Internet Economics and Financial Technology

Computer Science COMSM0019

Lectures 3&4: Economics of the Internet I & II

PART II - Pricing

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Part II – How to price your digital products

- Differential pricing methods (price discrimination)
- The network effect (a key concept for Internet/FinTech)
  - Building critical mass
  - Lock-in/standards

Price Discrimination

When a seller finds ways to charge different buyers different prices, depending on their willingness to pay.

- *1st degree:*
  - Customised pricing: each pay as much as they value the good. Pure first degree is discrimination is very difficult. Online auctions can get close.
- *2nd degree:*
  - Here, customers reveal their type via their purchase. Offer customers different product versions or bundles of products at different price points.
- *3rd degree:*
  - Offer different prices to different groups, based on some observable characteristic, such as geography, age. E.g., Student discounts on rail fares, peak/off-peak fares, cheap Wednesday night cinema tickets.

AIM: to increase producer surplus

Customised Pricing (1st Degree PD)

- A monopoly seller would like to charge a buyer the maximum they are willing to pay, and so get all the benefit of trade (i.e., no consumer surplus, all producer surplus)…
- The seller cannot know the true value to each customer, *but* data about past behaviours of the customer could be used to guess…

Customised Pricing (1st Degree PD)

- Amazon (2000), people found that if they deleted their cookies, Amazon would charge them *less* for a given product.
  - Using past purchase history to guess they were willing to pay more than average?
  - Amazon (Jeff Bezos) apologized and claimed they were simply changing their prices very quickly as an experiment, not price discriminating.

- Office Depot and others use 'customers browsing history and geolocation' to vary 'offers and products displayed.'

Big data and customer profiling makes this much easier online

Legality? Ethicality?

Pricing by group (3rd degree PD)

- Used widely for physical products and services:
  - Student discount (train/rail cards), Elderly (OAP) discount (reduced price theatre tickets), Pink razors cost (6.2%) more
- Similar business models online:
  - E.g., Student/academic software versions. Premium business versions.
- Also:
  - The travel site Orbitz has been accused of steering people who access it with a Mac OS to pricier hotels…
  - Uber (2017) varying prices according to customer location

DISCUSS: Legality? Ethicality?

Versioning (2nd degree PD)

- Offer customers different versions to help them reveal their willingness to pay.
- Having different versions with different prices means you can attract customers who would otherwise not buy
- Commonplace in the physical world: e.g., car models. Hardback vs paperback books.
- Digital versions are:
  - Easier to prepare than physical versions: simply 'cut down' functionality of the full version.
  - Near-zero cost to duplicate.

Digital versioning

Because of these two factors, versioning is used extensively and more creatively than in the physical economy.

- 'Try before you buy' time-limited versions.
- Free versions with cut-down functionality. (eg Games)
- Free delayed information (eg stock feeds)
- Pay for no ads (e.g., Spotify)
- These allow a customer to build a 'true valuation' of a product. People usually value something more when they have it than when they don't. Particularly useful for 'experience goods'.
- Free versions are also very important for building 'the network effect' (we will discuss this later.)

Economics of versioning

Having different versions with different prices means you can attract customers who would otherwise not buy:

Assume we have a product X with a price of £10.

- Consider 2 customers:
  - The 'product addict' who values it at £20, and
  - The 'casual user' who values it at £8.
- Then the company will sell one unit, at £10.

Now let the company introduce a 'cut-down version' at £5, which:

- the addict values at £8, and
- the casual user values it at £7.

The company will now sell one of each version, and make £13.

QUESTION: What pricing would maximise profit in this situation? Assume customers will buy the 'best' version if both have equal net utility

Answer….

- Price cut-down at £7 to get the casual sale.

- What is the most that addict will pay for full version?
  - Cut-down has a net utility of £1 (£8 - £7).
  - Pricing Full version at £19 will also give net utility of £1 (£20-£19).

  So, assuming customers will buy 'best' version if both have equal net utility (or surplus), this will give an income of £26.

‘Competing against yourself’

- The risk of versioning is that people willing to pay for the higher price version will go for the lower price one.

- Using previous example, with prices: full = £19, cut-down = £7
  - Consider a 3rd customer, the ‘keen user’, who is willing to pay £16 for the full version and £9 for the cut-down version.
  - At these prices, the keen user will get more surplus/utility from buying the cut-down version (£9-£7=£2), and the company will lose a sale of the top-end model (since £16-£19 = -£3).
- Choosing price points and functionalities is therefore critical from a business perspective – particularly when free versions are used.

QUESTION: What pricing would maximise profit now?

ANSWER:

EITHER sell 2 cut-down and 1 full, OR 2 full and 1 cut-down

To sell 2 cut-down:

- Need to price cut-down at £7.
- Full can then be priced at £19 as before.
- Total sales: (2 x £7) + £19 = £33

To sell 2 full:

- If cut-down model is priced at £7, what is the most Keen user will pay for Full version?
- Net utility of cut-down version at £7 is 2.
- Therefore most they are willing to pay for full version is £16 - £2 = £14.
- So total sales will be (£14 x 2) + £7 = £35

Personalisation (Extreme versioning)

- Personalisation of product is versioning taken to the extreme, and moves it to almost 1st degree price discrimination.
- Allow customers to construct their own most-valuable version.
  - E.g., Dell computers a pioneer (choose RAM, CPU, Disk, Monitor, etc.)
- Economics, but also psychology… people tend to 'upsell' towards the almost-top option when offered with different options.

Bundling (2nd degree price discrimination)

- 'Bundling' is the selling of a number of products/services together for a single price.

- Some example bundles:
  - Microsoft Office
  - Google Apps for Business
  - A music CD
  - A newspaper (a bundle of information and entertainment)

- Like versioning, it can be used to sell more to customers who would otherwise not purchase.

Economics of bundling - example

A company sells new word processing and spreadsheet software.

Imagine 2 customers. Alex is a regular word processor user, valuing the new software at £12, and an occasional spreadsheet user, valuing it at £10. Bea is the reverse, valuing the spreadsheet at £12 and word processing at £10.

- If the company sells the products individually at £12, they sell 2, giving £24.
- If the company sells the products individually at £10, they sell 4, giving £40.
- If instead the company sells the bundle at £22, they sell 2 bundles, giving £44.

Bundling is especially effective for information goods (since zero marginal cost). Think of MS Office's success. By packaging a word processor and spreadsheet together, they capture customers who only value one, or both. A competitor wanting to enter market has already lost most attractive customers. If competitor wants to compete directly, it must offer both packages, which dramatically increases fixed development costs.

Digital Bundling / Unbundling

- Because digital goods have very low variable costs bundling is cheap to perform. (A copy of MSOffice is as cheap to sell as a copy of MSWord).
- But because no physical substrate is needed online, there is less commercial pressure to bundle: newspapers, CDs can ‘unbundle’.
- This can reduce profit overall, and also can introduce competition for parts of the bundle.

Unbundling of News…

- Headline news has long been cross-subsidized – business, sports, travel, home and garden are where the money is made…
- Easier to target advertisements in these areas.
- People value news, and do access it, but....
- In an 'unbundled world',
  1. News cannot be cross-subsidized by the other parts.
  2. Raw news is a commodity, so competition drives price to zero.
- A challenge for the news industry…

A similar story for other media providers such as music

Economics of The Network Effect

- Many digital goods draw benefit from the network of users
- This is true for all financial technologies

Let's look at the economics of this network effect…

Externalities

If two parties trade, and it has an effect on others who had no say in the trade, it is known as an *externality*.

- A *negative externality* imposes *costs* on others – such as pollution.
- A *positive externality* provides *benefit* to others – such as fire safety measures in the home.

Network externalities

- A *network externality* is a particular kind of externality.
  - It occurs when the act of buying a product or service confers indirect cost or value on all those who already have bought the product or service.
  - (Note: we are talking about the 'customer network' not computer networks…)

- Again, they can be positive or negative, e.g.:
  - In 1930 - Buying a car has a positive effect on others with cars, as it encourages provision of petrol stations, roads etc.
  - In 2019 - Buying a car has a negative effect on others with cars, as it makes the roads more congested.

‘The Network Effect’

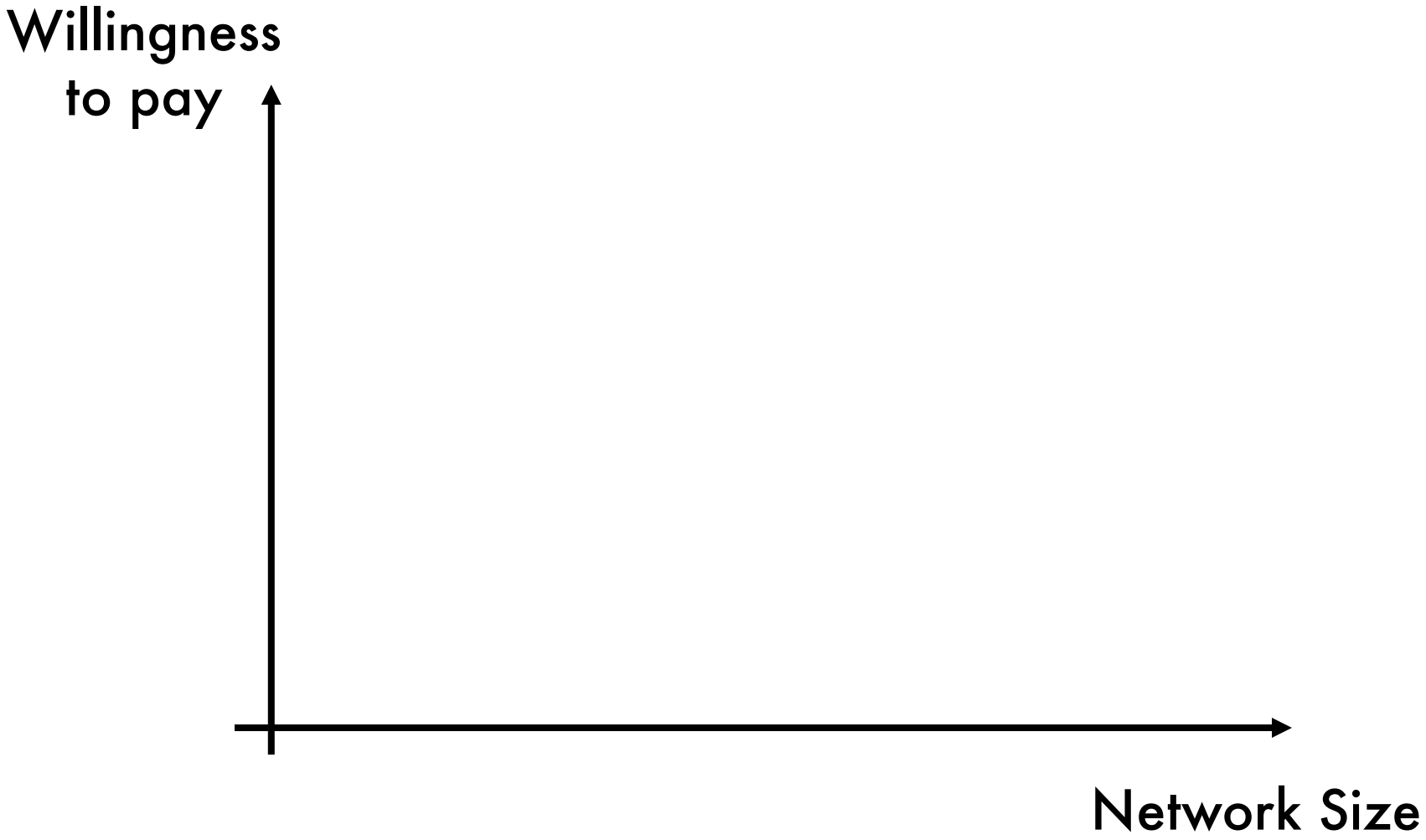
- Positive network externalities are more common and extreme in an online world…
  - Microsoft Office
  - Ebay provider rating
  - Social networks
  - Multi-player games
  - Bitcoin

- Compatibility, sharing files
- More trust, accountability
- More communication, information
- More realism, more fun
- More opportunities to pay

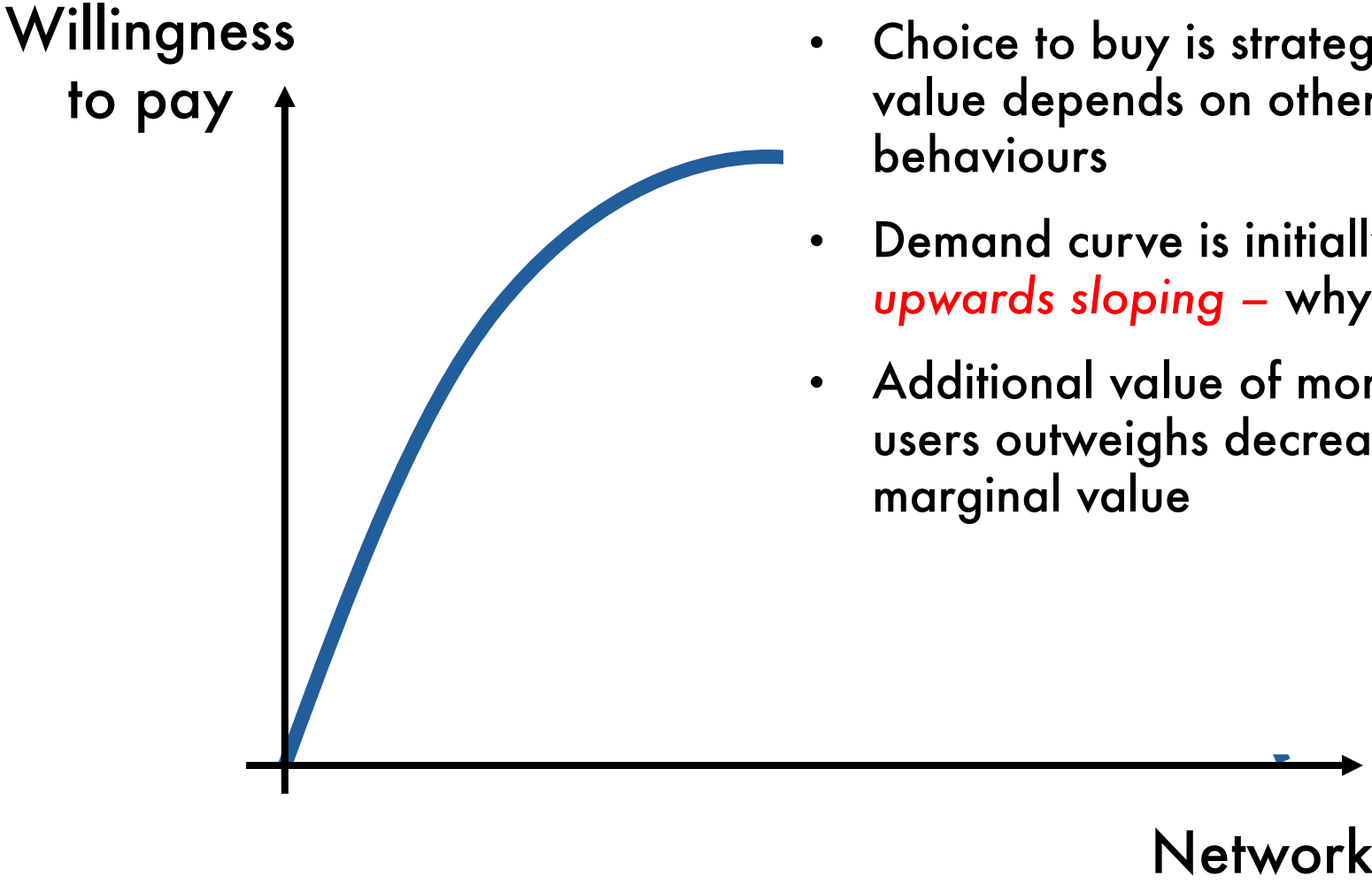
QUESTION:

How do positive network externalities work in each of these?

Economics of the Network Effect

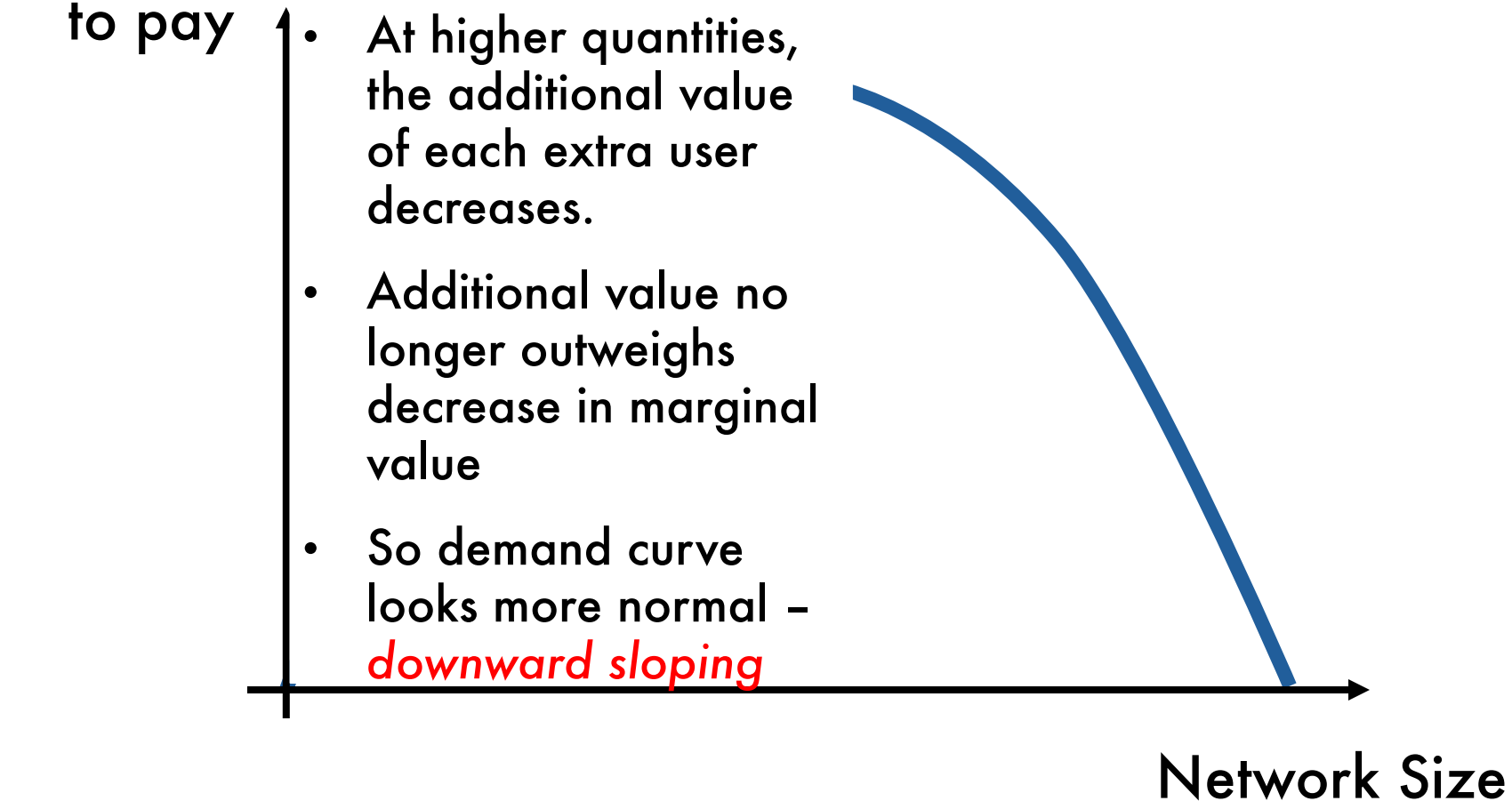


Network Effect Demand Curve



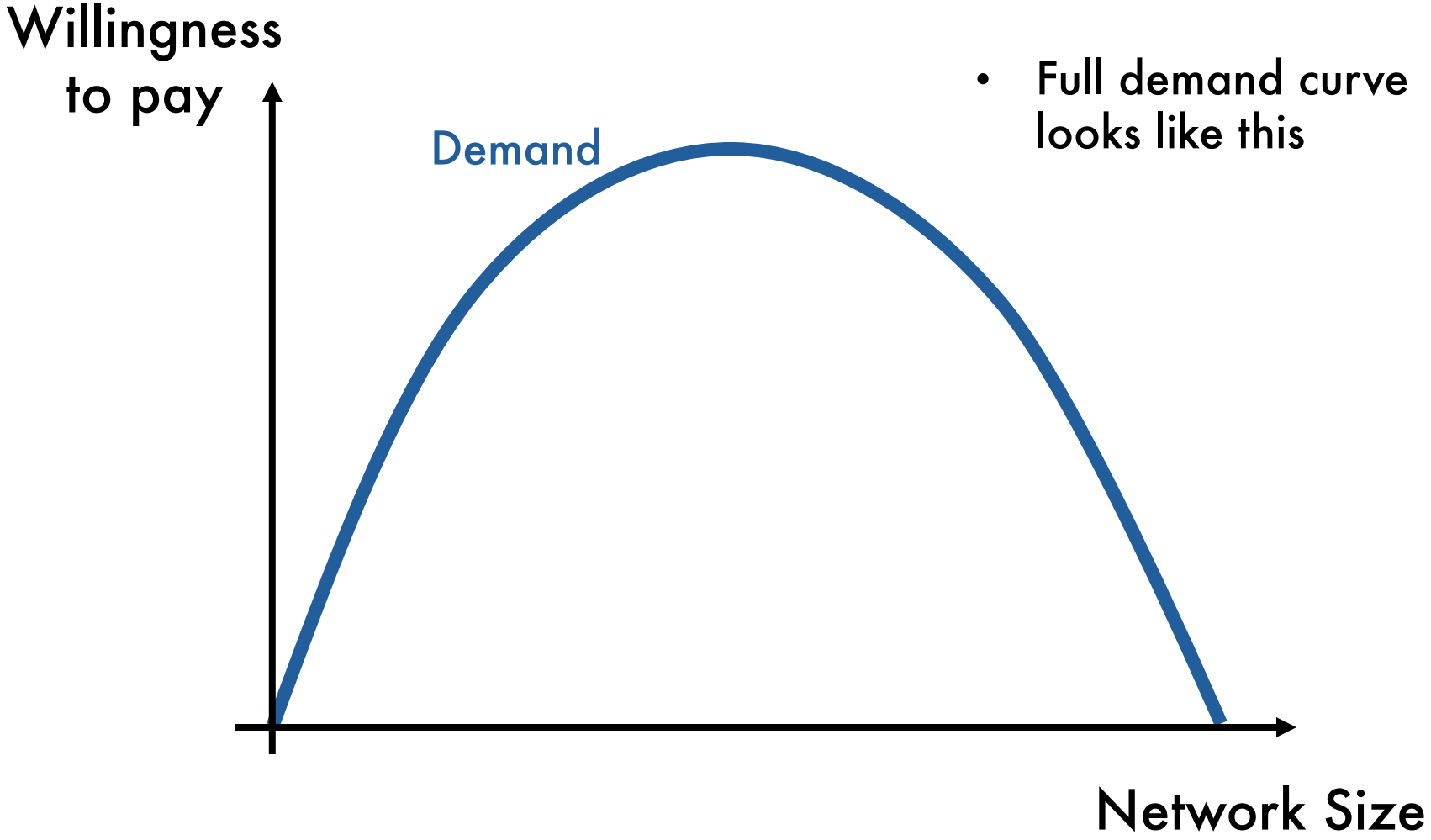
- Choice to buy is strategic. The value depends on others' behaviours
- Demand curve is initially *upwards sloping* – why?
- Additional value of more users outweighs decrease in marginal value

Network Effect Demand Curve



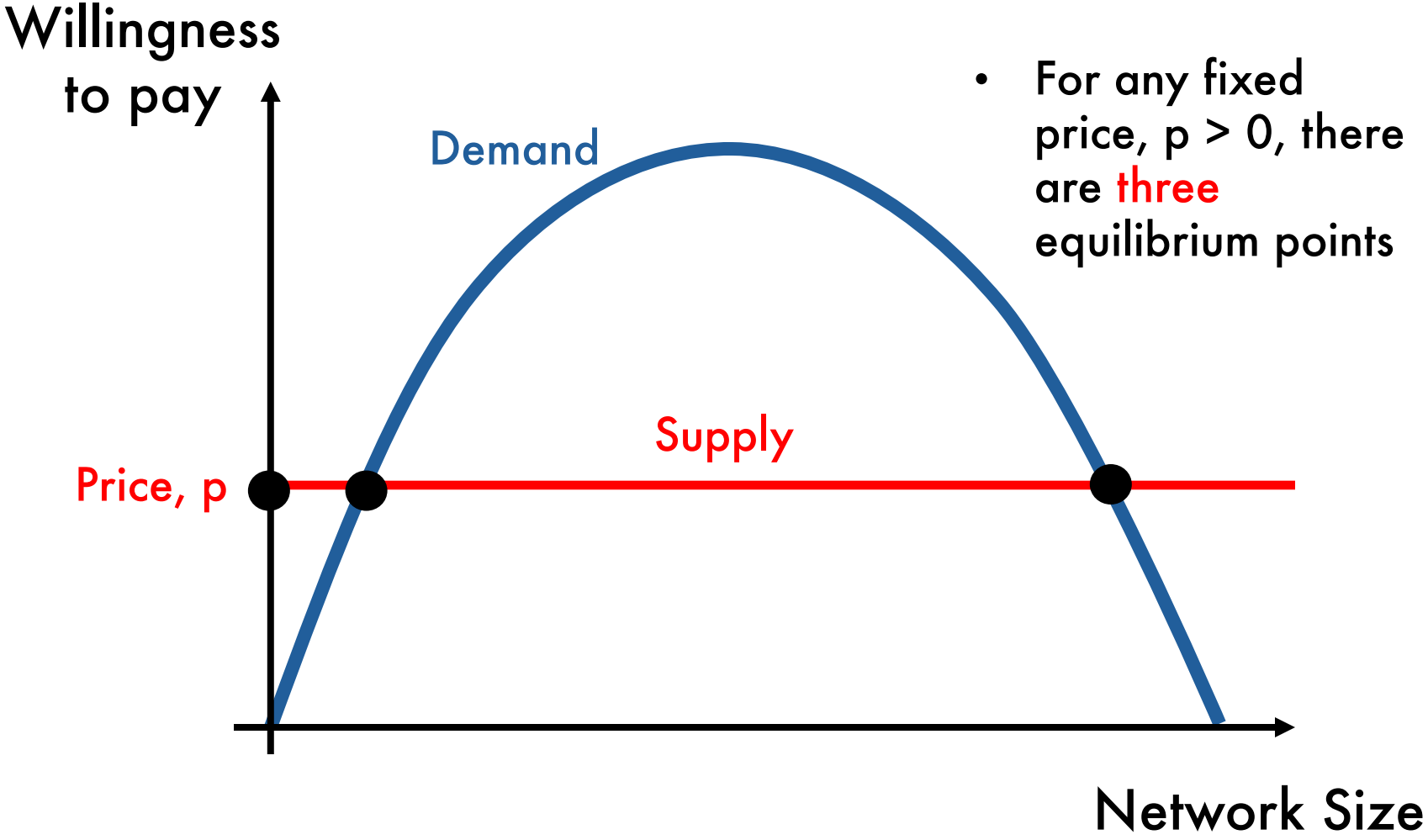
- At higher quantities, the additional value of each extra user decreases.
- Additional value no longer outweighs decrease in marginal value
- So demand curve looks more normal – *downward sloping*

Network Effect Demand Curve



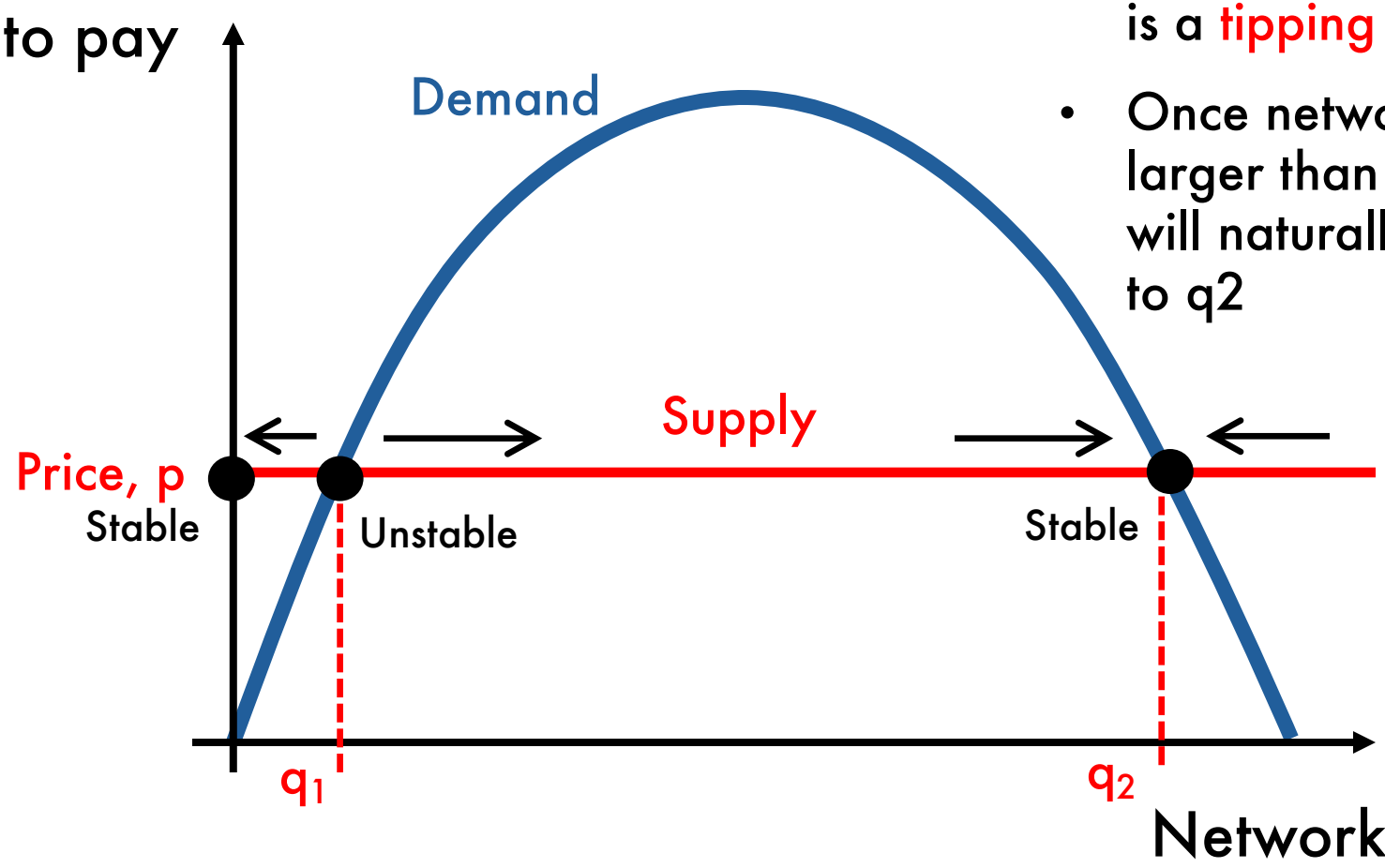
- Full demand curve looks like this

Network Effect Demand Curve



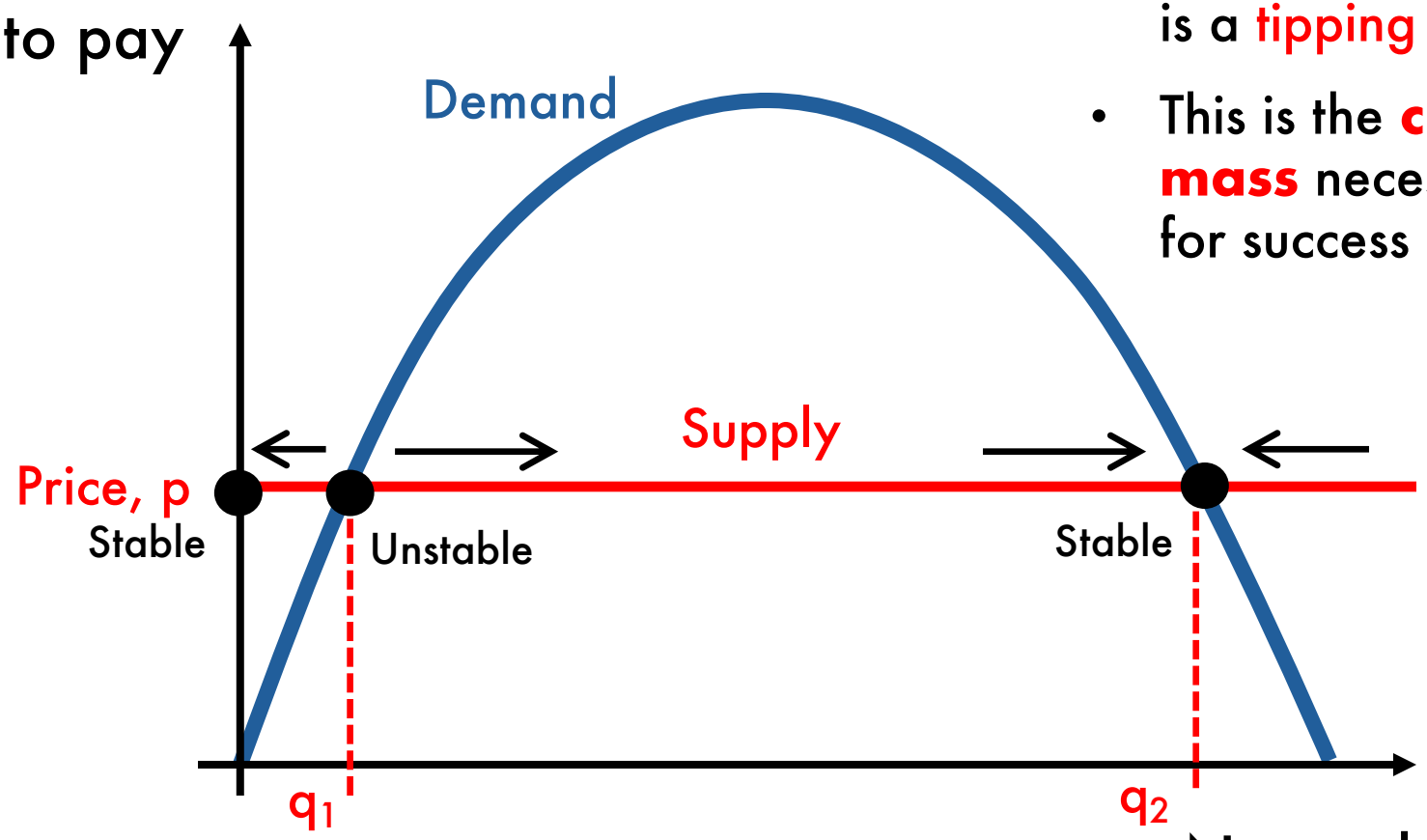
- For any fixed price, p > 0, there are three equilibrium points

Network Effect Demand Curve



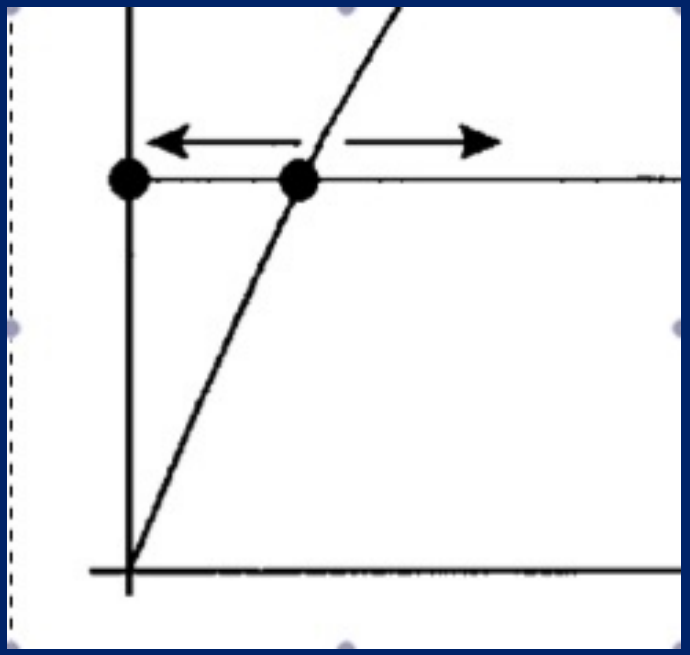
- Middle equilibrium is a tipping point
- Once network is larger than q1, it will naturally grow to q2

Network Effect Demand Curve



- Middle equilibrium is a tipping point
- This is the **critical mass** necessary for success

‘Penetration Pricing’



Trying to reach critical mass

- Early adopters will have a low valuation, so need to charge them less to build the network. E.g., cheap fax machines…
- The nature of digital goods/services gives new ways of doing this….

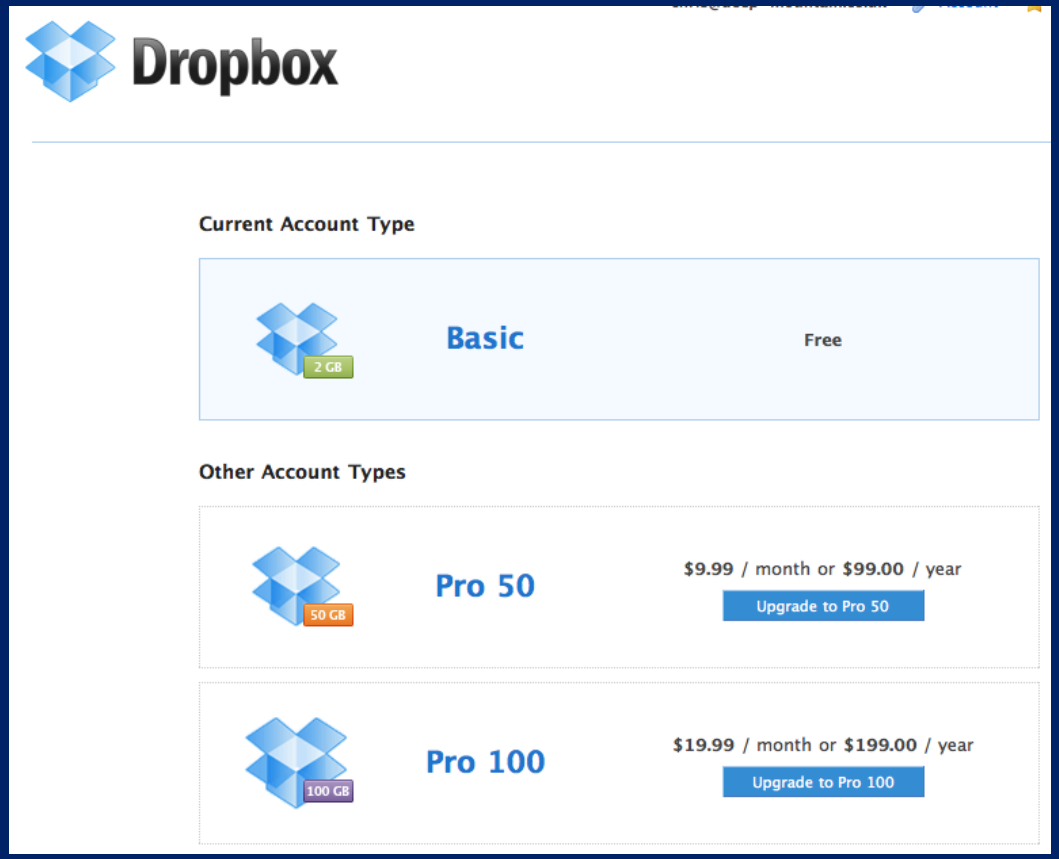
The Use of Free Versions to build networks…

- Because duplicates of digital goods are almost zero cost to provide, they can be given away for free…

- Adobe Reader: Free 'purchase' of Reader adds value to the network of Acrobat users. If Adobe had to charge even a small amount for reader, it would have dramatically reduced take-up of Acrobat, and it would not be in the near-monopoly position it is in today.

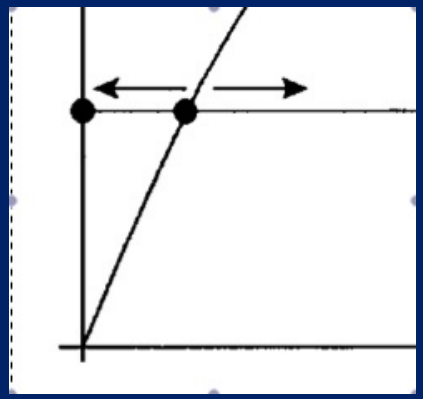
‘Freemium’ and the Network Effect

- The ‘Freemium’ business model is to offer different versions at different prices, including a free one.



Converting Free to Premium…

- The providers of the free service, of course, want you to upgrade. This can be simply because you get used to the service and like it…
- But if the network effect is at work…
  - Encourage you to build the network, by inviting friends/colleagues. You will be building the part that is most valuable to you…
  - And hence the value of the service for you increases, so you become willing to pay a price for a premium version.



Trying to reach critical mass

Switching Costs and Lock-In

- Switching from one product/service to another similar one can have additional costs – the *switching costs*.
  - E.g., learning the controls on a different TV.
- Switching costs in the digital world are very common and often great.
  - Compare switching your car from Ford to Vauxhall, versus switching OS from Windows to Mac OSX
- When switching costs are very high, buyers are said to be '*locked in*' to one provider.
  - The cost of changing is so high compared with potential cost savings or service benefits, that the customer cannot afford to switch.

Sources of switching costs in the digital domain

1. Training how to use the system

   Software can be complex to use, and the user needs to build up expertise and experience. If the competing product has a different use model, retraining will be required costing time and money. E.g., operating systems.

2. The Network Effect – convincing others to switch

   If the product is used by others who the user interacts with, and is not compatible with competitive products, then the user would need to convince others to change at the same time (e.g., WhatsApp)

3. Setup costs

   Software/service needs to be set up with, for example, your personal details and preferences (e.g., Paypal, Amazon).

4. Reduced service quality due to loss of information

   CRM information stored by a service provider over time can improve the quality of service. Moving provider can therefore reduce the quality of service (e.g., Netflix recommendations).

Digital Monopolies

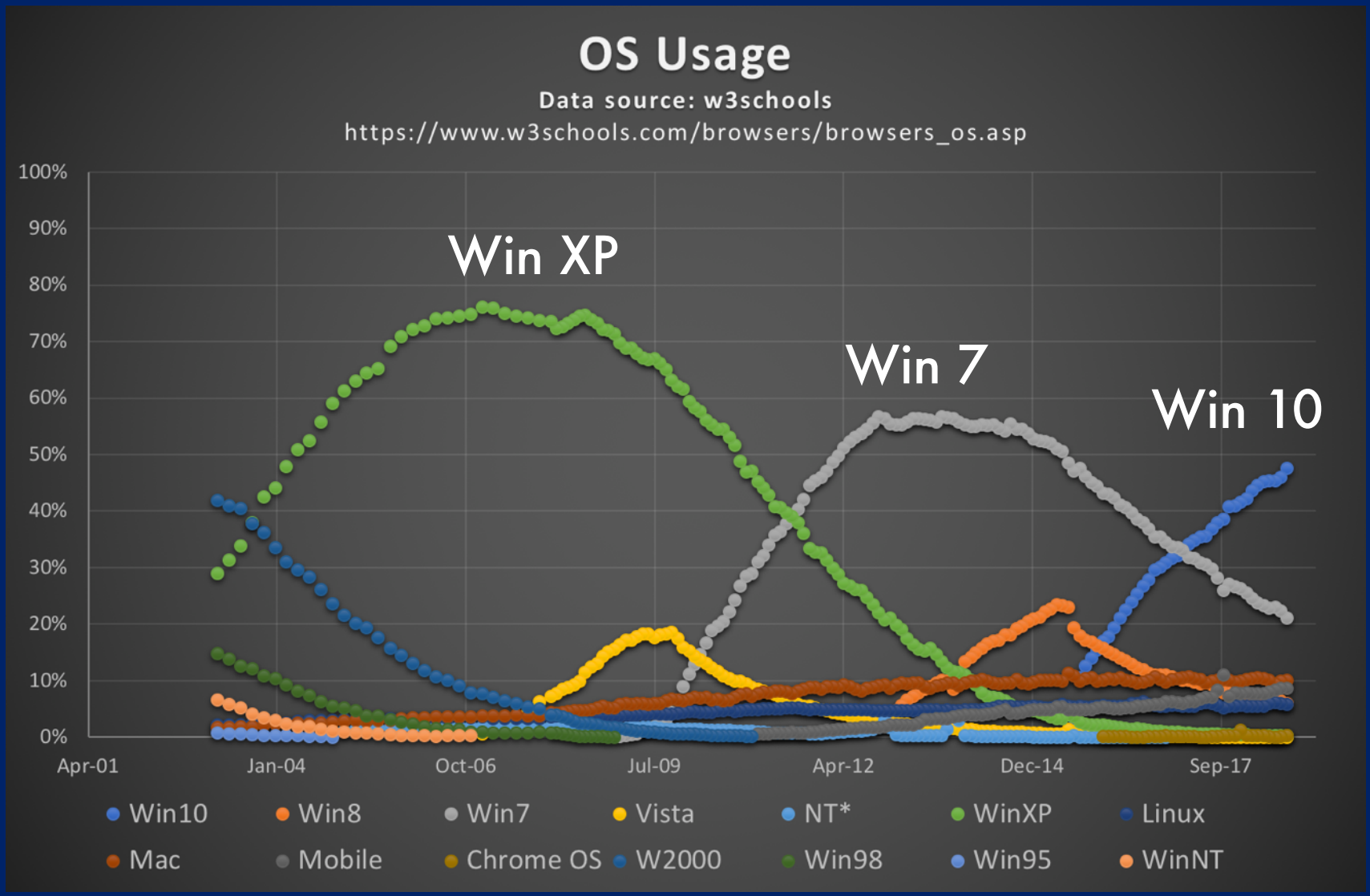
- Where both network effect and lock-in is great, we would expect to see monopolies emerging. Where it is less so, competition is easier….

Question:

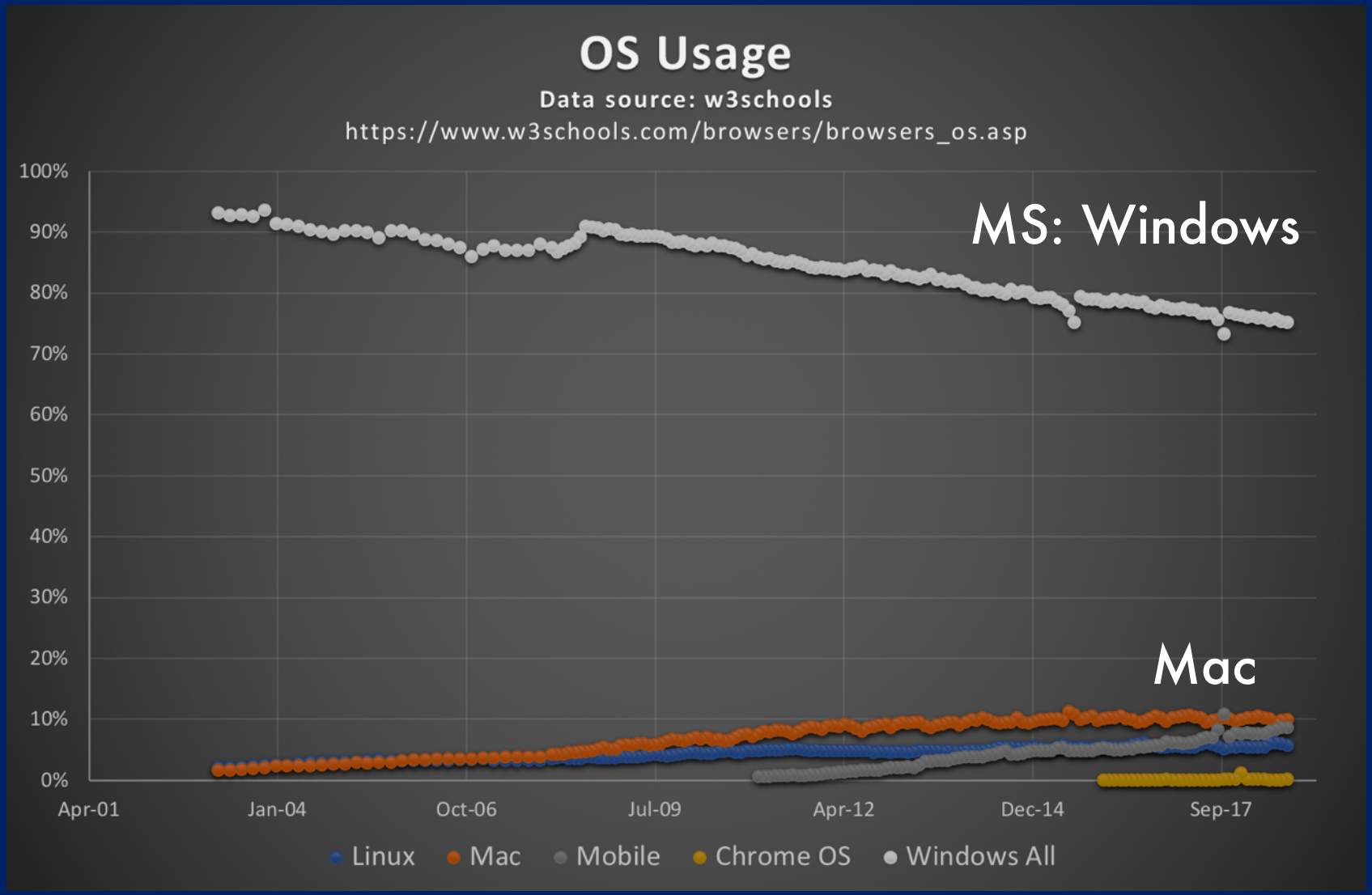
Would you expect to see monopolies emerging around:

- Operating sytems?
- Web browsers?

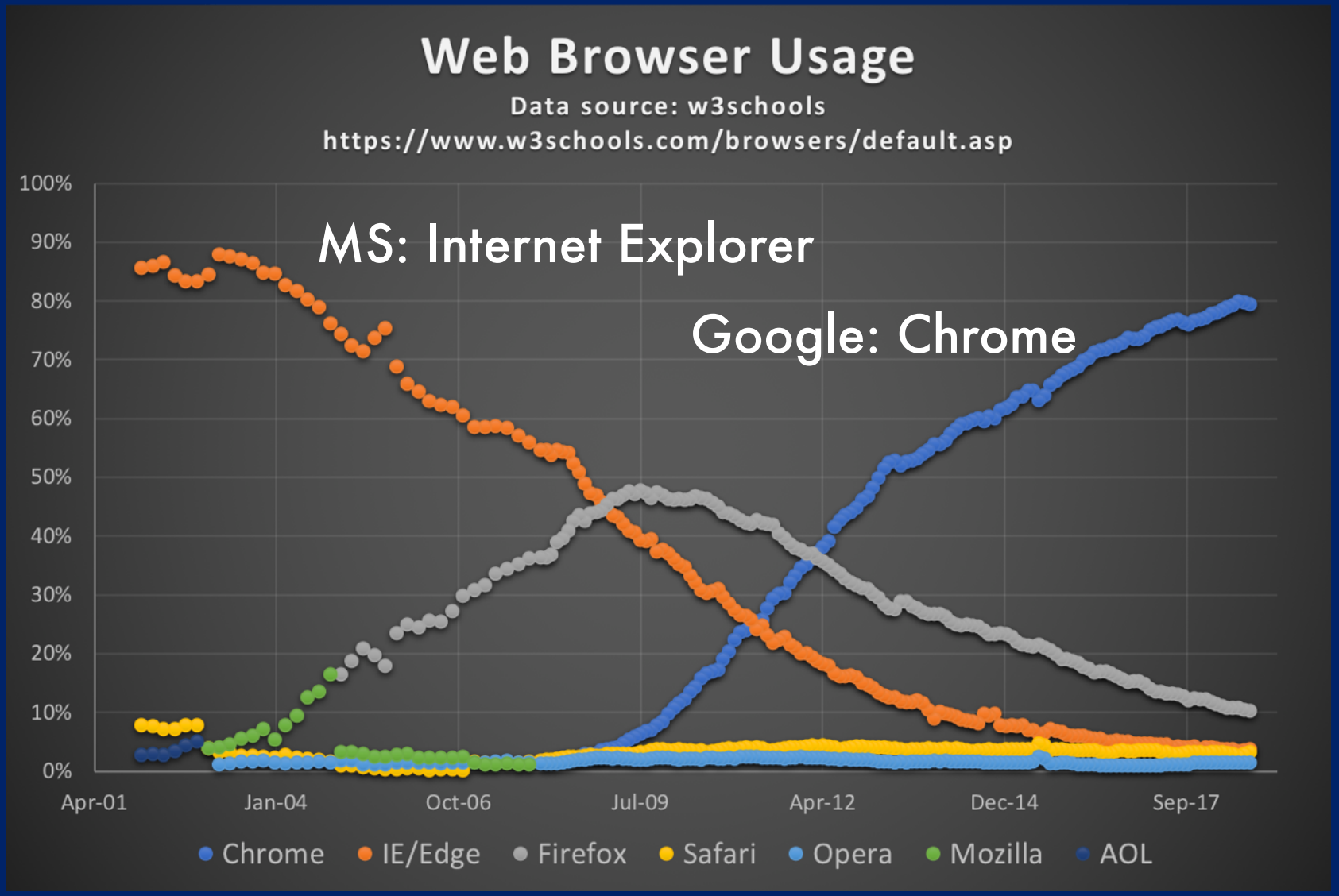
Operating System Share



Operating System Share



Web Browser Share



Breaking into a Network…

- Proprietary formats are a powerful means of enforcing monopoly over a network of users.
  - E.g., .doc format of MSOffice.
- In 2007, OpenOffice reverse-engineered this format allowing OpenOffice to compete.
  - Significantly reduced the network lock-in
  - But still left switching costs associated with training and support. And simple inertia…
- Result: MS Still dominant, but OpenOffice making some inroads. Up to 20% in some countries, particularly where government agencies have chosen to switch.

Opening up a network through standards

- Adopting industry-wide standards allows a user network to be shared between providers:
  - Your part of the network is opened up to competition
  - But also the 'network effect' of competitor's users give value to your users.
  - And the value of the overall network increases to potential new users, bringing more customers overall.

- Trade off – The pie is bigger, but your slice may become smaller.

Economics of Standards…

1. Standards *Leader*: One player, often the major player, sets the standard by opening up their proprietary format.

2. Standards *War*: Two or more players compete to determine which standard is adopted.

3. Standards *Negotiation*: Two or more players negotiate a standard collectively.

Examples on next slides…

1. Standards Leader

- A standards leader opens up a proprietary format with the aim of increasing the size of the overall network of users.
  - E.g., Adobe PDF – format made public from an early stage.

- How does the leader make money from this?
  1. Exploit leadership position to produce the best products in competition with others (Adobe Reader)
  2. Produce proprietary value-added products and services which build on this standard (e.g., Adobe Acrobat Distiller)

2. Standards War

- Competing parties already have too much invested in each to allow negotiation. Hence battle in the marketplace.
- Usually not good for either sellers or buyers…
- Tactics:
  - Penetration pricing to build market share (reach critical mass)
  - Alliances with those selling complementary products:
    - e.g., the DVD forum bringing electronics and film together.
  - 'Expectations management': customers want to buy the winner, so declare victory early
    - e.g., two rival modem formats each claimed 80% market share in 1990s

3. Standards Negotiation

- Negotiation is more common nowadays as players talk early.
- Less of a commercial risk than a standards war.
- But, different players still want to have an upper hand in the new market that is opened up.
- Each party can make the threat of withdrawal if they don't get their way.
- But for this threat to be credible, they must be in a strong position if standardisation fails.
- Hence parties are likely to continue researching their proprietary formats as a fallback and bargaining chip.

Summary

- Internet technology surge due to 'combinatorial innovation'.
- Low variable costs of digital goods, combined with high fixed costs, force prices down in competition, leading to monopolies or zero-priced goods/services.
- The 'network effect' further contributes to this. Reaching critical mass in the network is essential.
- Commodity competition driving zero pricing means new business models are necessary online.

Next week:

- Auctions

Example Questions

A.7: What is "bundling"? Name a well-known bundled software product and provide a numerical example to show how bundling can be used to increase total sales' revenue.

[5 marks]

A.11: Draw a clearly labelled supply and demand diagram for a competitive market, showing a negative shift (i.e., a reduction) in supply following a market shock. Referring to the diagram, explain the expected result on price and quantity sold.

[6 marks]

B.1(b): Describe, in detail, the three degrees of price discrimination. Give examples of each and use a diagram (or diagrams) to demonstrate why price discrimination can be beneficial to a monopoly provider.

[9 marks]

Sources

The Economics of Information Technology – An Introduction

Varian, Farrell and Shapiro (2007)

- Available in electronic form from the library.
- Recommended reading: PART ONE

Information Rules

Shapiro and Varian, 1998,

- Longer, easier to read, aimed at business audience

Economics

Michael Parkins, (9th Ed), 2014, Pearson

Final word

- Next week:
  - Monday 5pm-6pm: MVB 1.08 - ”Eikon Lab”
- Individual Projects:
  - I have some free time on Wednesday afternoon to meet.