# Profitable Piracy and Media Development in the Music Industries

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# Main Aims

Under promotion effects of piracy

- Effects of copyright enforcement on profits of original producers
- Effects of the development of media industries on original producers

# Background

- In Vietnam, copyright infringement did not damage but rather increased profits. (Promotion Effect)

- Musicians in developing countries have very little mass media on which to broadcast their content.

$\pi^2$

# Model

- A profit function of a singer (monopoly)

$$\pi = \pi^1 + \pi^2 = \left\{ p^1\left(q^1, q^2, q^3, M\right)q^1 - C^1(q^1)\right\} + \left\{ p^2(q^1, q^2, q^3, M)q^2 - C^2(q^2)\right\}$$

$\pi^1$ Profits from the performance

$\pi^2$ Profits from original CD sales

$M(\underline{M} \le M \le \bar{M})$ Level of media industries

Market 1: Stage performance

Market 2: Original CD

Market 3: Pirated CD

- Assumptions of External Effects on Demand

Stage performance

$$\frac{\partial p^1}{\partial q^2} > 0, \frac{\partial p^1}{\partial q^3} > 0, \frac{\partial p^1}{\partial M} > 0$$

Original CD

$$\frac{\partial p^2}{\partial q^1} > 0, \frac{\partial p^2}{\partial q^3} < 0, \frac{\partial p^2}{\partial M} > 0$$

1) Promotion effects of piracy on performance

2) Competition of original CDs with piracy

3) Reciprocal positive externality between performance and original CD

4) Positive effect of media on demand

- A pirate's profit function (perfect competition)

$$\Pi = p^3(q^1, q^2, M)q^3 - C^3\left(q^3, E\right)$$ (E: Level of enforcement)

$$\frac{\partial p^3}{\partial q^1} > 0, \frac{\partial p^3}{\partial q^2} < 0, \frac{\partial p^3}{\partial M} > 0, \frac{\partial C^3}{\partial E} > 0, \frac{\partial^2 C^3}{\partial q^3 \partial E} > 0$$

1) Positive effect from stage performance $q^1$

2) Negative effect from original CDs

- Timing of game

A singer first determines $q^1 and\ q^2$

Then a pirate determines $q^3$

# Equilibrium

- The first-order condition for maximizing pirate's profits

$$p^3(q^1, q^2, M) = \frac{\partial C^3(q^3, E)}{\partial q^3} \qquad \Rightarrow \tilde{q}^3(q^1, q^2, E, M)$$

$$\partial \tilde{q}^3 / \partial M > 0 \quad \partial \tilde{q}^3 / \partial E < 0$$

- The first-order condition for maximizing singer's profits

$$\tilde{\pi} = \left\{ p^1\left(q^1, q^2, \tilde{q}^3(q^1, q^2, E, M), M\right) q^1 - C^1(q^1) \right\}$$
$$+ \left\{ p^2(q^1, q^2, \tilde{q}^3(q^1, q^2, E, M), M) q^2 - C^2(q^2) \right\}$$

$$\frac{\partial \tilde{\pi}}{\partial q^1} = \left( \frac{\partial p^1}{\partial q^1} + \frac{\partial p^1}{\partial \tilde{q}^3} \frac{\partial \tilde{q}^3}{\partial q^1} \right) q^1 + p^1 + \left( \frac{\partial p^2}{\partial q^1} + \frac{\partial p^2}{\partial \tilde{q}^3} \frac{\partial \tilde{q}^3}{\partial q^1} \right) q^2 - \frac{dC^1}{dq^1} = 0$$

$$\frac{\partial \tilde{\pi}}{\partial q^2} = \left( \frac{\partial p^1}{\partial q^2} + \frac{\partial p^1}{\partial \tilde{q}^3} \frac{\partial \tilde{q}^3}{\partial q^2} \right) q^1 + p^2 + \left( \frac{\partial p^2}{\partial q^2} + \frac{\partial p^2}{\partial \tilde{q}^3} \frac{\partial \tilde{q}^3}{\partial q^2} \right) q^2 - \frac{dC^2}{dq^2} = 0$$

$$\Rightarrow \begin{matrix} q^1 *(E,M) \\ q^2 *(E,M) \end{matrix}$$

- Solution

$$q^1 *(E,M), q^2 *(E,M), \tilde{q}^3(q^1 *, q^2 *, E, M) \equiv q^3 *(E,M)$$

- Assumption

$$\frac{dq^1 *}{dE} = \frac{1}{|D|} \left\{ -\frac{\partial^2 \pi *}{\partial q^1 \partial E} \frac{\partial^2 \pi *}{\partial \left(q^2\right)^2} + \frac{\partial^2 \pi *}{\partial q^1 \partial q^2} \frac{\partial^2 \pi *}{\partial q^2 \partial E} \right\} < 0$$

$$\frac{dq^2 *}{dE} = \frac{1}{|D|} \left\{ -\frac{\partial^2 \pi *}{\partial q^2 \partial E} \frac{\partial^2 \pi *}{\partial \left(q^1\right)^2} + \frac{\partial^2 \pi *}{\partial q^2 \partial q^1} \frac{\partial^2 \pi *}{\partial q^1 \partial E} \right\} > 0$$

$$where\ D \equiv \begin{vmatrix} \frac{\partial^2 \pi *}{\partial \left(q^1\right)^2} & \frac{\partial^2 \pi *}{\partial q^1 \partial q^2} \\ \frac{\partial^2 \pi *}{\partial q^2 \partial q^1} & \frac{\partial^2 \pi *}{\partial \left(q^2\right)^2} \end{vmatrix}$$

- Proposition 1

A singer's profit strictly increases (or decreases) with the level of copyright enforcement, E, if and only if

$$\frac{\partial \pi^{1}*}{\partial q^{3}*} \text{ (marginal promotion effect of pirated CDs)}$$

$$\begin{matrix} < \\ = \\ > \end{matrix} -\frac{\partial \pi^{2}*}{\partial q^{3}*} \text{ (marginal competitive effect of pirated CDs)}$$

# Concavity /Convexity of the Profit Function

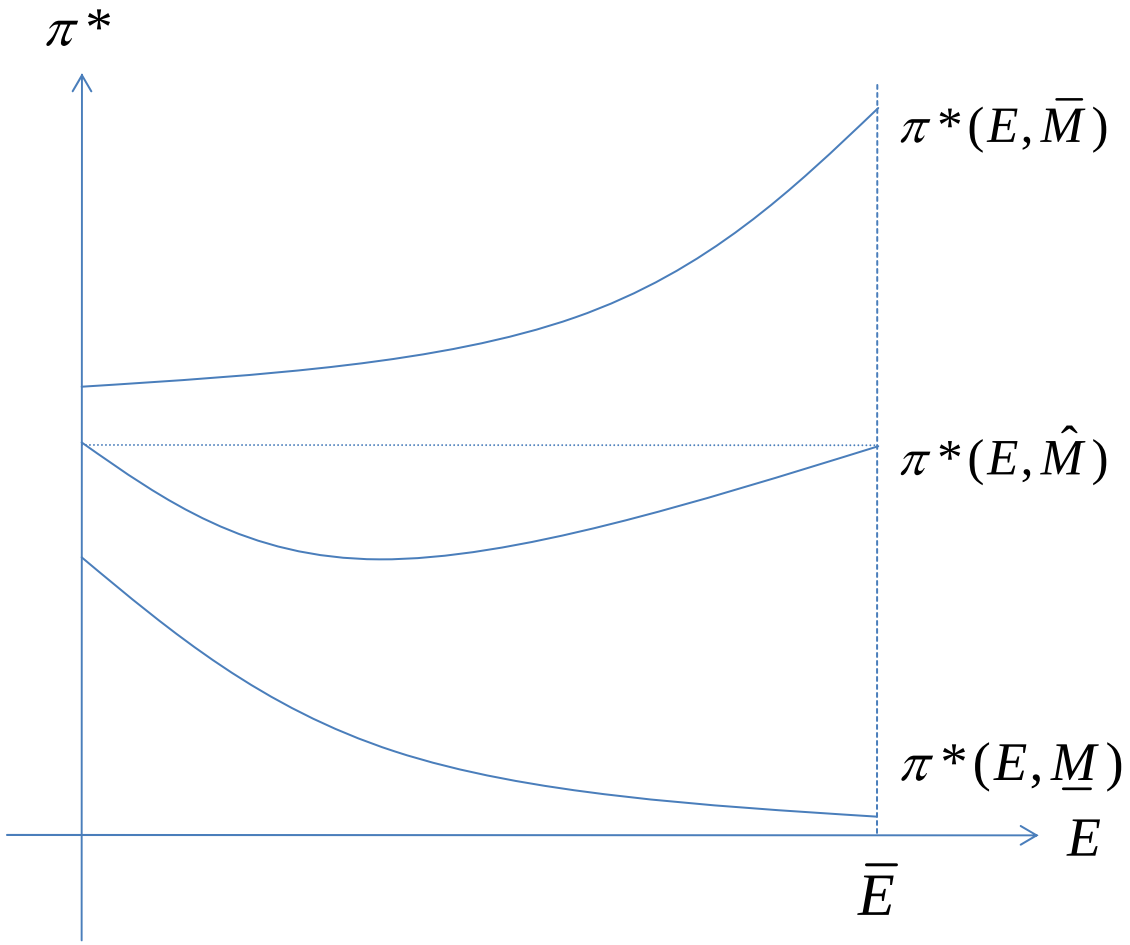
- Effect of media industries $\frac{\partial \pi^*(E,M)}{\partial M} > 0$
- Assumptions

$$\frac{\partial^2 \pi^*}{\partial E \partial M} > 0$$

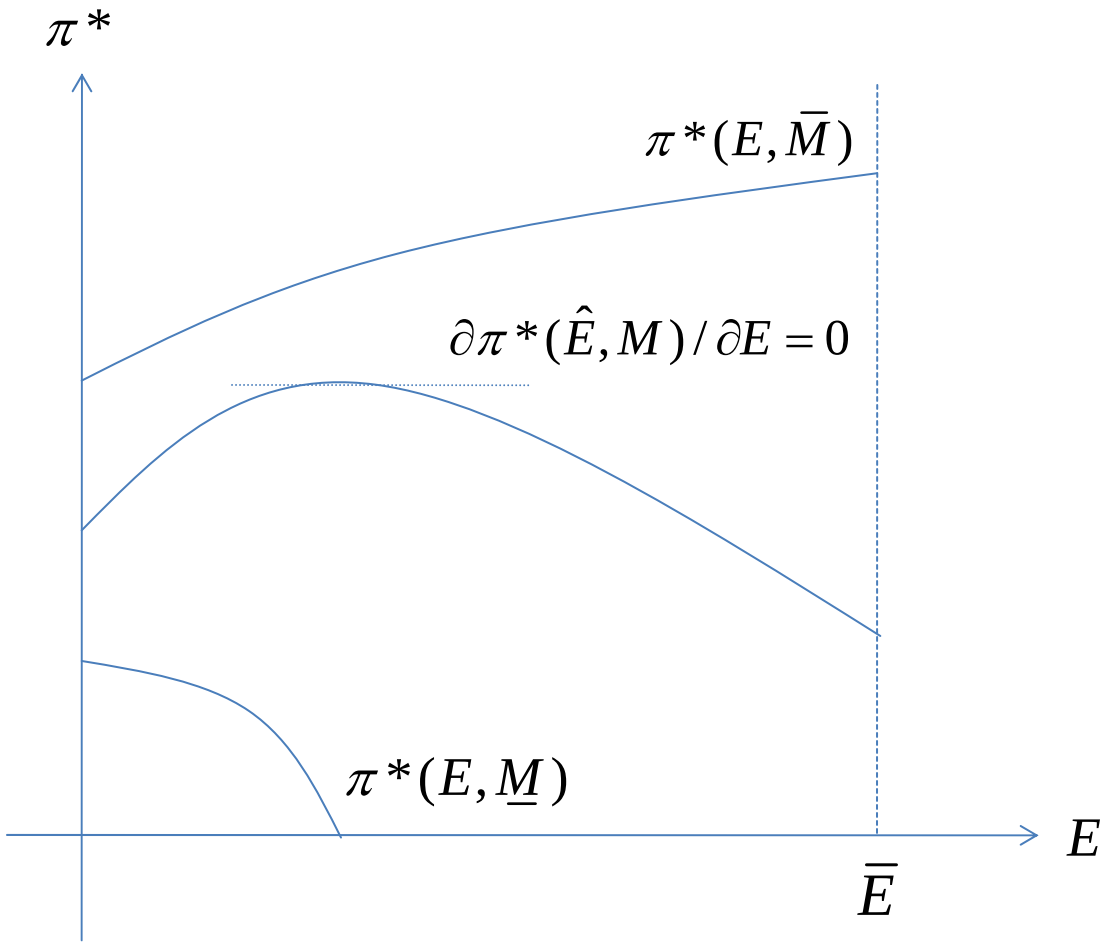
$$\frac{\partial \pi^*}{\partial E} < 0 \quad at\ E = 0\ and\ M = \underline{M} \qquad \text{(Developing country)}$$

$$\frac{\partial \pi^*}{\partial E} > 0 \quad at\ E = \overline{E}\ and\ M = \overline{M} \qquad \text{(Developed country)}$$

# Convex profit function



# Concave profit function



# Proposition 2

$$If\ \frac{\partial^2 \pi^*}{\partial E^2} > 0\ (convex),$$

$$a\ privately\ opitmal\ E\ shifts\ \ from\ 0\ to\ \bar{E}$$

$$If\ \frac{\partial^2 \pi^*}{\partial E^2} < 0\ (concave),$$

$$a\ privately\ opitmal\ E\ gradually\ increases\ with\ M$$

Implication:
Singers in developing countries have two possibilities. According to opinions in Vietnam, most singers support no enforcement although the economic growth rate is very high. That suggests that they face a convex profit function.

# An Example: The Vietnam situation

- Most singers cannot earn profits from a CD sale while they can use it as an effective promotion tool.
- They produce a minimal amount of CDs, that is, the cost for releasing a CD is a fixed cost for promotion.

- Profit functions

$$\Pi = p^3(q^1, \bar{q}^2, M)q^3 - C^3\left(q^3, E\right)$$

$$\pi = \pi^1 + \pi^2 = \left\{ p^1\left(q^1, \bar{q}^2, q^3, M\right)q^1 - C^1(q^1)\right\}$$

$$+\left\{ p^2(q^1, \bar{q}^2, q^3, M)\bar{q}^2 - C^2(\bar{q}^2)\right\}$$

$\bar{q}^2$ Minimal amount for releasing a CD and a given

- Solution

$$q^1*(E,M), \bar{q}^2, \tilde{q}^3(q^1*, \bar{q}^2, E, M) \equiv q^3*(E,M)$$

$$\frac{\partial \pi*}{\partial E} = \left( \frac{\partial \pi^1*}{\partial q^3*} + \frac{\partial \pi^2*}{\partial q^3*} \right) \frac{\partial q^3*}{\partial E} < 0 \; because \; of \; \frac{\partial \pi^1*}{\partial q^3*} + \frac{\partial \pi^2*}{\partial q^3*} > 0 \; in \; Vietnam$$

# Economic Welfare

- Welfare function

$$W(E,M) = U\left(q^1*, q^2*, q^3*\right) - \sum_{i=1,2,3} C^i(q^i*) - C^E(E)$$

$C^E(E)$ Cost function of enforcement

- Necessary condition for maximizationn

$$\frac{\partial W}{\partial E} = \left(p^1* - \frac{dC^1}{dq^1*}\right)\frac{\partial q^1*}{\partial E} + \left(p^2* - \frac{dC^2}{dq^2*}\right)\frac{\partial q^2*}{\partial E} + \left(p^3* - \frac{dC^3}{dq^3*}\right)\frac{\partial q^3*}{\partial E} - \frac{dC^E}{dE}$$

$$= \left(p^1* - \frac{dC^1}{dq^1*}\right)\frac{\partial q^1*}{\partial E} + \left(p^2* - \frac{dC^2}{dq^2*}\right)\frac{\partial q^2*}{\partial E} - \frac{dC^E}{dE} = 0$$

Sufficient condition for maximization ?

# Concluding Remarks

- Heterogeneity of singers

  Under a convex profit function with respect to the level of copyright enforcement, singers are divided into two groups: those supporting maximal and those against any copyright enforcement. In such a situation, a severe conflict takes place between these two groups.

- Lax enforcement

  In most developing countries, they must obey international copyright laws, as well as domestic laws. However, even if they enact such laws, how to enforce these copyright laws is a different issue.

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