**Analytical Methods Outline**

1. **DECISION ANALYSIS AND GAME THEORY**

**Decision Analysis**

* Gamble: decision with more than one outcome. “Best decision” does NOT mean best outcome/results.
* Best Decision**:** one that results from the appropriate method (AM). AM depends, in part, on probabilities.
* Method In Text: Decision Tree 🡪 start with the ***right side*** of the tree. Move left.
  + Big question: how many options do we have?
  + **Sensitivity Analysis:** how much do the numbers of the DT have to change to alter the outcome? The more resilient to changed circumstances 🡪 the more likely it is a good choice.
* Risk Aversion**:** valuing a gamble at ***less*** than its expected value. Risk neutral hold out for expected value. Risk seeking. People are inconsistent, depends on decision.
  + Explain irrational behavior of deviation from expected payoff? Look at other factors. Warm glow? Excited thrill? Hope? Guilt of missed opportunity? Don’t get stuck on one particular dollar figure.
  + Value of reputation?
  + **One-shot v. repeat player:** Average payouts reflect the expected outcome of multiple repetitions. If you’re only playing once, you may be less willing to risk the loss.
  + **Unsustainable harms:** If you cannot pay the cost of losing the gamble (e.g. you would go bankrupt), then you may have to take a less-good option that is also less risky.
    - On the other hand, if a company is willing to go bankrupt, then the actual losses from a risk are limited to the amount of assets the company has to lose. This may make the company more inclined to take risks.
    - Note that there are other losses, however: future profits are lost, as are the jobs of employees (including the managers, who may therefore not be willing to go along with a bankruptcy-risking plan
  + **Non-pecuniary benefits:** satisfaction, reputation, embarrassment of trial, etc.
  + **People tend to be more risk adverse than corporations**. Why?
    - Risk: the possibility of payoffs that are widely disparate.
    - Arbitrage: situation of ***zero risk and w/ profit***. Always stand to make money. Very rare. Ex. bought up all lottery tickets.
    - Anticipatory Regret: possibility of future loss.
    - Diminishing marginal utility of money: Not about making the most money, but about producing the most well-being.
    - Corporations, unlike people, do not have well-being. Single goal of ***shareholder wealth***. Align more exactly with Expected Value. **Takeaway:** greater the wealth 🡪 less risk aversion. More risk neutrality.
  + Way to neutralize risk
    - Patent trolls: buy patents from risk-adverse inventors and then pursue corporations.
* Benefit Of DT
  + Right decision if you know *all* the numbers.
  + Allows for reviewability and amenability. Clients/other associates/partners can analyze and help.
  + Discovers underlying assumptions and probabilities.
  + Exhibiting decisions leads to better decisions statistically

**Game Theory**

* Prisoner’s Dilemma:
  + **Dominant Strategy:** strategy that earns the player a higher/same payoff than any other strategy, ***regardless*** of what the other player chooses to do. **Strictly Dominant Strategy** (even more demanded by rational): whatever the other person does, I am going to get more than by choosing any other strategy.
    - “Foe” is a strictly ***dominant*** strategy.
    - What about other factors? Reputation if public? Desire to be cooperative? Desire to be a “bulldog”? How do you want to present yourself?
  + *How much is “fairness” worth?* Ultimatum game (values fairness). One purposes an ultimatum (split b/t $10). Other chooses to accept ultimatum. If she doesn’t accept, both get nothing. If other player is ***fully rational***, then should be able to propose $9.99 and $.01. No one would take this deal. Sense of fairness. Pay for fairness; punish for unfairness. More ppl participate at a 9/1 ratio if the pot is bigger ($100k).
* Nash Equilibrium: No regret situation. No individual player regrets their decision given what the other players did. Can be influenced by publicity or discussion. Prisoner’s dilemma not subject to change b/c of discussion, but can be subject to change w/ **binding contracts**.
  + Ex. $100 given to all the room. If we all choose to invest, all get $200 back. If one person does not invest, all invested money is lost. Eventually, reach a state where no one invested (ppl seeing that at least one person was not investing 🡪 positive momentum towards not investing). Or, everyone investing (also a Nash equilibrium).
* Strike Lawsuit: patent infringement suit on eve of merger/acquisition.
  + Non-credible threat: harmful for litigator to go ahead, so he doesn’t when big company ignores him. Needs to make threat credible.
* Example
  + **Dominate strategies:** neither Amy nor Bill have a dominant strategy. Amy is best off picking discovery if Bill picks Expert Witness, but she’s better off picking no discovery if Bill picks Consultant or Do Nothing. For Bill, he is best off with Consultant if Amy picks Discovery, but he is best off with Expert Witness if Amy chooses No Discovery.
  + **Nash equilibrium:** I don’t see any Nash equilibriums. If Bill believes Amy will choose discovery, then he’s best off picking consultant. But if Bill pick’s consultant, Amy will have regrets, wishing she’d had picked no discovery. If Bill believes Amy will pick no discovery, he’ll pick expert witness, and Amy will regret not picking Discovery. Likewise, any of the three options that Amy believes Bill will choose, if she consequently chose what is best for her according to that belief, Bill will have regrets.

|  |  |  |  |
| --- | --- | --- | --- |
|  | (Bill) Expert Witness | Consultant | Do Nothing |
| (Amy) Discovery | 3, 4 | 5, 7 | 9, 2 |
| No Discovery | 2, 10 | 8,8 | 12, 4 |

* Moral Hazard: incentives are altered in such a way that hurts **both** parties. A moral hazard is a situation where a party will have a tendency to take risks because the party taking the risk **will not feel the costs risked**. In other words, it is a tendency to be more willing to take a risk, knowing that the potential costs or burdens of taking such risk ***will be borne, in whole or in part, by others***. A moral hazard may occur where the actions of one party may change to the detriment of another after transaction/contract has taken place
  + Moral hazard is seen for services such as insurance and warranties. In these cases, after the deal is done, one of the parties to the deal (in this case, the person purchasing the insurance or warranty) may be more careless because he/she has the insurance, and thus does not need to pay the full cost of damage. For instance, a person possessing insurance against theft may be less careful about closing the windows when leaving the house. Here, it is not the prior information that either party has, but the inability of the insurance provider to control and monitor increased risk-taking behavior that creates the potential for market failure.
    - Another e.g. 🡪 seatbelts.
* Adverse Selection: asymmetry in information prior to a deal.
  + E.g. lemons in used-car market. Potential buyers know of the higher probability of lemons in market, so will be unwilling to pay a high price. Sellers of good cars (not lemons) won’t be willing to sell for low price, so many potentially mutually benefiting transactions will never occur. Also, fire-insurance market—ppl with homes (high risk) will buy insurance, which raises premiums out of reach for ppl with low-risk homes.
  + **How to solve?** Obtain information. It is an imperfect remedy though b/c obtaining information requires money. Or, gov. action 🡪 require everyone to have fire insurance.

1. **#ACCOUNTING**

**Accounting 101**

* Financial Statement includes: ***Balance Sheet****,* ***Income Statement****, and* ***Cash Flow Statement***
  + **Balance Sheet:** financials of a company at a particular date. “Snapshot.” Two years typically to give sense of direction.
    - **#Assets:** resources with “(1) ***probable*** future economic benefits (2) obtained or controlled by an entity resulting from ***past transactions or events***.
      * See example (p. 114) for listing order convention
      * **Current assets:** already money or expect to turn into money *w/in the next year*.
      * **Fixed assets:** last *longer than a year*.
      * **Cash equivalents:** high liquidity. E.g. bank accounts. Companies differ (lots of discretion) on how terms are used/defined. Ex. how much liquidity qualifies for cash equivalent? Depends on goals, perception you want to give.
        + High cash = flexibility? But seems like not using a lot for growth/investment. Low cash = maybe indicate future growth.
      * **Short-term investments:** *less than a year*. Where to draw line between STI and cash equivalents?
      * **Inventories:** how much “stuff.”
      * **Prepaid expenses:** e.g. rent paid for future.
      * **Fixed assets, net:** e.g. buildings
      * Sources of money? Direct profit (customers) or investment equity or lenders. Assets typically go up for one or more of the following reasons
        + (1) the firm made money
        + (2) the firm borrowed money
        + (3) investors contributed money in return for shares of stock
    - **Liabilities and Owners Equity**: Liabilities represents creditors’ claims and owners equity represents owners’ claims
      * **#Liabilities:** “(1) ***probable***future sacrifices of economic benefits (2) arising from ***present obligations*** to transfer assets or render services in the future (3) ***as a result of past transactions or events***” (i.e. the inverse of assets)
      * Equity = Assets – Liabilities; Liabilities = Assets – Equity; Assets = Equity + Liability (latter is the Fundamental Equation of Accounting)
      * See example (p. 115) for listing order convention
      * For the typical U.S. corporation (where the owners are shareholders), equity includes funds contributed by shareholders (capital stock) and accumulated profits (retained earnings)
      * This portion of the balance sheet tell us the sources of funding for the new assets
      * Net income is, in essence, added to owners’ equity; net loss is subtracted from owners’ equity
    - Equity: assets minus liabilities
    - #Revenues: increases in equity resulting from asset increases and/or liability decreases from **delivering goods or services or other activities** that can constitute the entity’s ***ongoing major or central operations***.
    - #Expenses: decreases in equity resulting from asset decreases and/or liability increases from **delivering goods or services or other activities** that constitute the entity’s ***ongoing major or central operations***
  + **Income Statement (a.k.a. *result of operations*)**
    - Unlike the balance sheet, which shows a snap shot, *this summarizes revenues and expenses over (typically) a year.*
    - Summarizes profitability
    - When revenues exceed expenses, the entity has earned a profit; otherwise the entity has suffered a loss (income statements are thus also called *profit and loss statements*)
    - **Net sales (revenue):** profit from customers.
    - **Cost of Sales:** not all “cost of sales.” Only how much company paid supplier for the thing that the company sold.
    - **Gross profit**: Net sales – Cost of sales. E.g. Joe’s Hot Dog Vender – revenue minus COGS.
    - **Net loss:** real number.
    - See example (p. 118) for listing order convention (specifics can vary, but generally there are revenues, which are reduced by expenses)
    - *cost of sales* can also be called *cost of goods sold*; *gross profit* can also be called *gross margin*
  + **Cash Flow Statement** 
    - Like income statement, this summarizes revenues and expenses over a period
    - Highlights the manner in which the entity obtains and uses cash; in other words, the changes in the entity’s cash position over the period
    - See example (p. 122) for listing order convention
    - Although a cash flow statement is mostly derived from the balance sheet and income statement, it’s extremely useful when an entity’s liquidity (ability to make payments on time) are in question
* Double Entry Bookkeeping
  + Financial statements are biased toward concrete transactions; e.g., the market’s sudden distaste in a product will not be noted
  + T-accounts (a.k.a journal entries)
    - Left side is debit; right side is credit
      * Assets increase on the left; Liabilities and Equity increase on the right
    - Double entry: each credit is coupled with an equivalent credit
      * If the amounts aren’t initially equal, you record the opposite on each side of “Equity” (see the diagram at top of p. 129 for example)
    - You “net out” the T-accounts and record each in the balance sheet
  + **Books – what value?** Conventional rule: use ***historical cost***. Accounting rule departs from accurate representation for sake of verifiability (e.g. receipts). “Book value” of an item 🡪 what it says in financial statement. Actual value could be less.
    - Exchange asset for another asset = asset for asset swap.
  + **Won’t appear on balance sheet:** human capitol, experiences, patents?
    - Accounting rules supposed to keep in line. Not allowed to estimate value
  + **Expense accounts and revenue accounts** 
    - **Revenue:** “(1) Increase in equity, (2) which arises from delivering goods or services, (3) or other activities that constitute the entity’s ongoing major or central operations”
      * Revenue Recognition Principle: when you can count revenue. Only AFTER you’ve done whatever it is you do to get money. Ex. advance ticket sales 🡪 NOT revenue.
    - **Expense:** “(1) Decrease in equity… (ditto above)
    - If the these criteria are met, the amounts are recorded in expense and revenue accounts instead of equity accounts (see diagram on p. 131 for an example)
    - **Surplus:** revenue – expense.
    - Expenses increase on the left; Revenues increase on the right
    - You “net out” the expense and revenue accounts and record each in the income statement
    - Investment from shareholders and dividends paid to shareholders don’t count as revenues or expenses
    - Revenue minus expenses will appear in the “owners equity” section of the balance sheet as “retained earnings” or “accumulated deficit”
    - When you stock up on inventory, you credit “cash” and debit “inventory”
    - When you sell goods, you credit “inventory” in the amount you initially spent, and match it with a debit for “cost of goods sold (COGS),” which is an expense account; next, you debit “cash” in the amount you just received and match it with a credit for “revenues”
      * Accrual accounting:
      * ***FIFO*** (First In, First Out): assuming costs rise over time, results in *more income* for tax purposes, but makes the graph over time *look better*
        + Companies typically choose this method - they’d rather look good ☺
      * ***LIFO*** (Last In, First Out): assuming costs rise over time, results in *less income* for tax purposes, but makes the graph over time *look worse*
  + ***Faithful representation***: accuracy and relevancy of numbers. Primary concern for accounting. Relevant = could have an impact. Good numbers have evidence (e.g. receipts) to back them up.
* The Entity Concept
  + The division between owners and corporations can be difficult to define in small operations; remember that the finances of the entity alone must make sense
* For nonprofits, the equivalent of assets is *accumulated surplus* or *net assets*
* *Moving interest up the right side of the balance sheet*: means improving assets over liabilities
* Conservative Bias Of Accountants: Examples**:**
  + Strict definitions of assets and liabilities
  + ***Monetary unit concept***: anything not easily convertible to $ amounts are usually not recorded
  + Preference for *historical cost* over *market value*
* Matching Principle (application of this principle is discretionary)
  + **Revenue** is allocated to the *period during which effort is expended* (completed) in generating it
  + **Expense** is allocated to the *period in which the benefit from it will contribute* to income generation
    - *Deferral*:
      * Deals with scenarios in which “revenue” (under the Matching Principle) and cash come in different years
      * If, for a given transaction, there was “revenue” for the year (under the Matching Principle), and *you expect money shortly* but haven’t yet received it, you debit an asset account called “accounts receivable” and, credit “revenue”; The following year, when you receive the cash, you debit “cash” and credit “accounts receivable”
      * If, for a given transaction, there was no revenue for the year (under the Matching Principle), but you receive cash, you debit “cash” and credit a liability account called “deferred income”; The following year, when you perform so as to qualify for “revenue,” you credit “revenue” and debit “deferred income”
    - *Accrual*:
      * Deals with scenarios in which “expense” (under the Matching Principle) and cash are spent in different years
      * **LIFO v. FIFO** (see above)
      * *Capitalization and depreciation of expenditures*:
        + Applies when you buy an asset that will benefit you for years
        + First, you *capitalize* by crediting “cash” and match it with a debit for “equipment”
        + Then, over a time period over which you think it will last, you make annual deductions (credits) to “equipment,” with a matching debit in an expense account called “depreciation”

If your goal is to increase earnings (e.g., for P.R.), you want to capitalize expenditures, and depreciate over a long period

If your goal is to decrease taxes, you don’t want to capitalize them, or at least you want the depreciation over a short period

You can get creative here to adjust the historical graph

* Interest: rent on using money. **Another expense**.
  + Matching principle: record all the expenses you incur in achieving a certain level of revenue. All expenses that lead to revenue needed to be recorded in that year.
  + **Adjusting Entries** (made ***before*** balance sheet is made): depreciation, interest, etc
* Depreciation: begin with historical cost. Then, determine terminal value (value that you get when you dispose of an asset at the end of its useful life in your business). TA is a prediction, sort of make up (discretion). Then, predict how long they will last 🡪 period of useful life. Next, depreciation schedule (big first year drop b/c of new to used?)
  + Accelerated depreciation: losing value quicker up front
  + Straight-line depreciation: losing equal amounts each year.
  + Want high depreciation to attract investors. Want low depreciation to save taxes.
* Contingent Liability: If ***probable*** 🡪 need to put down. If ***reasonably possible*** 🡪 only need to put as a footnote. If ***remote*** 🡪 don’t have to say anything about it.
* Fair Value: price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date.
  + Level 1 Inputs: quoted prices (unadjusted) in **active market** for ***identical*** assets or liabilities that the reporting entity ahs the ability to access at the measurement date.
  + Level 2 Inputs: observable but not level 1. Quoted prices for ***similar*** assets or liabilities in **active markets**. Quoted prices for ***identical/similar*** in **non-active markets**.
  + Level 3 Inputs: ***unobservable*** inputs for asset or liability. Little/no market activity available. Developed based on the **best information available in circumstances**, might include reporting entity’s own data. Reporting entity shall not ignore information about market participant assumptions that is ***reasonably available w/o undue cost and effort*** (doesn’t seem like you need to do much)
* **Example—Cope’s Research Services**
  + **Loan covenants:** additional terms that restrict the loan beyond $$ and interest rate. E.g. “callableif <1.2 assets/liabilities.
    - When do loan covenants get measured? Not usually continually. But financial statements on intermediate basis. Quarterly or annually?
  + **Advertising:** generally CANNOT put down as asset (worth cannot be identified), but can put down “direct advertising” 🡪 call-in numbers; coupons; etc.
  + #8 – 210k not revenue yet b/c we haven’t delivered yet. Needs to be a liability until then.
  + #9 – cannot recognize donation b/c, like in-house patent, too hard to value.
  + #12 – if **contingent liable** is ***probable*** 🡪 need to put as liability. If ***reasonably possible, but not probable*** 🡪 only need to put a footnote. If ***remote*** 🡪 don’t have to say anything about it.
    - It is DISCRETIONARY. Stupid to not put “remote.” Affects settlement, litigation, and investing. Management decision. Bank won’t spend $$ to find out the probability or not. No one will find out!!
  + #13 – three solutions to problem of if we sold $10 book or $12 book. ***Management discretion*** options:
    - LIFO – last in first out. Pretend that items sold are the most recent ones that you purchased. 6.5k gross margin.
    - FIFO – first in first out. 7.5k gross margin.
    - Averaging
  + #11 – closed corporation: shares not publicly traded. What ***purpose*** did we buy it? Three options
    - Held to maturity security (maturity = date that you get paid for certain financial instrument) – not stocks 🡪 good indefinitely. No expiration date.
    - Available for sale security – if price is right in future, we might sell. But our intention is NOT to sell in ***near future*** (at least a year).
    - Held for trading security – means along with regular business, we’re doing securities business on side. Plan to resell w/in the next year.
      * Any money earned by selling it before end of the year goes into **net income**. Investment profit.
      * At end of year, held for trading security is no longer valued at historical cost. Revalue at ***fair value***. If FV is greater than historical cost 🡪 difference appears as profit. “Unrealized gain.”
        + What does FV mean in respect to security? Level 1,2,3 inputs. Level 1 and 2 not available. Level 3 – called cousin, said stocks doubled. Lvl 3 highly manipulatible. But historic costs also inaccurate.
  + #14 – NOT an expense because not central to our business activities. Direct decrease in equity.
  + #15 – do we have to spend money to audit writer to make a more exact estimate? Nope! Use the information that is available. As long as we’re honest, no huge cost is imposed to find more accurate estimates. Matching principle says work needs to be done in period in which revenue is declared. Author hasn’t finished and we haven’t delivered.
    - **Percentage of Completion Method** (determines when you can declare revenue). Author said 99%. Only applies in projects that are extended over time. Most applied in construction business. Have to pretty certain of payment (like getting it upfront). Take percentage of project that is done, and take the percentage of the deferred revenue as revenue. Have an obligation to put the expense relating to the ***revenue claimed*** (percent that we’ll be paying author).
  + #17 – rumor is NOT enough. No obligation to verify rumor.
  + #16 – reasons why fishy: happens at end of the year (companies begin to see what their financial statements will look like at end of year). Selling twice the amount we sold in past (unusual price). Include 90-day return privilege. 🡪 need to include contingent liability? Only if it is “probable.” End of year maneuvers:
    - Repo 105 (Lehman Bros) – sell 50B asset for 50B cash. Pay of liabilities 🡪 lower ratio. Had repo contract to buy back assets for 50B in cash. Treating it as ***sale*** instead of ***loan***.
    - **Window Dressing:** making financial statements look good at the end of the year.
    - **Channel Stuffing:** year-end sale to boost revenue. Especially at the wholesale level. Cannibalize next year’s revenue for this year’s profits.
    - **Goodwill (on balance sheet):** not what you think. Refers to when you acquire another company, you take all their assets and value them at fair value. Compare that fair value to amount you’re paying for the company. The gap between price you acquired company and fair value of the assets 🡪 goodwill. Assets together can have extra value than separate.
  + **Interest** in finance - ***rental of money***

**#Ratio Analysis (of Financial Statements)**

* Liquidity: ability of the firm to meet its **short-term financial responsibilities**. An indication of how much cash (or assets that can quickly be converted into cash) a business has at a given time, relative to its short-term liabilities. *Current assets should always be greater than short-term liabilities*. Ratio should be greater than 1.5-2. Increase ratio = increased liquidity. BUT if increase is driven by account receivables (red flag).
  + *Current Ratio* = Total Assets / Total Liabilities.
  + Or look at cash reserves on Cash Flow Statement
* Solvency: ability to meet **long-term responsibilities**. If a firm has too much debt (too highly leveraged), its solvency is imperiled (even a slight downturn in profitability could leave the firm incapable of paying creditors). Financial services highly leveraged (90% of assets). Manufacturing much lower (Amazon 60%).
  + *Debt to Equity Ratio* = Total Liabilities / Owner’s Equity
  + *Leverage Ratio* = Total Liabilities / Total Assets
  + *Interest Coverage Ratio* = EBIT (earnings before interest and tax) / Annual Interest Expense
* Managerial Efficiency: Accounts receivable should ***not be more than 15%*** relative to firm’s annual sales. Bad sign if customers aren’t paying their bills. For turnover ratio, the higher it is, the more efficient the firm’s inventory management is, or, in other words, the shorter the period of time items stay in inventory, the lower the firm’s cost of maintaining inventory is.
  + *Managerial Efficiency* = Accounts Receivable / Sales Revenue
  + *Turnover Ratio* = COGS / Year-End Inventory
  + Or interest payments to debt (providing a measure of a firm’s interest costs)
  + Or after-tax income to pre-tax income (measure of a firm’s tax rate)
* Profitability: Margin represents the sales remaining after direct costs. Supermarkets typically have much thinner (lower) margins, whereas high-tech firms like Microsoft have much higher ones.
  + *Margin* = Operating Earnings / Sales Revenue
  + *Return on Assets* = Net Income (Operating Earnings – Interest Expenses and Taxes) / Total Assets
  + *Return on Equity* = Net Income / Total Owner’s Equity
* Earnings Per Share And Price Earnings Ratio:
  + *Earnings per Share*  = Net Income / # of Shares Outstanding (measurement of the amount of earnings attributable to each share)
  + *Book Value* = Total Owner’s Equity / # of Shares Outstanding

1. **FINANCE** (taking advantage of mispriced stuff)
   * FINANCE
     + Need to be totally comfortable with accounting definitions, finance theory of value 🡪 something is worth the properly discounted future cash flows derived from possession of the object (includes positive/negative cash flows). What is proper discount rate? Complicated. Not obvious. Discount rate is **connection** between present value and future value. PV 🡨🡪 FV. 🡪 = interest rate. 🡨 = discount rate.
       - Predicting future interest rates is uncertain business. Use historical data (treat with skepticism, not great at prediction).
     + Also know for sure the levels of financial data – levels 1, 2, and 3. For valuation of assets.
     + **Two kinds of annuities:** annuities due (due Jan 1) and ordinary annuities (payable Dec 31).
       - **Perpetuity** is kind of annuity that goes on forever.
     + **Survivorship bias:** mutual funds that didn’t beat stop market ***closed*** and merged with the winning one. Only winning ones survived, so gives perception that funds are consistently beating markets. Or CEO’s that do well 🡪 champs or just lucky ones?

**The Time Value of Money**

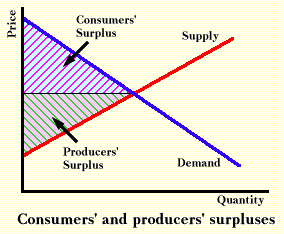
* Market Value – value at which market is pricing asset.
* Standard Of Value More Fundamental Than Market Value – ***Financial Theory of Value***: sum of all future cash flows properly discounted down to market value.
  + Need to predict future cash flows.
  + Assign a discount rate
* The Time Value Of Money: The relationship between the value of money received today and the value of money received in the future.
  + Comparing Current Dollars to Future Dollars
    - $100 PV v. $100 in 10 years.
      * (1) Gives up ***opportunities up*** that you could do with the $100.
      * (2) Future $100 might be worth less in the stuff I like to buy. ***Inflation***.
      * (3) ***Credit risk***. They might not be able to pay me in 10 years.
    - Demand $100 + interest for 10 year amount
    - **TABLE 1:** *Future Value of $1*. E.g. Greece needs to raise 100 million dollars, so it has decided to issue 20-year zero-coupon bonds. Its investment advisors determine that the bonds will have to yield 10% interest in order to attract enough investors. What will the face value of the bonds be?
      * The face value of the bonds would be $672.75 million (table 1 – intersection of 10% and 20 years).
      * **Zero-Coupon Bond:** it is a promise to pay to its owner a certain sum at some particular date in the future, its "maturity date." It pays nothing to its owner until the maturity date, but it is priced when initially sold at a value below the amount it promises to pay at maturity (its "face value"). The interest on the bond is the difference between its sale price and its face value. So, e.g. a 12-year zero coupon bond sold for 1M that has a face value of 1.6M would yield an effective interest rate of 4% compounded annually.
      * Example 1 (from page 232 in the text): How much will $1,000, left for 10 years in an account yielding 5% annual interest, grow to?
        + Find the intersection of 5% and 10 years in Table 1 (1.62889)
        + Multiply 1.62889 by $1,000 (the amount deposited) = $1,628.89.
      * Example 2 (Internal Rate of Return): An investment returns 2.3 times the amount invested after 8 years. If you had deposited the amount of the investment in a bank account instead, what interest rate would have yielded the same amount of money after 8 years?
        + ~11% (8 years, look over until you find 2.3 = 11%)
  + Compound interest
    - Period of compound interest – makes a difference. Shorter the interest period🡪 faster $$ will grow
  + Finding the Present Value of a Single Future Payment: Calculate the current value of a payment to be made at some future point. E.g. lottery win entitles payment of 1M at the end of the year, or a payment of $940k today.
    - Figure out what sum of money placed in a bank account with 5% interest will grow to 1M at the end of a year.
    - 5% at 1 year (table 2 – PV of $1) = 0.95238 \* 1M = 952, 238
    - So the 940,000 offer is not high enough, it is better to wait until the end of the year to get the 1M
    - **TABLE 2:** *Present Value of $1*.
      * Example 1 (from bottom of p. 234): How much would you have to put in the bank today at 5% interest in order to have $1 million at the end of 4 years?
        + Find the intersection of 5% and 4 years (.82270)
        + Multiply .82270 by $1m = $822,700.
        + (The text gives the more exact answer: $822,702.47.)
      * Example 2: Which is worth more, a payout of $1 million after 20 years, or an immediate payment of $300,000, if the appropriate interest rate is 7%?
        + Find the intersection of 7% and 20 years (.25842)
        + Multiply .25842 by $1m = $258,420, which is the present value of the $1m payment. So, $300,000 now is worth more.
  + Future Valuation of an Ordinary Annuity: Calculating the future worth of annual payments.
    - **TABLE 3:**  *Future Value of an Ordinary Annuity of $1*
      * Example 1: You have arranged for a year-end deduction of $10,000 from your salary to go into your 401k account every year. The 401k account yields 6% interest compounded yearly. How much will you have in the account at the end of 18 years?
        + Find the intersection of 6% and 18 years (30.9057)
        + Multiply 30.9057 by $10,000 (the amount of your annual contribution) = $309,057
  + Valuing a Stream of Future Payments (annuity): Calculate the present value of stream of future payments. E.g. Client can take $17 million now, or 25 annual payments of 1 million. What should he do?
    - **Perpetuity** (annuity that goes on forever): PV of perpetuity 🡪 PV = annual payment / interest rate.
    - **TABLE 4:** *Present Value of an Ordinary Annuity of $1*
      * 4% is what Massachusetts has to pay to sell its debt
      * At 4%, $15.6 million is the present value of the $1 million payments
      * So the client should take the $17 million now.
    - E.g. What is the rate of return of a 15-year annuity that costs 500k and will pay 50k per year?
      * Between 5.5-6% (table 4 – intersection of 15 yr and the percentage rate that would equal 500k if you took that percentage rate and multiplied it by 50k)
    - Example 1 (from pages 235-36): Which is worth more, 10 annual payments of $50,000 or 1 payment now of $400,000, assuming that 5% is the appropriate interest rate?
      * Find the intersection of 5% and 10 years (7.72173)
      * Multiply 7.72173 by $50,000 (the amount of the annual payment) = $386,086.50. So, the present value of the annual payments is less than $400,000.
  + Internal Rates of Return: The interest rate implicit in the cash stream. You can think of the IRR as the rate of growth a project is expected to generate.
  + Deciding What Interest Rate to Use
    - Option 1: Look at the ***characteristics*** of the entity/individual who is making the payments (creditor), i.e., the interest rates that the **creditors are charged by their creditors**.
      * Indicates the risk of the creditor not being able to pay. Use if this is primary concern.
    - Option 2: Look at the ***interest rate*** at which the **borrower can save (or invest)**.
      * Use if borrower will be saving the money for future use (investing), or will invest now.
    - Option 3: Look at ***interest rates*** at which the **borrower can borrow money**.
      * Use if borrower needs cash now.
* Efficient Market Hypothesis – well-traded markets have right price built into buying/selling.
  + Average return on stocks: general upward trend in market.
  + **Weak form of EMH:** can’t do any better just looking at ***past prices***.
  + **Semi-strong form:** claims you can’t do any better than widely diversified mutual fund. Can’t pick good/bad stocks not just past prices, but ***ALL publicly available information***.
    - What investment banks do (advise ppl on buying stocks/bonds). Problems with consistency of returns. Hear positive news, but not bad. Leads to perception that ppl know what they’re doing. Why can’t they predict? 🡪 ***Bargains***. Timeline is too short. Happens too fast. Any chances for gain and quickly reflected in market price.
    - Figure 11.1 – run up to deal. Insider information.
  + **Strong form:** can’t actually make money in a given stock market EVEN if you have ***inside information***.
    - Different markets are more or less efficient. NYSE is semi or weak form efficient. Doesn’t work in less-efficient markets b/c those markets don’t prevent insider trading. Might be strong-form efficient.
    - Some ppl argue insider information is a *good thing* 🡪 markets function more efficiently when ALL information is incorporated. Right companies are getting the money. Insider info is only ***buying*** shares. NOT not buying.
* #Risk & Return
  + The **return** on a financial asset is the ***total economic benefit that an asset generates*** over a certain period of time (typically a year)
  + **Risk** is a measure of ***expected variation in return***. Risk relates to the amount of uncertainty regarding the return that a financial asset will achieve over a period of time.
  + Empirical investigation of financial markets has discovered that there is a strong and consistent relationship between the return on various classes of assets and the variation in return (risk) of those assets
    - **Risk premium**: The quantity by which return on an asset class exceeds the overage return on US Treasury bills over the same period
    - THUS… a primary goal of financial analysis has been to document the risk/return characteristics of different kinds of financial assets
      * “A major premise of financial analysis is that the future performance of financial assets will, to some degree, be comparable to past performance”
  + Where do we cut off the historical data for predicting markets? Relevancy vs. inclusiveness. Perhaps more weight to more recent years? Graphs in handout give each year equal weight.
  + 10x standard deviations (basically) never occur.
    - Martingale System:
      * Like SD, we don’t expect machine to break 🡪 disaster.
      * Impact on financial markets: big surprises 🡪 impoverished the bank.
  + **Stationarity:** idea that coin is changing as we’re gathering the data.
  + Investors can determine how much they’re going to get (expected value) and the chance they’re going to get it (risk).
    - Expected value risk
  + Investors only really care about risk of portfolios.
    - Engage in diversification. Have judge risk of investment against background of all other investments available to investor. Combing investments reduces risk of individual stocks quite a bit.
  + **Systematic risk (non-diversifiable):** risk that ***affects the whole market***. All stocks go down (on average) b/c of systematic event (e.g. U.S. in trouble). Can’t avoid w/ diversification.
    - Get benefits of diversification with ~30 stocks.
    - How to overcome systemic risk? Invest in bankruptcy firm? Russian stock market? Measure of how much individual stock has systematic risk (moves in the direction of all the others) 🡪 high beta (moves in same direction as other stocks, plus some) and low beta (moves less in the direction as other stocks).
      * Gold – low beta investment (ppl buy gold when stock market is bad).
      * High beta increases risk. Low beta decreases risk.
        + Beta = 1 (current risk of portfolio)
        + Beta >1 (increased risk)
        + Beta < 1 (decreased risk)
    - Big question: will investment increase/decrease non-diversifiable risk?
  + **Non-systematic risk (diversifiable risk):** goes away when you diversify portfolio. Takes upwards of 30 different stock investments.
* Capital Assets Pricing Model (#CAPM) (doesn’t work; predictions are awful): what price should be based on the fact that investors care about two things: (1) size of return, and (2) risk associated with expected return.
  + **Required return on a stock = secure rate + the equity premium x beta of the stock**.
    - E.g. The return on Ames General Dynamics stock is likely to be 14% this year, according to your calculations. Ames treasury bonds pay 5% and the equity premium is 5%. If your estimate of the stock's beta is 1.2, would it be a good investment?
    - 5 + 5(1.2) = 11%. As the stock is like to be 14%, 11% is a bargain!
    - **Equity premium = average return of class – secure rate**.
  + **Secure investment (no-risk investment):** treasury bill rate. Currently .1%. Secure rate historically is 3.7% (see handout).
    - Risk premium: depends on nature of investment
    - How much return do you need to take on extra risk? Risk investment (11.8% for large-company stocks) – no risk investment (3.7%) = 8.1 % = **risk premium**.
  + Equity premium puzzle: stocks seem to give huge investment bonus w/o being seemingly justified? Awfully large gap to be justified by riskiness. Why would you even invest in bonds?
* Annuity: pairing of two separate streams of cash – interest in & annuity payment out
  + Increases by interest and decreases by amount of annuity payment. E.g. $1m investment @ 8% 🡪 lasts forever. 80k in interest into account at end of year, and 80k paid out. Still $1m.
  + “Ordinary annuity” – paid at end of year.
  + Table 4: if you want $1 paid out every year for five years at 10%, you need to put in $3.79. If you paid $100k 🡪 how much would get out at 10%? 100k/3.79 = $26,385.
* For-X Ex.
  + Some brokers demand a larger margin between personal & broker money 🡪 “larger margin.” Less margin, less return.
  + **“Margin call”** – investment begins to decrease, bank will call and require greater margin.
* Leveraged Buyout
  + Standard LBO target has no debt and solid assets.
    - EBIT – earnings before interest and taxes
    - For RoE, what is the right income to use? EBIT? Net Income? 🡪 ppl do it different ways.
* #EBIT – Earnings before interest and taxes
* EBITDA – Earnings before interest, taxes, depreciation, and amortization.
  + Operating expenses would already be taken out. Depreciation and amortization don’t involve the changing of cash. Just shrinking assets. EBITDA will tell you how much money coming in.
  + Find it sometimes before the last line of operating costs
* Valuing Rite Aid And Wal-Mart
  + How do you value a company? **Fair value**.
    - Level one input: Market capitalization. But will never give bargains (mispriced asset)
    - Look at comparable companies. What is comparable? Ex. CVS to Rite-Aid. Standard in housing market (looking at recent sales in area).
    - Look at book value: assets minus liabilities.
      * Not reliable. Disregards going concern value – value that is generated by putting all assets together. Always higher than book value except when company is about to go under. And book value also leaves out all assets you would want to look at (in-house developed stuff).
      * How much too low is book value usually? Typically about 3x (market to book value). 🡪 look at book value and multiply by three.
    - **Financial theory of value** (standard of value, allows us to claim that there are bargains): properly discounted future cash flows. Need to know discount rate and future cash flows to calculate.
      * **Capital asset pricing model:** gives us *discount rate based on riskiness of investment*.
      * Two sources of cash flow for owners of share of stock: (1) periodic payments 🡪 ***dividends*** (in case of corporation); (2) capital appreciation that comes from selling share.
        + Start with predicting dividends for life of the investment.
        + Add appreciation in share.
* Survivorship Bias**:** mutual funds that didn’t beat stop market ***closed*** and merged with the winning one. Only winning ones survived, so gives perception that funds are consistently beating markets. Or CEO’s that do well 🡪 champs or just lucky ones?

1. **CONTRACTING**

* #Contracting Basics
  + **Why Ks are made?**
    - Ks are only made b/c they are ***mutually advantageous***
      * Differences in Valuation (pick Price in middle)
      * Advantages in Production (E.g. Economies of scale, specialization in performance, having a special ability or characteristic)
      * Complements (E.g. oil supplier and pipeline builder can supply oil cheaper)
      * Borrowing and Lending (B gets money, S gets interest)
      * Allocation of Risk (E.g. insurance policy, investment partnerships)
      * Different Expectations (Predictions about prices always vary a bit)
  + **Components of a good K:**
    - *Incentivizing desirable behavior* → perform when optimal, don’t when not
    - *Workable:* be verifiable at a reasonable cost, and clear/interpretable
    - Contingencies that *take risks into account → and allocate to best bearers*
    - *Predetermined methods* of dispute resolution
  + **Checklist**
    - (1) Enlarge the K pie
      * Note: Whenever a K term increases net value, there is a way to include a term that will make both parties better off
    - (2) Incentives → Are they aligned?
      * Why people may not perform poorly: (i) **Repeat business**, (ii) **Reputation**, (iii) **Ethics**
    - (3) Uncertainty and Risk Bearing (including possibility of re-neg)
    - (4) Practical Enforceability: Remember clients are unlikely to know about feasibility & cost
      * For a K term to be workable (succeed in inducing the desired outcome) any condition on which it depends *must be readily understood and its occurrence (or non-occurrence) must be verifiable at reasonable cost*
      * Terms to be *readily verifiable and interpretabl*e by courts and arbitrators
      * If they aren’t, at least should figure out a way to make the conditions easier to apply – perhaps through an expenditure or an effort of some king
        + E.g. specify that outside expert evaluate “difficulty”
    - (5) Disputes and resolution → ALWAYS a possibility (unless complete K but impossible)
      * (i) Contingent Provisions, (ii) Arbitration, (iii) Damages (liquid)
* Production Contract: Ks for production or construction
  + **Flat fee Contract:** Amount paid is fixed and specified in the K.
    - Incentive: use cheap materials (concern about ***quality of goods/services***). Incentivized to **minimize costs**. Counter incentives**: reputation and repeat business.**
      * **Buyer Solution:** (1) Specify them in advance 🡪 overcomes incentives; (2) Require approval/provide oversight.
      * **Problem:** (1) Need expertise/expensive to get info; how to foresee everything? (2) Inconvenient
      * **Reputation:** maintained and generated today by internet. Influenced by who can pay to remove negative review or pay to publish positive reviews. Online reputations often manufactured.
      * **Additional problems if paid up front**. Solution 🡪 ***escrow*** (some of purchase price goes into account that belongs to neither party). If you can withhold money, other party has to do suing. If we retain money, we are in much better position
    - (In)flexible: often have to be re-negotiated
    - Risk: Contractor bears all risk (b/c pays for costs)
    - Net Welfare: Higher under flat than c-p. Lower K price and less waste
  + **Cost Plus Contract:** Buyer pays whatever the costs turn out to be plus something extra. Extra can be fixed amount or based on costs (% of costs)
    - Incentive: use overly expensive materials. Financial incentive to ***overspend***. Also, NO incentive to search for bargains.
      * **Buyer Solution:** (1) Cap costs on individual items or general cap (hard to know what cap should be and expensive to find out), (2) Require approval
      * **Problems:** (1) Need expertise to know costs, (2) Inconvenient
    - Flexible: usually don’t need to be renegotiated when changes are made
    - Risk: Buyer bears risk by definition; ***pays costs no matter what***
    - Paid Per Hour (Kind Of Cost Plus Arrangement)
      * Provide cap. Ex. litigation issue that client will not pay beyond.
      * Problem: sets a goal to ***go up to***.
* Principal/Agent Contract: One party (*principal*) Ks with another (*agent)* to do something
  + **Performance-based (output-based):** Payment depends on productivity as measured by some specified criterion (e.g. sales clerk on commission)
    - Agent Incentives: Aligned w principal’s; Directed towards performance. Strength depends on specifics of the K (e.g. what % of profit he gets)
      * **Problem:** may NOT be strong enough to make agent do stuff. Or if get high % of gains/loss maybe expensive/unworkable for principal. Also, issue of picking the right specific criterion to measure performance.
    - Risk: ***Agent bears risk*** b/c may not be able to predict own performance
    - Solution: guarantee a base salary and augment with profit-based component
  + **Input-based**: Payment is tied to input (e.g. time spent, construction costs)
    - Agent Incentives: (1) to do things that tend to lead to profits but (2) no incentive to increase profits along other dimensions (**e.g. be efficient**)
      * **Solution:** pay to observe/direct asses agent’s performance
      * **Problem:** expensive, and often imperfect. $$ to monitor.
    - Risk: Typically don’t put risk on agent (he knows how many hrs he works)
  + **Fixed-fee**: Simply paid a fixed amount (e.g. accountant for doing taxes)
    - Agent Incentives: NO direct incentive for the agent to *perform well*
      * **Solution:** make fee contingent on *satisfactory effort* (after monitoring) or *quality of final product*
    - Risk: Agent bears little/no risk UNLESS *amount of effort needed is uncertain upfront* (e.g. lawyer may not know when litigation will end).
* Complete Contract: K is *completely specified* if the list of conditions on which the actions are based is explicitly exhaustive (e.g. says when do/don’t have to perform). Theoretical.
* Efficient Breach: a party should be allowed to breach a contract and pay damages, if doing so would **be more economically efficient than performing** under the K
  + S’s cost of perform > damages and damages ≥ value of performance to B
* Pareto Improvement: Makes some better off and none worse off. Situation of a rule/transaction/intervention such that ***all effected parties claim to be better off***. Ex. many voluntary transactions as long as they don’t have externalities. Many gov programs are not pareto improvement. Ex. airport – benefits larger society, but harms local homeowners
  + Pareto optimal K: cannot be modified to raise the expected well-being of parties
  + PI *rarely happens*. Instead, ppl look towards Kalder-Hicks Improvement.
* Kaldor-Hicks Improvement: Whenever some are made better off and those that are made better off could *in theory* **compensate those that are made worse off** (so Pareto improving outcome results). 🡪 make ***overall pie bigger***. Utilitarian. Paying off losers is just too hard. And can be incredibly impractical. People loose from some, win from others. **In general, everyone is better off.**
  + *Note:* doesn’t require compensation actually be paid, merely that the possibility for compensation exists. Basically, it happens whenever net benefit arises.
* Reward System (IP): give creator reward for making thing, and anyone can sell it
  + Pro: Encourages creation AND results in optimal Q (b/c not sold at monopoly P)
  + Con: in order to determine rewards, gov ***needs info*** about the value of the works
* Contracting Out – take advantage of **specialization and market competition; avoid union deals** (pension plans) and other benefits. Privatization drives **down costs and improves quality**.
  + **Problems:** employees might not be treated as well.
* Foreseeing Problems
  + Contingent Provisions: More is better until the MC of drafting/neg > MU
    - Also want to think about what you think a tribunal would do absent such a provision – but leaving it up to them can be *risky/expensive*
  + #Damages for Breach: Generally better than leaving to tribunal
    - **Advantages:**
      * Results in savings
      * Reduces uncertainty
      * Fewer/no resources spent at trial/arbitration than if contested
      * Protects potential victim of breach from risk
    - **Factors to consider in picking liquid amount**
      * (1) *Incentives* it will create: e.g. not to miss delivery date
        + High – most incentive not to breach
      * (2) Who can *better guard against risk*
        + More risk averse victim: want higher damages
        + More risk averse breacher: want no/lower damages
      * (3) How it will *affect K price* (high damages = high K price)
  + Arbitration: Pick (1) Who will do it, (2) What rules to set
    - Parties get to decide who the arbitrator is
      * Industry expert with experience in dispute resolution > judge > industry expert with little/no experience in dispute resolution
    - **Benefits:** may be *cheaper, faster*, let them have someone who is an expert deal with the issue rather than judge who might not know much about the field
      * Gives the parties privacy (b/c not public record)
* Allocation Of Risk
  + *Put on party able to control/know/handle risk*.
  + Law firm associates bear risk (at will employees). Why? Unequal bargaining power. Law firm doesn’t want to bear risk? Trade with 5% reduction in salary?
    - Varying salaries w/ performance? Selects candidates according to hidden information (those who intend to work hard and predict quality performance). Need to specify kind of performance you want and what “quality” means. Billable hours? Problems with efficiency. Performance reviews? Problems with subjectivity, politics, or personality issues.
    - CEO base compensation + raise in stock price. **Problems:** focus on short term or stock price might NOT be accurate reflection of CEO job.
    - Doctors: flat fee? Supplement with specificity or reviews? Hours not necessarily good proxy for effort/quality.
* Purchase and Sale Agreement
  + Need pre-approval from bank to give $ range.
  + Provision to inspect title and premises after signing.
  + Purchase and sale agreement = option contract. Seller is locked up to sell, and buyer can keep shopping.
  + Who pays for inspections? Other pests? Ways to get out of contract either restricts or expands worth of contract for buyer.
  + Financial contingency – bank gets to independently value property to see if they want to allow loan.
  + Liquidated damage clause – deposits escrowed in case of buyer breach.

1. **#MICROECONOMICS**

* THINK ABOUT:
  + **Market factors** (below) and solutions/incentives/consumer v producer surplus. Also consider risk aversion/deterrence.
  + **Price discrimination**
  + **Elasticity** (of both supply and demand) – not only of the good but also in relation to other goods.
  + Question numbers.
* **Free Perfect #Markets are Terrific?** Perfect market is based on four assumptions:
  + 1) Consumers are ***rational and informed***.
  + 2) Many buyers and sellers (***vigorous competition***). If not, problems of monopoly & monopsony.
  + 3) ***No public goods problem***.
  + 4) ***No externalities*** (effects on parties outside market, e.g., ppl outside pistol market being shot).
    - If you have perfect market, government is harmful to public welfare (perfect market maximizes welfare). To justify intervention, have to show one of the above interventions.
  + **Claims:**
    - Maximal voluntary transactions at equilibrium. Voluntary transactions in a perfect market increase well being. E.g., briefcase for $10. If willing to pay $80 🡪 increase of ***social surplus*** of $70 (consumer + supplier surplus). If consumer, called consumer surplus. If seller, called supplier surplus (difference between what seller was willing to sell for and what he actually sold).
      * Government should maximize overall surplus when dealing with markets.
      * Demand curve used to determine reserve price.
    - Since we have maximum voluntary transactions, we have maximum surplus.
    - For 0 production costs, the correct price for total social surplus is 0. Everyone who wants one, gets one
  + **Shortage:** at current price, more demand than there is supply.
    - Where government intervenes and produces shortage, illegal markets arise.
    - Or, rationing by government occurs. Like in wartime. Ends up being ***really costly*** 🡪 lots of effort to collect and sort through info, print coupons, and still doesn’t prevent black market.
  + **Imperfect Consumer Information**
    - Lots of investments require government-mandated disclosure of information.
    - Informing consumer is basic move. But often, providing information won’t work b/c consumer won’t understand.
    - **Other alternative:** regulate quality of the product or regulate purchase of a product (enforced buying of insurance).
    - **Consumer Sovereignty:** consumer is the best chooser of what happens to him. You know best your preferences? Freedom has an intrinsic value? Economics favors consumer sovereignty.
      * Nudge (Sunstein): psychological and environmental factors affect choice.
  + **Where government intervenes?** 
    - Education; medical care; drugs; gambling; transportation; savings; marriage; eating, automobiles; etc. Anywhere they don’t intervene? No…maybe online hand crafted goods.
      * Government points to all categories of imperfections of markets, but mostly to ***lack of information***.
      * Problem: people like to choose for themselves
* Basic Terminology
  + **Maximum Willingness to Pay**: The price where the consumer is indifferent between buying the product and going without it. Depends on individual’s wealth/income level and whether he has viable alternative/substitute. May also depend on how many he already has (less likely to pay as much for a 2nd car as for a 1st).
  + **Producer Surplus**: The difference between the cost of producing the product and the price. The area between the supply curve and the price line. The profit.
  + **Consumer Surplus**: The difference between the maximum willingness to pay for the product and the price paid. The area between the demand curve and the price line.
  + **Value Created** = **Producer surplus + consumer surplus.** Both consumer and producer are better off after the sale because consumer’s willingness to pay > cost of production. This is efficient because there was pie/surplus to split.
  + **Competitive** **Market**: P = MC. Many producers of identical goods.
    - Consumers and firms in competitive markets are price *takers* (not *makers*)
    - S and D determine P (y axis) and total Q sold (x axis). Always move to equilibrium.
  + **Perfect** **Market**: perfectly matches the competitive model and no issues. NO need for gov regulation
    - Perfect market information
    - No Externalities (and no public good problem)
    - No participant with market power to set prices (no monopoly)
    - No barriers to entry or exit; Equal access to factors of production; Profit maximization
  + **Market** **Equilibrium**: Occurs when Q and D are at intersection of P and Q
    - Equilibrium Price and Quantity
  + **Price Floor**: Places a minimum on the price of a good. (some P > MC)
    - Only changes things if the floor is *above* the equilibrium P [No shifts, just slides]
      * Creates *excess supply* (QD falls, QS rises, P artificially fixed high)
      * Fix: allocate max Q of sales for each supplier 🡪 artificially keep Q S low
    - Effect: Limits total surplus cos people who would D at MC aren’t buying at P
      * Benefits producers who sell the good. Transfers surplus to seller
  + **Price** **Ceiling**: Places a maximum on the price of a good (some P < MC)
    - Only changes things if the ceiling is *below* equilibrium P [No shifts, slides]
      * Creates a *shortage/excess D* (D rises, S falls, P artificially fixed low)
      * Fix: distribute supply among consumers 🡪 fix how much each can D
    - Effect: Limits total surplus cos things that have P < MC < D are not being made
      * Benefits consumers who buy the good. Transfers surplus to buyer
      * But inefficient, ARBITRARY allocation of goods (not by who values most)
  + **Commodity** **Tax (VAT)**: Places an additional cost on buying things; increases after-tax P
    - Always changes things [Shifts D, S slides]
      * D *shifts* inward by amount of tax
      * P falls by *less* than the tax amount (to meet demand)
      * Q falls (slide down S curve b/c of price fall)
  + **Subsidy**: will increase Q Supplied (shift curve *out*) 🡪 P falls
  + **Externality**: Action creates an externality if it influences the well being of another person
    - Can be positive/negative; future/contemporaneous effects; certain/probabilistic.
    - Socially desirable act = (internal + external costs) < (internal + external benefit)
  + **Pigouvian (corrective) Tax**: party makes a payment to the state *equal to the harm the party is expected* to cause. Creates financial incentive to reduce harm.
    - Reflects *anticipated* harm; is paid to *state.*
    - [Whereas tort liability: liability for harm *already* done; paid to victims]
  + **Natural** **Monopoly**: Arises if much cheaper for one company to produce all than for many to make a bit. This is desirable b/c it leads to savings. ***But don’t want profit max pricing.***
  + **Imperfect Competition:** more than one seller but not high competition.
    - Firms could be selling identical (e.g. gas) or sub similar (e.g. BK v. McD) products
  + **Oligopoly**: Markets w small number of firms (2-10) who consciously take into account how other firms will react to what they do and how they might collude (compete strategically)
  + **First** **Degree** **Price** **Discrimination**: Monopolist charges exactly what ***each customer*** is willing to pay. P = D for each one of them. No deadweight loss. No consumer surplus. E.g. bible salesman.
  + **Second Degree Price Discrimination**: Discriminate by ***quantity*** 🡪 get industrial by offering lower P
  + **Third** **Degree** **Price** **Discrimination**: Monopolist matches price charged to the D curve for ***particular groups of customers*** (e.g. location, consumer age/gender/profession)
    - Need to be able to (1) Differentiate customers/sub-groups, (2) Prevent re-sale/cheating
  + **Welfare** **Economics**: Organizing framework that economists have for analyzing *normative* questions (i.e. what policy *should* we adopt?). Its about evaluating effects/results.
  + **Central Theorem of Welfare Economics:**If society can costlessly redistribute wealth, then regardless of the measure of social welfare, the social maximum can be achieved by ***redistributing wealth and then allowing competitive markets to function*** (assuming no impediments to market functioning like lack of consumer info, bad externalities etc.)
    - Basically, want markets + taxes
  + **Social** **Welfare** **Function**: the measure by which economists evaluate social welfare
    - Economists don’t assume any specific measure of welfare is objectively correct
    - **Utilitarian** **SWF**: Welfare = ∑ of individuals utilities
    - **Rawlsian** **SWF**: Welfare = utility of the least well of person in society
    - **Egalitarian SWF**: Most equal. E.g. ∑utilities – av. squared deviation from mean
    - **Domain (of a SWF)**: Says *who’s* welfare we are going to consider at all
  + **Public** **Good**: (1) Non-excludable, (2) Non-rival
    - ***Non****-****Excludable*** Good: cant stop people from consuming them 🡪 causes **Free** **Riding**
    - ***Non****-****Rival*** Good: one person’s use doesn’t diminish any other’s
    - ***Congestible******Good***: at some levels, consumption falls, but at others are non-rival
* #Demand Curve: The relationship between the ***market price and the quantity demanded*** by the market. **As price goes up, demand will go down**. The demand curve tells us how many units will be sold at a given price.
  + Elasticity of Demand: The percentage change in quantity divided by the percentage change in price. This measures the responsiveness of demand to a change in price.
    - Price elasticity of demand =
    - If the elasticity is greater than 1.0, the demand relationship is said to be elastic. If it is less than 1.0, it is said to be inelastic.
    - Elastic demand curves are more responsive and appear flatter (e.g. airline travel for leisure- this is not necessary, so people will fly less in response to even a slight rise in prices)
    - Inelastic demand curves are less responsive and appear steeper: this means that demand will not change much even if the price changes (e.g. urban transit- people need it to get to work, so will use it about the same regardless of price fluctuations)
  + Cross-Price Elasticity: The degree to which demand for one product changes as the price of another product changes.
    - This indicates the interchangeability of products. So, if demand for one product rises as the price for another rises, then the two products are largely interchangeable. (As Sentras become more expensive, people substitute away and demand more Escorts.)
  + Factors that shift D curves:
    - Income level (and thus also VAT taxes and income tax)
    - Price of substitute goods
    - Price of complementary goods
* #Supply Curve: The relationship between the fixed market price and the quantity the market will produce. As the number of units produced increases, so does the cost of production.
  + This can be considered in terms of a single producer: the more units that are produced, the more costly it is per unit.
  + Or, this can be considered in terms of multiple producers: some producers can make the product for less than others. As the necessary supply increases, less efficient producers are able to enter the market. Producers at lower points of supply curve have lower costs (more efficient). Producers at higher points of curve have higher costs (less efficient and least likely to produce because smaller profits to be gained).
  + Elasticity of supply =
  + Factors that shift S curve (not from book):
    - Changes in price of labor or raw materials
    - Subsidies
    - Taxes (income, capital gains)
    - Technological advances
    - Diseases (in agriculture) or natural disasters (land)
* Market Equilibrium: The point at which the demand curve and the supply curve intersect. This is the price point of the product. It tells us how many units of the product will be produced and the price at which they will be sold.
  + At this point, the quantity produced will be exactly equal to the quantity demanded by consumers
  + The competitive equilibrium is efficient, because only (and all) those who value a product more than its cost of production will purchase it.



* + Area under demand curve is total value. Area under supply curve is total production costs. Area under the price line is total amount paid by consumers for Q they purchase.
* Loss/Gain Of Surplus Due To Changes In Supply And/Or Demand
  + Total surplus is the area between the supply curve and the demand curve to the left of the equilibrium point. The difference between consumer valuation and production cost.
    - I.e., consumer surplus + producer surplus
  + When the supply curve or the demand curve shifts, there can be some loss and/or gain of surplus.
  + Events can cause a shift in the demand curve or the supply curve. This will result in a rise or fall in price.
    - E.g. 1, on Valentine’s Day there will be an upwards shift of the demand curve as a result of an increased willingness to pay for roses. This will cause production to increase (bringing ***less efficient producers*** into the market) and the price will rise. This results in an increase in producer surplus.
    - E.g. 2, there are reports about negative health effects of beef. People are willing to pay less for beef. As a result, the demand curve falls, and thus production drops and prices fall. This results in a loss of producer surplus.
  + The rise of costs will force producers to pay more to produce the good. This will cause the price to rise. The shift of price will force consumers to pay more, thereby reducing consumer surplus, and the loss of production will reduce producer surplus.
    - This will also push some people out of the market completely- it is no longer possible to produce the product at the low price they were willing to pay.
* #Monopoly Pricing And Deadweight Loss
  + A monopolist can raise the price and reduce the quantity produced in order to gain more surplus from higher prices than they lose from pushing people out of the market. This produces deadweight loss.



* + Monopoly pricing ***increases producer surplus***. But it ***reduces consumer surplus*** in the form of higher prices (for those who still buy) and deadweight loss (for those who are pushed out of the market).
  + It is profit maximizing for the monopolist to produce where **marginal cost = marginal revenue**. It will produce as long as marginal revenue is greater than marginal cost and be indifferent at the point where the two curves intersect.
    - Intersection between MR curve and MC curve determines the correct ***quantity*** (profit maximization point). Why? Beyond this point, marginal cost exceeds the amount of extra revenue they would get. Reduces profit. How to determine ***price***? Look at demand curve above intersection of MR and MC = **monopoly price**.
    - **Where will competitive market end up?** Intersection between MC and D. 🡪 more overall surplus, but less PS than in monopoly market
  + The loss in producer surplus (due to consumers with low maximum willingness to pay being pushed out of the market) is very small (because the cost of producing those units was high) compared to the gained producer surplus from increased prices.
  + **Rent Seeking Behavior:** When a company, organization or individual uses their resources to obtain an economic gain from others WITHOUT reciprocating any benefits back to society through wealth creation. The monopolist will increase the price until the gained producer surplus equals the lost producer surplus. Efforts to get a monopoly. Unproductive.
  + The total lost consumer surplus + lost producer surplus equals deadweight loss:
  + Outcome is NOT “efficient” because there are consumers who should be served by the market (who value the product above the cost of production) but are not. Size of the total pie is smaller bc of the DWL.



* + Network Externalities: When others benefit from a monopoly situation, e.g. everyone benefits from the Microsoft monopoly on Windows, because programming can be standardized, making far more programs available to people at lower cost.
  + Natural Monopoly: Sometimes a monopoly is the most efficient, as when there are very high startup costs, e.g. public utilities.
    - However, it *is* desirable to prevent the monopolist from charging the high monopoly (profit max) price that results is low Q and thus deadweight loss
      * 🡪 Price Regulation is justified
    - Ideal form of price regulation? allowed price should be the MC of production
      * Problem: MC pricing will cover marginal costs (buying gas and maintain network), but not high cost of constructing the network
        + 🡪 will need more funds to stay in business
      * Possible Solutions:
        + 1) Gov can give the company a subsidy
        + 2) Fix price a bit higher than MC (e.g. P = AC) 🡪 COST PLUS

Problem: defeats the purpose a bit, since you are gonna lose surplus (still be under Q)

* + - **Other Inherent Problems**
      * 1) Difficulty gov regulators have in getting accurate info
        + Monopolist has the info, and incentives to skew it
      * 2) Monopolist has little incentive to lower its costs if the price it can charge is based on them
      * 3) Regulators may be “captured” by the industry
    - Government could own and operate the company itself, and then price at MC
      * Problem: Gov can be inefficient cos of its various constraints.
  + Ologopoly and Monopolistic Competition
    - Imperfect Competition: more than one seller but not high competition
      * Firms selling identical (e.g. gas) or substantially similar (e.g. BK v. McD) products
    - Oligopoly: Markets in which there is a small number of firms (2-10), and the firms consciously take into account how other firms will react to what they do as well as how they might collude (compete strategically)
    - Monopolistic completion: larger number of firms than oligopoly (e.g. all nail salons in city), each firm has a slightly different product (e.g. different locations, specialties), firms don’t really take into account how others will react to what they do individually
      * NB: firms enter industry til supernormal profits are competed away. Though each is mini-monopolist, don’t make substantial profits cos entry lowers its D curve
      * E.g. Shop in suburb: You can raise the price so far and not lose customers
    - **A number of issues can arise in imperfect competition** 
      * 1) **Price wars**: P can be driven down til none is making a profit (but actually a loss)
        + Because, if products are identical, whichever has the lowest price captures the *whole* market, so its race to bottom
        + But, learning that price wars suck, more likely to do….
      * 2) Collusion: make explicit agreement to set a high price
        + By acting as one, can set the single monopoly price
        + BUT: these violate antitrust laws and carry sanctions
      * 3) Tacit accommodation not to undercut each other
  + Socially Valuable Monopoly: When pharmaceutical company has patent, monopoly for certain number of years. Patents exist to incentivize innovation and this is a positive result of monopoly because it means people will have better drugs.
    - **Copyright and patents** – clear deadweight loss, but we want to *promote innovation and invention*.
      * Do away w/ copyright and patents, but have government reward producers based on demand of product? Gov. reward system would *mimic monopoly price and eliminates deadweight loss.*
  + Price ceiling: a legal maximum on the price at which a good can be sold. E.g. rent control, price controls on gasoline, price ceilings on water during a draught. ***Leads to a shortage*** because suppliers won’t produce enough goods to meet demand unless the price is allowed to rise above the ceiling.
  + Price floor: a legal minimum on the price at which a good can be sold. E.g. minimum wage. ***Leads to surplus*** because suppliers produce more goods than are demanded unless the price is allowed to fall below the floor.
  + **Why Monopoly Arises** 
    - 1) Single owner **buys crucial input to production**, so others cannot compete. *Ownership of key resource*.
    - 2) *Government created monopoly* 🡪 patent and copyright. Transportation. Party invents something and gets © or patent
    - 3) **Natural Monopoly:** market being most efficient when there is only one provider [gov may approve]. E.g. a market that requires a large infrastructure to operate (providing water or electricity or other utilities) → makes competition difficult and socially wasteful. Or building a second bridge over a river where traffic is minimal
      * Control of natural resources (e.g. DeBeers)
      * Barriers to entry (e.g. Disney World)
      * Technical superiority (e.g. Google)
      * Economies of scale (e.g. Amazon)
    - Worried first about **demand curve**. Would we want monopoly over elastic or in-elastic demand curve? ***Elastic***. E.g., if monopoly over insulin, people would may horribly high prices.
    - Real question: how much power does a company have to set the price of good? Monopoly is only distributor w/ no alternative. Never happens, but is a question on how good/accessible is the alternative? The question really is monopoly or not, but how much monopoly power?
  + **More than one price monopoly** – involves price discrimination 🡪 maximizes producer surplus. **First degree price discrimination** 🡪 figure out what reserve price is for *each person, one at a time*, and get all of the surplus (e.g. bible salesman).
    - Hard to identify individuals. So identify groups 🡪 students (very elastic) and non-students (less elastic).
    - Price discrimination increase total social surplus, and decreases dead weight loss
  + Example Problem Chart

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Price | Quantity | Revenue | Marginal Revenue | Total Cost | Marginal Cost | Profit |
|  |  | (Price x quantity) | (How much more earned by additional quantity) | (Quantity x cost per item) | (How much more $$ it will cost to go to next quantity) | (Revenue minus Total Cost) |

* #Externalities: effects that extent outside market
* **The Problem** 
  + Socially desirable act = (internal and external costs) < (internal and external benefits)
    - Since only consider ***internal***, decisions will be inappropriate in one of two ways:
      * 1) Too much activity that causes external harms
        + Acts that cause nuisances, pollution, dangerous behavior all will occur more often than socially desirable
      * 2) Too little activity that generates external benefits
* **Non-Legal Solutions**
  + **1. Bargaining** 
    - The Idea: If there’s frictionless bargaining b/w creator of externality and the parties affected by it: bargaining will take place and a mutually beneficial agreement will be concluded if such an agreement exists in principal (Coase)
      * This means any externality problem will be eliminated: any undesirable action will be forestalled by agreement
      * e.g. Z can landscape his yard for cost of 1k, but only gets 500 value. But, neighbors’ collectively value it at 900. Lost benefit 400.
        + Thus, if neighbors pay Z between 500 and 900, then both win (e.g. if pay 700, net to Z is 200, to neighbors 200)
    - Problems
      * 1) **Asymmetric Information means bargaining might fail**
        + Asymmetry of info leads to miscalculations in bargaining

Esp. likely that you will miscalculate the cost/benefit to the other party (aka. how much they value something)

E.g. if neighbors think the value of waste to the factory is only $100 (instead of 1K), then they won’t offer enough

* + - * 2) **Bargaining may not even happen b/c of**
        + Other party is unknown.
        + Distance b/w parties (e.g. driver going to hit victims later)
        + Number of parties (collective action problem; free riding)
        + Lack of knowledge of external effects (don’t realize externalities)
        + Reluctance to bargain 🡪 we just don’t like confrontation!!

And may not want to monetize some stuff (e.g. quiet)

* + **2. Markets**
    - Negative externality e.g.: Cap-and-trade, only pollute if benefit > cost
    - Positive externality e.g.: market for pollination service of bees (rent bees to farmers)
    - BUT: not all problems can be solved through organized markets (e.g. factory)
* **Legal Rules**
  + Relative strength of factors will depend on the context
    - E.g. tax is best for the factory (b/c doesn’t require a lot of knowledge, and little ability to pay problem)
      * But, tax wouldn’t work for people not cleaning their icy sidewalks
  + **3. Types of Legal Rule**
    - a. Direct Regulation
      * State directly constrains behavior to reduce problem. Requires enforcement. NOT efficient b/c it constrains all people to all the same level.
        + Prohibit factory from polluting hazardously
        + Put a cap on how much fisherman can catch
        + Prevent businesses from opening in residential areas
    - b. Assignment of Property Rights and their Protection (injunctions)
      * Protect rights at the request of right-holders
        + E.g. If neighbors have right to clean air, give the neighbors an injunction against the factory, enforce w police power
    - c. Tort Liability as Financial Incentive (damages)
      * Make injurers pay for the harm they inflict. Incentivized to reach an efficient level of safety. Only invoked when there is problem/accident. Prevents undue waste
      * Tort liability: injured parties can bring suit and get compensation (and punitive to reduce incentives more)
        + *Note: we’re assuming strict liability*
    - d. Corrective (Pigouvian) Tax (another financial incentive)
      * Under these, party makes a payment to the state equal to the harm the party is expected to cause
        + E.g. factory pays for harm pollution is expected to cause
        + Tax something 🡪 get less of it. Problem with regulation: one size fits all. Like speed limits, cannot distinguish between bad and good drivers. But with taxes, it naturally distinguishes b/c only those who are engaging in *something valuable enough to incur tax will continue to do it*.
        + Administrative costs. Expensive
    - **Corrective tax v. tort liability:**
      * Corrective: reflects *anticipated* harm; is paid to *state*
      * Tort: liability for harm *already* done; paid to victims
      * But both create financial incentive to reduce harm
  + **Factors to Consider**
    - a. Information of the state
      * Complete info = know benefit to injurer, cost to injured
        + If the state has *complete* info: every rule leads to optimality

E.g. if state know if cost > benefit

(a) reg: then prevent pollution

(b) property right: give right to clean air

(c) tort: polluter wont, cos wont wanna pay

(d) tax: likewise, wont wanna pay

* + - * If the state has *incomplete* info: (d) tax and (c) tort are best
        + Cant necessarily achieve optimality through reg or property rights assignment: doesn’t know which action is best

E.g. if state doesn’t know whether costs are > or < benefits, cant know if reg prohibiting pollution will help

* + - * + BUT, as long as state has info about the magnitude of the harm, (d) and (c) will achieve optimality

If make liability/tax = cost of harm, then

If benefit > cost 🡪 will pollute

If benefit < cost 🡪 wont pollute

Benefit of tax and tort is that they make the injurer compare cost/benefit 🡪 harness the info that injurers have about the cost of stopping/benefit of the action to them.

* + - b. Information of victims
      * Relevant to functioning of rules requiring victims to play enforcement role
      * For victims to bring tort suits (c) or get injunctions to protect their property rights (b), they have to know
        + 1) who might harm them, and
        + 2) what the harm might be

e.g. if pollution is colorless and odorless, wont know to get an injunction or bring suit

* + - c. Administrative costs
      * Costs borne by state and parties in association w use of a legal rule
        + (c) Tort liability is the best in this respect cos the legal system only becomes involved if harm is done (under the others, its involved whether or not there is harm done)

Is significant advantage if chance of harm is small

* + - * However, the admin costs can be low under the others
        + (a) might be easy to determine whether party is complying with a reg; can be done through random monitoring to save resources
        + (d) levying tax may be cheap (e.g. if its paid at the time a product is purchased – tax fuel for pollution)
      * Basically, have to look at the particulars in each case
    - d. Amerliorative behavior of victims
      * victims can take steps to reduce harm (e.g. use clothes dryer instead of hanging outdoors in the smoke)
        + This is desirable when taking these steps is cheap and effective (accounting for injurer’s opp to reduce harn)
      * Under (a) reg, (d) tax, and other approaches that don’t compensate victims for harm they actually incur 🡪 victims have natural incentive to take optimal precautions cos they bear their own losses
        + But under (c) tort liability, this incentive is lacking cos they get compensated for losses they suffer
    - e. Ability of injurers to pay
      * (c) For tort to induce potential injurers to behave appropriately, they must have assets to make the required payments (and not be judgment proof)
        + Especially relevant if its likely that the potential harm > injurers assets (e.g. explosion at factory exceeds company’s assets)
      * (d) this is much less of a problem in tax. The tax = expected harm (which is usually much < than actual harm)
      * (a) and (b) almost avoid this problem completely
  + So, in Sum
    - (a) **Direct Regulation**
      * Info of Gov: If complete, all good. If not, BAD
      * Info of Victims: Don’t care
      * Admin Costs: always borne. But can be small (e.g. do random checks)
      * Behavior of Victims: Cos no compensation, victims have natural incentive to take optimal precautions cos they bear their own losses
      * Ability of injurers to pay: No problem!
    - (b) **Property Rights + Enforcement**
      * Info of Gov: If complete, all good. If not, BAD
      * Info of Victims: Important since they bring injunctions (who/what)
      * Admin Costs: depends on the situation
      * Behavior of Victims: Cos no compensation, victims have natural incentive
      * Ability of injurers to pay: All good, No problem!
    - (c) **Tort**
      * Info of Gov: So long as know magnitude of harm, optimal.
      * Info of Victims: Important, since they bring suits (need who/what)
      * Admin Costs: Only borne *if* suit brought 🡪 best if small chance of harm
      * Behavior of Victims: BAD, compensation = no incentive (BUT comp. neg)
      * Ability of injurers to pay: Big problem esp. if judgment proof
    - (d) **Pigou**
      * Info of Gov: So long as know magnitude of harm, optimal. BUT otherwise BAD 🡪 Need to measure harm
      * Info of Victims: Don’t care
      * Admin Costs: always borne. But can be small (pay at time of buying gas)
      * Behavior of Victims: Cos no compensation, victims have natural incentive
      * Ability of injurers to pay: Not really an issue cos tax = *expected* harm which is small
* Imperfect #Consumer Info
  + **Can cause purchasing errors = loss in surplus**
    - 1) Consumers may overestimate the value of a good 🡪 buy what shouldn’t
      * e.g. buy bottled water thinking (wrongly) tap is bad
    - 2) Consumers may underestimate the value of a good 🡪 NOT buy what should
      * e.g. not buy eggs (wrongly) thinking they’re bad for you, even though you really like them and would buy them if you knew they weren’t bad for you
  + **Can also distort the quality of goods produced**
    - If consumers undervalue something, the producers wont make that thing if consumers wont pay more for it than it costs
      * e.g. if consumers would value reinforced doors at 100 if they understood its value, but they don’t. Thus, car maker wont reinforce doors.
  + POLICY RESPONSES
    - 1) **Provide Consumers with info**
      * Gov can provide info directly and indirectly
        + Directly: tell them that eggs are good for health
        + Indirectly: grading and licensing (e.g. restaurants in NY)
      * ***Problems with this: Invariably Insufficient***
        + 1) Gov has to put time/money into finding out quality of goods and services. And this may well be impossible
        + 2) Transmitting the info can be expensive (e.g. ads)
        + 3) Consumers ability to absorb/understand the info is limited – we are inundated w info every day
    - 2) **Regulate Purchases**:
      * Can do this by discouraging and encouraging purchases
        + **Discourage:** tax or ban purchases (e.g. prohibit people from buying things w/o a medical license)
        + **Encourage:** subsidize or provide goods (e.g. give out fire extinguishers)
      * Problems with this:
        + 1) ***Administrative expense*** (hard to tell whether this is gonna cost more or less than info provision)
        + 2) Only works if gov has ***good info about consumer desires***

e.g. wrongly think we’d want reinforced doors if we knew the safety benefits. maybe we don’t like the clunky-ness

or wastefully make something a prescription drug

* + - 3) **Regulate Product Quality**
      * e.g. Mandate that producers make re-enforced doors
      * Problems: Similar to those w consumer regulation
        + Effectiveness of reg on product Q depends on knowledge of consumer desires
    - 4) **Do nothing:** Given the cost of providing info and expense and possible harm to consumers from regulation, might be best to do nothing
      * Esp. when gov has only OK info about consumer desires
  + **Consumer Sovereignty:** consumer is the ***best chooser of what happens to him***. You know best your preferences? Freedom has an intrinsic value? Economics favors consumer sovereignty.
    - Nudge (Sunstein): psychological and environmental factors affect choice
* Government Intervention
  + **Minimum wage**
    - Pros: If D for labor inelastic, ∆ in Q small, workers able to consume more and better
    - Cons:
      * D is elastic, so ∆ in Q very large and fair amount of empirical evidence that you can get rid of low-wage workers if they are too expensive
      * Even if D is inelastic, creation of deadweight loss and oversupply of workers, which leads to an allocation problem: how to hire among the increased pool of applicants?
  + **Price Gouging** 
    - Bad for:
      * Elastic goods – supply will be lower
      * Inelastic goods – allocation problem
    - Elastic goods (e.g. gasoline, bottled water, generators 🡪 D inelastic, S elastic)
      * More potential sellers would come into the area when prices are higher
      * With anti-gouging laws, making potential sellers of movable goods not come to the distressed area
    - Inelastic goods (e.g. motel rooms)
      * D curve not particularly in/elastic 🡪 becomes more inelastic
      * With inelastic supply + market handle the huge increase in D for motel rooms 🡪 slight increase in Q but huge increase in P
      * If fix price at the original equilibrium price 🡪 allocation problem.
      * Better not to have anti-gouging laws: market selects people who need the room the most
        + Problem: some people too poor to pay the price
        + Solution: emergency loans, standard cash grants
  + **Ban v. regulations** 
    - Botox: incentives to secure monopoly over administration of botox
      * Pros: safety concerns
      * Cons: would have a lot more consumer and social surplus if price were lower, no real regulatory concerns (Botox injections ≈ routine drawing of blood)
* #Public Goods
  + The Issue
    - Public Goods are 1) Non-excludable, 2) Non-rival
      * 1) **Non-excludable:** If the good is there, you cannot exclude people, or cannot exclude or collect for w/o great cost. Ex. fireworks display, air quality. Not like clean water, which can be measured easily
      * 2) **Non-rival:** One person using does not impact another’s ability to use the same thing. Often this is a matter of degree. Marginal cost would be zero. Providing one more unit is free – add additional consumers for nothing
        + e.g. fireworks and national defense
    - Public goods will be inadequately supplied by the private sector because, since they are non-excludable, you ***cant limit supply to payers***
      * 🡪 thus, cant charge consumers for the provision of the goods
    - Examples
      * PGs: National defense, lighthouse, Clean Air, NPR radio, National park
        + Fireworks 🡪 Could exclude w big fence but too expensive. Congestible.
      * NOT (excludable): Public school, PBS TV, Public libraries, Caves, Clean water
      * NOT (rival + excludable): Museum
  + Need Public Provision
    - Direct Public Provision
      * A desirable public good (e.g. lighthouse) can be built by state
      * **Problems** with public provision of public goods:
        + (1) Government has to ***get info*** about benefits and costs to determine whether it’s a good worth supplying

**Notable difficulty:** people have incentive to ***distort the truth*** when asked about the value they place on the goods

🡪 since exaggerating truth costs them nothing

* + - * + (2) Cost of ***raising funds*** through taxation
        + (3) Imperfections of the political process
    - Indirect Public Provision
      * Instead of providing the good itself, the state can pay private company to
        + E.g. build roads, do basic research, build lighthouse
  + Qualifications
    - (1) **Private Provision:** in some contexts, private parties can convert a public good into an excludable one and be able to charge for it (e.g. erect tall fence around fireworks display area; put toll booths at the entrance to some roads)
      * **Problems:** (1) the private supplier would be able to act as monopolist, charging monopoly price 🡪 deadweight loss
        + (2) there is a cost to exclude nonpayers (e.g. fence cost); where the state need not make such expenditures
    - 2) **Congestible Good:** public good may not be entirely non-rival 🡪 use leads to congestion. Potentially rivalrous. Non-rivalry up to a certain point. E.g. adding drivers on a road or to a concert.
      * Congestion effects make it socially desirable to limit use of a public good to those who value it the highest
      * Might be socially optimal to have a $5 toll on a road (depending on how bad the congestion effect is, and the cost to the provider of erecting and staffing the tolls)
* #Social Welfare Function: type of objective function. Domain will be set of all objects that we care about. SWF will assign a value to all items in the domain.
* Five Quick Points
  + 1) Notion of utility or wellbeing is ***totally general***: includes **anything individual cares about**
  + 2) Concept of measure of social welfare is built from individuals utilities only
  + 3) There is **no single preferred or objective measure of social welfare** 🡪 analysts can examine any and determine what social policy will follow
  + 4) Many measures **reflect a preference for distributional equity**
  + 5) Distributional equity under any measure of welfare is better pursued through our ***income tax (and welfare) system*** than any other social policy
* What is it?
  + Refers to the organizing framework that economists have for analyzing *normative* questions (i.e. what policy *should* we adopt?)
  + Economists use the *utility* to refer to a person’s well-being 🡪 anything we think is good
    - Economists look *solely* at utility measures – b/c by definition, the other stuff depends on something *no one* cares about 🡪 can violate pareto
    - But even within utility measures, there’s wide scope to choose from
  + Economists evaluate social well-being with a measure of social welfare
    - KEY: don’t assume any specific measure of welfare is objectively correct
* Social Welfare Functions
  + If you’re going to be rational 🡪 need a goal
    - Governing a corporation 🡪 aim is to max profit to shareholders
  + But that’s rare in most times in life
    - What do we do? Stay LOCAL 🡪 compare rules, look for *better* law, not optimal
* Domain: calculate list of outcomes for various individuals – U1(9), U2(8), U3(3), U4(8) etc. How to put them all together? Three possible ways:
  + (1) **Utilitarian** – simply ***add together wellbeing of all people in society***. For above, would be 28. Every individual counted the same amount. Problem: ignores distribution. Ignores person with (3). Looks like others are exploiting the one. Institutionalizing envy?
  + (2) **Rawlsian** – concern should focus on the ***person who is worse off***. Standard: how well off is the worst off group? U1(8), U2(7), U3(4), U4(7) is better than above, even though total wellbeing is less.
  + (3) **Egalitarian** – add in a ***penalty for unequal distributions***. Look at deviations from average, minus it from total score
* #Limitations of Surplus as a Measure of Social Welfare
  + 1) **Surplus represents an aggregate: *ignores* distribution**
    - Could be enjoyed mainly by rich
    - Could be mainly in form of PS (but, ultimately, profits go to firms owners)
  + 2) Surplus depends on **allocation of wealth in the population**, because a person’s willingness to pay for something (i.e. the measure of value used to calculate surplus) depends on how much wealth he has
    - e.g. larger surplus might be created by making sweater for rich people’s poodles than for PB for poor people (who are less willing to pay b/c they have less means)
  + 3) Surplus as measure of welfare is based on the assumption that **consumers properly appreciate the benefits** of what they buy
    - But if they *overestimate* the value: willingness-to-pay exaggerates the benefits of consumption
    - If the *underestimate* the value: willingness measure understates the benefits of consumption
  + But, all in all, its helpful proxy – it corresponds to the “pie” society has to enjoy
* Central Theorem of Welfare Economics
  + If society can costlessly redistribute wealth, then regardless of the measure of social welfare, the social maximum can be achieved by redistributing wealth and then allowing competitive markets to function
    - (assuming no impediments to market like lack of consumer info, bad externalities)
  + Best Way to get max social welfare
    - 1) Produce goods and services in the most *efficient* manner
    - 2) Then *distribute* them to maximize the social welfare measure
  + Better than Legal rules
    - 1) Income tax can be employed in principle to meet distributional objectives, and using legal rules to do so may interfere with the other purposes of legal rules
      * E.g. say neg is cheaper than SL (cos neg leads to less litigation), but that the neg rule leaves a poor group of people worse of than SL does. We prefer SL > neg on distributional grounds, but neg > SL on social cost grounds. Thus, can have neg, and then remedy the problem by lowering taxes on (or make transfers to) worse off
        + 🡪 moving to SL increases litigation unnecessarily
    - 2) Legal rules oft only influence a small subset of the population
      * The groups legal rules influence are typically heterogeneous in their wealth or need for money (making rules a blunt instrument)
    - 3) Legal rules are an expensive way to achieve distributional goals
      * e.g. regulating housing quality causes lord to raise rent

1. **#ECONOMIC ANALYSIS OF LAW**

* LAW AND ECONOMIC ANALYSIS: stays within the realm of possibilities and confronts hard issues straight on. Takes seriously the promotion of the well-being of other people.
  + ***Exam Strategy:*** Mention direct market effects and externalities, including emotional/moral effects. Then say, it’s an empirical question! Run into lots of measurement problems.
  + Modeling is about making assumptions that are unjustified but you hope will be met with exceptions.
* Comparing various legal structures by comparing outcomes by determining who will be effected and how much.
  + Parking meter: 100% at $25. 30 people full time meter people paid 30k/yr. Improvements? Cut meter people in half. Cuts 50%, but raises rate to $50. For rational person, offers same level of deterrence. OR, raise rate to $100, and cut employees to 7.5. Continue 🡪 you get psychological problems of scapegoating and justice. Connecticut law: $1000 every time you litter.
    - Psychological properties that skew above trend: ***risk seeking, risk avoidance***, etc. Most people are NOT risk neutral. So changing percent and fine rate at comparable rate won’t necessarily get same amount of deterrence. Thrust in behavior law and economics to make analysis more realistic.
  + **Controversy:** to many, unpalatable take on justice, fairness, and morality generally.
    - Fairness: ultimatum game 🡪 chooser decides split of money, decider determines whether to accept. Put a price on fairness by varying splits.
    - Morality: torture at what cost? Can be reduced to the strength of individual moral beliefs. Price: 500 kids in our scenario. Value can be quite high: terrorists give their own lives for moral principles.
    - What about morality benefiting societal welfare generally? Fairness/morality/justice thought to not be independently valuable, but only valuable to the extent they promote societal welfare
* Problem 3: Torts
  + If negligence rule is adopted, how much blasting will there be? High activity. Because if you use reasonable standard of care, company pays nothing. ONLY bear costs of care, not ***any of the accidents costs***.
  + Under SL, company will take socially optimal option b/c their calculus will be the same as overall social welfare calculus.
    - Moral insight: ppl don’t like SL b/c it doesn’t seem fair.
  + **Should we have tort liability at all?** Deterrence. But does tort system really add anything? E.g. driving fast on highway. Compensation. But insurance system is much more efficient at delivering compensation. Punishment. Person really isn’t paying, but insurance system is. 9
    - Product safety: deterrence? Already significant level of deterrence in place with loss of business b/c of bad marketing
* **A. The Economic Approach**
  + Econ approach seeks to answer two questions about legal rules:
    - 1) Descriptive: what is the effect of rules on outcomes/behavior
    - 2) Normative: are certain rules socially desirable
  + We used stylized models to answer
    - 1) Descriptive: actors are forward-looking and “rational”
      * We pretend there are no biases in decision making
    - 2) Normative: evaluate rules with reference to stated measure of social welfare
  + Two simplifications we make
    - 1) The measure of social welfare *ignores distribution of income*
      * Including it would complicate the analysis but *not change the conclusions* (cos of redistribution thru transfer & taxes)
    - 2) We’re ignoring fairness and morality in the analysis proper (no *independent*)
      * BUT NB: These notions of fairness (our ideas of morality) have great social advantages 🡪 w/o them, society as we know it couldn’t function
        + Thus, welfare econ says, it is desirable that people believe in these notions and that social resources be used to instill them

BUT, this does *not* mean should give it independent weight

* + - * NB: in principle, the pursuit of any notion of well-being that isn’t based positively and exclusively on the well-being of individuals will, in some cases, make *everyone* worse off
        + Thus, if you want to be pareto efficient, must reject any notion of social good that doesn’t depend only on utility

**Criticism of Economic Analysis of Law**

* A. Inability to Predict Human Behavior and Irrationality
  + The Critique: Human behavior is really hard to predict 🡪 thus, economic models cant tell us what the effects of legal rules are
  + Response: Sure, but that’s not a criticism of econ analysis except to the degree that such analysis fails to use the best model of human behavior
    - Doesn’t mean it isn’t the *best* predictor (and thus, even if not perfect, should still want to use the best predictor over others)
* B. Indeterminacy of Recommendations
  + The Critique: Econ analysis is indeterminate in its recommendations.
  + Three sources of indeterminacy:
    - 1) We may be unable to predict the effects of a legal policy choice
      * Response: that’s not a demerit of econ analysis per se. Would only be so if there were *better* predictors than econ.
    - 2) Econ analysis is malleable: there is a long list of variables than an analyst can consider and choose from
      * Response: true, but the choice of what to consider in an analysis should properly be regarded as governed by practicality and convenience, not as imparting arbitrariness to analysis in principle
    - 3) There is no objective method for weighing the interests of individuals
      * Response: sure, but there is much to be said about the choice of policy *given* a measure of social welfare
* C. Political Bias
  + The Critique: econ analysis has a political orientation, the conservative view, which endorses the status quo
    - Response: must separate the political views from those who use it from the field itself. Being based on welfare econ, and unassociated with any view about the virtue of distributional equity in the social welfare measure, there is no political orientation inherent in econ analysis of law

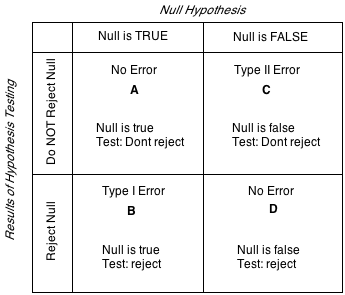
1. **STATISTICAL ANALYSIS**

* Conclusions From Statistics Are Almost Always Wrong. Why? People are motivated to collect data for certain conclusions.
  + Unless you get “significant result,” you don’t get publication. Results in strong incentive to improperly handle data.
* Probability
  + Three different strands:
    - 1) **Classical**—origins in gambling. Equally probable outcomes {sample space}.
      * **Conditional probability:** starts with sample space, then proposes some additional fact. Ex. conditional that X won on first roll (7 or 11), what probability that X rolled a 5? 4/8 (1/2).
      * **Bayesian Probability:** tells you the probability of H (hypothesis), given O (observation). P(H,O). How is the probability changed given observation of particular fact?
    - 2) **Frequency-based** (long run frequency) – belief that probability statements concern what would happen in the ***long run***. Doesn’t make sense in a lot of cases, e.g., Hillary elected in ’16. Makes sense, e.g., in coin flip. Longer you flip, the closer you get to probability frequency.
      * Never comes up in courtroom…
    - 3) **Subjective** – peoples subjective idea of what the chances are that a given event will happen.
      * No right answer, unlike long run frequency. What there is is ***conditional probability*** 🡪 probability that results from prior probability. P(H). P(H/Z) 🡪 probability of H given that Z has been observed. Updating probabilities using Bayes theorem.
* Handout 1
  + 1. Start with sample space.
    - Base rate (all graduate students who practiced safe sex in America who have HIV): 1/10k. Initially, Jane has 1/10k chance.
    - P(H, O):
    - **Sensitivity of the test** (if person has characteristic, chance that the test will show it): 99.9%
    - **Specificity of the test** (likelihood that if they don’t have the characteristic in question, they’ll get a result that says they don’t have it):
    - Answer: Jane has 1/11 chance she has aids.
    - To determine how practically good a test is, need BOTH base rate and sensitivity/specificity.
* Burgers/Chocolate (One Variable Data)
  + Types to present data: histograms, dot plots, pie charts, back to back stem & leaf graph (more useful than mean/SD/median/variance)—retains information.
    - Can look for **outliers** and trim.
    - Look for **gaps**.
    - Look for **shape** of data. If shape gets cut-off, suggests people would have gone higher/lower. “Single peak.” “Right/left skewed.” “Bi-modal.” Convincing legal statistics revolve around convincing shape.
* #Hypothesis Testing
  + Chemical Factory and baby weight: birth weight major indicator of present/future health. How much is this an aberration? 6/10 coin flip or 99/100? Not unusual, random variation, or significant shift?
    - Apply z or t test—how likely are we to observe this big of a difference?
  + Steps
    - 1) **Formulate Null Hypothesis** (some statement, the rejection of which, would be useful to your thesis) E.g. the change in birth weight is not statistically significant down.
    - 2) **Decide how statistically strong the evidence will have to be to justify its rejection.** In classical hypothesis testing, you have to decide ***in advance***. Courts have set single level of improbability as a standard 🡪 5% or 1/20 (or fewer).
      * ***If*** the null hypothesis is true, how likely will it be that I will see result X in my testing? What is the result that is ***so unlikely*** that merits rejection of null hypothesis? What level of improbability that will lead us to reject the null hypothesis?
    - 3) To predict probability, you need **means** and **standard deviations**.
    - 4) Determine what **statistical procedure** is ***appropriate*** to get P-value. Going to depend on what the hypothesis is and what the data looks like.
      * (Test that is in the book) **Z-Test** (see notes).
      * Sample mean: 116.5 oz
      * Population mean: 118 oz
      * Population standard deviation: 8 oz
      * Z = -3. Plug into table (p. 487). 🡪 .0013. Likelihood that we would get an average as low as 116.5 is 13/10,000.
  + Do we want the same level of probability for all hypotheses? Hard to say in advance.
  + **File-drawer problem:** MOST studies never see the light of day. Throw away all studies that don’t reject null hypthosis, and keep the on that does. E.g. 20 companies testing coke v. pepsi, and 1/20 rejects null.
* Multi-Variable Statistics
  + **Pearson Correlation Coefficient:** number that ranges from -1 to +1. Standard way to measure strength of kind of relationship between to variable. Kind = ***linear relationship***. Variables are good when highly correlated.
  + “Best fitting line” – comes closest to various points.
  + **Linear Regression Analysis** – point is to be able to find second variable given you know the first. If have no idea, look at the average.
  + **Two points about correlation**
    - If two variables are not correlated, it DOESN’T mean they’re not related. E.g. u-shaped curve. Not linear, but still related.
    - High correlation does NOT mean causal relationship. E.g., if two variables have the ***same cause***, they may correlate, but one does not cause another. J
  + **Linear Regression equation** (always has same form): y = a + bx
    - x = variable you’re using to predict with. (amount of fat)
    - y =outcome variable. (calories)
    - b = coefficient
  + How do you decide best-fitting line?
    - How far from the line (in vertical direction), then squared.
  + ANOVA chart
    - SS – sum of the squared errors. Total = difference between value of the average and the value of each point in data set. Square all these errors, and then add them up. Will give you total amount of squared errors.
  + R Square – how good the prediction will be. E.g., .92 = 92% of squared error reduced.
* Multiple Regression – Add Additional Variables.
  + Equation: y = a + b1x1 + b2x2 + b3x3…
    - y = outcome or dependent variable.
    - x = independent or predictor variable.
  + E.g., employment discrimination.
    - **Operationalization:** can’t use variable unless you can make a valid measurement. Some variables are difficult to measurement (e.g. whether someone has negotiated a raise or not).
    - Performance reviews – tainted variable?
    - Often, different variables are used, so equations on either side come out different ways.
    - **Dummy variable**: only takes on the variable 0 and 1. Handles categories like males/females.
    - t Stat – one of big group (like z score) that is supposed to assign probability of getting some value, given some null hypothesis. Way of doing hypothesis testing.
    - Associated with t stat is a probability. Probability that variability isn’t associated at all (This variable coefficient in the population = 0).
* General Terms Of Statistics
* **Classical Probability (Equa-probable)**: Fixed set of equally probable outcomes
  + Outcomes are determined by a limited set of variables and the probabilities for all outcomes are all equal (no reason one will come up more than any other)
  + **Probability space**: total set of all possible outcomes
* **Frequency Theory of Probability (Long Run Probability**): how to ascertain probability when you cannot determine it theoretically. It’s about repeated events. Its what we do in **statistics**
  + Long run relates to the infinite/large possible set (of flips or whatever else)
* **Subjective (Bayesian) Probability**: Subjective judgment of single events, “a probability is a rational belief that one has about a proposition based on a particular set of evidence”
  + **Bayes Theorem**: updates the *prior* probability to the *posterior* probability (what your probability should be given new info) on the basis of new info
  + *Note: this is another area of false expertise*
* **Sensitivity (of a test)**: If you have HIV, how likely you get +ve result [i.e. True Positive]
  + Sensitivity = true positive/ (true positive) + (false negative)
* **Specificity (of a test)**: If you don’t have HIV, how likely you are to get –ve result [i.e. True Neg]
  + Specificity = true negative / (true negative) + (false positive)
* **Base Rate (prior probability)**: How prevalent the thing we’re testing for is in the pop
  + Base rate = (true positive + true negative) / (TP + TN + FP + FN)
    - Higher base rate = fewer false +ve and more false –ve
  + % of +ve tests that are true +ve = number of TP / TP + FP
* **Multiplication Rule for Probabilities**: Probability of A AND B happening is p(A) x p(B)
* **Categorical** **Variable**: Requires assigning each individual to a specified category and so
  + Needs a **dummy variable** (0/1)
* **Quantitative** **Variable**: Is itself a number (measured as a number)
* **Operationalization**: reducing a concept to a practically measurable thing
* **Stem and Leaf Plot**: Separate into “bins” and then stick the data in the bins
* **Histogram**: Bar graph. Most common way to represent data.
* **Statistics**: numerical descriptions of *samples*
  + Sample mean (x-bar)
  + Sample variance (s2)
  + Sample SD (s)
* **Parameter**: numerical descriptions of *populations*
  + Pop mean (µ)
  + Pop variance (σ­2)
  + Pop SD (σ)
* **Population**: All the individuals you are concerned about and want to get information about.
  + These can be actual (United States’ population) or limited to a specific group of people, which are inaccessible or imaginary (all of the coin flips of a coin)
* **Census**: data set w scores on one or more variables for *all* the individuals (entire pop)
* **Sample**: smaller group selected from the population to do (1) hypo testing, (2) estimation
* **Representativeness of the sample:** degree to which a sample represents the population distribution w/ respect to a given variable
* **Simple** **Random** **Sample**: selected in a way that it was no more/less likely than any other possible sample of same size (equal chance of winding up as sample as any other sample)
* **Convenience** **Sample**: Used b/c its easy or cheap to access. Issue is representativeness
* **Social Desirability Bias**: people present themselves as better than they are, as wanna be
* **Motivational** **Bias**: people may have own political/personal investment in the outcome
* **Acquiescence** **Bias**: people give the answer the questionnaire is designed to get
* **Validity**: extent to which a measuring instrument measures what its meant to measure
* **Normal Distribution**: Family of distributions, differ as to mean and SD. Noted as **Ν(µ, σ)**
* **Normal Curve**: Bell shaped and symmetrical. Mean = mode = median.
* **Rectangular Distribution**: all equally distributed
* **Left/Right Skewed Distribution**: Left is lowest on left; mean < median. Vice versa
* **Unimodal**: has one mound (NB: is modal cos mode = most frequent)
* **Bimodal**: tells us that there are two different categories within your sample and they sort themselves out when illustrated in the graph
* **Mode**: Most popular/frequent
* **Mean**: Arithmetic average. Need more info than this.
* **Median**: When lined up in order, the one in the middle or average of the two in the middle
  + Wont be affected by outliers
* **Trimmed Mean**: Mean after a bunch of individuals are excluded (e.g. outliers)
* **Resistant Statistic**: Statistic such that no single or few set of values can really upset your analysis
  + (e.g. a new piece(s) of data, even outlier, wont change much if you add it in)
* **Outlier**: Observation that is numerically distant from the rest of the data.
  + Could show measuring error or heavy-tailed distribution
* **Range**: Highest value – lowest (measures dispertion)
* **Variance (σ2)**: = ∑(X –µ)2/n OR if only have data on sample, ∑(X –µ)2/(n-1)
* **Standard Deviation**: measure of spread around the mean. Is not “resistant,” so affected by outliers.
  + If all same value, SD = 0. SD is the √variance.
* **Chebychev’s Rule**: for any data set, at least 75% of the data points lie within 2 SDs of the mean, and at least 89% lie within 3 SDs of the mean.
* **68-95-99.7 Rule**: In normal distribution, % of individuals within 1, 2, 3 SDs
* **Central Limit Theorem**: When you plot the means of the distributions, regardless of what the original shape of the population is, you will get a normal curve.
  + Higher n (no in sample), the SD gets smaller and it begins to approximate a normal curve
  + Mean of this population of samples of the mean = same as population mean
  + SD of the pop of samples = SD of the population/ √n
* **Z-score**: tells how far, in SDs, any given value is from the mean. If +ve, value > mean
  + Population: Z = (x - µ) / σ
  + Sample: Z = (x-bar - µ) / (σ / √n) *[NB: can use s for σ if n > 30]*
  + Percentage: Z = (p-hat – p) / [√(p(1-p)) / √n] *[p-hat is sample mean, p is pop mean]*
* **#Z-table**: converts the z-score into a %. % on table is % that’s *less than* your X (or x-bar) [p(x < z)]
  + 97.5% is z = 1.96. 🡪 so with both tails that’s your 95%!
  + Z-table on ***p. 487***
* **Hypothesis** **Testing**: Start w a hypo about a mean. Select sample and find mean.
  + Ask if the mean is so different from the hypo that its unlikely the hypo could be true
* **Null** **Hypothesis**: What we test. Says there is no difference b/w hypo mean and pop mean
* **Statistical** **Significance**: Level at which we reject the null. Norm is 0.05. Calculate with z’s
  + On the z-table, 5% corresponds to z > 1.96 or z < -1.96
* **Statistically Significant Difference**: Difference b/w hypo mean and mean of random sample that justifies the claim that the sample was taken from a pop w a mean that differs from the hypothesized mean (i.e. lets us reject the null)
* **Type I Error**: test says reject null; but null is actually true (find guilty but he’s innocent) [False Pos]
* **Type II Error**: test says don’t reject null; but null is actually false (guilty found innocent) [False Neg]
  + *NB: more you correct test to minimize one type, more likely other type will occur*
* **File Drawer Problem**: Only show the studies that have stat sig. Not those that don’t.
* **Cancer Cluster Problem**: Someone has to be at the tail of the normal distribution.
  + Doesn’t mean there’s anything special about them!!!
* **Estimation**: lets us use sample data to make educated guesses about pop parameters
* **Point Estimate**: e.g. sample mean is a point estimate of the parameter (pop mean)
* **Interval Estimate**: specifies both a range of values and the probability that the true value of the parameter is somewhere within this range. (e.g. 95% chance pop mean is in range)
  + Sample mean +/- (s / √n)\*z-score of % you want (e.g. for 95% = 1.96)
    - The bigger the n 🡪 the *smaller* the range
  + Note: sampling mean = µ; sampling SD = (σ / √n)

Multi-variate Statistics

* *Note: ALWAYS ASK “is this a good* ***operationalization*** *of what I’m measuring?”*
* **Scatterplot**: Each individuals scores on both variables are plotted as single point
* **Linear** **Relationship**: y = a + bx. If perfect, can calculate the y from any x and vice versa
  + a = y-intercept, b = regression coefficient (slope). Y =
  + Can be weak, moderate, or strong relationship. Strong = better predictor.
* **Correlation**: reflects a linear relationship. Doesn’t imply cause, cause doesn’t imply it.
  + But it does imply that one variable can be used to predict the other for a given individual. Just means we cant predict that by changing one variable we’d change the other.
    - E.g. motivation and performance are highly causally related but r = 0
* **Pearson Correlation Coefficient** **(r):** -1.0 < r < +1.0. precise measure of strength and direction of the linearity of relationship. Very affected by outliers (of all kinds)
  + 0 = no relation. r > 0 (+ve) = positive corr. r < 0 (-ve) = negative corr.
  + *Note: Cos these are derived from sample data, all those sample-pop stuff applies*
* **Common** **Response** **Problem**: thinking of correlation as indicator of causation
* **Confounding**: correlation coefficient misleads as to the strength of a causal connection b/w two correlated variables b/c it reflects, not just that relationship, but also the influence of one or more other variables whose individual effects cant be easily isolated/assessed.
  + The variables are **confounders** or **lurking variables** (correlation ≠ causation)
* **Simpson’s Paradox**: a trend that appears in different groups of data disappears when these groups are combined, and the reverse trend appears for the aggregate data
  + Happens if (1) different group sizes, (2) different rates for groups
* **Simple Linear Regression**: technique for deriving and using an optimal linear equation
  + Limit 1: Has to be linear relationship for this analysis to predict effectively
  + Limit 2: Doesn’t catch or account for subpopulations
* **Linear Regression Equation**: (y = a + bx) equation that is likely to produce, on average, the best estimates of the value of the variable to be predicted, given our data
  + **Response Variable** **(y)**: variable whose value is to be predicted
    - Cos linear regression depends only on correlational information, and correlation is bidirectional (i.e. if A s correlated w B, B is w A), either can be response variable
  + **Explanatory Variable** **(z)**: variable from which the prediction is made
  + **Regression coefficient (b)**: shows strength and +ve or –ve of correlation
    - Stronger correlation = better predictor
  + **Y-intercept (a)**: y (response variable) when x = 0

**I. How To…**

* Do Some Bayes
* 
  + Base Rate (how common trait is in population): 10%
  + Sensitivity (p will get +ve result | +ve for real): 90% of those w it get +ve [True Pos; D]
    - 10% of those with it get –ve [False Neg; C 🡪 type II]
  + Specificity (p will get –ve result | -ve for real): 80% of those w/o it get –ve [True Neg; A]
    - 20% of those w/o it get +ve [False Pos; B 🡪 type I]
  + Null: they don’t have it
    - 90% of the 10% who have it will get +ve 🡪 0.09% [D]
    - 10% of the 90% who have it get -ve 🡪 0.01% [C (Type II)]
    - 80% of the 90% who don’t have it get –ve 🡪 0.72% [A]
    - 20% of the 90% who don’t have it get +ve 🡪 0.18% [B (Type II)]
  + How good is this?
    - Rate of correct +ve (TP/TP+FP): 0.09+0.18/0.27 🡪 is p(actually +ve | +ve test)
    - Rate of correct –ve (TN/TN+FN): 0.72+0.01/0.73 🡪 p(actually –ve | -ve test)
* Make a histogram
  + 1) Define and list the names of sufficient equal-sized categories to allow every score in the data set to be placed into one and ONLY ONE category
    - *Note: there is no “right” number of categories, but a good starting point is the Square Root of the number of individuals in the data set*
  + 2) Tally the number of scores that fall into each category. Use these numbers to create a table called a frequency distribution.
    - *Note: could also use a probability distribution (give the % of individuals in the data set that fall in the category). The resulting histograms look the same either way.*
  + 3) label the x-axis of a graph with the name of the variable and its unit of measurement (e.g. rate of return and %). Then mark of a scale that reflects the category boundaries. Label the y-axis *frequency*, note the unit of measurement (e.g. number of funds) and mark off a scale appropriate for the frequencies in the categories.
  + 4) For each category, construct a bar.
* Analyze a histogram
  + 1) First thing to look at is the shape. Specifically, how the actual shape compares to various ideal shapes. These include:
    - Rectangle (*Rectangular distribution*)
    - Normal Curve (*normal distribution*) 🡪 v. important
      * Leptokurtic (narrow)
      * Platykurtic (broad)
    - Skewed distribution (left = lowest on left)
      * Income is often right skewed, easy exams left
  + 2) Also look at hilliness
    - Unimodal: has one mound
    - Bimodal: has two mounds 🡪 Suggests sub-population
      * *NB: call this modal cos mode = most frequent*
  + 3) Look for gaps and outliers
    - Gap: makes us ask why its there
    - Outliers: things much higher/lower
      * May be result of measurement error, or not
* Calculate #Standard Deviation
  + Step 1: find the mean
  + Step 2: measure deviation from mean. For each. (“For a data set, subtract the mean of the scores from the value of each score to find the score’s deviation from the mean)
  + Step 3: Square the deviation scores
  + Step 4: Sum the squared deviation scores
  + Step 5: Divide ∑deviation scores by n (size of the same) = variance
    - OR, if you only have data on a ***sample of the population***, then by (n-1)
  + Step 6: take the square root of the variance
* Calculate z-scores in a Population
  + 1) Subtract the mean of the distribution from any value to get the deviation score
  + 2) Divide the deviation score by the SD of the distribution 🡪 z = (x - µ) / σ
    - If the Z-score is +ve: value is > mean
    - If Z-score is –ve: value is < mean
* Calculate z-scores in a Sample
  + Z = (x-bar - µ) / (σ / √n)
    - X-bar = sample mean.
    - µ = population mean
    - σ = population standard deviation
    - n = size of the sample
* Analyze a Normal Curve
  + Example: 68-95-99.7 Rule
    - Height of 20 yo men is normal. Mean is 5’9, SD of 3: N(69,3)
    - What % of 20 yo men are taller than 6ft (72’’)?
      * 68% will be within 1SD: thus between 66 and 72
      * Remaining 32% will be LESS than 66 or MORE than 72
      * Since its normal, 32/2 % are MORE than 72 = 16%
  + Example: Find z-scores
    - 72 – 69 (height we want – mean) = 3
    - Divide the deviation score/SD so 3/3 = 1
    - Thus, Z = 1. aka. 72 inches is exactly 1SD bigger than mean
  + Example: Use z-score
    - What % of 20 year old American men are taller than 74inches.
      * 1) Get Z-score: (74 – 69)/3 = 1.67
      * 2) Find the 1st dp of the Z-score in the Z-table (1.6)
      * 3) Find the 2nd dp of the Z-score in the Z-table (0.7)
      * 4) Find where the row and column intersect 🡪 number there is the proportion of 20 yo men with a height the Z-score of which is < 1.67 (i.e. shorter than 74). Here .9252
      * 5) Convert the proportion into a % 🡪 92.5%
* **REVIEW**
  + Assignment 7
    - Tort system NOT good at compensation – costs huge amount of money. Should be insurance. Retribution? Undermined by wide-spread use of insurance. If tort system is going to be justified, must contribute to efficient social precaution taking.
    - $50 is guaranteed cost. Not a risky number. $40 is ***expected*** cost. Could be higher or lower. If found no illness 🡪 just threw out a ton of money. If found a bunch 🡪 saved a bunch of money. Deal with uncertainty by using expected value as actual value. Qualification is risk aversion. How hard are these numbers? Need sensitivity analysis. And how is the $1m measured?? If eyesight is ***invaluable*** (beyond value; priceless; infinitely valuable) 🡪 destroys economic analysis. No number. Cannot proceed sensibly w/o number. Would sap whole budget.
      * Solve by making a $10 co-pay? Allows some ppl to take test who value it highly, and allow others who don’t want to bear the cost to opt out.
    - Statistical life – everyone valued the same.
      * Market prices are grounded in ***actual preferences***. Judge-determined preferences are ***plucked from the sky***.
  + Assignment 8
    - Any particular sequence is equally likely of 16 different possibilities.
    - Practice generating all four possibilities.
    - #3 – prediction is 1/1000. Can’t be the relationship between abuse and murder that we want to introduce. The right connection would be “if a woman is murdered, and she had been abused previously, how likely is it that her murder was the abuser?” ~50%.
    - #4 – for ***sampling*** 🡪 use n-1.
      * Validity = means the survey is measuring the thing it is supposed to measure. E.g. asking about height and give the right number 🡪 valid. But men often add a couple of inches. ***Motivational and acquiescence bias***. And this type of estimation is often inaccurate.
  + **Best equation = minimizes squared error of prediction**.
  + For samples, **randomness** is more important than bigness.
    - How good is your mult regression equation? R - squared.
    - Are you variables any good? Start with one variable (best) and use to predict outcome. Pick another variable that has high correlation with outcome variable. Did R – squared go up? If so, helped the equation. Too see if variable is adding anything 🡪 ***take variable out*** and see if affects R – squared.
      * Second test to see if variable matters: ***hypothesis testing***. Look at “t Stat” on sheet 🡪 critical number for hypothesis testing. Looking for “P value” that is sufficiently low to reject null hypothesis.
  + Difference for STD in Finance and Statistics (if know whole population, use n; if using only sample, use n-1).
  + Deadweight loss – quantity is inappropriate in terms of social welfare.
  + Microeconomics: Public Goods – advertising revenue depends on size of audience, so high quality programs won’t be supported because not getting the audience?
  + Historic cost is used for everything that is not a *financial instrument*.