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
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

- Level of Innovation = \( I(\text{Appr. Value, Cost}) = I(V, C) \)
- 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
But in Reality

Or Even
But in Reality

Or Even

Innovation Space

Without IP (or Open)

With IP
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)
  - 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
Model
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 $(f_I, \phi)$
- Some model (M) of competition determines (for each $f_I, \phi$)
  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:

\[ IS = \{(f_I, f_m) \in [0, 1] \times [0, 1] : f_m \leq f_I\} \]

\[ = \{(f_I, \phi) \in [0, 1] \times [0, 1]\} \]
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)
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 $g^{IP}$
Results
Results

- 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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Welfare

- For inno. $f_i, \phi$ 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
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