Lecture 22: Multi-Sided Monopoly

October 27, 2021

Version 1

Required Reading

- Pillado, E. (2019, November 7). Demystifying Network Effects [Web Page]. Retrieved from https://stories.platformdesigntoolkit.com/nfx-cc1dd3aba061
- Evans, D. S. et al. (2011). *Platform Economics: Essays on Multi-Sided Businesses*. Retrieved from https://ssrn.com/abstract=1974020
- From the above textbook, please read **pages 102-103** (Monopoly Two-Sided Firm) **and 268-270** (The Economics of Multi-Sided Platforms)

Other Sources

- Alibaba Group [Web Page]. (n.d.). Retrieved from https://www.examinechina.com/blog/alibaba-group/
- Desjardins, J. (2018, March 1). Internet Giants: Who Owns Who on the Web [Web Page]. Retrieved from https://www.visualcapitalist.com/internet-giants-owns-web/
- Knight, F. H. (1921). *Risk, Uncertainty and Profit* [1957 re-issue]. Boston and New York: Houghton Mifflin Company. Retrieved from https://archive.org/details/in.ernet.dli.2015.52405/page/n1/mode/2up
- Lin, M. (2018, January 30). Tech in China: The Home of Billion Dollar Companies [Web Page]. Retrieved from https://medium.com/bruin-entrepreneurs-stories/tech-in-china-the-home-of-billion-dollar-companies-1bb9ff2dd629
- Press, G. (2018, April 8). Why Facebook Triumphed Over All Other Social Networks [Web Page]. Retrieved from https://www.forbes.com/sites/gilpress/2018/04/08/why-facebook-triumphed-over-all-other-social-networks/#3f87dd856e91

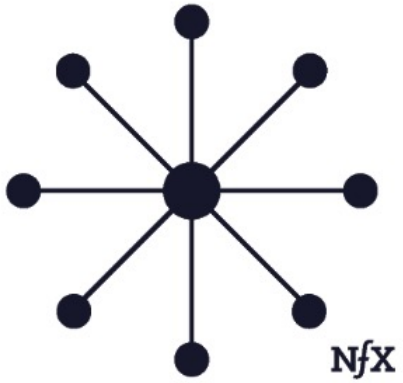
ESSENTIALS (20 slides)

Multi-Sided Markets

- What do Alibaba, Google, match.com & Facebook have in common?
- They're *multi-sided businesses*.
- Part of their business might be selling goods…
- BUT a lot of their business is *connecting people*: buyers to sellers, readers to advertisers, people with spare rooms to people looking for a temporary rental, people with cars to people needing a ride, people looking for a relationship to each other.
- These types of businesses make money on *transactions*, which means they WANT a lot of people on ALL sides of their firms.

Possible transactions grow with members

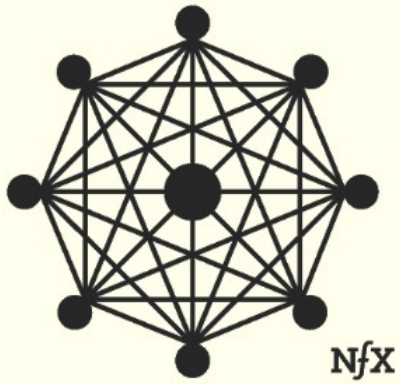
Sarnoff's Law



$V=n$

The value of the network (V) increases in direct proportion to the size of the network (n).

Metcalfe's Law



$V=n^2$

The value of the network increases to the square of the number of users in the network.

Reed's Law

$V=2^n$

Source; NFX*Bible

Networks may grow proportionally to the network size but there are forming groups that scale faster in value than others (because of influence or interconnectedness).

(Pillado, 2019)

The chicken or the egg problem

- Traditional monopolist's problem: trade off a rise in price with a fall in quantity demanded.
- For a multi-sided firm, say, one serving Buyers and Sellers…
- You get money from connecting Buyers and Sellers.
- Buyers will join if you have enough Sellers…
- Sellers will join if you have enough Buyers.
- How do you START your firm?
- And once you start, how do you set prices for each side?

Jean Tirole's definition (Quoted in (Evans, 2011))

- "A market is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount; in other words, the price structure matters, and platforms must design to bring both on board."
- If we saw a traditional firm *giving away* services, we'd think anti-competitive, predatory pricing was going on…
- …but we don't bat an eyelid when YouTube or Google do it.
- "If you are not paying for it, you're not the consumer; you're the product being sold." -Andrew Lewis [blue_beetle]

Let's investigate this with a simple model

- A two-sided monopolist connects Sellers, S, and Buyers, B, and charges each of them a (potentially) different price per transaction, p_s and p_b.
- Quantities demanded depend strictly on prices: $Q_s(p_s)$, $Q_b(p_b)$
- Suppose the volume of transactions, Q_T, follows Metcalfe's Law, so
- $Q_T = Q_s(p_s) \times Q_b(p_b)$
- Our monopolist gets paid twice for each 'match', so their revenue is
- $(p_s + p_b) \times Q_T = (p_s + p_b) \times Q_s(p_s) \times Q_b(p_b)$
- This intentionally simple case understates network effects.

What happens if you raise the price?

- Suppose you raise one of the price by a little bit.
- To be specific, suppose you raise the price charged to sellers, p_s.
- What happens?
- The price goes up, which is good for our monopolist…
- …BUT quantity demanded by sellers, $Q_s(p_s)$, falls.
- As far as our two-sided monopolist is considered, that's not the end:
- That fall in $Q_s(p_s)$ is *magnified* by buyer demand, $Q_b(p_b)$…
- …since transaction volume, $Q_T = Q_s(p_s) \times Q_b(p_b)$

A reminder about elasticities

- Remember what price elasticity of demand is:
- $\varepsilon_S = \frac{\%\ \text{change in } Q_s}{\%\ \text{change in } p_s}$
- For a small change in a variable X (call the amount of this change dX),
- $\%\ \text{Change in X} \cong dX/X$, and this is more accurate the smaller dX is.
- We can use this to rewrite our elasticity expression:
- For small changes in price, $\varepsilon_S = \frac{dQ_s/Q_s}{dp_s/p_s} = \frac{dQ_s}{dp_s}\frac{p_s}{Q_s}$

What happens if you raise prices just a bit?

- Suppose I raise p_s by a *tiny* amount I'll call dp (no 's'; you'll see why, soon.)
- Quantity demanded by sellers, $Q_s(p_s)$, falls by a small amount dQ_s, and I have a formula for how much that is:
- $\varepsilon_S = \frac{dQ_s}{dp}\frac{p_s}{Q_s} \rightarrow dQ_s = \varepsilon_S \frac{Q_s}{p_s} dp$
- In terms of transactions volume, that fall in Q_s is *magnified* by Q_b:
- $dQ_T = \varepsilon_s \frac{Q_s Q_b}{p_s} dp$
- Great… so, what does that buy us?

Professor Knight's Big Idea (1921)

- Law of Choice: "*In the utilization of limited resources in competing fields of employment, which is the form of all rational activity in conduct, we tend to apportion our resources among the alternative uses that are open in such a way that equal amounts of resource yield equivalent returns in all the fields*."
- Translation: We have limited resources (time, money, mental health, etc.) and LOTS of different things we could be doing with them.
- We go for the highest 'bang for the buck' (utility per resource cost), and in doing so, eventually equalize 'bang for the buck' across possible uses of the resources.
- The reason? *Diminishing marginal utility* from most things: each additional unit of a good or service brings in less satisfaction than the previous one.
- Also applies to substitutable inputs (e.g. machines vs. people), except there it's *diminishing marginal product* driving things. Consider a restaurant with 0 cooks, and keep adding more cooks…

A quick example: Cookies and Cake

- Let ‘utils’ be the units of utility (happiness, or satisfaction).
- Note that there’s *diminishing marginal utility* of consumption for any given good. 1st cake slice: great! 100th in a row: not so great!
- Your two competing uses of money are cake & cookies.
- Suppose Cake costs $10 and gives 200 utils (bang/buck = 20 utils/$)
- Suppose Cookies cost $5 and give 50 utils (bang/buck = 10 util/$)
- You have $100, and are currently spending $50 on cake, and $50 on cookies.

You'll want to change that…

- If you're spending half your money on cookies & half on cake, you'll want to shift some money FROM cookies TO cake:
- Lose 10 util/$ to get 20 utils/$.... at first.
- BUT as you gain cake, marginal utility of cake falls. If it falls to below 10 util/$, you'll want to shift money to cookies.
- Only when bang/buck is equal for all options will you be 'happy'.
- That's the *only* time you won't have an incentive to change what you're doing.
- "A happy ball is a stable ball." –Prof. Malcom Stott
- THAT'S Knight's insight: when the dust clears, if you've made your choices wisely, bang/buck will be equal across all possible uses of a resource.

Bang for your buck

- Remember Knight's 'Law of Choice': people shift resources around until they have the same bang for the buck.
- Suppose you're in charge of a two-sided monopoly.
- You're trying to decide how much you should charge.
- Your advisor tells you that if you raise (only) seller prices slightly, transactions will fall by 10%, but if you raise (only) buyer prices slightly, transactions will only by about 2%.
- That suggests you could improve your situation by charging a little *less* to sellers and a little *more* to buyers: you'd gain more than you lose.
- The only time you *wouldn't* want to tinker with prices is when the 'bang for the buck' – transactions lost or gained for a given small price change – is the same.

Bringing in the math

- We already know the change in Q_T due to raising p_s by a tiny amount dp:
- $dQ_T = \varepsilon_s \frac{Q_s Q_b}{p_s} dp$
- Substitute ‘s’ for ‘b’ and vice versa to get the buyer version:
- $dQ_T = \varepsilon_b \frac{Q_b Q_s}{p_b} dp$
- (Now you see why dp didn’t have a subscript: same change for both.)
- The ‘buck’ is dp, the ‘bang’ is dQ_T, so bang/buck = dQ_T/dp
- Dividing dQ_T by dp, the ‘dp’ on the right side drops out.

Using Knight's Law of Choice

- Setting bang/buck equal for changes to seller & buyer prices:
- $\varepsilon_s \frac{Q_s Q_b}{p_s} = \varepsilon_b \frac{Q_b Q_s}{p_b}$
- $\varepsilon_s \frac{\cancel{Q_s} Q_b}{p_s} = \varepsilon_b \frac{\cancel{Q_b} Q_s}{p_b}$
- $\frac{\varepsilon_s}{p_s} = \frac{\varepsilon_b}{p_b}$
- $\frac{\varepsilon_s}{\varepsilon_b} = \frac{p_s}{p_b}$
- **The ratio of prices is equal to the ratio of price elasticities**.
- The side with the *lower* elasticity gets charged the *lower* price!

Wait, isn't that backward?

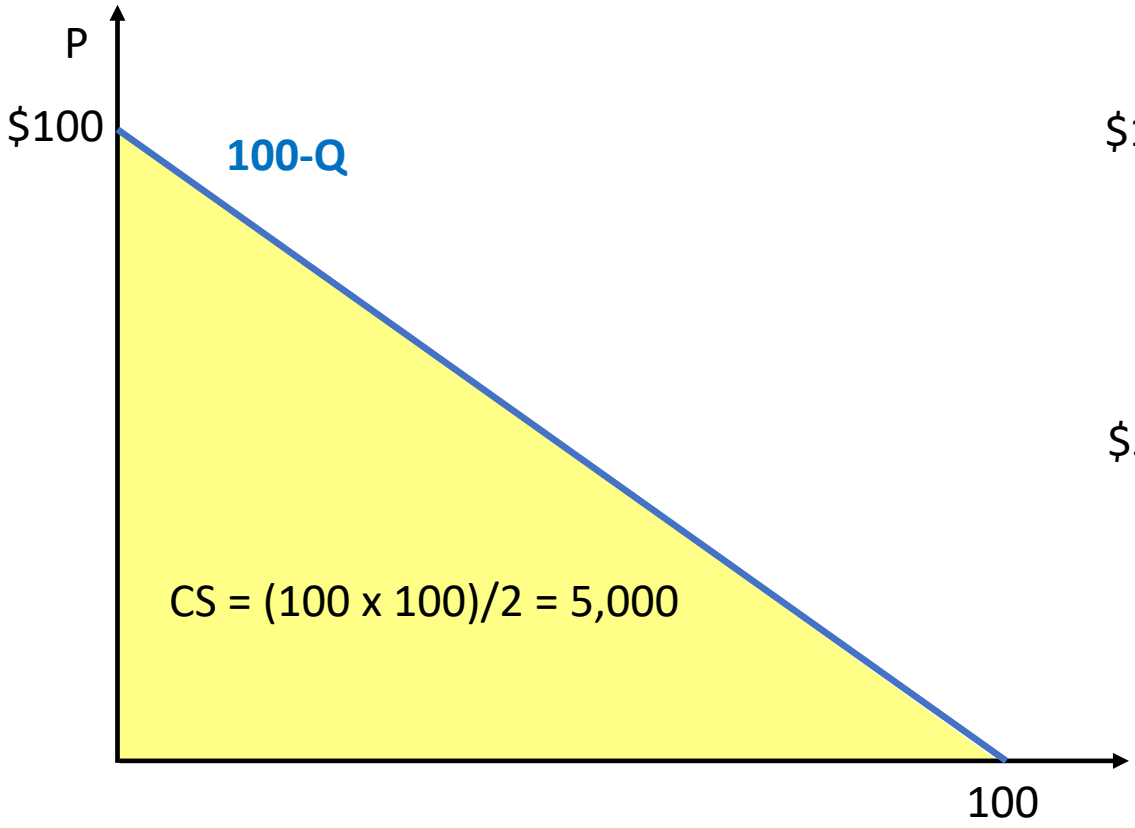
- We've all heard the stories about regular monopolies, where if the buyer has inelastic demand, the monopolist will raise the price as high as possible, because quantity demanded doesn't change…
- (Think of an insulin monopoly selling to diabetics.)
- What's going on here?
- The difference is because our double-sided monopolist cares about *transactions*, not the demand from each side separately.
- The 'odd' effect is because the impact of a change in *one* side's price is multiplied by the quantity demanded on the *other* side.
- Also, the profit-maximizing in each market will be *less* than a traditional monopoly, because the focus on transactions allows the two-sided monopolist to appropriate some of the surplus that two one-sided monopolists would not.

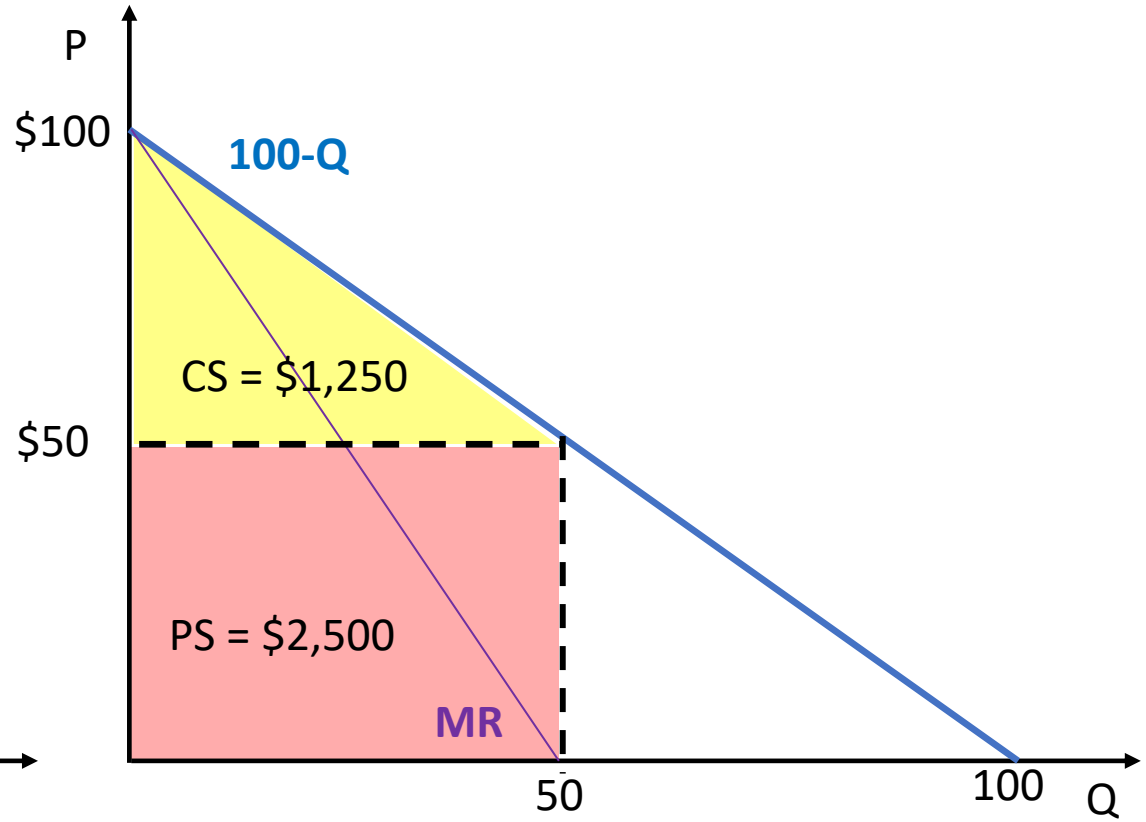
A simple example

- Consider the situation where both markets, buyer & seller, have demand given by Q = (100 – P), and there are no costs to production.
- For a traditional monopolist, in each market,
- Revenue = P x (100 – P)
- Using calculus (marginal revenue = marginal cost), the monopolist will choose P so that
- P = 100 – P → P = 50
- If the market were perfectly competitive, of course, the price would be equal to marginal cost (0).

Perfect Competition & 1-sided Monopoly

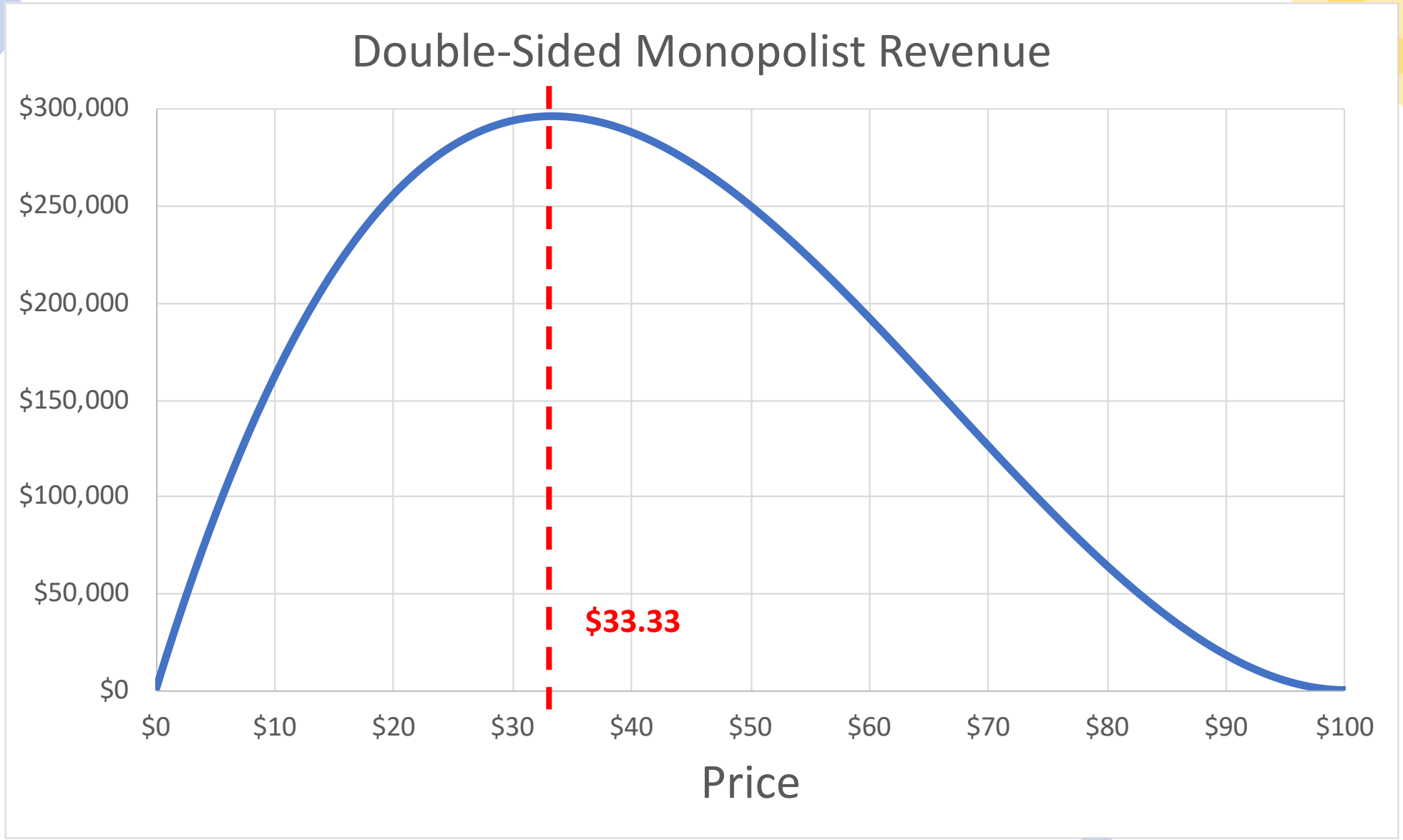
In each market…



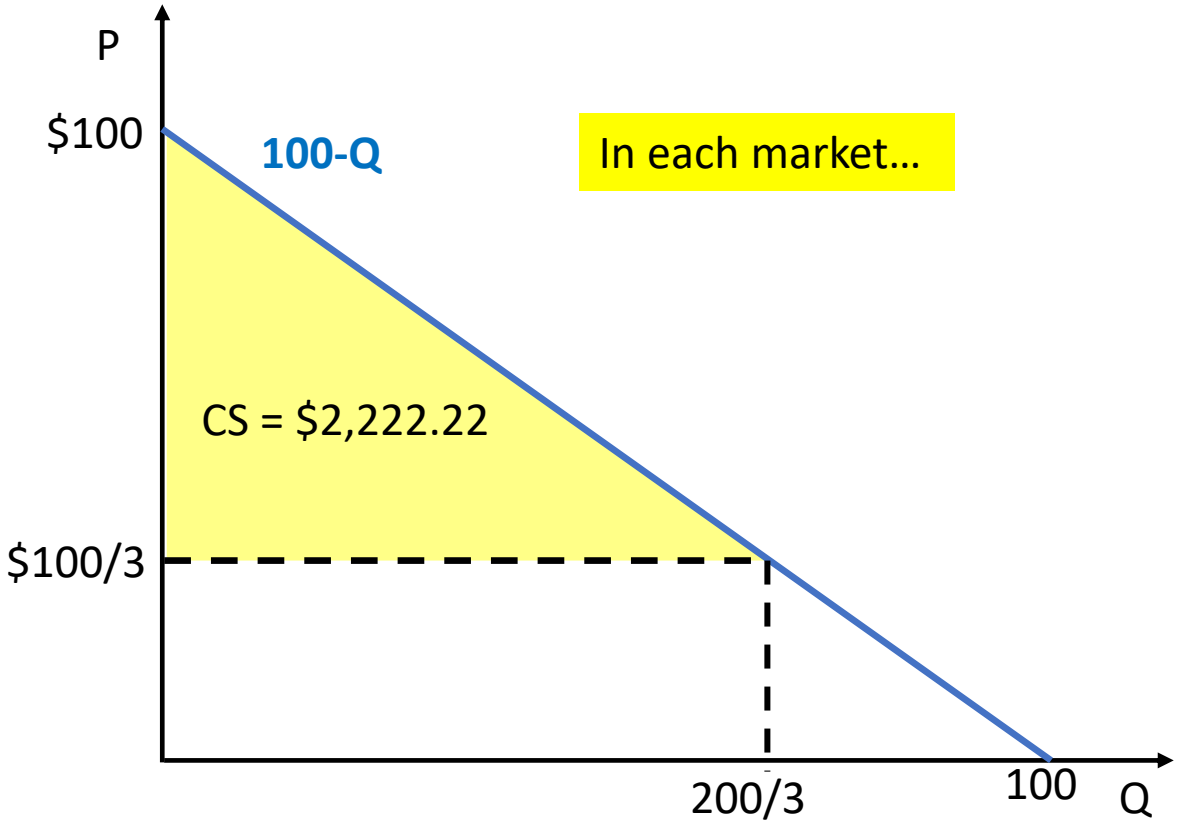


What about the two-sided monopolist?

- Revenue = $(P_s + P_b) \times (100 - P_s) \times (100 - P_b)$
- Since there's no difference between the two markets in this example, though, we can just set $P_s = P_b = P$.
- (There's nothing to make the prices differ.)
- Revenue = $2P \times (100 - P)^2$
- Differentiating and setting the derivative equal to zero: $6P^2 - 800P + 20{,}000 = 0$
- Right away we see marginal revenue is quadratic…
- Solving for P, the two roots are P=100/3 and P=100
- We know the second root, P=100, can't be right, because then Q = 0.
- →P = 100/3
- This is less than the single-sided monopolist's price of 100/2.


Double-Sided Monopolist Revenue
$300,000
$250,000
$200,000
$150,000
$100,000
$50,000
$0
$33.33
$0
$10
$20
$30
$40
$50
$60
$70
$80
$90
$100
Price

Results for our simple 2-sided monopoly



- Why no producer surplus square?
- Not a concept we can compare directly to the earlier diagrams.
- Remember, our monopolist charges per *transaction*.
- There are a total of (200/3) x (200/3) of those, so the monopolist earns $148,148.15

AFTER HOURS

- Things to watch out for (4 slides)

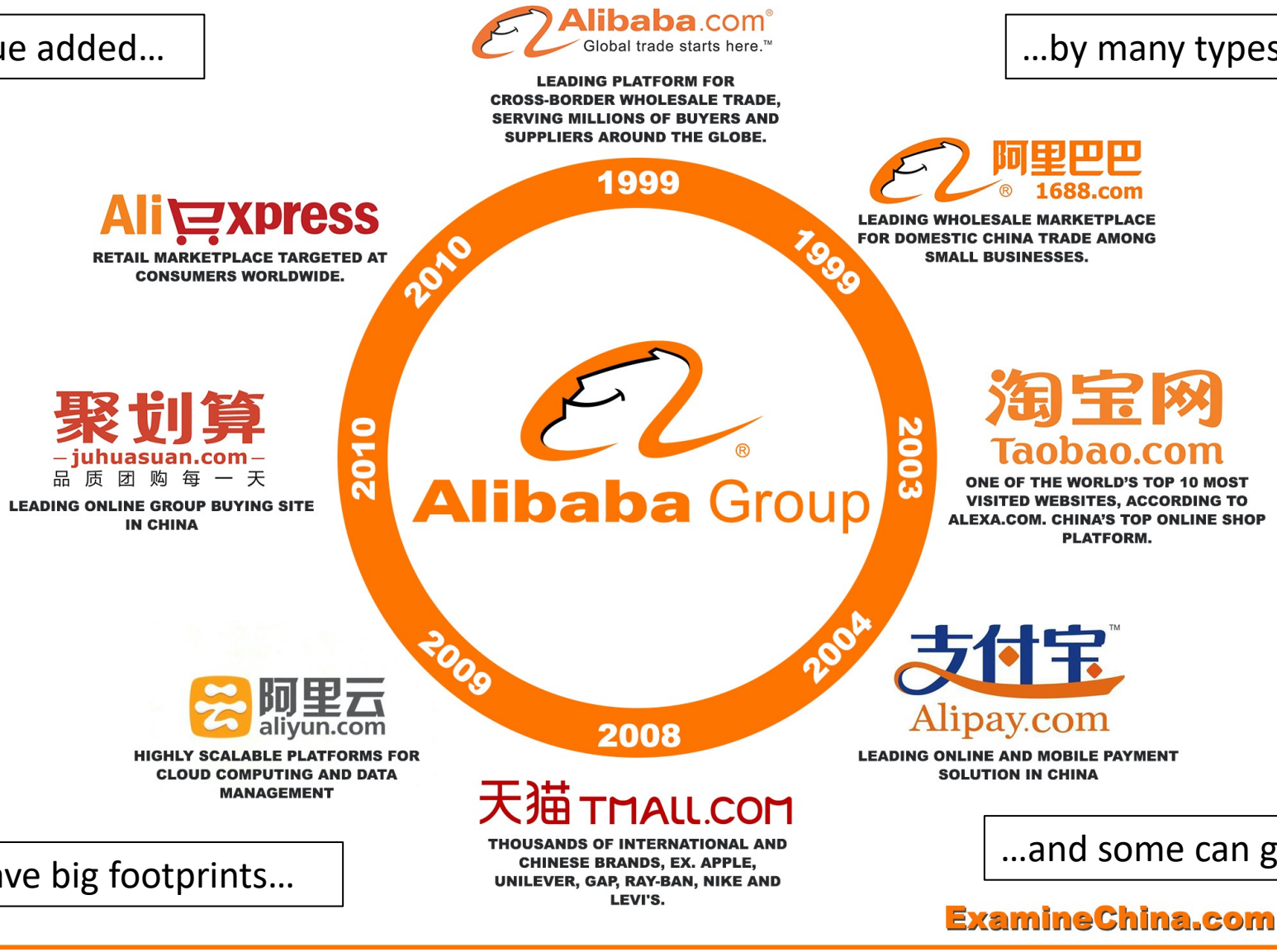
So… sounds good?

- We have a monopolist that wants to solve an important problem: matching buyers with sellers, advertisers with readers, etc.
- AND because their business scales with *transactions*…
- They're able to internalize some of the societal gains that are externalities to traditional monopolists:
- Their deadweight loss will be smaller than usual, because they *want* more participants in each of the markets.
- Is there anything competition policy analysts should look out for?

ALL COMPANIES IN ALIBABA GROUP

Lots of value added…

…by many types of match-making



Big multi-sided firms can be big for good, society-enhancing reasons – BUT you need to be careful *because* they are big.

BUT giants leave big footprints…

…and some can get caught underfoot.

ExamineChina.com

Things competition policy analysts should look out for

- Winner takes all: Big incumbent advantage. Entrants face a chicken/egg problem: “I need lots of sellers to convince buyers to use my site, but I need lots of buyers to convince sellers to join my market.” If an existing firm already has lots of each…
- Moving into next-door markets: “While you’re using the App Store and iTunes, why not try Apple Pay?”
- Closed Platforms: Each ecosystem (Facebook, Google, Alibaba, etc.) has its own valuable information, that can be difficult for other firms (or researchers, or governments) to access.
- Collateral Damage: Multi-sided firms have good reasons to give some sides low (even zero) priced goods, to increase transaction volume. If one side of a multi-sided firm’s business is another firm’s entire market, some firms with valuable products could go out of business (or sell out to the multi-sided firm?)

Why don’t we see complete winner-takes-all?

- If the ‘chicken and the egg’ situation gives such a big advantage to the first big firm… why don’t we see more monopolies?
- The same reason there are multiple stock exchanges (sometimes, even in the same country).
- Multi-sided firms can *differentiate* themselves in what they offer their different sides, gaining some market power.
- Community & provincial papers look different to advertisers & readers.
- The Nintendo eshop, Playstation store & XBox GamePass have loyal customers – who bought into the market with a hardware purchase.
- Also: matching markets are *contestable* if a challenger has enough of a perceived quality advantage. e.g. Myspace & Livejournal → Facebook.