

EC2212 Industrial Growth and Competition

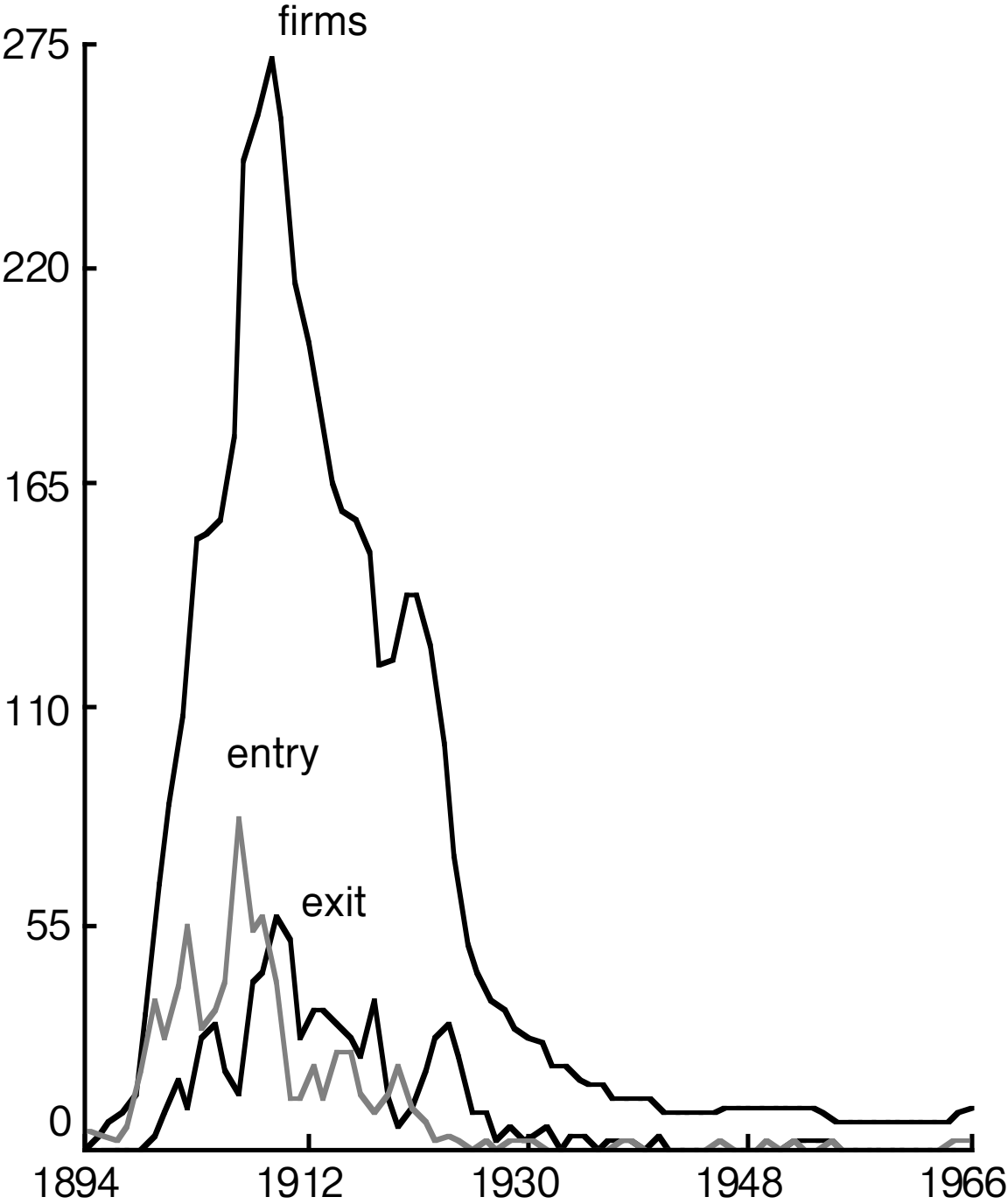
Lecture 6

Sustaining technology lets skilled
early entrants destroy competitors.

Shakeouts

- New products: often rise then fall in number of producers
- Fall in number of producers often called a “shakeout”
- Most products have shakeouts, within 3+ decades of when the market forms
- Can be very dramatic: US automobiles went from 273 producers to 5
- Concentrated market shares tend to result

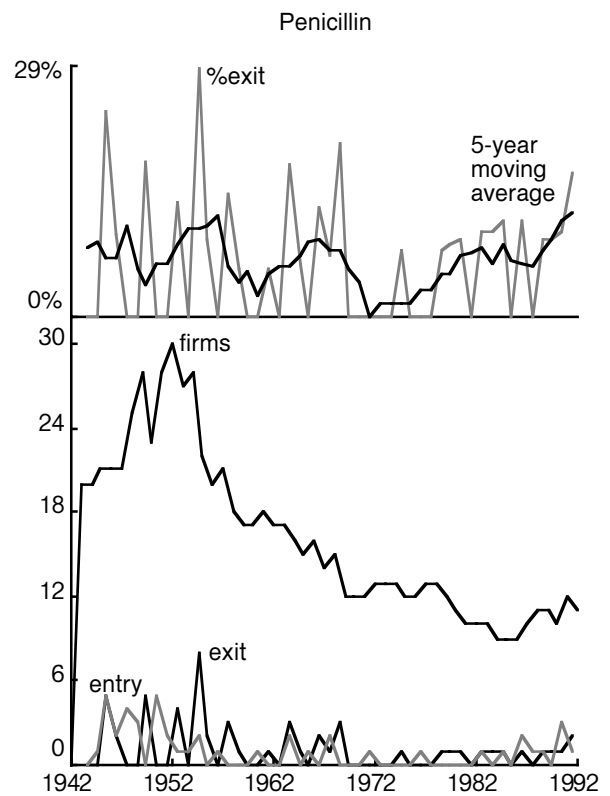
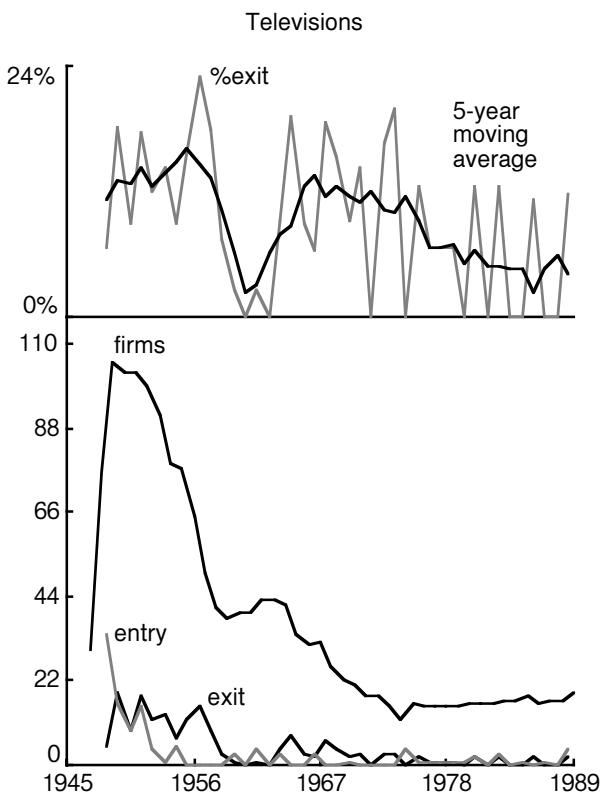
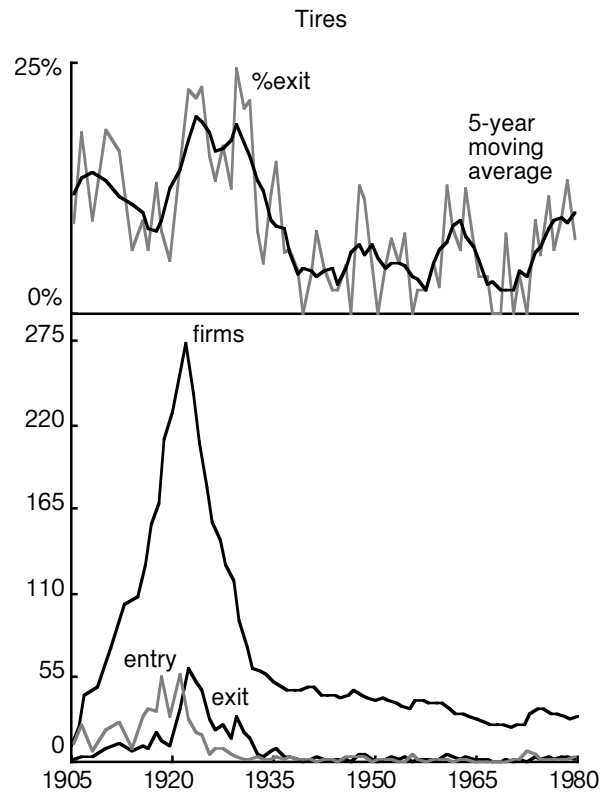
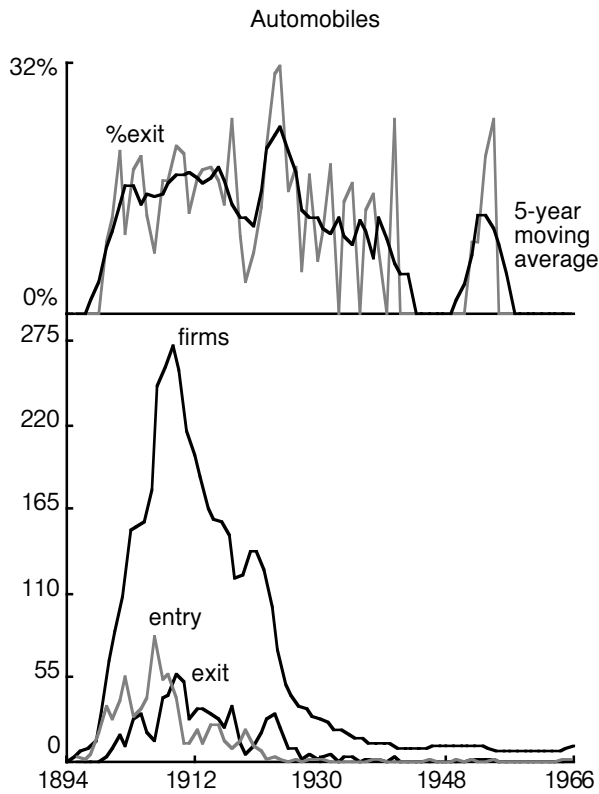
US Automobile Producers, 1896-1966



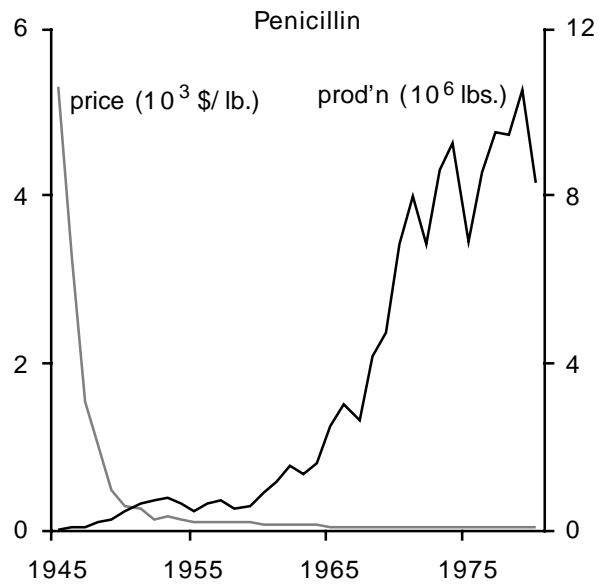
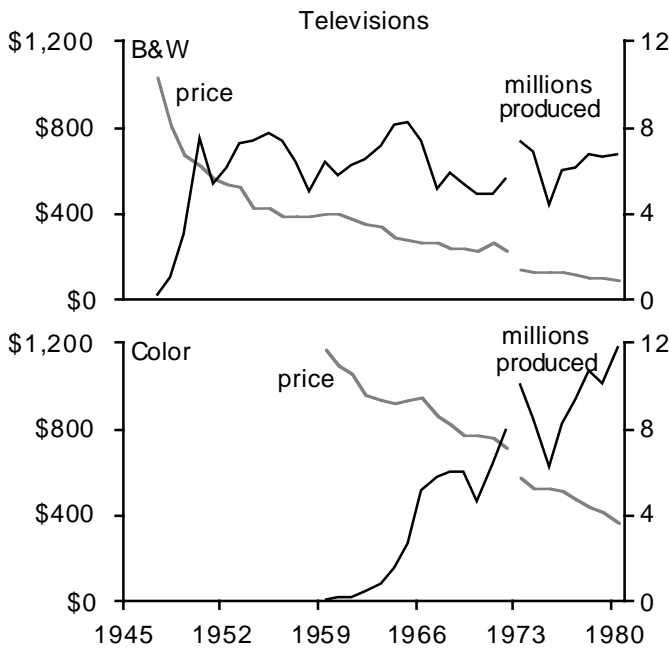
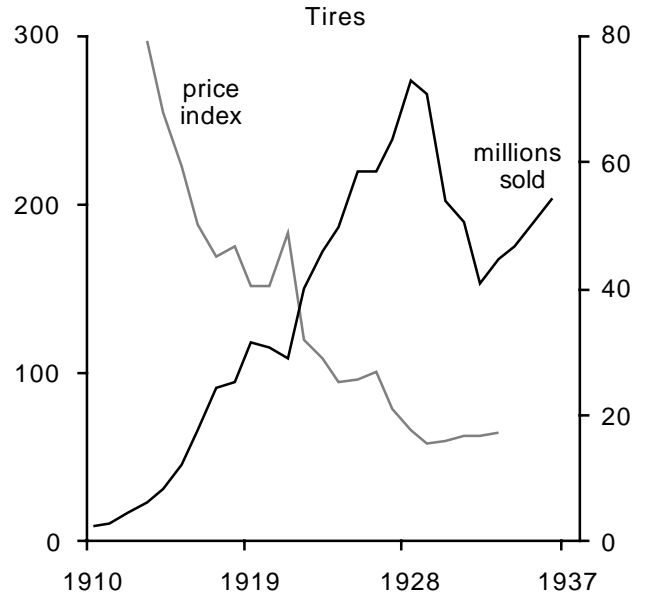
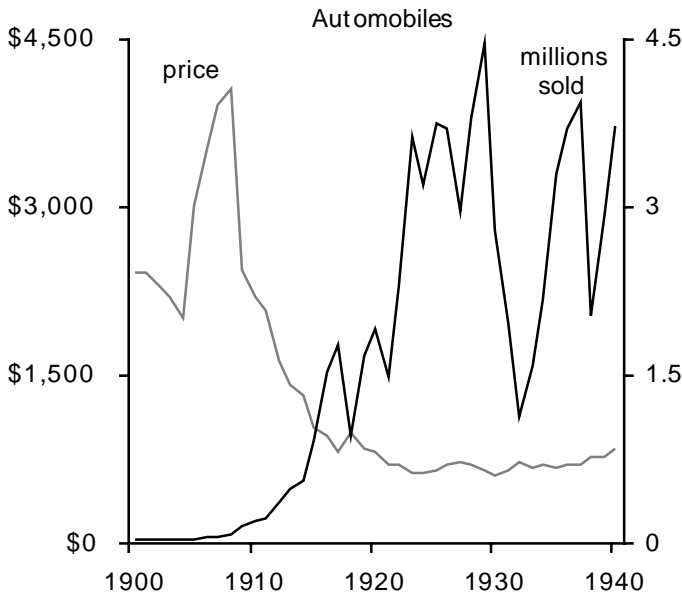
Why Do Shakeouts Happen?

- Focus on the main cause
- ... in products with severe shakeouts
- You will see
 - Evidence on entry and exit
 - Theory that best fits the facts
 - approximately, Klepper (1996, 2001)
 - Evidence on early-movers, technology
- Then discuss ramifications

Firms, Entry, Exit in Four Products (US)



Price and Output in the Four Products



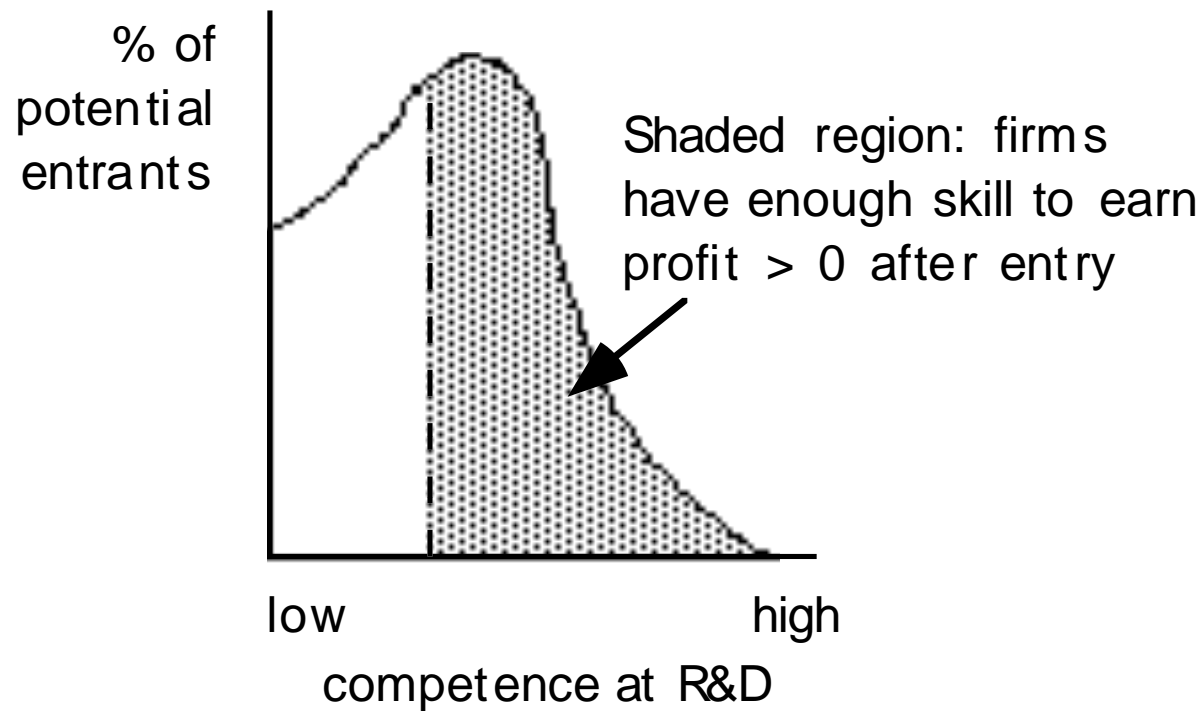
Explanation of Shakeouts

Part 1 of 3

Entrants and Their Skills

More Skilled Firms Can Earn More Profit

Potential Entrants in Year X

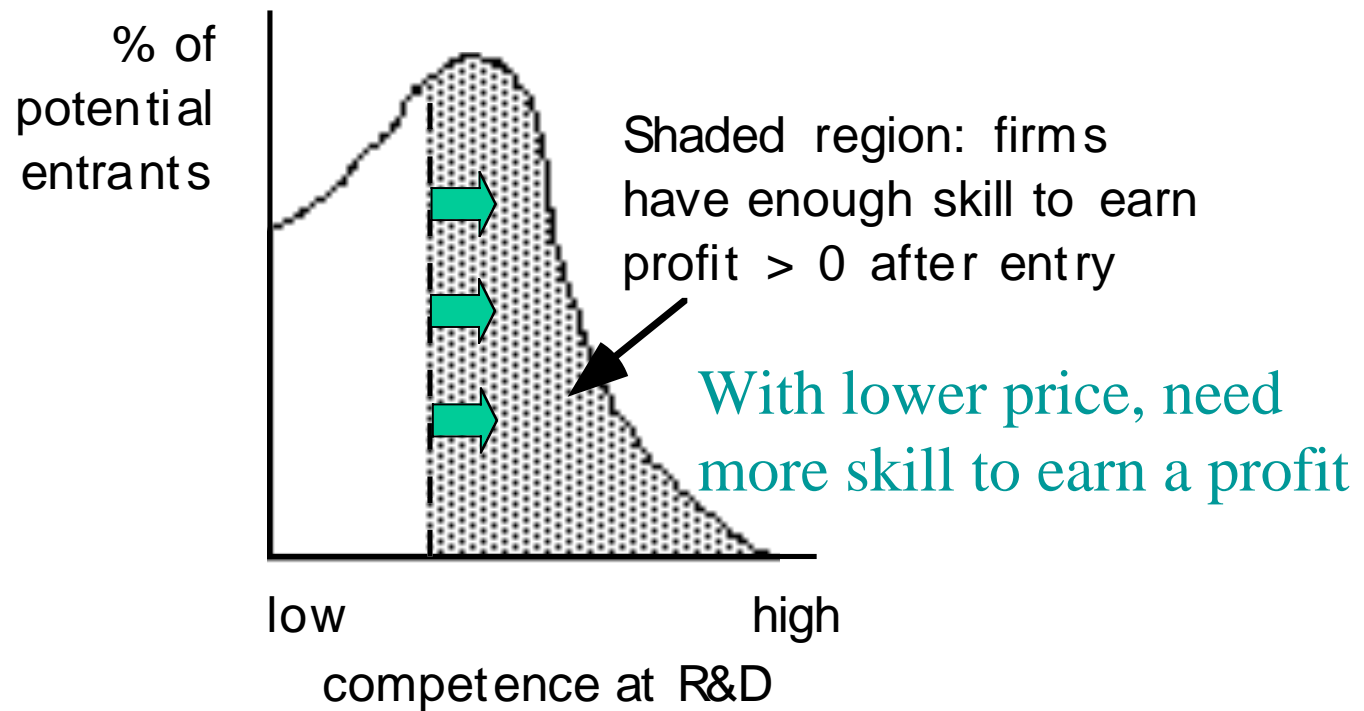


Entry & Growth Drive Down Price

- Limited number of firms have skills needed to enter, at any point in time
- Each year some number of firms can enter
- Firms enter fairly small, but then grow
- Entry and growth increase total output
- More output, lower price (demand curve)

Skill Needed to Enter Rises over Time

Potential Entrants in Year X



Explanation of Shakeouts

Part 2 of 3

R&D, Size, and Profit

R&D with Imitation

- R&D improves quality, lowers cost
- Decreasing returns to R&D
- Cost-per-unit-of quality $c = c(R)$, $c' < 0, c'' > 0$
- Firms benefit from R&D during 1 time period
- Firms imitate all past innovations in the next period

Firm i's Profit at Time t

$$\Pi_{it} = (p_t - [c_t - s_i c(R_{it})])Q_{it} - R_{it} - g(Q_{it} - Q_{it-1})$$

- p_t price per unit of quality, $p_t = f(\sum Q_{it})$
- $[c_t - s_i c(R_{it})]$ cost per unit produced
 - c_t highest possible cost given imitation of past R&D
 - s_i firm i's skill at R&D
 - $c(R_{it})$ cost decreases with current R&D, $c' < 0$, $c'' > 0$
- Q_{it} output produced
- R_{it} spending on R&D
- $g(Q_{it} - Q_{it-1})$ cost of growth, $g' > 0$, $g'' > 0$

Implications of the Profit Function

- Firms choose R_{it} , Q_{it} to maximize profit
- Larger firms spend more on R&D
 - Spread cost of R&D over more output
 - Remember lecture 3
- Growth is limited
 - Firms grow each period
 - Increasing marginal cost limits growth
- Size (Q_{it}) and skill (s_i) enhance profit

Explanation of Shakeouts

Part 3 of 3

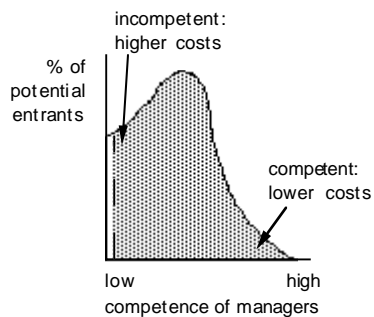
Exit (given Size and Skill)

Who Exits When?

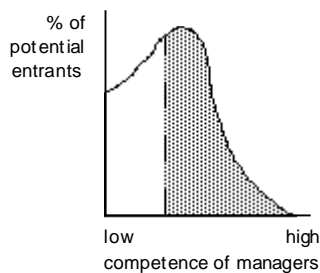
- Firms exit if $\Pi_{it} < 0$
- Growth causes exit at every t
 - Growth $\rightarrow \Sigma Q_{it} \rightarrow p_t \rightarrow$ profit
- Exiting firms are smallest, least-skilled
 - Since size and skill enhance profit
- Earlier entrants are larger, *ceteris paribus*
 - Have had more time and incentive to grow
- Skilled early entrants are long-run survivors

Summary in Course Notes, p. 89

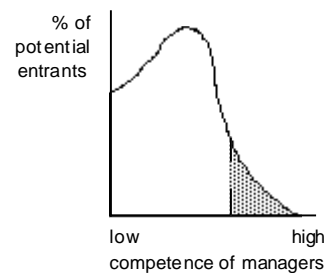
(Potential) Entrants 1895-1904



(Potential) Entrants 1905-1909



(Potential) Entrants 1910-1916



(By mid-1920s, entry becomes impossible.)

How big are firms that entered in 1895-1904?

circa 1904 | small

circa 1909 | medium (but 80% have exited)

circa 1916 | large (but 90% have exited)

How big... entered in 1905-1909?

small

medium (but 80% have exited)

How big... entered in 1910-1916?

small

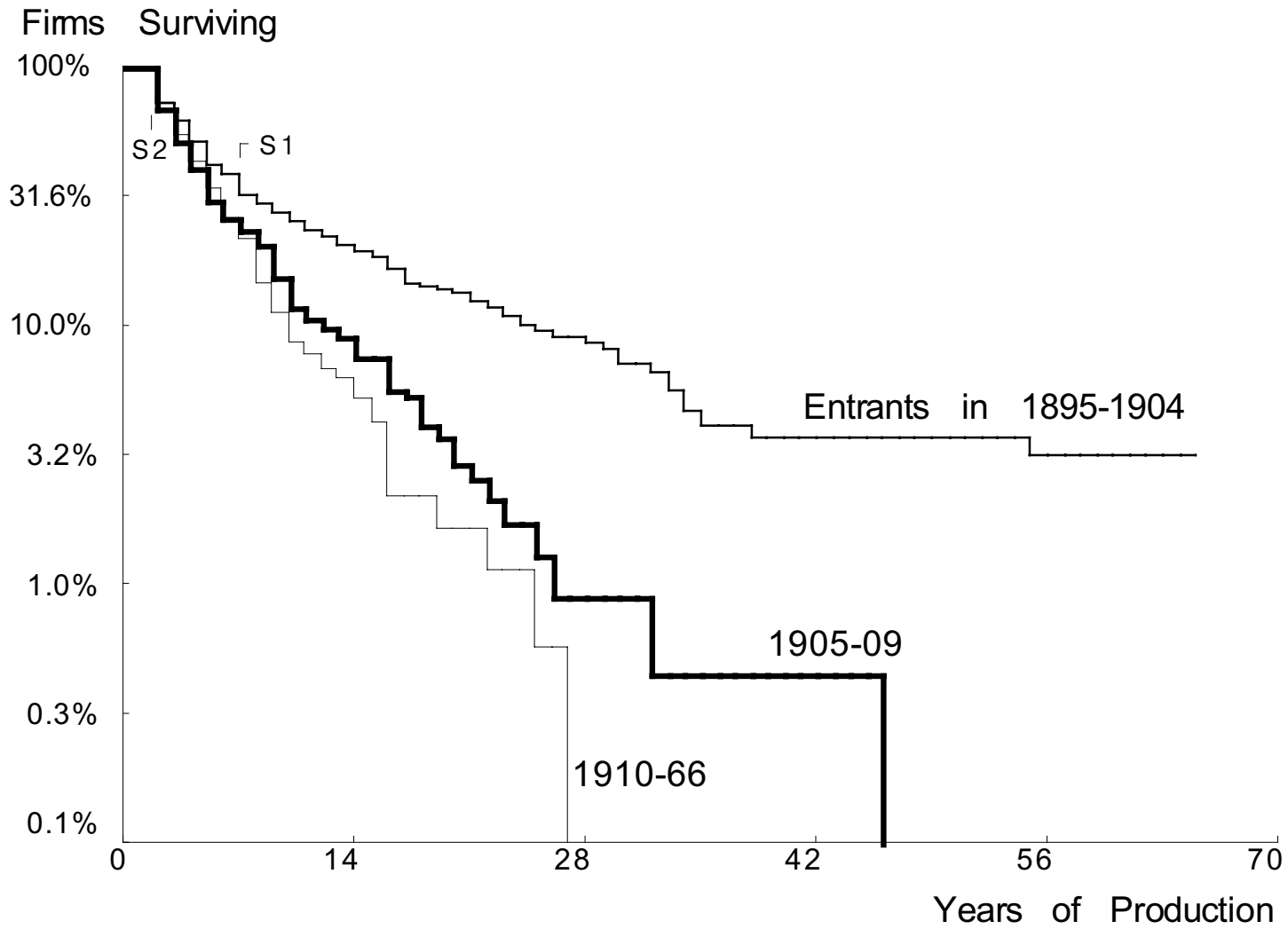
Firms always enter at small sizes.
As time goes on, surviving firms grow.
At any point in time, earlier entrants are larger than later entrants.

Size and competence reduce a firm's costs. Because of survival of the fittest, firms in each group are forced out until only competent early entrants remain.

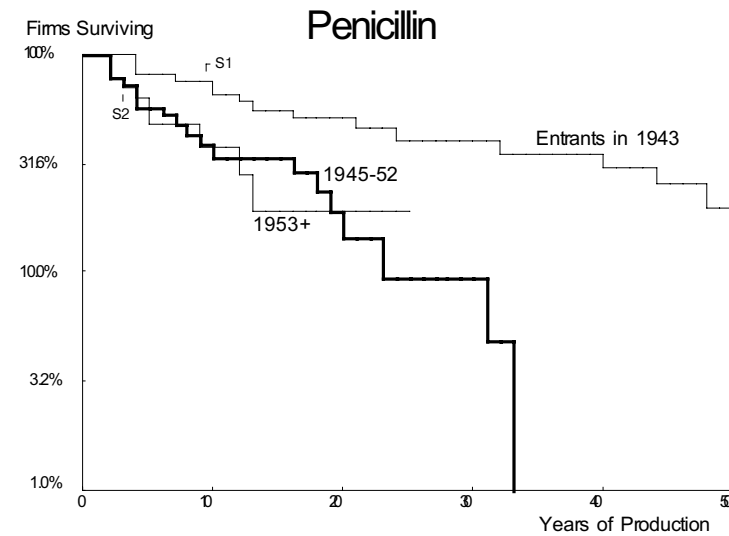
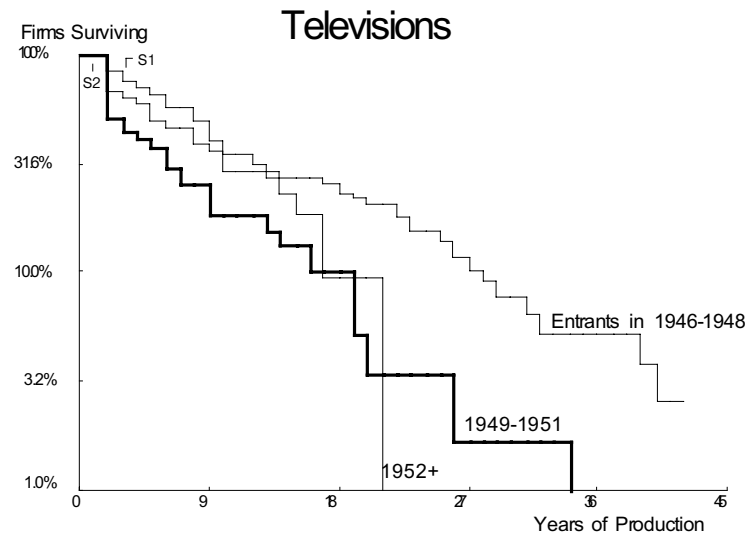
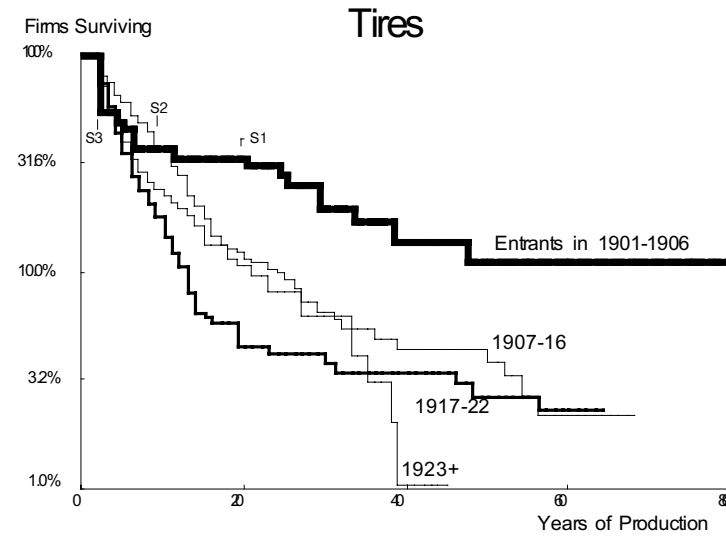
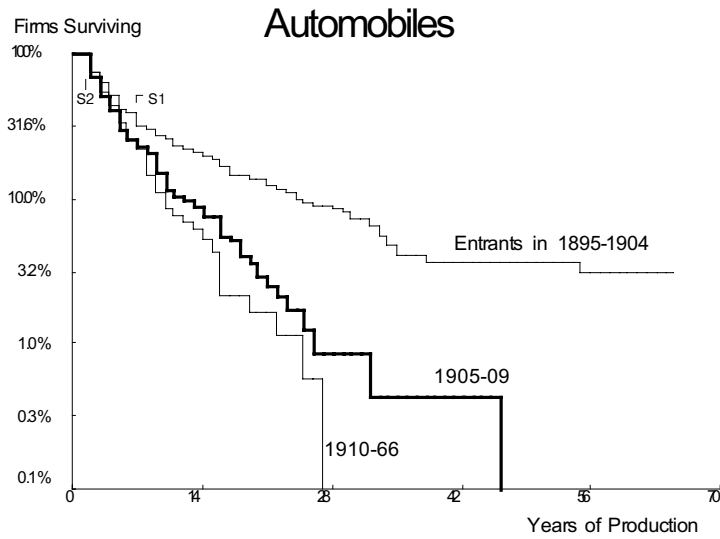
Implications of the Theory

- Shakeout
 - Entry eventually stops
 - Exit continues forever, causing shakeout
- Earlier entrants have lower chance of exit
 - Maybe not at first (depends on skill distribution)
 - But eventually even high-skilled late entrants exit
- Earlier entrants do more R&D
- Firms successful at R&D survive better

% Survival by Entry Date of Automobile Producers

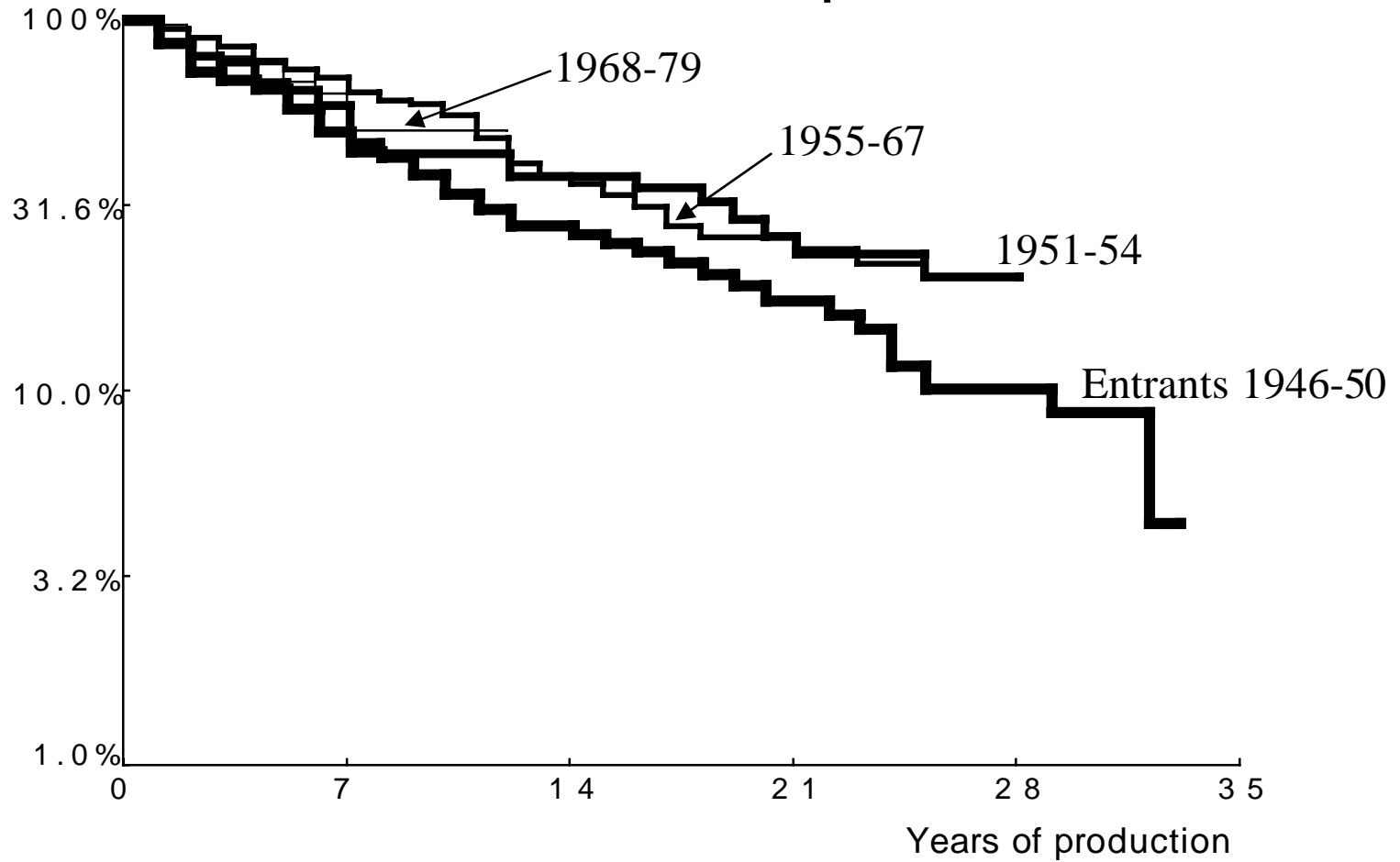


% Survival by Entry Date in the Four Products



% Survival by Entry Date in a Non-Shakeout Product

Pens, Ballpoint



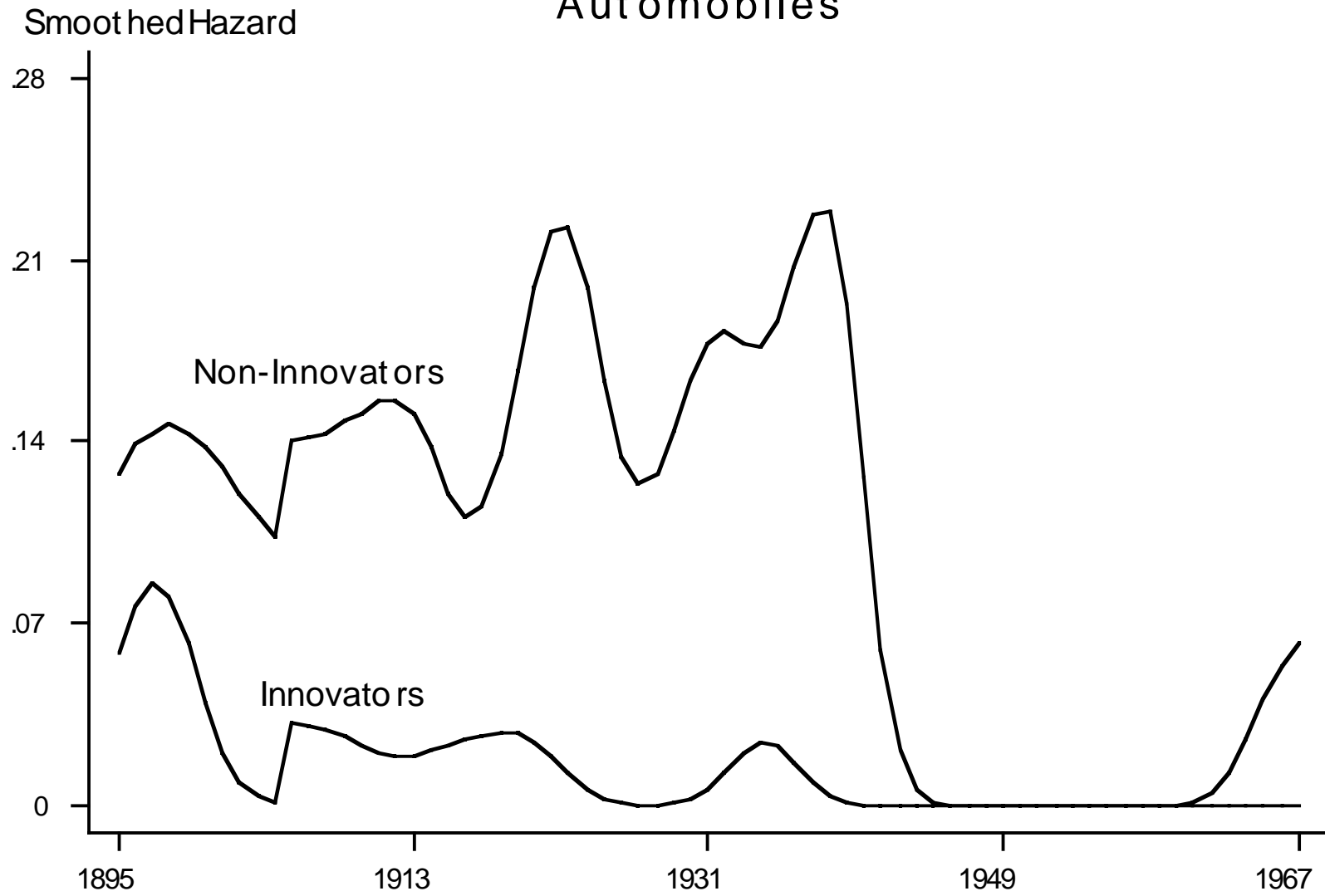
Innovation, % Adoption, by Entry Time in the Four Products

Use same entry-time cohorts as previously, but divide tires cohort 1

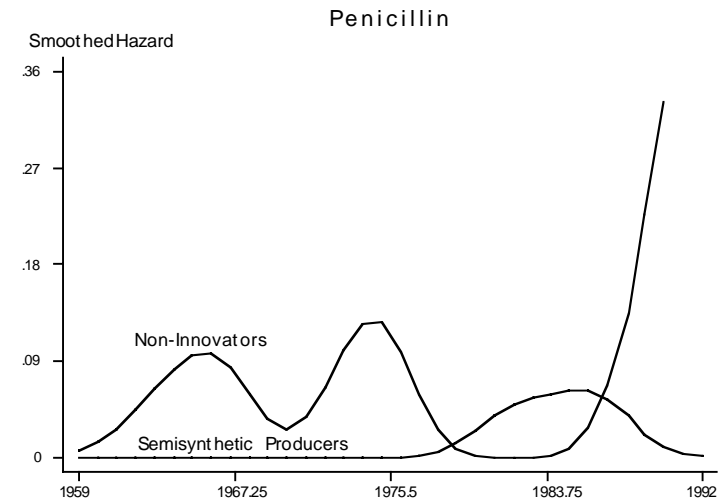
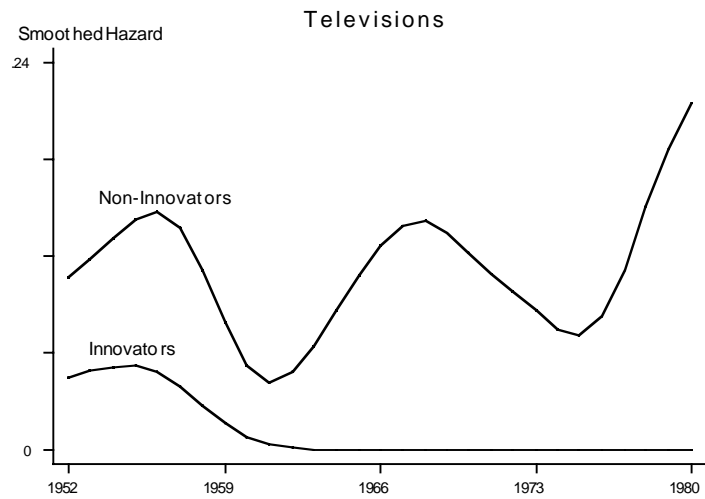
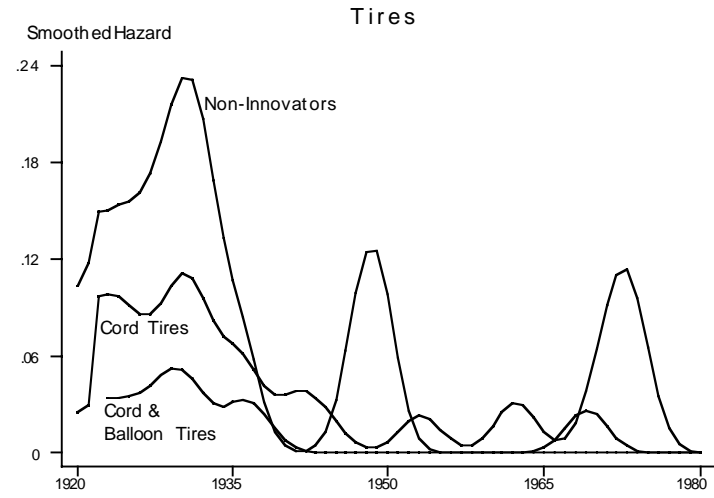
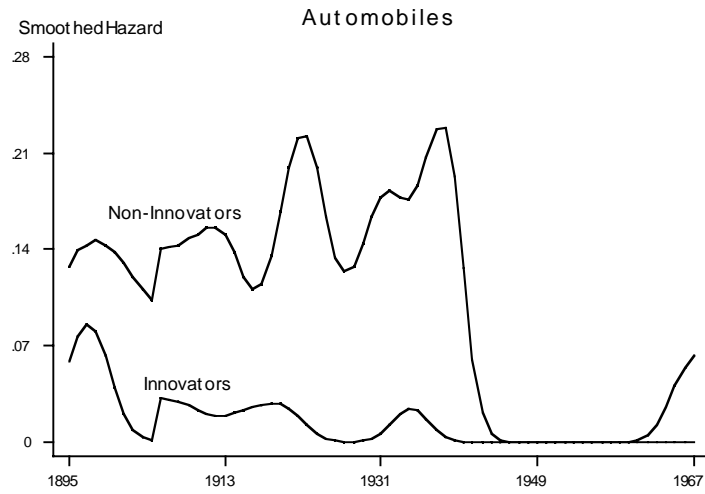
Relative innovation rates by product & innovation type — compare cohorts

Product	Innovation type	Cohort 1		Cohort 2	Cohort 3
Automobiles	Product	9		2	1
Automobiles	Process	3		0	0.1
Tires	Product	1		0	0
Tires	Cord 1917	36%	8%		
Tires	Cord 1920	100%	73%	62%	
Tires	Balloon 1923	63%	16%	7%	
Televisions	Product	2		1	0
Televisions	Process	63		7	0
Penicillin	Process	5		0	0

Innovation and Exit Automobiles



Innovation and Exit in the Four Products



Ramifications of Shakeouts

- In industries with strong sustaining R&D
- High-skilled early entrants dominate
- Other firms may profit for a while
 - But eventually forced to exit
- Enter early, keep up with R&D, to survive
- Concentration is a natural result
 - Anti-trust authorities often investigate
 - But expect concentration with legal behavior