# 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:

$$v \geq p \tag{1}$$

$$p \geq d, \tag{2}$$

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

$$v - p/k - t \geq 0 \tag{3}$$

$$p\frac{n}{k} \geq D. \tag{4}$$

- 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.

# Social cost of sharing

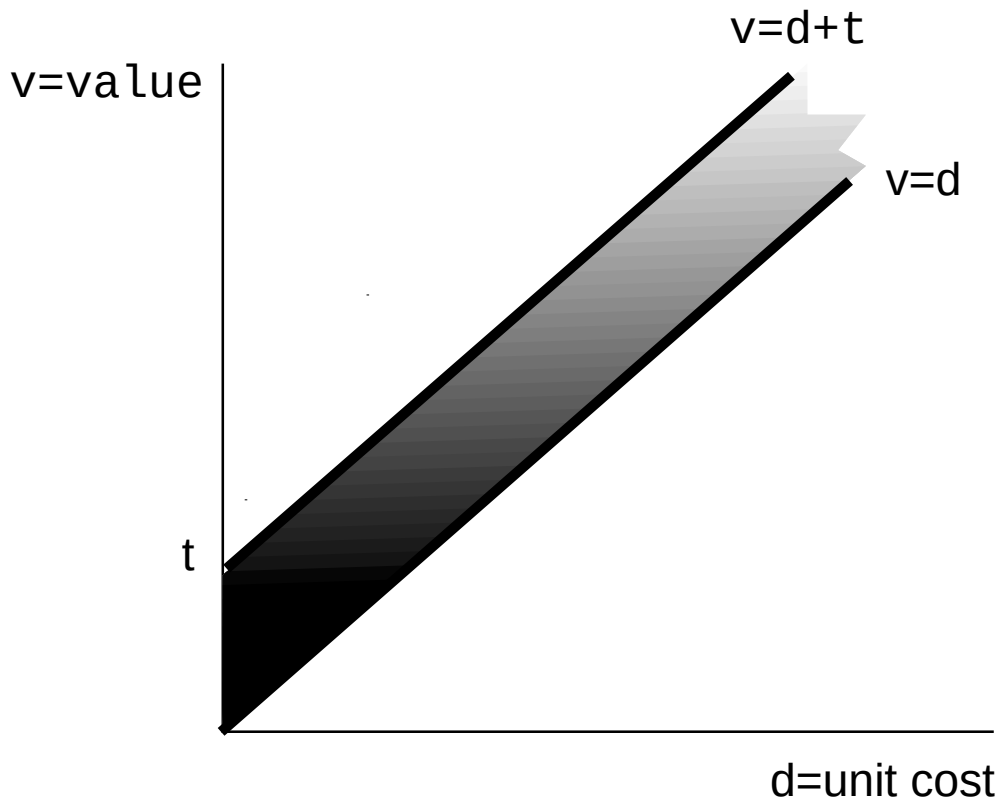



Figure 1: Shaded area indicates products that won’t be produced due to sharing.

# 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 $3t$.

# Social cost of sharing

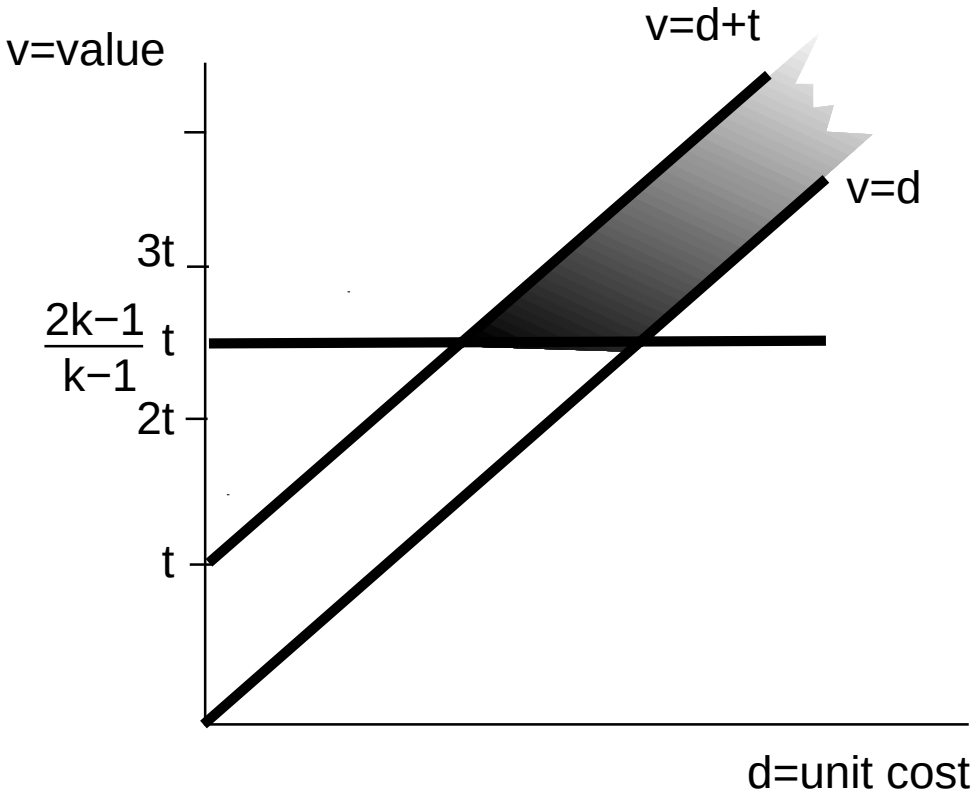



Figure 2: Shaded area indicates lost value.

# 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:

$$p_m = (v - t - c)k \tag{5}$$

$$\pi_m = (v - t - c)kn - D. \tag{6}$$

- 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

$$p_\ell = \frac{k}{k-1}(t+c) \tag{7}$$

$$\pi_\ell = \frac{k}{k-1}(t+c)n - D. \tag{8}$$

- 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:

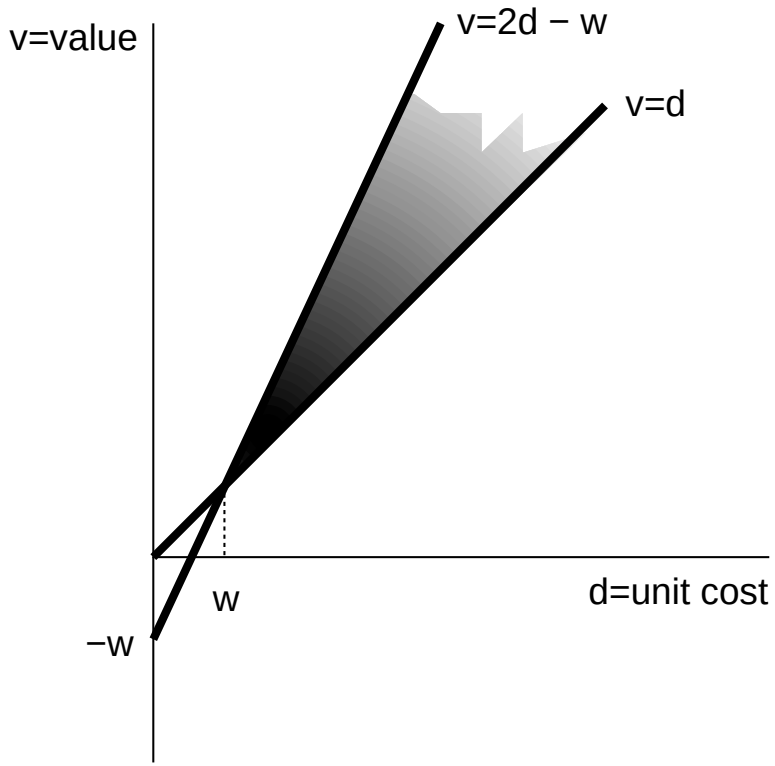
$$v - 2\sqrt{pw} + w \ \geq 0, \tag{9}$$

$$\sqrt{pw} \ \geq d. \tag{10}$$

# Social cost of sharing

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