Incentives are determined by the size of the reward, which depends on two levers

• Length
  (1) Patents, 20 years
  (2) Copyrights, author’s life plus 70
  (3) Trade secrets, forever
  (4) Trade marks, forever

• Breadth

  Intellectual property is a right to exclude others from making or using the product. For that purpose, what constitutes the product? For exclusion, how similar does the product have to be?
What is breadth? (an economist’s word)

• Breadth excludes horizontal substitutes
  – Amazon one-click patent
    Should the Barnes&Noble double-click system infringe?
  – Patent on the Harvard oncomouse
    Does an oncowalrus infringe?

• Or ... breadth might define the investment cost required to enter
  – How much must a firm invest to skirt the patent?

• Breadth can exclude vertical substitutes
  – Spread sheets, Visicalc, Lotus 123, Borland quattro, finally Excel

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How does the patent life or size of reward matter?

• Two arguments

• Long patent life (high reward) leads to
  – More innovation (good)
  – Unnecessary deadweight loss on inventions that would emerge in any case (bad)

• Long patent life (big reward) can lead to patent races
First pointing: innovation versus deadweight loss

Higher reward (patent life $T$) increases the number of ideas that are developed, but also increases deadweight loss.
Second point: High rewards lead to patent races

• Racing can be inefficient.
  – Duplication of effort.
  – Pursuit of wrong ideas.
    (the problem of aggregating information)

• Is a race beneficial for society?
  – May duplicate costs (bad)
  – May increase the probability of success or the time of discovery (good).

• We cannot know whether a patent race is good or bad without knowing how innovation works. We need the right model of the creative environment.

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Races.

• If successes and failures are independent, “duplication” is not well defined.
• Suppose (for simplicity) that each firm pays a fixed cost $c$ upfront to enter the race.
• Suppose each firm has an independent probability of success in each time period.
• It may take several time periods to receive the innovation. The innovation will be sooner if there are more firms, but the cost is also higher.
Races: How does the probability of success increase with the number of entrants?

• If successes and failures are independent, “duplication” is not well defined.
• See the slides on the $800m pill.

http://socrates.berkeley.edu/~scotch/innovation/800m_pill.pdf
• $P(n) =$ probability at least one firm succeeds
• $S =$ social welfare in case of success
• What does the diagram look like, and how many entrants will there be if the private reward is less than $S$?
• Should the private reward be less than $S$?

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• Modify diagram to account for the fact that the winner receives less than the whole social value.
• Reduces number of entrants, possibly to the efficient number.
A third defect of high rewards: Anxious investors might invest in a high-cost idea even though someone else has a lower-cost idea for the same market

- Suppose idea 2 is better than idea 1: \((v_1 - c_1) < (v_2 - c_2)\)

- If rewards are very high, the owners of both ideas might invest, which is pure duplication.

- If rewards are a little lower, the owner of idea 1 might invest, but not the owner of idea 2 (the wrong idea).
Size versus Structure of the reward

• So far we have mainly been discussing the optimal size of the reward, however it is given. But a reward of a given size can be structured in different ways.

• Two policy levers:
  – Length $T$
  – Breadth
    Broader rights are more profitable in each period. A narrower patent reduces the price of the patented good, due to competition.

• Thought experiment: Hold the desired size of reward fixed, say $100m. Should the patent that achieves this be long and narrow? Or short and broad?
Breadth as the cost of entering the market

Blue box: monopoly profit (one firm)

Each pink box: the profit of each firm if there are 2 firms (patentee + entrant) in the market. There will be entry if the cost of entry is no larger than each pink box. (Why?)

What if the cost of entry is lower than the patentee’s R&D cost?

With entry, how much profit does the patent holder earn? How much does the entrant earn? How much do the two firms earn together, relative to a monopolist?

Can the patent holder get the whole pink area of profit (both boxes?) Think about licensing.
The ratio test

• Why might it be socially better to allow entry and competition in the market? (Breadth can do this.)
• What is the “cost” of raising money by giving out market power? Answer: deadweight loss.
• Want to minimize the deadweight loss per dollar raised. Minimize the ratio of deadweight loss to profit in the market.
• A lower price for a longer period reduces the ratio of deadweight loss to profit. Allow entry!

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Some conclusions on patent design

• Rewards can be too high:
  – Where ideas are scarce, high rewards lead to many innovations, but also a lot of deadweight loss on innovations that would happen anyway.
  – Were ideas are common knowledge, so races develop, high rewards lead to duplicated cost and possibly to litigation.
  – High rewards can encourage investment in bad ideas for which there is a substitute better idea.

• In at least some circumstances, it is best to structure rewards so that patents are long and narrow. The length will compensate for the narrowness. The narrowness puts patent holders under a threat of entry, so they will license to keep prices low. This reduces the deadweight loss per dollar earned for innovation.