Industry Supply and Rents

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Lecture 5
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Introduction

Today we'll consider the aggregation to industry supply

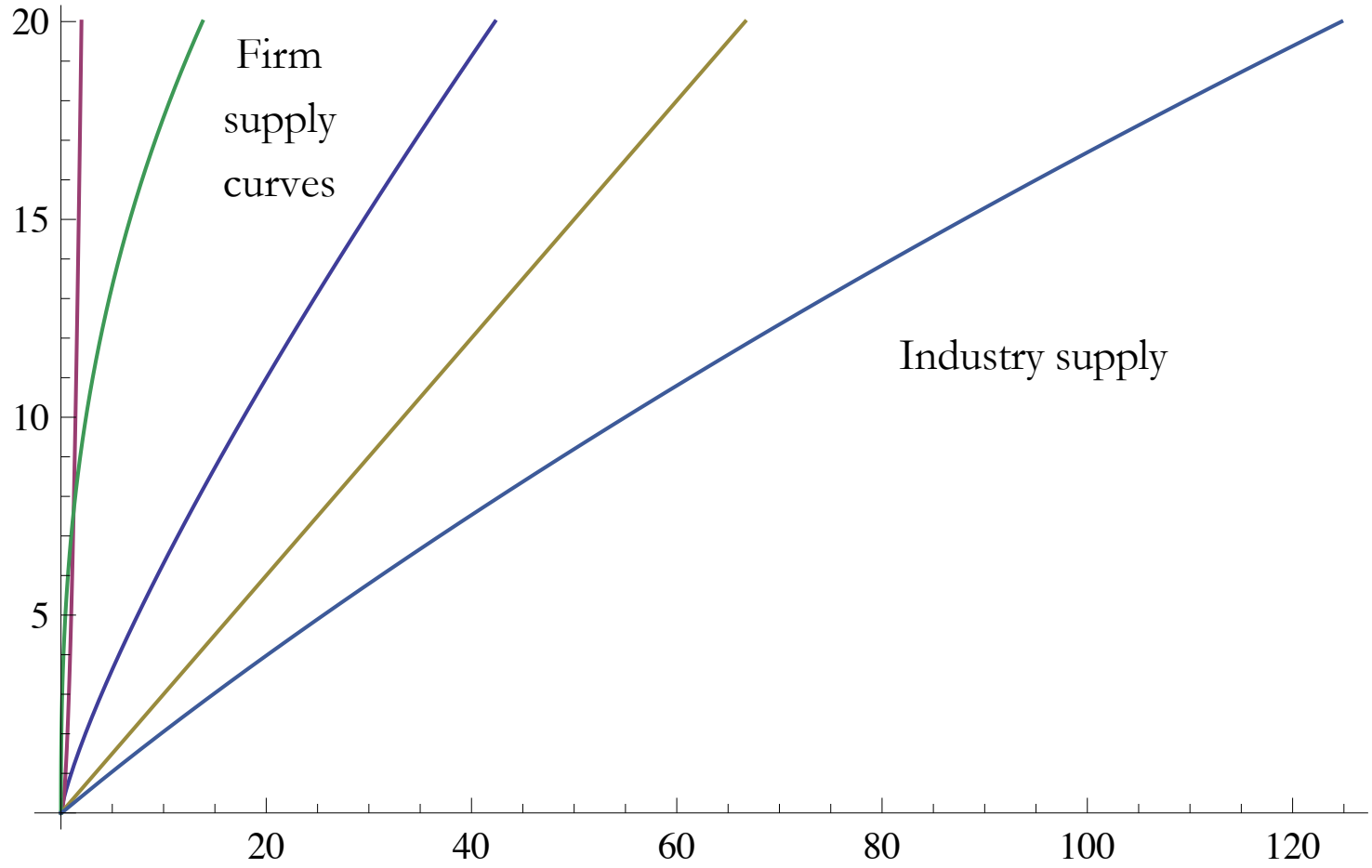
1. Adding up and entry points
   - Industry supply derived from adding individual supplies
   - Because firms enter at some point, kinks and discontinuities
   - Uncertainty about entry points smooths this out
2. Free entry, barriers to entry and the long-run
   - Rent from some firms being more efficient than others
   - Textbook analysis: in the long-run, entry eliminates profits
   - Except when there are barriers to entry (good or bad)
3. Rents and problems with the concept of free entry
   - I'll challenge this: people really do have different talents
4. Zipf's law and firm heterogeneity
   - Elegant empirical regularities on heterogeneity
5. Sets stage for many other things we will study

Summing supply horizontally

Deriving industry supply pretty simple

- Add up all supply curves *horizontally*: $\overline{S}(p) = \sum_i S_i(p)$
- This is particularly simple when all firms enter at 0
  - If derived from marginal costs, $\overline{S}(p) = \sum_i MC_i^{-1}(p)$
  - Aggregate inverse supply then $\overline{S}^{-1}(q)$
- Consider a simple example: (I costs \$1)
  - Production functions $\left(\frac{9}{5}I\right)^{\frac{5}{9}}, \left(\frac{3}{5}I\right)^{\frac{1}{3}}, \sqrt{\frac{3}{5}I}, \left(\frac{I}{5}\right)^{\frac{5}{7}}$; total costs?
  - $\frac{5}{9}q^{\frac{9}{5}}, \frac{5}{3}q^3, \frac{5}{3}q^2, 5q^{\frac{7}{5}}$; marginal costs?
  - $q^{\frac{4}{5}}, 5q^2, \frac{10}{3}q, 7q^{\frac{2}{5}}$; supply functions?
  - $p^{\frac{5}{4}}, \sqrt{\frac{p}{5}}, \frac{3p}{10}, \left(\frac{p}{7}\right)^{\frac{5}{2}}$; industry just sum of these
  - To graph, just switch axes (inverting messy)

Individual firm and industry supply with Cobb-Douglas

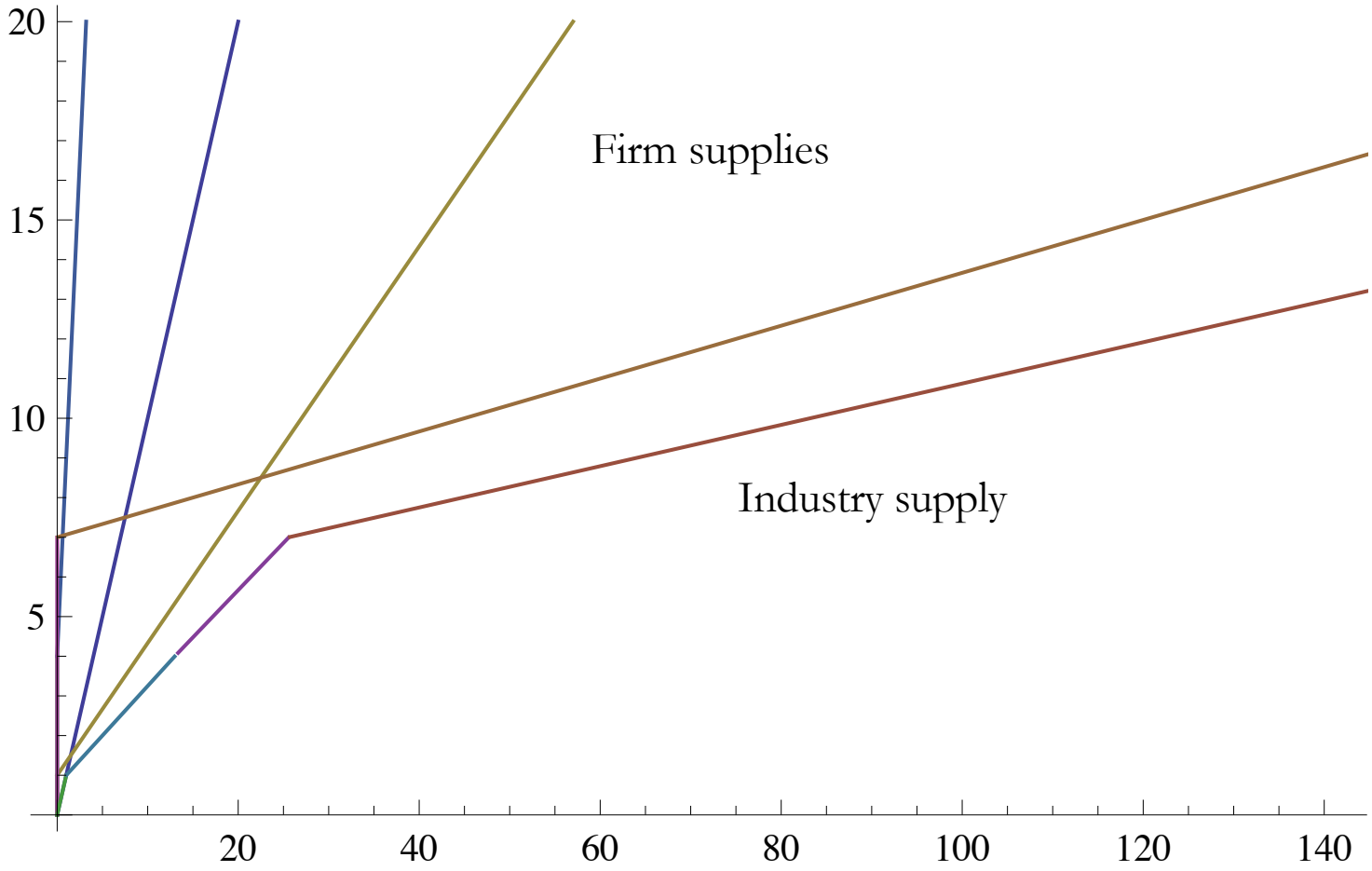


Entry points and discontinuities

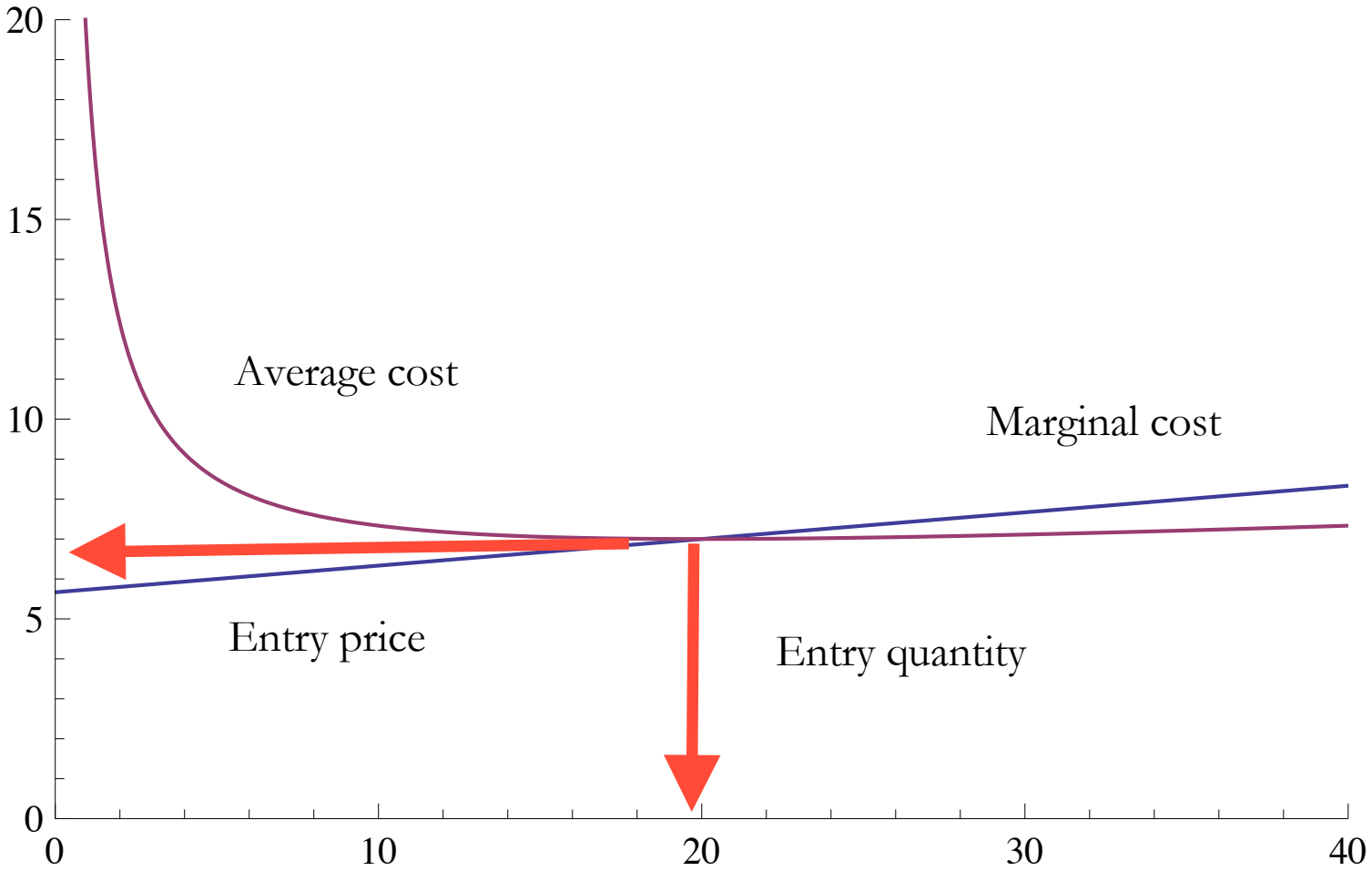
This was simple and nice because all firms entered at 0

- But many firms (with fixed costs) would not enter there
- They might require a higher price
- If they all enter at 0 quantity, this just causes kinks
  - Total costs $\frac{1}{2}q^2, q+\frac{1}{6}q^2, 4q+\frac{5}{2}q^2, 7q+\frac{1}{30}q^2$; MCs?
  - $q, 1+\frac{1}{3}q, 4+5q, 7+\frac{1}{15}q$; when to enter? Supply?
  - $0, 1, 4, 7$; $p, 3(p-1), \frac{p-4}{5}, 15(p-7)$; adding up gives kinks
- But if enter at positive quantity, real discontinuities
  - Fixed costs $0, \frac{25}{6}, \frac{5}{4}, \frac{40}{3}$, VC $\frac{q^2}{2}, \frac{q^2}{6}-\frac{2q}{3}, \frac{5q^2}{4}+\frac{3q}{2}, \frac{q^2}{30}+\frac{17q}{3}$
  - AC's $\frac{q}{2}, \frac{q}{6}-\frac{2}{3}+\frac{25}{6q}, \frac{5q}{4}+\frac{3}{2}+\frac{5}{4q}, \frac{q}{30}+\frac{17}{3}+\frac{40}{3q}$
  - MC's $q, \frac{q-2}{3}, \frac{5q}{2}+\frac{3}{2}, \frac{q}{15}+\frac{17}{3}$
  - Graph to find entry points, supplies
  - Supplies as before, except entry quantities $0, 5, 1, 20$

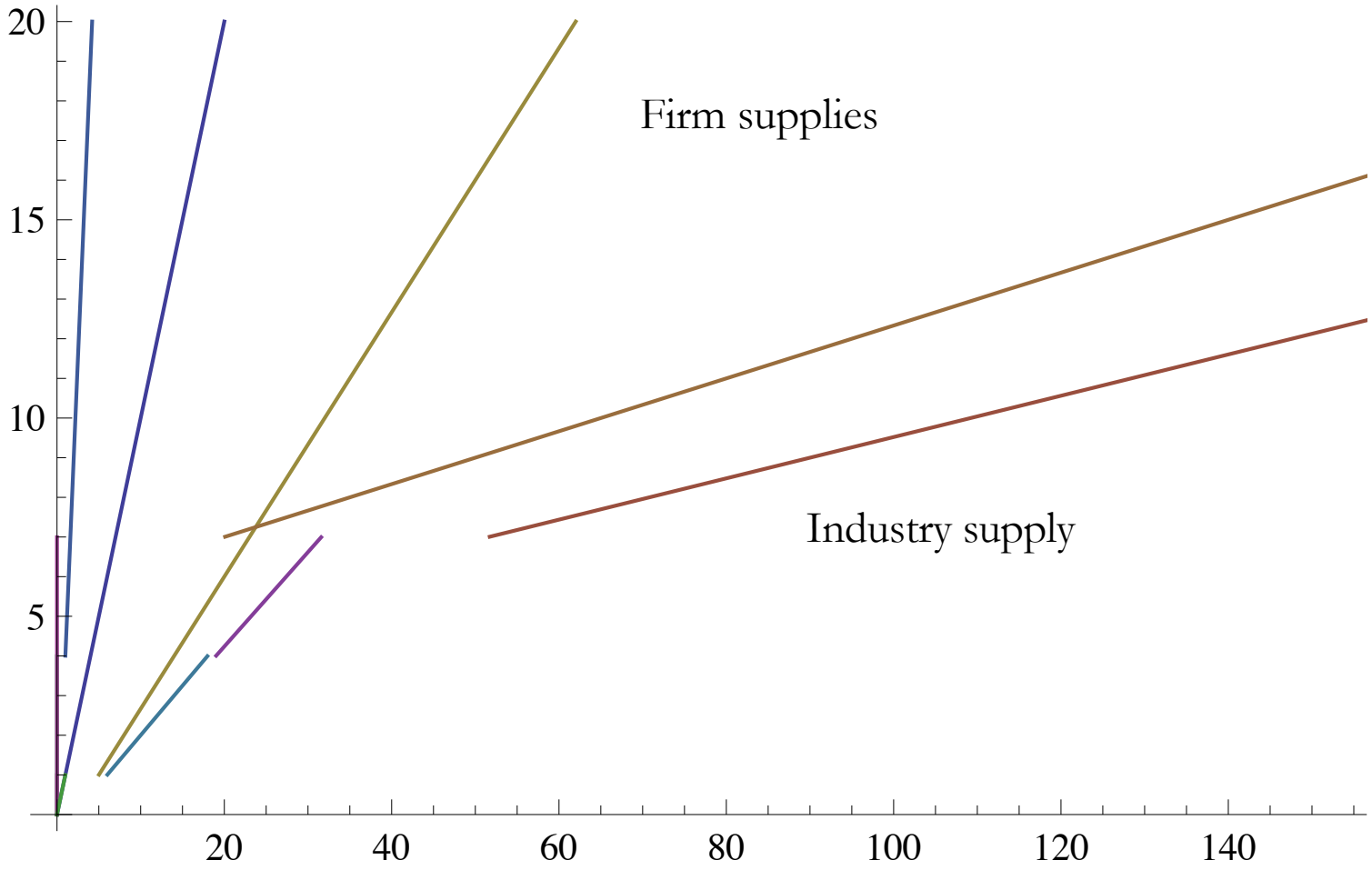
Entry causes kinks in industry supply



Finding entry quantities, supply



Discontinuities in industry supply from entry quantities



Uncertainty and smoothing out supply

This can be annoying:

1. Makes it difficult to use calculus (obviously)
2. What if demand cuts through one of these gaps?
   - Is there no supply?

In practice, problem is not as big as it appears:

1. Uncertainty smooth things out
   - Firms may have entry points, but usually not known for sure
   - This makes *average* or *expected* supply smooth
2. Discontinuities small if no firm makes big difference
   - In real world, individual firms do make big difference
   - But if they do, this is problem for competitive model
   - If demand went through gap, what would happen?
     - Firm reduce quantity to bring price back up, reap profits

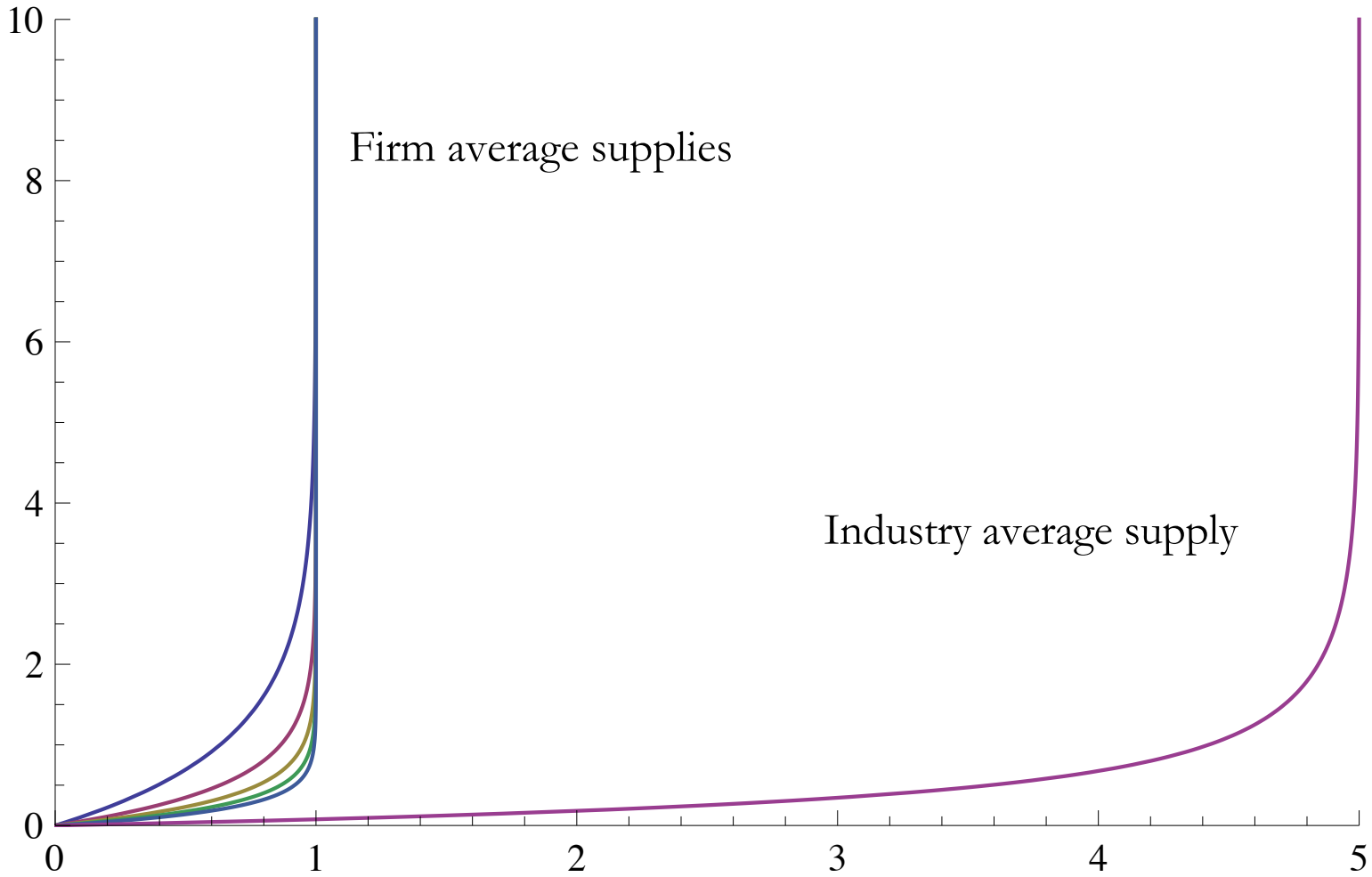
$\Longrightarrow$ Price-taking already rules out these problems

A numerical example of uncertainty smoothing

To get basic idea, let's take the simplest possible example:

- Suppose five firms; each will only produce 1 unit
- Question is: at what price will it start producing?
- Uncertain, distributions $F(p) = 1 - e^{-ip}, i = 1, \ldots 5$
- What is the expected industry supply?
  - Just sum of probabilities of supply, $\overline{S}(p) = 5 - \sum_{i=1}^{5} e^{-ip}$
  - Perfect smooth, despite discrete entry: uncertainty
  - Firm being small does the same: distribution

Graph of uncertainty smoothing industry supply



Profits and rents: the basic idea

In all these pictures, firms earned positive profits (rents):

- What determines size of these?
  1. From our earlier analysis, area to left of supply
     - The more firm is producing, the more rent
     - The wider range of prices at which they would produce
     - The more efficient is *average* relative to *marginal* unit
  2. But other firms help determine prices

     $\Longrightarrow$ How efficient relative to *everyone's marginal cost*
     - How much *better you are then others* is crucial

$\Longrightarrow$ Two basic sources of rents under competition

1. Your marginal product "stretches you far"
2. You are better than others, thus in high demand

$\Longrightarrow$ Those earning rents always "stressed" on margin

- Doctors, best restaurants, talented constantly turn down

Free entry and the long-run

But shouldn't these profits attract others to enter?

- Very classic idea: in long-run if free entry no profits
- Only short-term advantages allow profits
  - California Gold Rush quickly erased profits
- Any time firm has profits, someone will imitate
  - Groupon got out ahead, but quickly everyone copied
- If firm doing better than other, switch technology
  - Apple design of touch screen quickly copied
- Any time a firm is making losses, will exit market
  - Edible arrangements a fundamental challenge to this theory
- Long-run supply flat at minimum of average cost curve
  - Average cost here defined over *all possible technologies*
  - Every firm just viewed as one short-run technology

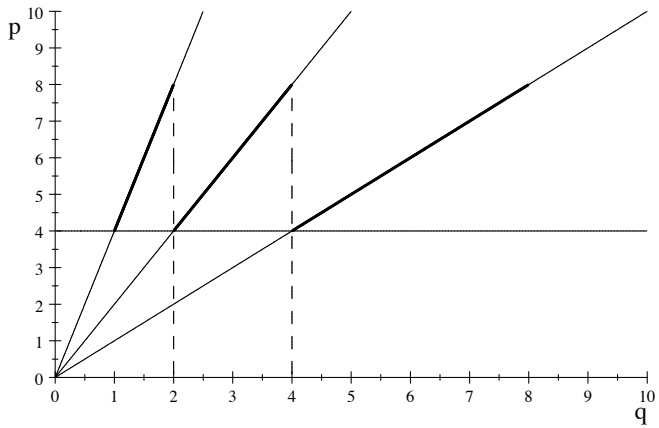
Efficient scale, integer problems and long-run supply

Well....not quite flat if...

1. Number of firms small
2. Entry occurs at non-trivial faction of total quantity

Then demand must grow beyond minimum by enough

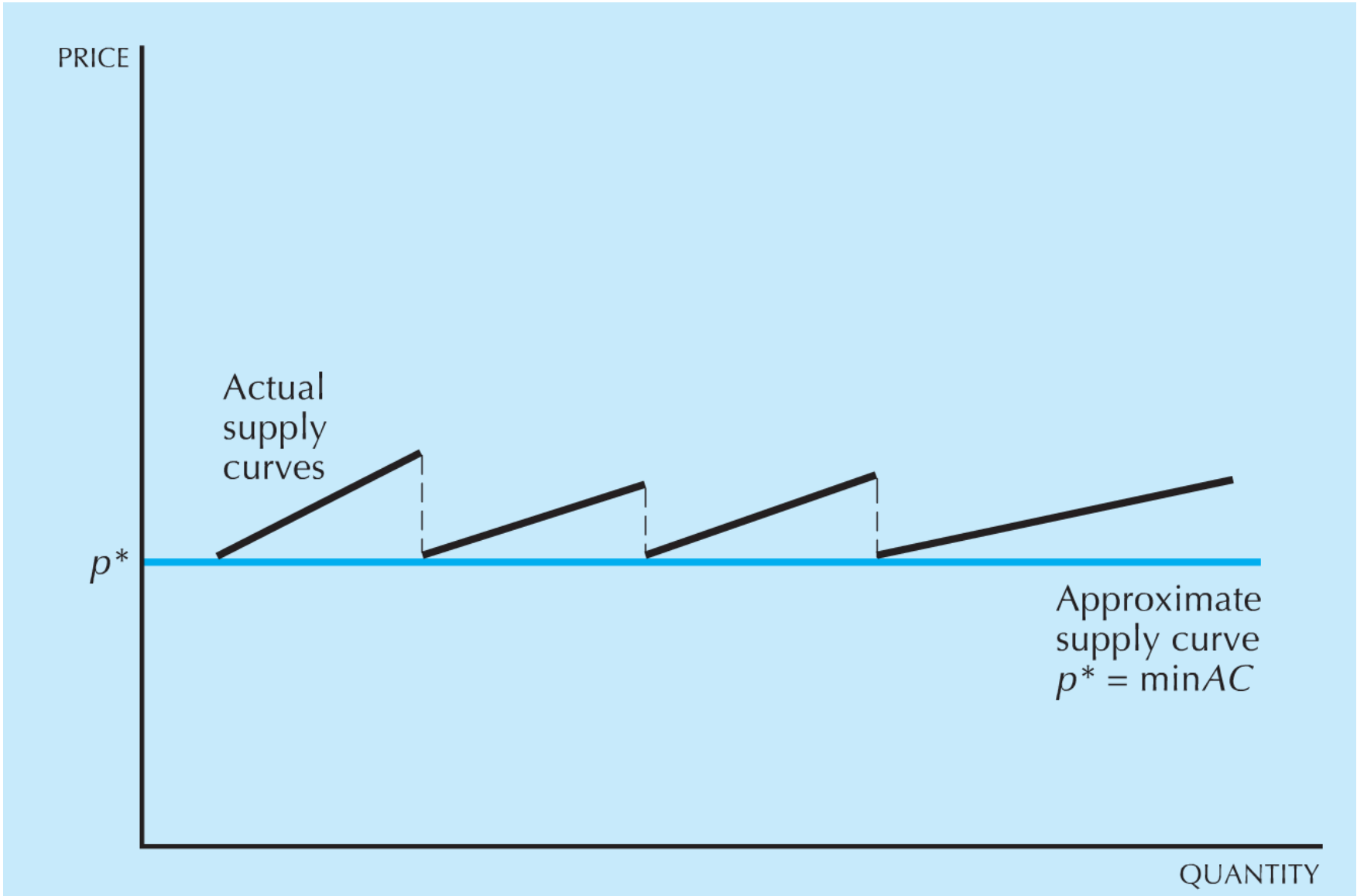
- As number of firms grows, so does elasticity without entry



- However, again, this is not very consistent with price-taking
  - If number of firms small, not price takers

$\Longrightarrow$ "Integer problem" mostly relevant with imperfect competition

Graphs of free entry and average costs



Rent-seeking and "bad" barriers to entry

This process of competition can be inhibited by policy

- Government intervention or private violence
- These impediments called *barriers to entry*; examples?
  - Doctors, taxi drivers and other licensed occupations
  - Regulatory barriers and compliance requirements
  - Violence in illegal markets (Mexican cartels)
  - Petty harassment and bigotry (minority-owned businesses)
  - Contractual arrangements from dominance in other markets
    - Beer on beaches in Perú
- These are usually created by lobbying, violence etc.
  - Economists call these activities *rent-seeking*
  - We view them as bad for three principal reasons?
    1. Effort expended is a social waste (profits dissipated)
    2. Usually benefits favored group, less deserving than average
    3. Requires inefficient restriction of supply, bad way to transfer

Intellectual property and "good" barriers to entry

First reason by far most important:

- Otherwise we wouldn't (want to) have intellectual property
- IP (patents, trademarks, copyrights) prevent entry
  - Without them, free entry drives profits to 0
  - But then how to recoup cost, attract to innovation?
  - We will discuss this problem extensively in Lecture 13

$\Longrightarrow$ What makes entry barrier good or bad is where rents go

1. Rents to drug mafias very bad because encourage violence
2. Rents to academic prestige probably good (create ideas)
3. Rents for authentic art probably good
4. Are rents for end of life drugs actually good?
   - They benefit people, yes, but...
   - We are spending way too much on this type of thing...
   - Populist anti-profit policy would stop health inflation

Free entry and talent

Regardless of good or bad, these barriers are extra-market

- Market, left to itself, will basically eliminate profits
- This is one of deepest and most cited economic ideas
- Quite useful (and right) in some contexts like IP
- But number is much more limited than might first appear
- The rest of the lecture covers natural limits to "free entry"

Basic problem is that many activities require rare talent

- If "any idiot" can implement optimal technology, sure
- But this is possible only in limited circumstances
- You cannot manufacture Steve Jobs or LeBron James
- Because such talent is scarce, it commands rent
- "Barrier to entry", but nothing artificial about it

$\Longrightarrow$ "Free entry" requires (means?) absence of need for talent

Industry breadth and rent erosion

A key factor is what one means by industry

- In long-run, profits on touch-screen smart phones eroded
  - But then Apple introduced tablets, App Store

$\Longrightarrow$ Narrowly defined technical processes often imitated

  - Nokia's cell phone edge did not last for long
  - American car companies and legacy airlines

- But broader industry defined by new products; examples?
  - Intel and process of microprocessor innovation
  - Google's constantly expanding empire
  - Microsoft and the battle to stay a step ahead

- Innovation machines are hard to imitate
  - You'd need to imitate process of generating ideas
  - Copying a particular technical process is not enough
  - Engine like this requires scarce talent (Steve Jobs)

Long-term adjustment and the superstar effect

Even in narrow industry, where prices come down over time...

- Not always by new entrants competing away profits
- Often stimulates technology so few can reach many

$\Longrightarrow$ Lower price, better quality but...

- Rents for those at the top, unemployment for others; exs?
  1. Music industry during the baby boom
  2. Professional sports during the 20th century
  3. Fast food revolution
  4. Gourmet food and celebrity chefs
  5. Mass production of design during 1950's
  6. Future of medicine and education?

- This is called the *superstar effect*
  - If one individual can reach *many* quality crucial
  - Markets may adjust by more superstars, not entry

$\Longrightarrow$ Long-term adjustment may actually increase rents

Importance of distribution of talent for rent

This all means that the distribution of talent is crucial

- Determines rents, nature of long-run responses, etc.
- But note, not *entire distribution that matters*
  - Only the people who are at top select in
  - Suppose that some are very good, others bad
  - If all the very good are the same, then effectively free entry
- The top part of distribution is called its *tails*
- If many people are way out, called "fat tailed"
  - This is case when geniuses are much better
  - Highly *unequal* distribution of talent
  - Also used for crises: Naseem Taleb's "black swans"
- Often, though, assumed that tails are "thin"
  - Implied by many statistical distributions (bounded, normal)
  - But this is not consistent with what we know...

What do we know about the distribution of talent?

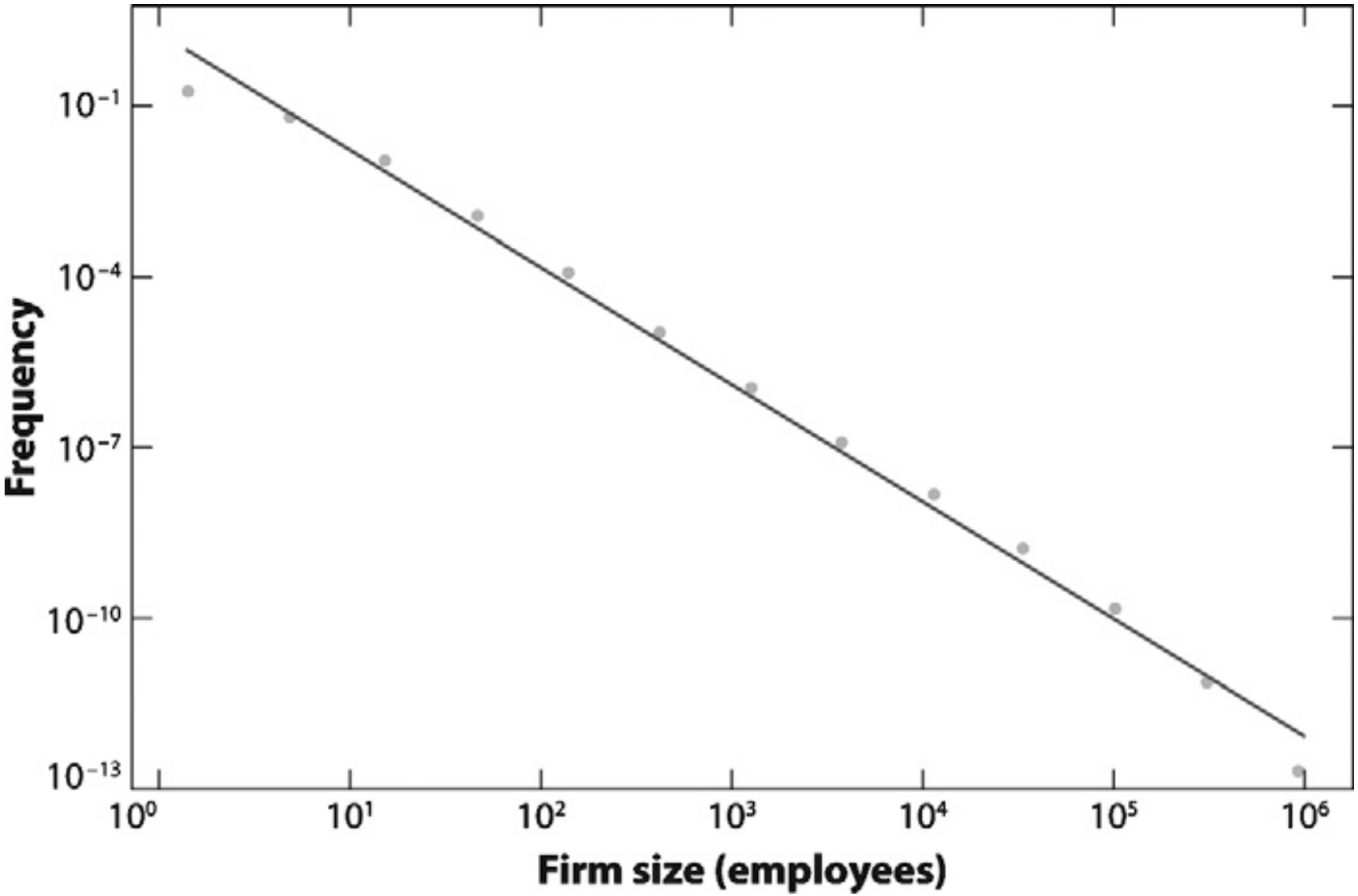
All data we have indicates talent *extremely* fat tailed

- Usually follows power law or *Pareto distribution*

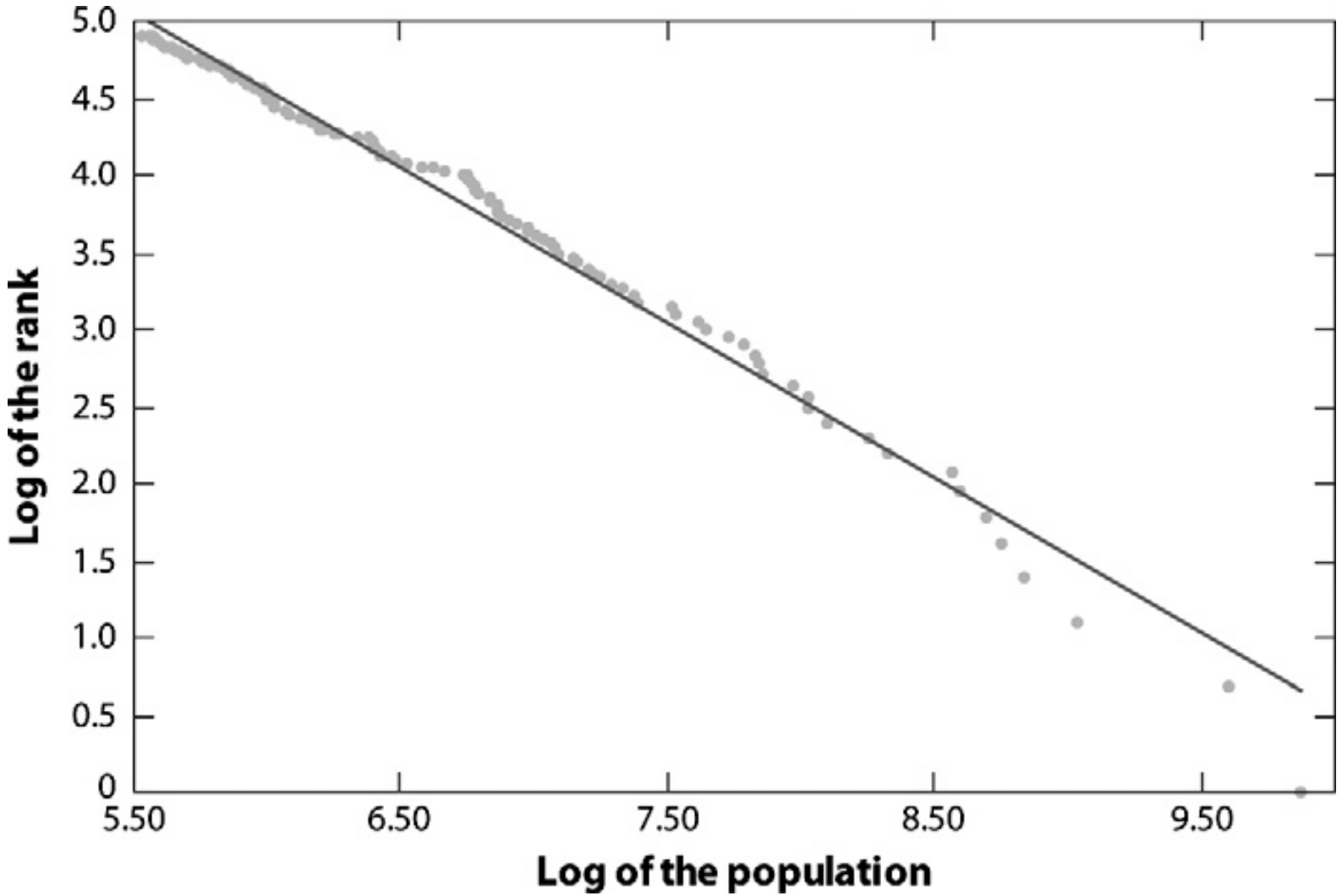
$$F(x;\alpha,x_{\min}) = 1 - \left(\frac{x}{x_{\min}}\right)^{-\alpha}$$

- Some ways of thinking about Pareto distribution
  1. Fraction with talent above $2x$ is $\frac{1}{2^\alpha}$ of that above x
     - Famous implication is if $\alpha \approx 1.2$ then 20% have 80% of talent
  2. The 5th most talented is $\frac{1}{5^{\frac{1}{\alpha}}}$ as talented as most
- Many distributions related to talent/heterogeneity follow:
  1. Income with $\alpha \in [1.5, 3]$; wealth with $\alpha \in [1, 2]$
  2. CEO compensation with $\alpha \approx 3$
- Most prominent is *Zipf's law*: $\alpha = 1$, 5th $\frac{1}{5}$ of 1st
  - I'll show two, but also words, comparative advantage, etc.

Firm size (overall or within industry) follow's Zipf's law



Zipf's law is particularly famous for cities



Also applies to relative use of words in English

Implications of heterogeneity for competition

This extreme heterogeneity at top raises questions:

1. Rents must be quite important, even in long-run
   - Undermines classic free entry logic in many contexts
2. Free entry more of an anomaly; IP way to redress?
   - If free entry possible in some cases, talent will drain out
   - This makes IP crucial for sustaining innovation
3. If some firms so much bigger, are they price-takers?
   - There still might be lots of firms, just some less small
   - But with strong diseconomies of scale...
   - This large heterogeneity will lead to market power
4. Income distribution is highly unequal
   - Redistribution may be very important
   - Raising taxes on very top can generate a lot
   - If value scales with income, demand curves like Pareto
5. Summarizes most of the rest of the course