Financial Economics

Lecture 04. Principles of Market Valuation

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Introduction

- Recall that the three pillars of finance are
  - Time value of money
  - Asset valuation
  - Risk management
- Many financial decisions are, in essence, the determination of an asset's value: how much are assets worth?
  - Value maximization is the objective of corporate management and household finance

Outline

- Law of one-price and arbitrage
- Valuation models
- The efficient market hypothesis

Relationship between asset value and price

- An asset's ***fundamental value*** is the price well-informed investors must pay to purchase it in a free and competitive market
- There can exist temporary differences between the ***market price*** of an asset and its fundamental value
  - Security analysts make their living by discovering these discrepancies
    - Recommend which stocks to buy (sell) because their price appears low (high) relative to fundamental value
  - Many well-informed professionals are looking for these discrepancies.
    - They profit by eliminating these discrepancies

Value maximization and financial decisions

- Financial decisions can be made rationally purely on the basis of value maximization, and without regard to risk preferences and expectations
  - Example
  - Alternative A: you get $100 today; alternative B: you get $95 today
  - If alternatives are equivalent in every other aspect, choose A because more is better than less.
  - What if alternative a is a risky stock worth $100 and alternative b is a safe bond worth $95?
- Markets for financial assets provide the information needed to choose between alternatives
- The **essence of asset valuation** is to estimate how much an asset is worth using information about one or more comparable assets whose current market prices we know.

The law of one price and arbitrage

- **Law of one price:**
  - In a competitive market, if two assets are equivalent, they will tend to have the same price
  - The law of one price is the most fundamental valuation principle in finance.
  - Enforced by a process called *arbitrage*
- **Arbitrage:**
  - Purchasing of a set of assets, and immediately selling another set of assets, in such a way as to earn a sure profit from price differences
  - *Arbitrageurs* engage in the business of trading similar assets with a price differential that cannot be justified by transaction- and transformation-costs

Arbitrage and the prices of financial assets

- Examples:
- Gold in any two parts of the country should not differ by more than the *transaction costs* of moving it
  - If gold in NY is $800 per ounce but only $750 per ounce in LA
  - Buy in LA, ship to and sell in NY
  - Transaction cost: shipping, handling, insuring, and broker fees, etc.
  - If transaction cost less than $50 per ounce, you are engaged in an arbitrage.
  - Such actions would drive the price in ny down while price in la up until the price discrepancy is below the transaction cost.

- For assets such as stocks, the transaction cost is much lower, nearly negligible.
  - Shares of a firm price the same at both nyse (new york stock exchange) and lse (london stock exchange), taking into consideration of the exchange rate.
  - Otherwise, arbitrageurs would buy low and sell high, further driving the prices to equalize.

Arbitrage and the prices of financial assets

- We expect the same financial assets trading on two markets to be priced very closely
- If two very similar securities trade at significantly different prices, we first suspect
  - Interference with normal market operation
  - Some unrecognized differences between the two assets

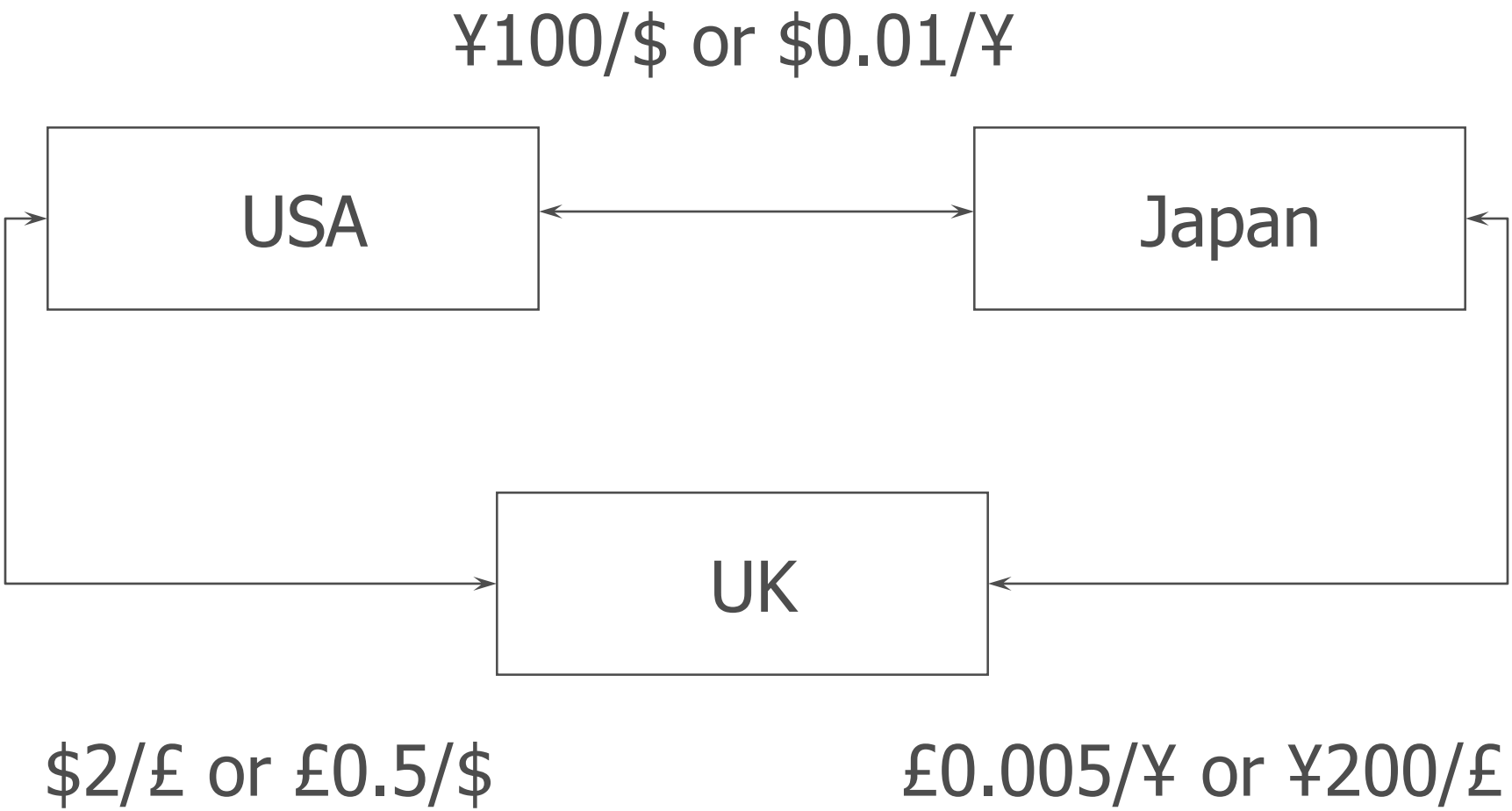
Interest rates and the law of one price

- Not only the prices of equivalent assets are the same but also that interest rates on equivalent assets are the same
- If two organizations with similar creditworthiness issue bonds with similar terms, then their interest rates will be similar
  - Otherwise, one could borrow at a low interest rate, and lend the money out at a high interest rate: **interest-rate arbitrage**
  - This will bring about an equalization of interest rates

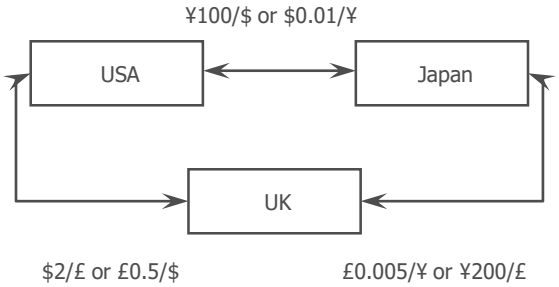
Exchange rates and triangular arbitrage

- The law of one price also applies to foreign exchange markets
- If three currencies are freely convertible in competitive markets, then it is enough to know any two exchange rates to compute the third exchange rate

Triangular arbitrage



Triangular arbitrage: example



- Two ways to buy 100 pounds for dollars
  - Approach 1: directly buy 100 pounds for 200 dollars
  - Approach 2: first buy 20000 yen for 200 dollars and then use the 20000 yen to buy 100 pounds
- The cost of dollars are the same using the two approaches. Otherwise, one could simply make money from triangular arbitrage.
- Suppose the price of pound is 2.1 dollar, rather than 2 dollar
  - At the dollar/yen window, convert 200 dollar into 20,000 yen
  - At the yen/pound window, convert the 20,000 yen into 100 pounds
  - At the dollar/pound window, convert the 100 pounds into 210 dollar
- You just converted 200 dollars into 210 dollars!

Triangular arbitrage

- If we select the form of the rate correctly, we obtain the relationship
- $R_{£/¥} = r_{£/\$} * r_{\$/¥}$
- Under the conditions specified, this equilibrium relationship must hold
  - Otherwise, a risk-free, almost cost-less, arbitrage will immediately reestablish the equilibrium
- More specifically, in the example
  - $R_{£/¥} = r_{£/\$} * r_{\$/¥} = 0.5 * 0.01 = 0.005$
  - $R_{¥/£} = 1/r_{£/¥} = 1/0.005 = 200$
  - The other two pair follow the same form
- More generally
  - $R_{a/c} = r_{a/b} * r_{b/c}$
  - $R_{a/b} = 1/r_{b/a}$
- If this relationship were to fail significantly, then traders would profit by immediately moving large sums of money round the diagram clockwise or anti-clockwise

Outline

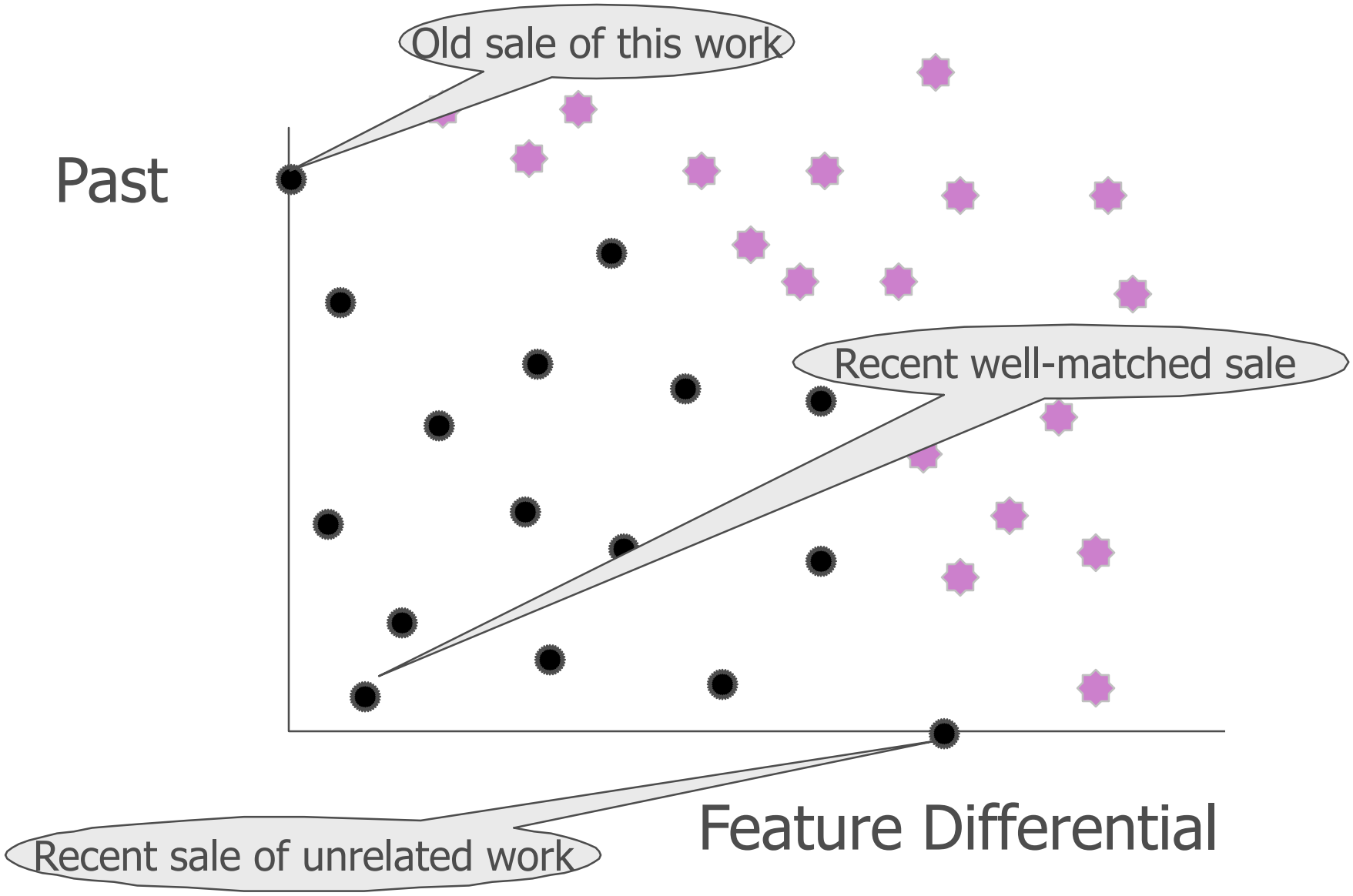
- Law of one-price and arbitrage
- Valuation models
- The efficient market hypothesis

Valuation using comparables

- Some assets are not traded, or are only traded infrequently, but we still need to evaluate them
- The *law of one price* may be used to evaluate assets, even when arbitrage can not be used to enforce the law
- Two cases
  - A work of art in an estate that needs to be evaluated for computation of estate taxes
  - A home that needs to be evaluated to ensure the fairness of property taxes

Valuation using comparables

- To evaluate a work of art, it is necessary to find assets that are "close" in feature-time space
  - The closer the features match, the longer the data collection period may be
  - The closer to the present time an asset was sold, the more diverse the features may be
    - Both kinds of "closeness" are needed
- Example
  - Collect prices and feature differentials for
    - Art by the same artist: 10-years
    - Art of the same quality: 5-years
    - Art from the same school: 5-years
    - Broadly similar art: 2-years


Old sale of this work
Past
Recent well-matched sale
Recent sale of unrelated work
Feature Differential

Valuation using comparables

- In the above diagram, the black stars indicate usable price exemplars, and the pink stars indicate poor exemplars
- The variable “feature” is a aggregate of many factors, some objective, some subjective
- From this information you can
  - Determine price trends in the general art market
  - Obtain trend-adjusted benchmark prices
  - Gain an understanding of how to adjust the benchmark for feature differences
- Ultimately, you need a valuation model

Valuation models

- A *valuation model* is a quantitative method used for estimating an asset's value from known prices of other assets that are not its exact equivalent
- The valuation model employed may depend on the purpose of the evaluation
  - Individual investor vs. Corporation manager

Stock evaluation using P/Es

- The **price-over-earnings** ratios of similar companies are determined
  - Future profitability, accounting methods, leverage, technology, and a host of other factors, will affect the exemplars' P/E ratios
  - Two firms with identical assets but very different debt/equity ratios are not really comparable.
- Based on these, an estimate is made of the p/e ratio of the non-priced firm
  - The earnings of the firm are multiplied by this P/E ratio to obtain an evaluation of its stock price
- Example:
  - You want to estimate the value of a share of XYZ stock and its earnings per share is $2.
  - Suppose further comparable firms in the same line of business have an average price/earnings multiple of 10.
  - The value of a share of xyz stock to be
  - Estimated value of a share of xyz stock=xyz earnings per share x average price/earnings multiple=$2 x 10=$20

How information is reflected in security prices

- Sometimes a stock price will rise sharply with the release of information
  - An important drug has achieved an important step on its road to being marketed
  - Poor trading results are announced, but they are better than those anticipated by traders
  - An unanticipated positive fed announcement
- Market traders form probability distributions of key stock-price determinants (example, sales revenue)
- When these distributions change to assimilate new information, the stock market *reacts*, and the price changes
  - At least some investors who buy or sell stocks are paying attention to the fundamental factors
- Sometimes stock price does not move when important news is officially announced, maybe because this information has already been reflected in the stock price
- Efficient market hypothesis

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Efficient market hypothesis

- The ***efficient market hypothesis*** states
  - An asset's current price reflects all publicly available information about future economic fundamentals affecting the market price
- The mechanism leading to the efficient market hypothesis
  - Collection of relevant information
  - Analysis of this information to obtain a price
  - Trading on this analysis until the price aberration is eliminated

Collection of relevant information

- Collect information or "facts" about a company, and the factors that may affect it
  - SEC filings, annual reports, clipping services, conferences with CEO /CFO, industry analyses, patent filings, rumors, discussions with competitors and customers, informal market surveys, advertising campaigns, recruitment activity, technological surveys…

Analysis of this information

- At one time, analysts were content to form just a point estimate of the price
- Given that the information is not perfect, analysts try to incorporate probability into their pricing, by working with ranges, for instance
- The more accurate the information, the smaller the price dispersion -> less risk

Trading on this analysis

- Based on her estimates, the analyst may recommend a trade to buy or sell
  - The magnitude of resulting trades depend on how good the risk-return trade-off of this stock compared to alternative investments available and how much money he has
  - The higher return and the more money, the more stock will be traded
  - The larger the estimated price dispersion (higher the risk), the smaller the position he will take in this stock
- Different analysts may have different recommendations
  - Different information
  - Different analysis
- The market price of the stock will reflect a weighted average of the opinions of all analysts (or investors) by the amount of money controlled