

# Industry Supply and Rents

E. Glen Weyl

University of Chicago

Lecture 5

Turbo Section

Elements of Economic Analysis II

Fall 2011

# Introduction

Today we'll consider the aggregation to industry supply

- 1 Adding up and entry points
  - Relatively mechanical, but possible 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
  - Only for narrowly construed, ex-post obvious industry
- 4 Zipf's law and firm heterogeneity
  - Elegant empirical regularities on heterogeneity
- 5 Sets stage for many other things we will study

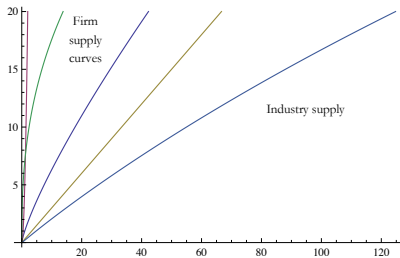
## Summing supply horizontally

Deriving industry supply pretty simple

- Add up all supply curves *horizontally*:

$$\bar{S}(p) = \sum_i S_i(p)$$

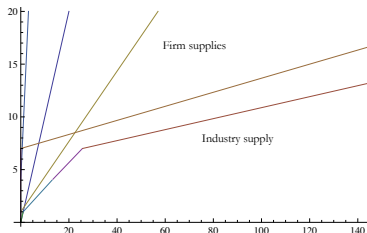
- This is particularly simple when all firms enter at 0
  - If derived from marginal costs,  $\bar{S}(p) = \sum_i MC_i^{-1}(p)$
  - Aggregate inverse supply then  $\bar{S}^{-1}(q)$



## Entry points and discontinuities

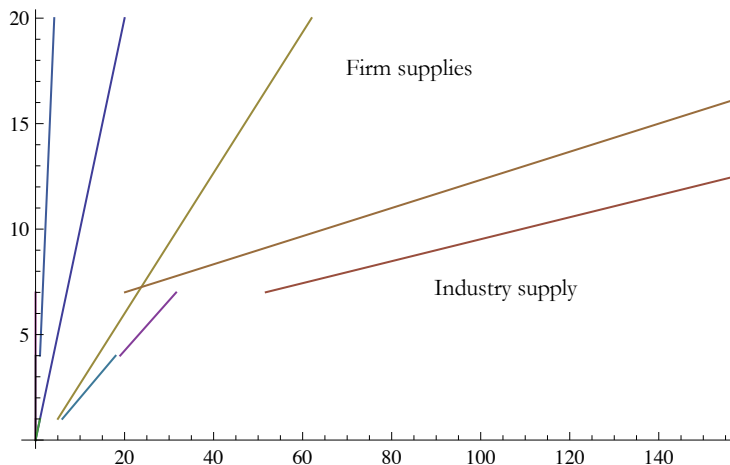
This picture was simple and nice because all firms entered at 0

- 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



But if enter at positive quantity, real discontinuities

# 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
- ⇒ Price-taking already rules out these problems
- Return to this in a few minutes and on Thursday

# 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
    - ⇒ How efficient relative to *everyone's marginal cost*
      - How much *better you are than others* is crucial

⇒ Two basic sources of rents under competition

- 1 Your marginal product “stretches you far”
- 2 You are better than others, thus in high demand

⇒ 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

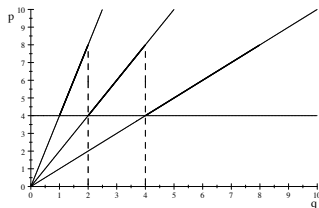
# Efficient scale, integer problems and long-run supply

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

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

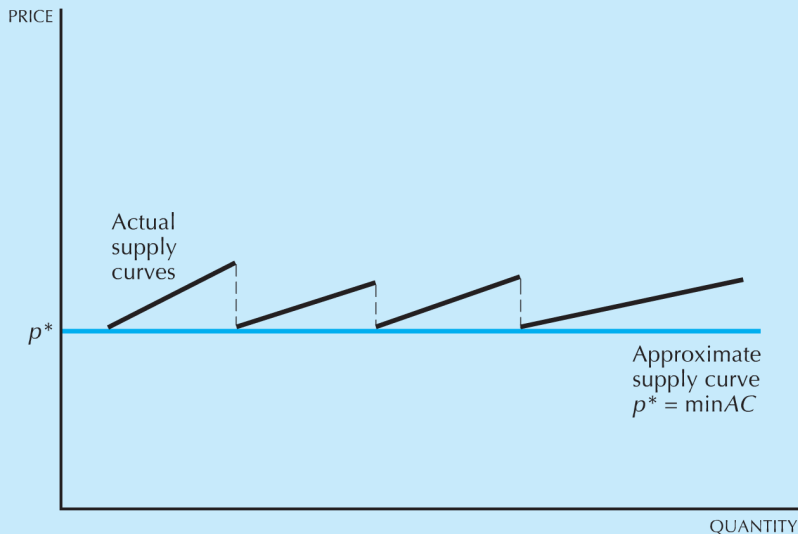
Then demand must grow beyond minimum by enough

- 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
- ⇒ “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; why?
    - 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

⇒ 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
- ⇒ “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
- ⇒ 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

⇒ 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

⇒ Long-term adjustment may actually increase rents

# Is entrepreneurial talent durable?

Basic assumption of free entry is that entry is durable

- Some fixed cost to adopt technology
- After that, cheap to imitate

Sometimes this is plausible:

- Reverse engineering and setting up imitator
- Studying to enter a profession that is in high demand
- Navigating initial regulatory bureaucracy and other barriers

But in other cases, this seems unlikely

- A great athlete requires much more than investment
- Adaptability and innovative capacity hard to learn
- Internet age: entering happens very rapidly

⇒ Often time is not most important element

# Might talent even be storable?

In fact, time might even work against entry

- Talent/will for entering storable in some cases; examples?
  - 1 Charitable giving for disaster-struck regions
    - Most classic example: short-lived desire for giving
    - Many disaster struck regions better off than chronic poverty
    - Sustained misery creates sense of inevitability
    - Desire to help any group storable, more than durable

⇒ Short-run response much greater than long-run
  - 2 The industry booms and career paths
    - Many people would only spend few years in some job
    - Finance in last 10 years, peace corp and service in 1960's
  - 3 Living abroad and starting your own company
    - Often for a few years in your life
    - Quick migration to tech sector, demand from China, but...
    - A long-term shock might cause less migration

## Importance of distribution of talent for rent

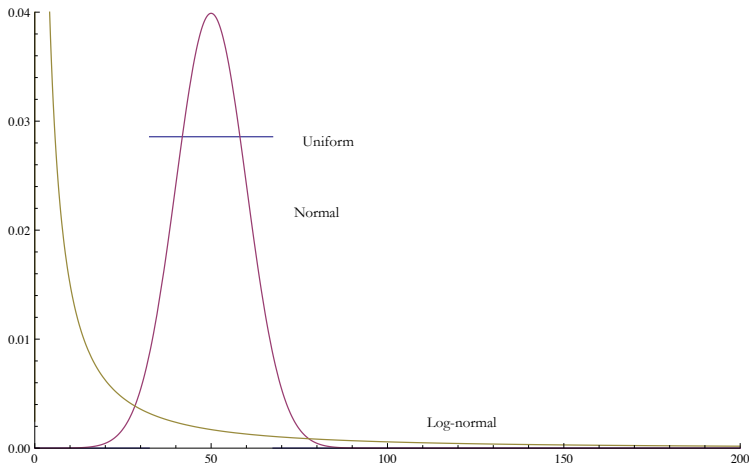
This all means that the distribution of talent is crucial

- 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
- A simple way to formalize is using *hazard rate*
- Let  $F$  be the CDF of talent and  $f$  be the PDF; hazard?

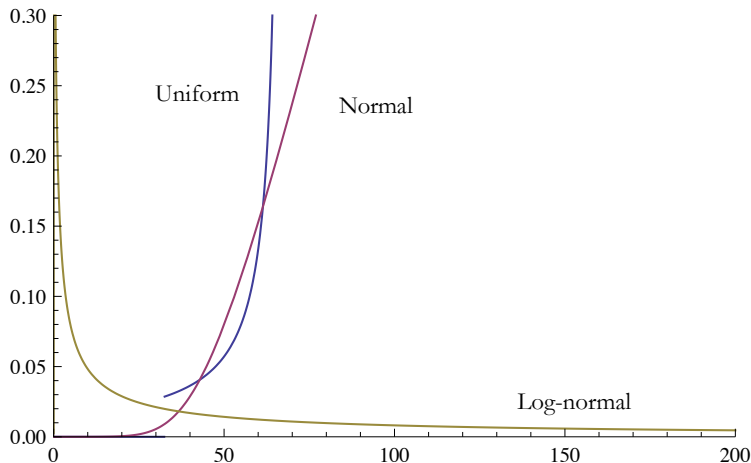
$$\lambda(x) = \frac{f(x)}{1-F(x)}$$

- If this increases for high  $x$ , *thin tails*, top similar
  - Extreme upper bounded, also Normal and most statistical
- When decreasing *fat tails*; examples?
  - Pareto distribution, log-normal, some extreme value

# Fat and thin-tailed distributions (same mean-variance)



# Fat and thin-tailed hazard functions



# What do we know about the distribution of talent?

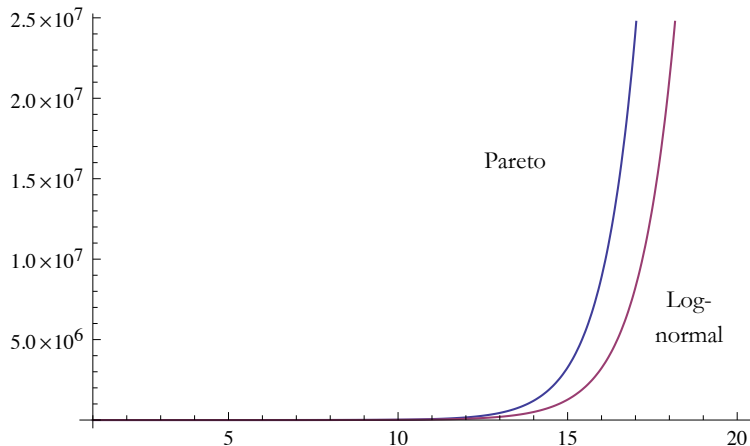
All data we have indicates talent *extremely* fat tailed

- Usually follows power law or *Pareto distribution*
- So fat-tailed that I couldn't even include it

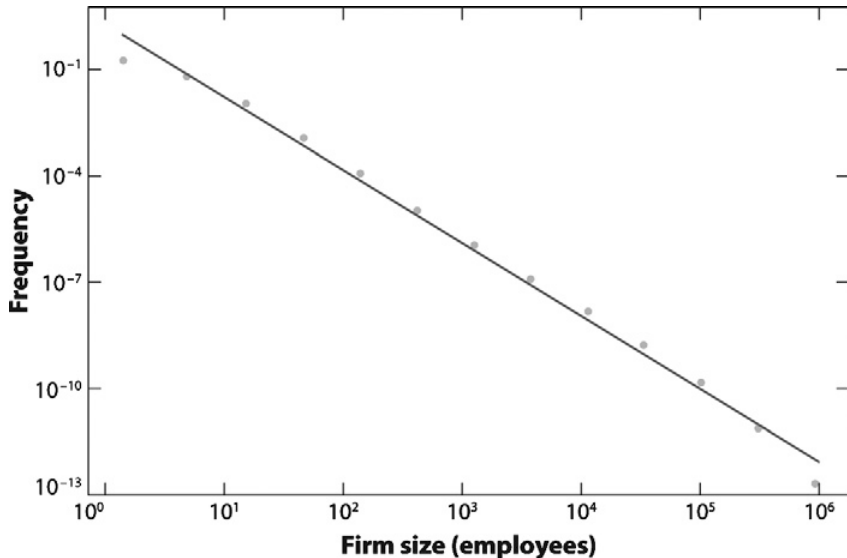
$$F(x; \alpha, x_{\min}) = 1 - \left(\frac{x}{x_{\min}}\right)^{-\alpha}$$

- ① Wouldn't fit on the other graphs
- ② Can't match mean and variance because they don't exist!
- But behaves roughly like log-normal until you get very high
- But then Pareto takes off
- Some ways of thinking about Pareto distribution?
  - ① Fraction with talent above  $2x$  is  $\frac{1}{2^\alpha}$  of that above  $x$
  - ② The 5th most talented is  $\frac{1}{5^{\frac{1}{\alpha}}}$  as talented as most
- Particularly common in *Zipf's law*:  $\alpha = 1$

# Inverse hazard for Pareto v. Log-Normal (log-scale x)



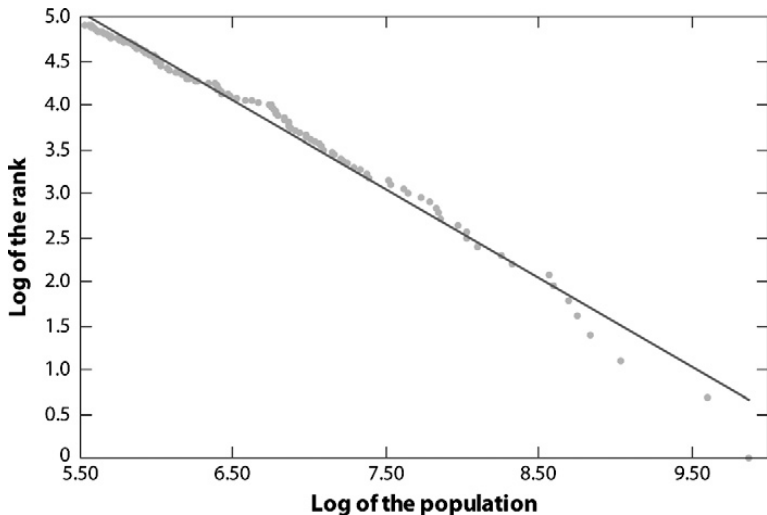
# Firm size (overall or within industry) follow's Zipf's law



# Power laws for income

- CEO pay scales with  $\frac{1}{3}$  power of firm size (so similar w  $\alpha = 3$ )
- More broadly income and wealth with  $\alpha \in [1.5, 3]$ 
    - Sometimes "Pareto principle": 20% control 80% of wealth
  - Also for revealed comparative advantage across countries
    - We'll talk more about this on Thursday
  - Broader take-aways:
    - 1 Talent, income and other social differences very large
      - Normal, finite upper bound way underestimate upper tail
      - Any model ignoring this misses fundamental attributes
    - 2 Heterogeneity particularly important at upper end
      - Those selecting into industry particularly heterogeneous
    - 3 Simple empirical regularities approximate well, often
      - Pareto distributions easy to work with (constant elasticity)
      - You'll see this on the problem set

## 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