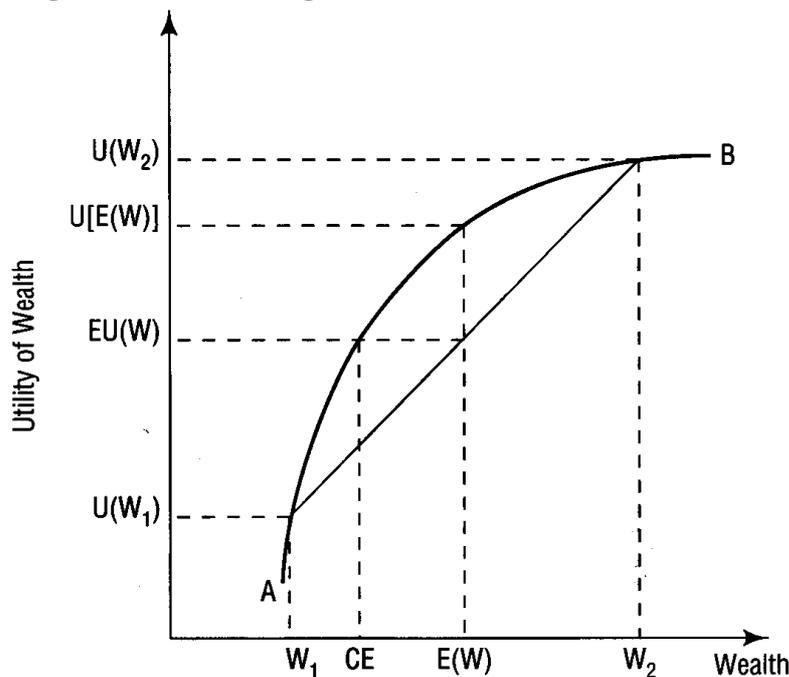
A *risk-lover* prefers asset A.

Someone who is *risk-neutral* is indifferent between the two.

Most people are risk-averse i.e. they prefer to hold the less risky asset.

Hence, holding everything else constant, if an asset's risk rises relative to that of alternative assets, its quantity demanded will fall.

Diagram illustrating risk aversion



(d) **Liquidity:** the

ease and speed with which an asset can be turned into cash relative to alternative assets.

The more liquid an asset is relative to alternative assets, holding other things constant, the more desirable it is, and the greater will be the quantity demanded.

(2) The benefits of diversification

To understand diversification more fully we first need to decompose the risk of an asset into two components:

$$\text{Asset risk} = \text{systematic risk} + \text{unsystematic risk}$$

Unsystematic risk is risk unique to an asset (specific risk) because it is related to the part of the asset's return which does not vary with the returns on other assets. We shall call this *diversifiable risk*. e.g. risk of decline in demand for a company's product due to discovery of defects.

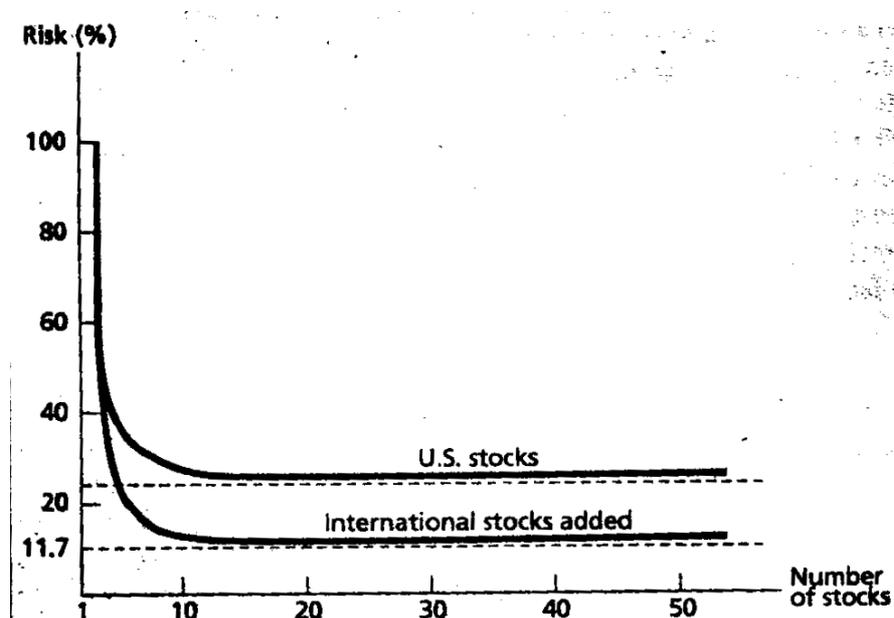
Systematic risk (market risk), on the other hand, cannot be eliminated through diversification - it is related to the part of the asset's return which does vary with the returns on other assets (market returns). We shall call this *undiversifiable risk*. e.g. decline in demand for a company's product due to a recession in the economy as a whole, which leads the stock market to fall.

With many assets in a portfolio, unsystematic risk becomes less important because when the unsystematic part of one asset's return goes up, it is likely that the unsystematic part of another asset's return has gone down, movements that cancel each other out.

Hence with enough diversification as a result of a portfolio containing a large number of different assets, the unsystematic risk contributes nothing to the total risk of portfolio. In other words, *the risk of a well-diversified portfolio is due solely to the systematic risk of assets in the portfolio.*

⇒ if we diversify sufficiently, the only component of an asset's risk that we need to worry about is its systematic risk.

Diagram illustrating overall risk declining with number of assets



The systematic risk of an asset is measured by a concept called its *beta* (β) - a measure of the sensitivity of the asset's return to changes in the value of the entire market for asset's (the market portfolio).
e.g. $\beta = 1$, $\beta = 2$, $\beta = 0.5$, $\beta = -1$.

(3) The Capital Asset Pricing Model (CAPM)

This model, developed in the early 1960's, gives a specific form to the general notion of a *trade-off between an asset's systematic risk and its expected return*. It postulates a positive linear relationship between the expected return on any asset i , and its systematic risk β_i , as measured in the following equation:

$$E(R_i) = R_f + \beta_i(R_m - R_f)$$

where,

$E(R_i)$ is the expected return on asset I ,

R_f is the riskless rate of interest (e.g. on treasury bills),

β_i is a measure of the extent to which the returns on asset I move with the returns on the market portfolio,

$E(R_m)$ is the expected return on the market portfolio.

Thus, the CAPM can be seen as splitting the expected return on an asset into two components,

(a) The first part (R_f) represents the current return on a close to riskless investment.

(b) The second part $\{ \beta_i[E(R_m) - R_f] \}$ is a surplus return representing a premium on the systematic risk attached to a particular share.

When an asset has a high β , meaning that it has a high degree of systematic risk, we would expect that investors would be willing to hold this asset only if it yielded a higher expected return.

Although the CAPM has proved to be useful in real world applications, it assumes that there is only one type of risk relevant to investors - the systematic risk of the asset as measured by its beta.

(4) Determinants of stock price movements

Stock price movements can be thought of as being driven by one of two factors:

(a) fundamentals

(b) other factors.

(a) Fundamental (economic) factors

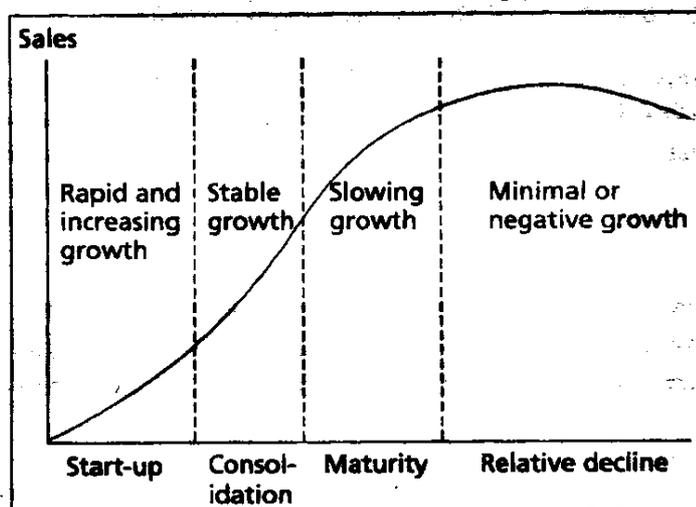
A firm's value should reflect the present value of its future net cash flows:

$$V_0 = \sum_{t=1}^{\infty} \frac{\text{net cash flows}}{(1+r)^t}$$

These net cash flows can be thought of as the earnings of the firm (profit after tax).

Thus, if we can somehow forecast a company's future earnings, we should be able to determine whether the company in question is under- or overvalued. To do this, numerous fundamental (economic) factors need to be constantly monitored e.g. **Macroeconomic factors:** global and national inflation, interest rates, exchange rates, growth in GDP, consumer trends, changes in the balance of trade and changes in regulatory, fiscal and monetary policy all affect corporate earnings.

Industry factors: sensitivity to the business cycle and stage in industry life cycle:



5 determinants of competition (Michael Porter); entry barriers, rivalry, substitute products, bargaining power of buyers, bargaining power of suppliers

Firm level factors: demand for the firm's product, the firm's balance sheet (e.g. how much debt it has), the firm's past profitability. These may be summarised by ratios such as the price/earnings ratio. A high P/E may indicate a firm is overvalued, unless the firm is expected to grow rapidly in the future.

We call analysis looking mainly at macro factors "top down" and that focusing on firm specific factors "bottom up".

All of these are regarded by many as the *fundamental reasons why asset prices change*.

(b) Other factors

Any other factors which cause stock prices to change, other than those due to fundamental reasons, are referred to as *other factors*.

(i) **Noise trading:** Shiller divides investors into two types; informed (rational) investors and uninformed (irrational) investors.

If uninformed investors buy/sell decisions push the stock's price away from the price justified by fundamentals \Rightarrow there will be a certain amount of *noise* in the price.

Given that there is already uncertainty about the stock's fundamental value, informed investors may be unwilling to capitalise on this discrepancy \Rightarrow a market correction may not occur.

(ii) The use of trends (and psychological factors) to forecast future price changes i.e. *technical analysis*.

Technical analysts make investment decisions based on recent trends in stock prices i.e. they believe that *if* trends are repetitive, investors can take positions in stocks to take advantage of a particular trend reoccurring.

This goes totally against the fundamentalist view!

Given that enough people use this as a method of basing their buy/sell decisions, this may help explain stock price movements.

e.g. Church of England marriages and stock prices.

\Rightarrow some trends, even without rationale, may influence stock price movements.

Stock market efficiency

(1) Introduction

In the Theory of Finance, what is meant by efficiency is a rather narrower definition than that used by economists.

Economists usually refer to a market being efficient if it is producing at minimum cost \Rightarrow in the context of financial markets \Rightarrow participants supplying and demanding funds are able to carry out transactions cheaply (at min cost) \Rightarrow operational efficiency.

In the Theory of Finance, the theory of efficiency really applies to:

efficiency in the transmission and use of information.

\Rightarrow efficiency in financial theory rests very much on information.

The general point is that,

if a market transmits and uses information efficiently then the current price in that market reflects all of the information that is available.

i.e. if a market is efficient \Rightarrow the current price reflects all available information.

An implication of this is that,

only unanticipated information should affect the price.

i.e. any change in the price must only be due to some unanticipated information coming to the market.

All of this implies that as investors attempt to capitalise on new information that is not already accounted for, stock prices should adjust immediately.

Fama (1970, 1972) put these ideas into some kind of testable proposition. He defined three forms of market efficiency:

- (a) Weak-form efficiency (WFE),
- (b) Semi-strong form efficiency (SSFE), and
- (c) Strong form efficiency (SFE).

These are three different *ranges* of how efficient a market may or may not be. They are all defined in terms of whether or not a person can make money by pursuing a certain trading strategy.

According to the EMH, if the current price is *really* reflecting all available information \Rightarrow then only unanticipated information can affect prices \Rightarrow there shouldn't be a trading strategy that you can adopt that would make you profits consistently.

However, if you had some information that *wasn't* reflected in current prices (\Rightarrow you know that the price will change in the future) then you can make profits \Rightarrow markets are inefficient.

(2) Forms of Market Efficiency

(a) Weak-form efficiency says that there should be,

no trading strategy that would be profitable given all the history of prices ($p_{t-1}, p_{t-2}, p_{t-3}, \dots$) at time t (now).

In other words, you cannot predict what is going to happen in the future by knowing what has happened in the past \Rightarrow technical analysis is redundant.

Thus, WFE suggests that security prices reflect all the information in past prices. Thus, investors will not be able to earn abnormal returns on a trading strategy that is based solely on past price movements

Let the trading strategy at time t be defined by some parameter α . Then

$$\text{WFE} \Rightarrow \alpha_t/p_{t-n} = 0$$

(b) Semi strong-form efficiency says that there should be,

no profitable trading strategy based not just on the history of prices but the history of all public information.

Public information also contains information on announcements by firms, economic news or events, and political news or events.

If we let θ be all public information, it must be true that

$$p_{t-1} \in \theta_{t-1}$$

Thus, if SSFE holds \Rightarrow WFE must hold. However, WFE may hold without SSFE holding. _

SSFE suggests that security prices reflect all public information (including the history of past prices). Thus, if a market is said to be SSFE, it should not be possible for investors to earn abnormal returns on a trading strategy based solely on past public information i.e.

$$\text{SSFE} \Rightarrow \alpha_t / \theta_{t-1} = 0$$

(c) **Strong-form efficiency** says that there should be *no profitable trading strategy that would be possible given any information.*

\therefore SFE \Rightarrow security prices fully reflect all information, even that which is not in the public domain e.g. private or insider information.

SFE \Rightarrow even if you have insider information, you cannot profit from it because it is assumed that prices somehow already reflect this insider information \Rightarrow there exists no profitable trading strategy which allows you to benefit from information which is not within the public domain.

If we let Φ be all information, where

$$p_{t-1} \in \theta_{t-1} \in \Phi_{t-1}$$

Then,

$$\text{SFE} \Rightarrow \alpha_t / \Phi_{t-1} = 0$$

(3) Testing for Efficient Markets

Read Madura pp 304-306

Exercises

If the expected return for the market portfolio is 5% and the risk free rate is 2%, what does the Capital Asset pricing model predict the expected return on a security with a beta of 3 to be?

What factors are likely to affect the demand for assets?

Distinguish between a risk-loving investor, a risk averse investor and a risk neutral investor.

Explain what you understand by the concept of diversification.

Explain what you mean by systematic risk. How is it measured? Do investors expect to be paid a premium for holding unsystematic risk?

What types of factors are included in securities analysis?

Explain the difference between weak-form, semi-strong form and strong-form market efficiency. Which is the most difficult to test? Which is the most likely to be rejected?