The Social Cost of Sharing

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Introduction

- Often IP is shared via libraries, license servers, video rental stores, Napster, etc.
- If IP is intended to be shared it is often priced higher than IP meant to be consumed individually.
- Sometimes price discrimination can be used, but if this is infeasible flat pricing generally reflects dominant use.
Questions

• High price encourages sharing $\rightarrow$ sharing encourages high prices. If sharing is costly, equilibrium is inefficient.

• What happens when producers set prices to discourage sharing?

• What about government penalties to discourage sharing?

• What kinds of IP are not produced due to sharing?
Baseline case

\( n \) consumers, identical value \( v \). IP costs \( D \) to develop, zero to distribute. A price \( p \) is viable if:

(1) \( v \geq p \)
(2) \( p \geq d \),

where \( d = D/n \).

Two interesting viable prices: the monopoly price \( p_m = v \) and the zero profit price \( p_z = d \).
Sharing

- Groups of size $k$ form, each individual paying $p/k$. Sales are $n/k$.
- Transactions cost to sharing of $t$
- Viability now requires

\[ v - p/k - t \geq 0 \]  
\[ p \frac{n}{k} \geq D. \]

- So $p$ is viable if:

\[ (v - t)k \geq p \geq dk \]
Dynamics

- Monopoly case: $p_m = (v - t)k$
- Monopoly dynamics: At $p_m$ people may want to share. This pushes price up even further. In equilibrium consumers end up with zero surplus, monopolist is worse off.
- Zero-profit dynamics: price is pushed up by sharing, consumers made worse off.
Figure 1: Shaded area indicates products that won’t be produced due to sharing.
Limit pricing monopolist

• Suppose monopolist sets price first in order to discourage group formation. Must choose $p$ so that:

$$\frac{p}{k} + t \geq p.$$  

• This means $p_\ell = \frac{k}{k-1} t$.

• This is more profitable than allowing the group to form when

$$\left( \frac{2k - 1}{k - 1} \right) t \geq v.$$  

• LHS varies between $2t$ and $3t$. 
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Figure 2: Shaded area indicates lost value.
Summary of limit pricing case

• No social cost to sharing for goods with low value, low development costs, or large numbers of users. Threat of sharing makes monopolist cut its price.

• Limit pricing doesn’t work for zero-profit producer. Groups form and make themselves worse off.
Penalties for sharing

- State or monopolist can impose a cost $c$ on those who share. Initially look at case where $c < v - t$. Replace $t$ by $t + c$ to find Nash equilibrium:

\[
(5) \quad p_m = (v - t - c)k
\]

\[
(6) \quad \pi_m = (v - t - c)kn - D.
\]

- If $v \geq t + c$ then profit is *decreasing* in $c$
- In this case, $c$ is not large enough to discourage sharing, but makes monopolist worse off.
Penalties for sharing, cont.

• If $c > v - t$ or limit price monopolist, we have

$$p_{\ell} = \frac{k}{k-1}(t + c)$$

(7)

$$\pi_{\ell} = \frac{k}{k-1}(t + c)n - D.$$  

(8)

• Monopolist wants $c \geq v - \frac{k-1}{k}t$. Monopolist prices at $v$, no groups form, outcome is efficient.
Endogenous groups

- Suppose $t$ depends on size of group, e.g.,
  $$t = w(k - 1).$$
- Optimal group size solves
  $$\min_k \frac{p}{k} + w(k - 1).$$
  - Answer is $k = \sqrt{p/w}$
  - Minimized value of $t$ is $2\sqrt{pw} - w$.
- A price $p$ is viable if it satisfies:
  
  $$(9) \quad v - 2\sqrt{pw} + w \geq 0,$$
  $$(10) \quad \sqrt{pw} \geq d.$$
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Monopoly price is

\[ p_m = \frac{1}{w} \left( \frac{v + w}{2} \right)^2 \]
Summary of endogenous groups case

- Low-value, low-cost goods are not worth sharing and will be produced anyway
- High-value goods \((v > 2d)\) will be produced and shared
- Limit pricing is irrelevant in this case