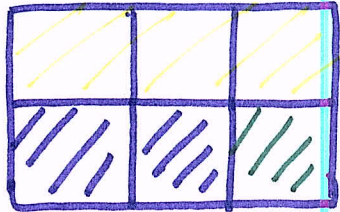


# Shares of Stock

| @: 01/28/2019

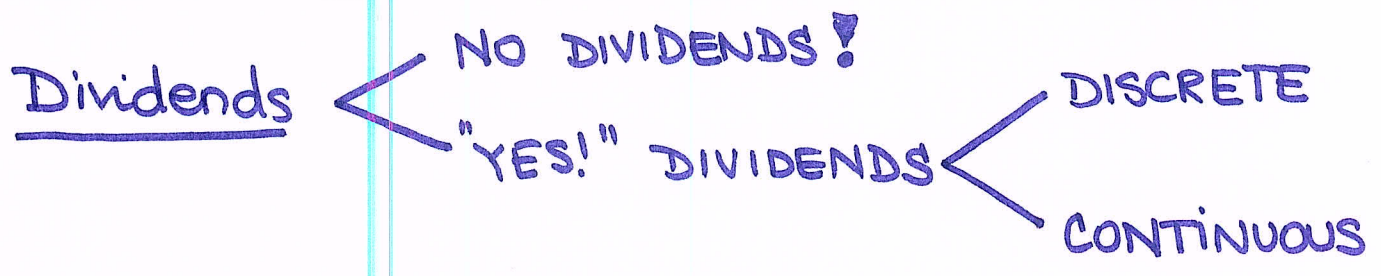


Allow continuously valued investment in shares of stock, e.g.,  $\frac{13}{17}$  shares

Ⓞ  $e^{-0.05}$  shares

Recognize: Shares of stock have a market price whose value at any future date is non-deterministic  $\Rightarrow$  this is a risky asset.

The reasons for investment:  
{ • dividend payments  
• stock appreciation



# Stock Exchanges

## Market Makers

- Bid price : what they are willing to pay for an asset
- Ask price : what they want to receive for selling the asset

Bid prices < Ask Prices

[Bid, Ask] or Ask-Bid

is called the BID-ASK SPREAD.

## Brokers.

Charge the commission

per transaction  $\left\{ \begin{array}{l} \text{fixed amount} \\ \text{proportion to} \\ \text{the cashflow} \end{array} \right.$

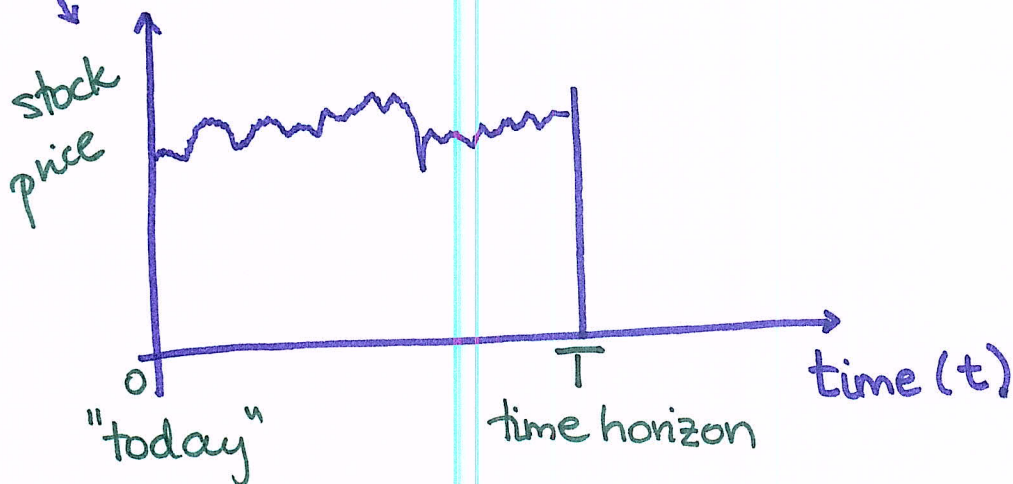
Assume no bid-ask spread & no transaction costs.

# Financial Portfolios

• RISKLESS ASSET : • loans, bonds, savings accounts  
(Risk-free)

• RISKY ASSET :  
• shares of stock  
• foreign currencies : Yen, Swiss Francs, ...  
• commodities : silver, gold, oil, soy beans, corn, ...

• DERIVATIVE SECURITIES (also risky!)



$S(t)$ ,  $t \geq 0$  ... stock price @ time  $t$

a **STOCHASTIC PROCESS**

TIME-VARYING  
&  
NON DETERMINISTIC

{  $S(0)$  ... initial stock price  
   $S(T)$  ... final stock price