Assessing the Impacts of Audio Home Copying Restrictions

Mannering, F., 1994. Assessing the impacts of audio home-copying restrictions. *Quarterly Journal of Business and Economics* 33(1), 30-46.

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Motivation

- Advances in digital audio recording (recordable CD, etc., that give near perfect reproductions relative to old analog technologies) raise questions about the suitability and intent of copyright law

- **Music industry:** Concerned that reproduction technology could impact revenue, jobs, and royalties and violate copyright law

Motivation (cont.)

- **Recording technology industry:**
  - Digital technology does not violate copyright law
  - Home copying of audio recordings actually stimulates sales by increasing listening exposure

Copyright Law and Home Copying

- First Congress passes copyright law in 1790, the law is updated in 1831 to include musical compositions
- **Intent:** To provide a protective environment for the creativity of the author so that the entire public may benefit

Copyright Law and Home Copying (cont.)

- To achieve "public benefit" the concept of "private use" is introduced
- The Sound Recordings Amendment to US copyright law (1971) includes audio home copying as a permissible private use
- Copyright act of 1976 does not mention "private use" but allows fair-use copying (copying for research, teaching, news reporting and criticism)
- Leaves "fair use" interpretation to the courts

Copyright Law and Home Copying (cont.)

- **Music industry:** Considers the 1971 Sound Recordings Amendment to be irrelevant because the 1976 law did not define audio home copying as a private use.
- **Recording technology industry:** The 1976 legislation did not change the basic principle of the 1971 amendment

Questions:

- Does digital audio technology necessitate a revision of the 1976 law to better define fair use, or can the interpretation of fair use be left in the hands of the courts?
- If copyright law remains unchanged in the presence of digital audio technology, what would be the likely impact on copyright holders and the general public?
- If copyright protection is increased to prohibit audio home copying, what impacts will result?

Demand and Value for Originals:

- Only a function of direct purchasers (direct appropriability)

Or,

- Influenced positively by the value users place on copies (indirect appropriabiliy)

Appropriability:

- Those seeking additional copyright restrictions tend to downplay indirect appropriability
- Those supporting digital technology at lax copyright laws tend to overstate indirect appropriability

Another concern:

- **Short-term** losses in consumer welfare resulting from more restrictive copyright laws
- Consumers of copyable materials have become accustomed to existing copyright law and have developed behavioral patterns that maximize their utility within this environment.
- Any restrictive change in copyright law will produce an immediate short-term loss in individual utility short-term losses in consumer welfare resulting from more restrictive copyright laws

Another concern (cont.):

- **Long-term** benefits may result in individuals' utility as a result of the musical diversity and nurturing of talent that presumably is encouraged by strict copyright laws
- But **short-term** losses in consumer welfare may produce political pressure that may force a copyright law revision before potential long-term benefits are realized

How to estimate short-term welfare losses?

- Consumer welfare addressed as a compensating variation problem
- That is, how much would you have to be paid to be as well off as you were before the policy change?
- Can use audio format decisions and compensating variation calculations (Small and Rosen, 1981; Winston and Mannering, 1984; Textbook page 343)

The Audio Format Decision

- Early 1990s choices:
  records, prerecorded tapes, made tapes, or compact discs

- Factors affecting format choice:
  - Musical preferences (heavy metal, rock, classical, etc.)
  - Existing audio stocks by format
  - Consumer socioeconomics
  - Price of fomats
  - CD vs. non-CD owners

Econometric Framework

- indirect utility function (prices and incomes as arguments) that describes the indirect utility that consumer k derives from a specific audio format purchase/taping choice:

$$U_{ki} = F_{ki}\left(k, \frac{p_{ki}}{y_k}, I_k, S_k, Z_k, \varepsilon_{ki}\right)$$

where:

U_k = The total indirect utility derived from the purchase/taping decision;

i = A particular format choice (records, prerecorded tapes, made tapes, or CDs);

Econometric Framework (cont.)

P_{ki} / y_k = Purchase price of format i to consumer k divided by Consumer k' s household income;

I_k = Vector of consumer k's existing format inventories (number of long-playing [LP] records, tapes, and CDs);

S_k = Vector of the stock of existing audio equipment (turntable, tape deck in car, CD player, etc.);

Z_k = Vector of consumer socioeconomic conditions and preferences that influence the choice of format; and

ε_{ki} = Random portion of utility that accounts for unobserved factors influencing consumers' audio choices

Econometric Framework (cont.)

- if ε_{ki} are assumed to be extreme value distributed (see McFadden, 1981), then a standard multinomial logit model results,

$$P_{ki} = \frac{EXP(V_{ki})}{\sum_{\forall I} EXP(V_{ki})}$$

P_{ki} = Probability of consumer k selecting format i;

V_{ki} = Mean indirect utility of format alternative i to consumer k (i.e., all elements of the random utility function except ε_{ki} ; $V_{ki} = V_{ki} + \varepsilon_{ki}$)

Welfare Effects

- Consider the effects of banning home copying.
- This effectively reduces consumer choices by one from:

records, prerecorded tapes, made tapes, or compact discs

to:

records, prerecorded tapes, or compact discs

- Welfare effects computed as a compensating variation

Compensating Variation (pg. 343)

- Early 1990s choices:
  records, prerecorded tapes, made tapes, or compact discs

$$CV_k = -(1/\lambda_k)\left[-LN\sum_{\forall I} EXP(V_{ki})\right]_{V_k^0}^{V_k^f}$$

where:

CV_k = Compensating variation for consumer k;

λ_k = Marginal utility of income;

V_{ki} = Mean indirect utility

Compensating Variation (Cont.)

V_k^0 = Mean indirect utility **before** the ban

V_k^f = Mean indirect utility **after** the ban

- For estimation V_{ki} is;

$$V_{ki} = \beta_{oi} + \beta_1 \left(\frac{p_{ki}}{y_k} \right) + \beta_{2i} I_k + \beta_{3i} S_k + \beta_{4i} Z_k$$

Where β's are estimable parameters and all terms are as previously defined

Compensating Variation (Cont.)

- It can easily be shown that marginal utility of income (λ_k) is equal to the income coefficient (β_1) divided by the household income y_k
- In computing the compensating variation, consumer compensating variations must be weighted by the reported frequency of purchase

Data

- A cross-sectional survey of audio consumers was conducted by Office of Technology Assessment
- 517 respondents were interviewed by telephone in September and October 1988
- 117 owned CD players and 400 did not (separate CD/non-CD models are estimated)

Data summary non-CD owners (CD owners in parens):

- Percent choosing long playing (LP) record format 17.0 (10.26)
- Percent choosing prerecorded tape format 75.0 (28.21)
- Percent choosing made tape format 8.0 (10.26)
- Percent choosing compact disc (CD) format 0.00 (51.27)
- Annual household income (dollars) 32,140 (40,120)
- LP record inventories 43.2 (60.5)
- Prerecorded tape inventories 26.1 (34.4)
- Made tape inventories 14.7 (29.1)
- CD inventories 0.00 (27.6)

- Percent with car tape deck 74.3 (86.3)
- Percent white/non- white 85/15 (87/13)
- Percent male/female 38/62 (58/42)
- Age (years) 34.6 (30.5)
- Education (years) 12.6 (12.7)
- Number of LP record, prerecorded tape, and CD purchases in the last month 0.21 (1.57)
- Number of household members 3.18 (3.18)
- Percent indicating sound quality is extremely important to listening 25.5 (58.1)

Model estimates non-CD owners (t-stats):

Variable	Estimated Coefficient
Constant for prerecorded tapes/made tapes	0.366 (1.03)/ -2.92(-5.64)
Format purchase price (in dollars) divided by annual household income (in 1000s dollars)	-2.327(-3.47)
Total record and tape inventory, defined for made tape option only	0.0059(1.76)
Car tape deck indicator defined for tape options (1 if have car tape deck, 0 otherwise)	0.7427(2.59)
Race indicator defined for CD option (1 if white, 0 otherwise)	0.905(2.80)
Sound quality indicator variable defined for prerecorded tape option only (1 if sound quality extremely important, 0 otherwise)	-0.449(-1.724)
Number of observations 400, Log-likelihood at zero -439.44, Log-likelihood at convergence -272.37	

Model estimates CD owners (t-stats):

Variable	Estimated Coefficient
Constant for prerecorded tapes/made tapes/CDs	1.34 (3.28)/-1.01 (-1.37)/0.728(1.10)
Format purchase price (in dollars) divided by annual household income (in 1000s dollars)	-1.618(-2.00)
Classical music indicator defined for compact disc option only (1 if listen to classical music, 0 otherwise)	0.933(1.42)
Car tape deck indicator defined for tape options (1 if have car tape deck, 0 otherwise)	0.7427(2.59)
Race indicator defined for tape options (1 if white, 0 otherwise)	1.211(1.91)
Sound quality indicator variable defined for prerecorded tape option only (1 if sound quality extremely important, 0 otherwise)	-0.582(-1.37)
Number of observations 117, Log-likelihood at zero -162.20, Log-likelihood at convergence -129.29	

Welfare Computations:

- Frequency-weighted average compensating variation of $1.62 (weighted by the individual's stated frequency of purchase, which gives more weight to the compensating variations of frequent purchasers)
- Thus, for each purchase/taping decision, the imposition of a home copying ban results in an average consumer welfare loss of $1.62.

Welfare Computations (cont.):

- The average made tape option is chosen 15.8% of the time
- The average consumer makes 1.58 tapes per 10 audio-format decisions
- This implies that each time the average consumer decides to tape, a compensation of $10.25 is required ($16.20/1.58) for the ban (to maintain consumer welfare)

What are the net impacts of a copying ban?

- 1987 sales of blank cassettes were 388 million, with surveys showing 84% are used for music recording, giving 326 million blank cassettes
- In our sample, 20.4% of tapings were on non-blank tapes (re-recorded) and the average made-tape has 1.63 album equivalents
- Thus, 409.54 million tapes (blank and nonblank) were used to record 667.55 million (409.54 x 1.63) album equivalents in 1987

Impacts of a copying ban (cont.)

- The sample of audio consumers also indicated that for every ten albums taped, a net of almost four would have been purchased if taping were not available (a net of 38 percent of taped albums are would-be purchases)
- Using this figure, the abolition of taping would increase purchases by 253.7 million album equivalents annually
- The average price paid per album equivalent of $7.80, there would be an industry revenue gain of $1.98 billion (253.7 x 7.80)

Impacts of a copying ban (cont.)

- But, because 326 million fewer blank tapes would be sold annually at an average price of $2.45 per tape, a $798.7 million revenue loss would be incurred by the blank tape industry
- This leaves a net industry revenue gain of $1.18 billion annually ($1.98B-$0.7987B)
- Consumer welfare losses can be based on the 409.54 million blank and nonblank tapes that no longer will be used for the made tape option

Impacts of a copying ban (cont.)

- Consumer welfare losses are estimated to be $4.2 billion (409.54 x $10.25 per blank/non-blank tape not being used).
- Because these consumer welfare losses exceed projected revenues, the estimated loss to society of an audio home copying ban will be approximately $3.02 billion per year ($4.2B-$1.18B)
- Thus, although audio home taping is costing the industry billions in lost revenues, an audio taping ban would be even more costly to consumers and result in net annual losses to society.

Concluding Remarks

- Although the current ambiguity of copyright law with respect to audio home copying may need to be rectified in light of the proliferation of digital audio recording technology, caution should be exercised because of potential welfare losses
- A copy- right law revision that effectively bans audio home copying will result in increased industry revenue, job opportunities, and artists' royalties
- But, but the short-term effects of such a policy will result in audio consumers paying a high price resulting in a substantial net loss to society

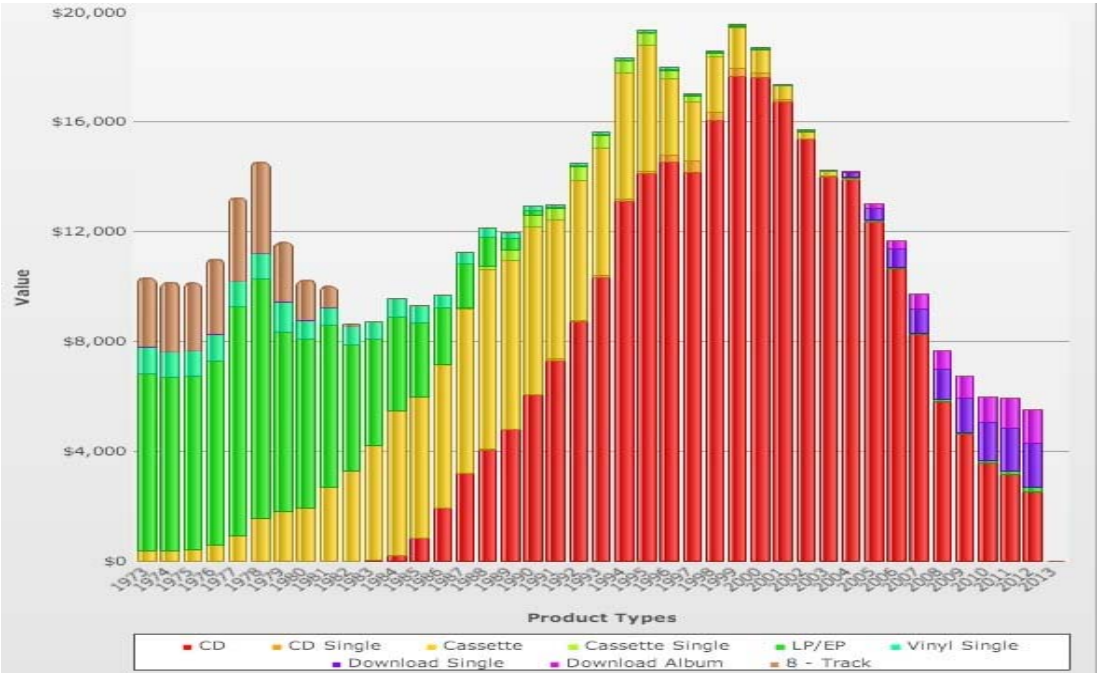
Concluding Remarks (cont.)

- The longer-term consequences of a ban are unclear, as issues relating to direct and indirect appropriability, investments of increased industry revenue, format price changes, new technologies, and shifting consumer tastes may lead to net benefits or even greater net losses over a period of years.

What has happened since 1987?

- No real copyright control over digital copying
- Industry revenues (in 2012 dollars):

  $19 Billion in 1999; 5.8 Billion in 2012



Impact on artists?

- Led Zeppelin, Queen, Simon and Garfunkel, Black Sabbath, Metallica, Kiss, Beatles, etc.
- vs. Katy Perry, Lady Gaga, etc.
- Touring vs. Album sales:
  - Bands used to tour to support their album sales where big profits were made
  - Now bands use albums to support their tours where most of the reduced profits now lie