Innovation and Imitation

With and Without IPRs

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Motivation and Background

Growing Amount of 'Open' Knowledge Production



- Open source software (Firefox), content (Wikipedia), etc

- Though how much ex-ante 'commercial' and

  profit-motivated still debated

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Impact of IP on Innovation/Creativity

- Controversy over impact of IP *on innovation/creativity*
  - Software/business process patents, Biotech, Music
    (Hip-hop)

Commonality

- Weak/No IP may be better for *innovation*

  - NB: NOT about impact of IP on welfare

- Open models may do better than closed ones

- Does not fit well with traditional theory ...

Traditional Theory

Innovation Space
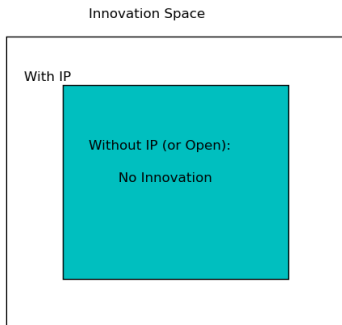
- Level of Innovation = I(Appr. Value, Cost) = $I(V, C)$

- Trad. view: $V^{IP} > V^{NIP} > V^{O} \approx 0$ and $C^{IP} = C^{NIP} = C^{O}$

- $\Rightarrow$ more innovation with IPRs

- In fact, more than that

- If imitation cheaper than innovation (and 'fast') then simple competition

- $\Rightarrow V^{NIP} = C^{IMM} < C \Rightarrow$ No innovation w/o IPRs

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But in Reality

Or Even

But in Reality

Or Even
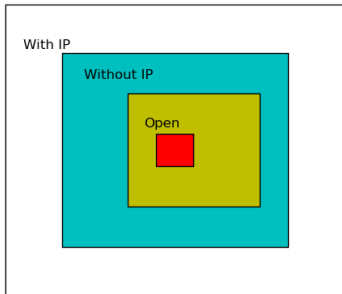
So What Gives?

- Two directions to go (theoretically and empirically)

- Focus on C

    - Maybe costs are lower w/o IP or when open

    - Will not look at this here – dealt with elsewhere

- Focus on V

    - Nonrivalry is clearly a simplification

    - Firms can appropriate returns w/o IPR (+ imitation costly)

        - Levin et al (1987), Mansfield (1986), Cohen et al (2001), and

          Arundel (2001)

    - So examine imitation and appropriation more carefully

What Does This Paper Do

- Incorporate imitation formally
    - Both costly in itself
    - And allows innovator some kind of first-mover role

- Occurrence and degree of innovation with imitation

- Natural conception of a general innovation 'space'

- Allows us to look at relation of:
    - Policy regimes (IP vs. no IP vs. Open) and welfare
    - Some general results and conjectures

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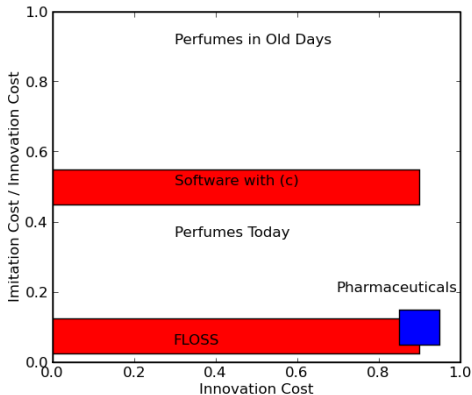
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Setup

- Innovation and imitation costs: f_I, f_m

- Imitation cost as proportion of inno cost: $\phi = f_m/f_I$

  - Assume imitation cost is always less than innovation cost

- As specified innovation is defined by tuple (f_I, ϕ)

- Some model (M) of competition determines (for each f_i, ϕ) inno income V

  - If $V > f_i$ then the innovation occurs, otherwise not.

  - In paper look at one natural case (Stackelberg)

  - Plenty of others: seq. entry, hotelling with choice etc etc

The Space of Innovations

- Under the assumptions given and using normalized
  variables the space of innovations is then the unit square:

$$
\begin{aligned}
IS &= \{(f_l, f_m) \in [0,1] \times [0,1] : f_m \leq f_l\} \\
   &= \{(f_l, \phi) \in [0,1] \times [0,1]\}
\end{aligned}
$$

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Location of Technologies and Industries

- Each (potential) innovation located somewhere in this space
- If uncertainty (for policy-maker) then location a distribution g
- Similarly industry/ies naturally represented by distbn g
- To left: conjectured industry locations (without IPRs)

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The effect of intellectual property rights

- Introduction of IPRs (patent or copyright) has natural representation:

  1. (Default) All imitation is prohibited $\Rightarrow$ all innovations occur.
  2. Original g^{NIP} is transformed to a new distribution g^{IP}

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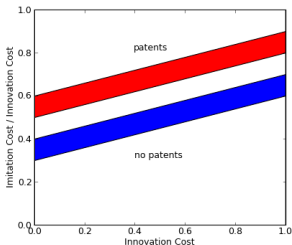
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- Basic question: given model M what innovations occur

    - With and without IP (and in Open case)

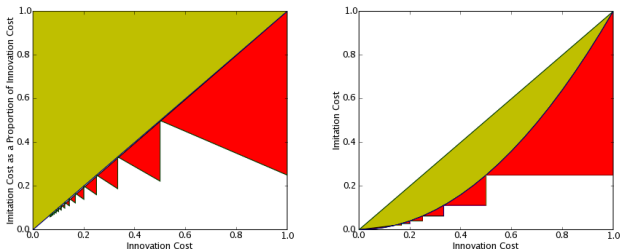- Next question: how does this relate to welfare

Figure: Innovation without IP in Stackelberg case. (yellow: non-integer no. of imitators ok, red: integer only)

- 'Feasible' imitation costs fall faster than inno costs

  - Stackelberg: 'Squared rule': $f_m \geq f_i^2$

- Given distbn g can get inno w/o IP and compare to with IP

- How does this generalize for arbitrary competition models M?

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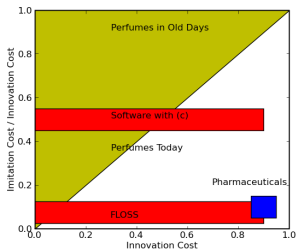
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Welfare

- For inno. f_i, ϕ can calculate welfare (assuming it occurs)

- Compare welfare with IP W^{IP} to welfare without IP W^{NIP}

- Result (any M): welfare ratios higher than inno ratios

  - (trad) given inno generates higher welfare w/o IP (less d/w)

  - (novel) innos that occur w/o IP have higher welfare on
    average than those that occur only with IP because costs
    are lower

- In stackelberg case/uniform distbn: welfare ratio = 75% vs.
  50% for inno ratio

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Conclusion

- General framework in which to look at innovation and
  imitation

    - One major aspect of why/when IP rights

    - Imitation ratio *falls* with inno cost

    - Understand changes in IPRs over time (Bonito
      boats/Perfumes etc)

- Innovation when imitation cheaper

- Welfare 'better' than inno when comparing no IP (or Open)
  to IP