

Chapter 7

Economic Perspectives on Home Copying

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Chapter 7

Economic Perspectives on Home Copying

INTRODUCTION

Economic harm—the “effect of the use upon the potential market for or value of the copyrighted work” — is one of four criteria considered by the courts in determining whether a use is a “fair use” and not a copyright infringement.¹ Consequently, much of the debate on home copying of audio and video materials has focused on economic analyses supporting or rebutting copyright owners’ claims of economic harms. Because home copying is a private use, applying the fair-use defense may be premature.² Some, nevertheless, do believe that the doctrine of fair use, as the “safety valve” of the copyright law, is able to deal with home copying and other private uses.³

New technologies and new private uses convey benefits as well as harms to various classes of right holders and users. These affect society’s economic welfare. Choosing an appropriate balance of harms and benefits is a political decision, not a technical one, in which the public has a stake.

Defining the legal status of private uses (like home copying) will involve weighing the effects on stakeholders of possible measures to restrict private uses against the consequences of not restricting them. Narrowly defining the legal status of a particular kind of home use (e.g., making digital copies of prerecorded music) would not resolve parallel issues for other technologies and industries.

This chapter explores the economic implications of home audiotaping and home copying in general. To do this, OTA commissioned Michael Katz, William Johnson, and Fred Mannering to conduct three independent economic analyses and analyzed several other studies performed by industry groups and private individuals.

All three of the economic analyses done for OTA illustrate a common theme: **In considering whether—or how—to adapt the law or technology to address home copying, it is as important to identify the ambiguous consequences of any proposed change as it is to quantify the more certain ones.** Katz develops a theoretical framework for analyzing the economic effects of home copying, and shows how the possible effects on various stakeholders depend critically on the underlying assumptions about supply and demand. Johnson develops a theoretical framework for analyzing the effects of home copying on the producers of original recordings and uses the OTA survey data to examine some factors that influence copying and purchasing behaviors. Mannering develops a model of consumers’ choice between purchasing and taping music and uses the OTA survey data to estimate the value consumers place on homemade tapes.

Mannering’s estimate of consumers’ valuation of homemade tapes is used to estimate the hypothetical economic effects on consumers and society from eliminating home taping.

¹Title 17, U.S. Code, Sections 107 (1)-(4).

²See ch. 3, and also: U.S. Congress, Office of Technology Assessment, *Intellectual Property Rights in an Age of Electronics and Information*, OTA-CIT-302 (Melbourne, FL: Kreiger Publishing CO., April 1986), pp. 193-198. The 1986 OTA report concluded that new information dissemination and reproduction technologies pose a number of legal challenges. One, the “problem of private use,” stems from growing home access to copyrighted electronic information, coupled with inexpensive copying and transmission. The legal problem arises because these technological changes raise the question of how far copyright proprietors’ rights should extend over private uses, and the copyright legislation provides meager guidance.

³Alleged harm is still relevant to the debate. In considering whether copyright proprietors’ exclusive rights should extend over private uses, Congress might wish to take the economic consequences of private uses into account.

While a ban on home taping is extreme, this scenario allows the effects of home taping on recording-industry revenues to be estimated in a manner comparable to earlier recording-industry studies, along with effects on blank-tape revenues, consumer benefits, and society's economic welfare.

The effects of private use, including home copying, on the efficient allocation of resources and society's economic welfare are complex and ambiguous. Even for one specific type of copying-home audiotaping—using survey data to estimate its effects on industry revenues or consumer benefits involves many assumptions and approximations. Choosing among assumptions about underlying factors is a subjective process. Some of the most crucial factors are very difficult to measure and several alternative assumptions may be equally plausible—for example, the extent to which consumers would increase purchases of recorded music, absent home taping. Thus, the same survey data can support disparate estimates, and this type of uncertainty is unlikely to be reduced by more data.

STAKEHOLDER STUDIES

By 1986, industry stakeholders—both individual firms and industry associations — had

sponsored almost a dozen surveys and studies, usually to support or oppose passage of home-copying legislation.⁴ Most were intended to show the alleged harm or losses that the sponsors incurred as a result of home copying.⁵ In the 1986 study, OTA noted discrepancies among these analyses, each of which used different methodologies, and which often focused on a specific product or market. More important, OTA noted:

“...[A] consideration of the beneficial effects of new technological uses to either new or existing markets for intellectual property is often absent from such estimates. Although the videocassette recorder [for example] may give rise to copying, it also permits the exploitation of markets that would otherwise not exist. Both factors must be taken into account in considering harm. The policy maker is therefore still left with a decision over who will benefit from new technological uses, and for what reasons.”⁶

Several of these analyses of alleged harm to the recording industry due to home taping were presented and debated during hearings on copyright and home taping in the 97th,⁷ 98th,⁸ and 99th⁹ Congresses. At each hearing, Alan Greenspan presented the results of the most recent analysis done for the recording industry by his firm, Townsend & Greenspan. In the 1985 analysis, sponsored by RIAA,

⁴See table & 1 in ch. 6 of this report and OTA-CIT-302, *op. cit.*, footnote 2, pp. 201-203, for summaries of these.

⁵There has been substantial disagreement as to whether harm should be used to determine rights, and where the burden of proof should lie.

⁶OTA-CIT-302, *op. cit.*, footnote 2, p. 201.

⁷“Copyright Infringements (Audio and Video Recorders),” Hearings before the Committee on the Judiciary, U. S. Senate, 97th Cong., 1st and 2nd sess., on S. 1758 (A Bill to Amend Title 17 of the U.S. Code to Exempt the Private Noncommercial Recording of Copyrighted Works on Video Recorders From Copyright Infringement), Nov. 30, 1981 and Apr. 21, 1982, pp. 917-971.

⁸“Video and Audio Home Taping,” Hearing before the Subcommittee on Patents, Copyrights, and Trademarks of the Committee on the Judiciary, U. S. Senate, 98th Cong., 2nd sess., on S. 31 (A Bill to Amend Title 17 of the U.S. Code With Respect to Home Recording and Audio Recording Devices and Media, and for Other Purposes) and S. 175 (A Bill to Amend Title 17 of the U.S. Code to Exempt the Private Noncommercial Recording of Copyrighted Works on Video Recorders from Copyright Infringement), Oct. 25, 1983, pp. 107-244.

⁹“Home Audio Recording Act,” Hearings before the Committee on the Judiciary, U. S. Senate, and its Subcommittee on Patents, Copyrights, and Trademarks, 99th Cong., 1st and 2nd sess., Hearings on S. 1739 (A Bill to Amend Title 17 of the U.S. Code With Respect to Home Audio Recording and Audio Recording Devices and Media, and for Other Purposes), Oct. 30, 1985, Mar. 25 and Aug. 4, 1986, pp. 146-176.

Greenspan estimated that in 1984, each instance of home taping cost the taper \$1.67 per album-equivalent, compared with an average retail price of \$6.80.¹⁰ On the basis of an earlier report on home taping by the firm Audits & Surveys, Townsend & Greenspan estimated that 42 percent of all home tapings from prerecorded material and 40 percent of off-the-air (broadcast) tapings would have generated sales, if taping had not been possible.¹¹ Then, assuming that 40 percent of home taping in 1984 was in lieu of purchases of records or prerecorded cassettes, the firm estimated 1984 retail losses of some \$1.5 billion. This figure included \$200 million in losses due to record prices being depressed 5 percent below what they would have been, absent taping.¹² Greenspan estimated that about 40 percent of these retail losses (about \$600 million) represented *compensable* losses to copyright owners and creators; this proportion was based on estimated lost revenues (net of manufacturing and distribution costs) using a hypothetical industry income statement. Moreover, as in his earlier testimonies, he stated that continued home taping had grave implications for the viability of the recording industry. Noting that recording-industry releases were

down by almost half since 1979, and that industry employment had declined from 29,000 in the late 1970s to less than 19,000 in 1984, Greenspan stated that further growth in home taping would cause further decline in these industry indicators. He concluded that the industry itself could not successfully respond to home taping with a pricing strategy. Raising prices to recoup losses would reduce sales and might increase home taping, and lowering prices to make taping less attractive would cut profits further and decrease the industry's capabilities to take the risks required by the nature of the business.¹³

Greenspan's two earlier studies had estimated losses to the recording industry amounting to \$1.05 billion for 1981 and \$1.4 billion for 1982. The Consumer Electronics Group of the Electronic Industries Association (EIA), the Audio Recording Rights Coalition, and the Home Recording Rights Coalition (HRRC) submitted dissenting comments and testimony disputing these estimates. In the first instance, EIA argued that taping estimates based on hypothetical questions and recall were unreliable and exaggerated the amount of taping actually done. Furthermore, EIA claimed that the analysis

¹⁰In this calculation, a blank tape was assumed to hold 1.875 album-equivalents.

¹¹"Home Taping in America 1983: Extent and Impact," Audits & Surveys (New York, NY: October 1983). The report was based on diaries of taping activity over a 1-month period from a sample of active tapers, as well as personal interviews and an in-home audit, of all tapes in the respondents' homes.

Earlier estimates of taping and displaced sales had been based on a consumer mail survey sponsored by Warner Communications, Inc. (WCI): M. Fishbein, S. Middlestadt, and M. Kapp, "A Consumer Survey: Home Taping," WCI (March 1982), as reported in "1981 Estimate of Loss Due to Taping: Tapers' Reports of Replacement (Executive Summary)," (Los Angeles, CA: WCI, April 1982).

¹²Greenspan calculated that the average annual price increase of all goods and services in the consumer price index was 6.7 percent from 1978-1984, while average prices of prerecorded tapes rose only 2.2 percent. According to Greenspan, "Had average prerecorded tape prices paralleled the general rise in consumer prices in 1984, they would have been 29 percent higher than they in fact turned out to be."

In general, failure of retail prices to match increases in the consumer price index does not always mean a decline in profit margins. Also, macroeconomic conditions (such as the recession during 1979-1981) can have a different effect on demand for entertainment (e.g., records and tapes) than on other items in the price index (e.g., food).

Greenspan also concluded that the recording industry's recovery since the early 1980s did not indicate that the "taping problem" had eased; rather, his analysis indicated that taping had reduced pretax profits, even during the recovery. Greenspan estimated that the proposed home-taping levy in S. 1739 would yield some \$200 million per year. See Hearings on S. 1739, op. cit., footnote 9, pp. 154-156.

¹³Hearings on S. 1739, op. cit., footnote 9, pp. 155-56.

for RIAA had ignored the stimulative effects of home taping on sales of recordings, and that some home tapes (e.g., selection tapes and tapes made for portable or car tape players) are not substitutes for prerecorded products.¹⁴ In the second instance, Greenspan's estimate of harm was rebutted by a panel representing HRRC and the Audio Recording Rights Coalition. The panel argued that the Audits & Surveys data used by Townsend & Greenspan were flawed and overstated the potential for sales displacement, and that the analysis ignored the stimulative effects of taping on sales and other benefits.¹⁵

HRRC and EIA contended that the new Townsend & Greenspan analysis of alleged harm for 1984 was subject to the same flaws as the earlier ones. They did not, however, offer any new empirical estimates.

Points of Contention

A pattern emerges in these debates. The published recording industry arguments and economic analyses deal *only* with estimates of alleged harms to the recording industry and copyright proprietors that arise from substituting home copying for purchases of prerecorded music. These alleged harms include lost sales, depressed prices, lower profit margins, and, ultimately, a decline in the number and diversity of new recordings being released. Survey data and models are used to estimate the extent of copying and the num-

ber of displaced sales. Representatives of the hardware and blank-tape industries then dispute the results on methodological grounds.

Although representatives of the hardware and blank-tape industries argue that the recording industry's figures are inflated, they have not published their own estimates of either economic harm or tangible/intangible benefits from home copying. Instead, they contend that when the effects on the recording industry and on consumers are considered together, there are net economic benefits to society. They argue that economic analyses used for policymaking must examine the costs and benefits to the various stakeholders.¹⁶ Their arguments propose several hypotheses about social (and recording industry) benefits from home taping. Because these hypotheses are not quantified, they cannot be compared with the recording industry's estimates of economic harm.

As an example of these lines of argument, one remedy proposed by the recording industry, songwriters, and music publishers is a surcharge on the price of a blank audiotape.¹⁷ The rationale for this hinges on the assumptions that:

- . home taping is a direct *substitute* for a purchase,
- . most blank tapes sold to consumers are used to copy copyrighted material, and therefore

¹⁴Hearings on S. 1758, op. cit., footnote 7, pp. 956-970.

¹⁵Hearings on S.31 and S.175, op. cit., footnote 8, pp. 340-467. The Audits & Surveys study for RIAA concluded that hearing home tapes was an almost negligible factor in decisions to purchase (Audits & Surveys, op. cit., footnote 11, pp. 14-15).

¹⁶Cited examples include, for example, economic harm to the recording industry from lost sales *and* benefits to the recording industry from technological innovations in hardware that open new markets, benefits to consumers from a wider set of choices and lower-cost access to music, etc. (Hearings on S. 1785, op. cit., footnote 7; Hearings on S.31 and S. 175, op. cit., footnote 8.)

¹⁷See "Joint Statement of the Music Publishers' Association, Inc., Recording Industry Association of America, Inc., and songwriters Guild of America Re: S. 1739, The Home Audio Recording Act," testimony before the Subcommittee on Patents, Copyrights, and Trademarks of the Senate Committee on the Judiciary, Oct. 30, 1985, pp. 49-62.

- . the surcharge would fairly compensate copyright holders for lost royalties.¹⁸

In arguing the fairness of blank-tape surcharges, proponents claim that most consumers tape to save money and that they would have purchased a recording if they were unable to copy.

In opposing such proposals, HRRC and EIA contend that home taping does not compete directly in the market for prerecorded music.¹⁹ They argue that consumers do *not* regard homemade tapes as perfect substitutes for prerecorded products: tapes can be reused, so home tapes may not be permanent additions to a consumer's music library. In addition, they contend that consumers' taping practices are such that the content of home tapes differs from what is commercially available and that consumers often tape material that they would not have purchased. They also contend that home taping can stimulate demand for prerecorded products. Asserting that it is not prohibited under current law, they point out that home taping offers significant intangible benefits to consumers by diversifying the choices available to them via "selection-taping," as well as the settings and forms in which they can enjoy music via "place-shifting." "Selection-taping" is making a tape with selections from one or more different artists or albums; "place-shifting" is

making a tape of an owned recording to play in a car or portable tape deck. HRRC and EIA suggest that consumers base their decision to purchase some recordings on the expectation that they can be copied for these purposes and that consumers are unlikely to purchase copies of the same recording on different media (e.g., a CD or record for home use and a tape for the car). RIAA, on the other hand, disagrees with these arguments. It views home-taping practices such as "place-shifting" as violations of copyright or, at best, of uncertain legal status, but certainly not condoned under the current law.²⁰

One area of continuing disagreement is whether only the effects of home taping (or a taping ban) on recording-industry revenues should be considered for policy formulation, or whether effects on blank-tape revenues and consumers' economic welfare should also be considered. A corollary to this disagreement is whether alleged *lost revenues* or *lost profits and royalties* should be used in considering "harm."

Viewing home taping as a violation of current copyright law, RIAA believes the absolute protection of copyrighted music and recordings to be the only relevant issue. Therefore, RIAA maintains that policymakers should only take into account the effect on record industry revenues, reflected in

¹⁸Some variants of this argument involve tape qualities and likelihoods of taping copyrighted material% given tape type.

For a discussion of the relative merits of blank tape and/or recording equipment fees and criteria for determining them, see: Timothy J. Brennan, "An Economic Look at Taxing Home Audio Taping," *Journal of Broadcasting & Electronic Media*, vol. 32, Winter 1988, pp. 89-103.

¹⁹In 1982, the Audio Recording Rights Coalition sponsored a telephone survey of audio tapers, intended to explore the tastes and practices of tapers (including the stimulative effect of home taping on purchases), but not to estimate the absolute amount of home taping in the United States: "Why Americans Tape: A Survey of Home Taping in the United States," Yankelovich, Skelly, and White, Inc., September 1982. Yankelovich, Skelly, and White reported the following results: (1) more than half of all home audiotaping does not involve prerecorded music; (2) home taping stimulates purchases of prerecorded music; (3) home tapers tape primarily to put together their own program of selections; (4) tapers also seek portability, convenience, quality, and availability through home taping; (5) saving money is not the primary motive behind home music taping; and (6) half of all home tapes of prerecorded music are made from the taper's own record or tapes.

²⁰H. Rosen, Recording Industry Association of America, Inc., letter to J. Winston, OTA, May 2, 1989 (enclosure with comments on draft ch. 8, p. 2).

sales displacement.²¹ Advocates of home recording such as HRRC and EIA consider that home taping is legitimate under the current law. Furthermore, they hold that studies of the effect of taping on the recording industry should consider only the effects on industry profits and royalty payments to performing artists and creators of works, rather than gross revenues to recording companies. They argue that the former incentives determine the long-term supply of new works.²²

The difference in relative magnitudes (gross revenues versus profits and royalties) is substantial. Greenspan estimated that 40 percent of alleged lost revenues represented “compensable” losses to copyright owners and creators (including the recording companies). Considering the recording industry’s rule-of-thumb that royalty payments to the performing artists and copyright owners amount to about 20 percent of the wholesale price of a recording (see ch. 4), the 40-percent-of-revenues figure for profits and royalties seems high.

Some of the major unresolved questions from previous surveys and analyses stem from their underlying assumptions, as well as from the survey designs. For example, the RIAA surveys examined *homemade tapes*, while the HRRC survey examined *home-taping incidents* (“Tapings”), so the results are not comparable. One important line of argument has concerned the efficacy of proposed levies in furthering the intent of copyright by providing incentives for the creation and dissemination of new works. Other differences have been methodological, concerning the construction of:

- . Measures of the amount of blank media of various qualities purchased by con-

sumers, and estimates of the proportion used for home taping of copyrighted material (as opposed to other uses such as in answering machines or to tape a baby’s first words).

- Measures of motivations for home taping, intended to test hypotheses as to whether home tapes displace or stimulate purchases.
- Measures of the amount of home taping being done and of taping patterns (e.g., selection-taping versus album taping, taping owned versus borrowed recordings, etc.).
- Measures of the extent to which taping stimulates purchases, or of estimated lost sales revenues from taping displacing purchases.

OTA concludes that the studies by the RIAA and EIA/HRRC are insufficient as a basis for policy making, for the following reasons:

- The methodologies and data for the surveys that were used as the basis for the studies were not published in their entirety, including details of the survey design and response rates, complete questionnaires, and disaggregate responses to all the questions asked. Therefore, independent replication of results and/or alternative analyses by disinterested parties are not possible. Because the studies were sponsored by those with a financial interest in their outcome, questions of bias in their design, execution, or reporting arise; the inability to independently replicate results leaves these questions open.

²¹H. Rosen, Recording Industry Association of America, Inc., letter to OTA, May 2, 1989 (enclosure with comments on draft ch. 8, pp. 1-2).

²²Gary J. Shapiro, Robert S. Schwartz, Steven R. Brenner, Home Recording Rights Coalition, memorandum to OTA with comments on economic issues, May 1, 1989, pp. 7-10.

- The survey data obtained for RIAA and HRRC are based on different units of analysis (tapes and tapings, respectively), in part because the analyses based on these data were intended to explore different mechanisms (e.g., sales displacement versus stimulative effects). Therefore, even if the RIAA and HRRC studies are equally valid, it is not possible to reconcile their disparate findings.
- The studies do not explore the effects on net economic welfare of home copying, or of proposed policies to restrict or eliminate it. Given that the current legal status of home copying is ambiguous, it is appropriate and reasonable to examine the effects on consumers, as well as on industry.
- The focus on active tapers, as opposed to the general population, does not permit analysis for the population at large. By surveying only active tapers, the studies do not fully consider consumers' motivations for taping versus purchasing—in particular, why some consumers do not tape, and whether tapers and nontapers have different perceptions of the acceptability or fairness of home-taping practices.²³
- While the recording industry's economic analyses of harm project increases in sales absent home copying, the estimates of lost sales revenues do not take into account the effect of price changes on the number of recordings purchased. The estimates assume that sales volume would increase substantially absent home tap-

ing.²⁴ But Greenspan's analysis and testimony also indicated that prices would be higher, absent copying. If consumers bought fewer recordings in response to these price increases then using the original estimate of increased sales volume in conjunction with higher prices overstates foregone revenues. Also, the RIAA estimates are of lost revenues, not lost profits, and the published analyses do not provide sufficient data to allow an independent estimate of profits.

The OTA survey and economic analyses were designed to remedy the first four of these points. OTA chose a population-based sample for two reasons: i) so that, where appropriate, the results would be applicable to the population at large, and ii) so that nontapers, as well as tapers, would have the opportunity to express their views. Including both tapers and nontapers is especially important in order for the OTA survey to shed new light on public perceptions about the fairness of home-copying practices and alternative policies.²⁵ The issue of sample design, however, was one of the most hotly contested aspects of the OTA survey's development. Both RIAA's and HRRC's view, shared by some of the other outside reviewers, was that the sample should consist of active tapers only, to get a larger number of observations of taping, given the study's limited resources. OTA's view, shared by some other outside reviewers, was that this advantage would be outweighed by the disadvantages of not being able to project results to the general public and, more important for a study for Congress, of ignoring the opinions of perhaps half the public.

²³The OTA sample design was chosen to allow projection of sample results to the population at large. To do so, it is necessary to know each respondent's presumed probability of selection (for example, based on Census profiles); for a sample of tapers only, this would be unknown. Therefore, the OTA sample consisted of randomly selected members of the public, including both tapers and nontapers.

²⁴See hearings on S. 1739, op. cit., footnote 9, pp. 152-154 for details of the 1984 estimates.

²⁵OTA had commissioned a phone survey on the public's familiarity with and acceptance of intellectual property rights, perceptions of a problem, and views on solutions, for the 1986 report. See "Public Perceptions of the 'Intellectual Property Rights' Issue," The Policy Planning Group, Yankelovich, Skelly, and White, Inc., February 1985.

As for the last point, the OTA and contractor analyses also assume that prices remain constant in the short term.²⁶ But even when prices are held constant, the use of alleged lost revenues (as opposed to profits and royalties) is contentious, as was mentioned above. One way to address this in a comprehensive analysis of the economic effects of home copying would be to compare current sales volumes, variety, costs, and prices with those where copying had been eliminated or restricted several years earlier. Even if such a comparison were possible, the analysis would require industry data over those years on both costs that varied with production volume and those that did not,²⁷ along with data on retail transactions.²⁸ Even then, it would be virtually impossible to establish accurately the relationships between possible financial incentives and the supply of new creative works, or to estimate the benefit to society from the additional "investment" in creative works (see the section below on private copying and social welfare). Absent these industry data, both the OTA and contractor analyses had to focus on changes in industry revenues and could not estimate the changes in the demand for recordings as a result of changes in prices or the impact on the long-term supply of creative works. Although the results of our analyses

reflect the relative magnitudes of industry-revenue, consumer, and net economic welfare effects, they are only benchmarks for considering policy options.

LITERATURE ON HOME COPYING

Several recent papers, prompted in part by the debates over home audio- and videotaping, have examined the economics of home copying.²⁹ Because economic effects of copying are complex and often ambiguous, these analyses usually rely on simplifying assumptions or specific conditions to reduce ambiguity. Therefore, the results must be interpreted in light of these assumptions and conditions.

The Effect of Private Copying on Welfare

Intellectual property is an example of the private production of a public good.³⁰ For intellectual property, ordinary market forces will not necessarily produce the most desirable social outcomes. Granting a limited monopoly via copyright attempts to balance distortions arising from the partial inability of

²⁶See the discussion of Mannering's analysis below.

²⁷OTA requested cost and variety data from the recording industry, but was only able to obtain the general, rule-of-thumb information presented in ch. 4. Naturally, the firms hold this information closely. (OTA staff interviews with recording-industry and RIAA executives, May/June 1988.)

²⁸Published retail statistics from the National Association of Recording Merchandisers (NARM) do not include this information. RIAA industry data report shipments valued at suggested list price; retailers typically discount from list price. It is possible to construct approximations over a series of years using discounting rules; however, industry production cost data for a number of years would still be required.

²⁹See also: OTA-CIT-302, *op. cit.*, footnote 2, especially ch. 6; and an OTA contractor report prepared for the 1986 assessment, "Economic Issues Relating to New Technologies and Intellectual Property," Stanley M. Besen, contractor report prepared for OTA by the Rand Corp., Dec. 1984 (Springfield, VA: National Technical Information Service, 1986).

³⁰For a discussion of public goods, see *The New Palgrave: A Dictionary of Economics*, John Eatwell, et al., editors (The Stockton Press, NY: 1987), pp. 1061-1066. A public good is one that is nonexclusive: once it is produced, it is impossible (or prohibitively costly) to exclude any individual from benefiting from it, whether or not he pays. Individuals have an incentive not to pay for the good, or to undervalue it, in hopes of getting access as "free riders." This results in inefficient resource allocation and underproduction of nonexclusive goods, and underlies the rationale for public support of activities like national defense and scientific research.

creators to exclude all nonpayers from obtaining their works.³¹ Without protection of copyright, the inability of creators to fully appropriate returns from intellectual property would result in the underproduction of new works.

In the long run, the effect of unlimited copying on society's economic welfare is ambiguous. It depends on a number of factors, including the degree to which copying affects the demand for originals, the degree to which copying affects the production of new works, and the degree to which consumers value additional variety.³²

The net social welfare effect of copying has two components: the effect on producers and the effect on consumers. Changing the amount of private copying (either increasing or restricting it) will affect not only the net level of society's economic welfare, but also the relative balance between producer and consumer welfares. This balance between gains and losses for producers and consumers is often the most visible and most hotly contested feature of proposed policies for redistributing the benefits from home taping. The specific effects of private copying on the economic welfare of producers and consumers depends on several factors:

- Whether private copying costs (including copiers' value of time) are lower or higher than producers' production and distribution costs (i.e., whether private copying is economically efficient or inefficient).
- c Whether producers increase the price of originals to reflect the value of copies made from them, or whether producers reduce prices in an attempt to discourage copying.
- Whether producers charge different prices for the same good, at least to copiers and noncopiers.
- To what extent copying is a substitute for a purchase.
- How consumers vary in their copying costs and tastes.
- Whether the additional variety of originals offered absent private copying would be "excessive" in economic terms.³³

Does increased copyright protection for goods like musical recordings and software increase or decrease society's economic welfare? Some claim that improvements in copyright protection will:

³¹ RIAA notes that nonexclusivity need not tie the hands of policy makers. For example, in some other countries where it was not deemed possible or desirable to prevent home taping, a royalty system was instituted with the intent of (at least partially) compensating for nonexclusivity. (H. Rosen, Recording Industry Association of America, Inc., letter to OTA, May 2, 1989, enclosure with comments on draft ch. 8, pp. 12.)

³² See, William R. Johnson, "The Economics of copying," *Journal of Political Economy*, vol. 93, No. 11, 1985, pp. 158-174. Johnson examines two models for copying to help explain why some consumers copy while others do not. The first model assumes that the cost of copying varies according to individuals' values of time. The second model assumes that large fixed costs must be incurred (e.g., purchase of recording equipment) to copy, but copying is subsequently costless. Johnson concluded that, for both models, copying redistributes income away from copyright proprietors, although the effects of copying on the prices of originals and on social welfare are ambiguous.

³³ See Stanley M. Besen, "Private Copying, Reproduction Costs, and the Supply of Intellectual Property," *Information Economics and Policy*, vol. 2, 1986, pp. 5-22. For example, Besen notes that copying will increase consumer welfare **and** producer profits in the short run, if private copying is efficient **and** the price of originals can be raised to reflect the value of the copies. On the other *hand*, copying may cause producers to reduce prices; this decreases both consumers' and producers' welfare. If, however, copying (by reducing the number of originals produced) reduces "excessive" variety, this can increase welfare in the long run.

The recording industry considers that consumers of its product have always valued additional variety and that, "excessive variety, if it exists, is an issue of business strategy for individual record companies, not a social welfare problem." (H. Rosen, Recording Industry Association of America, Inc., letter to OTA, May 2, 1989, enclosure with comments on draft ch. 8, p. 3.)

- decrease the loss to society from the *underproduction* of works—the loss in quality and variety of goods produced when some consumers can use them without paying, and
- increase the loss to society from *underutilization* of these works — the loss due to consumers who would be willing to buy the good at a lower price³⁴ but do not consume it at the given price, plus the loss due to consumers who spend more real resources copying than the producer would to make an additional unit of the good.

Novos and Waldman consider a case in which consumers differ only in terms of their costs of obtaining a reproduction (not in their valuations of the good), and in which private copying is economically inefficient. In this instance, increased copy-right protection could lead to a decrease in the social loss from underutilization, provided that all individuals continue to consume the good.³⁵

More generally, Novos and Waldman find that policies to increase copyright protection face a trade-off between losses due to underproduction and to underutilization. New copying technologies have tended to increase the former and to decrease the latter. If copying is inefficient, however, an improvement in copyright protection does not necessarily increase the underutilization loss. Also, if improved protection reduces the demand for

originals, this might increase the underproduction loss.

Overall, then, the implications of increasing copyright protection are complex, and the policy trade-offs are not simple. In some cases, market outcomes (where different classes of consumers are charged different prices of a good, such as journals, or where copyable and noncopyable goods, such as computers and software, are bundled) may be preferable to increased government enforcement.³⁶ In choosing between government and industry actions to prohibit copying, Novos and Waldman conclude that the government should act when its cost of doing so is lower than the producer's cost of altering the product.³⁷

Appropriability and Pricing

Private copying need not be harmful to producers, if copying is efficient and if producers can increase prices to take into account the value of the copies that will be made.³⁸ If not all consumers copy, or if consumers vary in the number of copies each makes from an original, then efficient pricing would require discriminating among these groups, charging them different prices according to their valuations of the originals, based on their ability to make copies. This type of price discrimination is usually infeasible, however, because it is costly and difficult to gather the necessary information on users' valuations of originals.³⁹

³⁴More specifically, who would be willing to pay the marginal cost of producing an additional unit of the good.

³⁵Ian E. Novos and Michael Waldman, "The Effects of Increased Copyright Protection: An Analytic Approach," *Journal of Political Economy*, vol. 92, No. 2, April 1984, pp. 236-246.

³⁶See also Besen (1984), *op. cit.*, footnote 29, pp. 13-23.

³⁷Ian E. Novos and Michael Waldman, "The Emergence of Copying Technologies: What Have We Learned?" *Contemporary Policy Issues*, vol. 5, July 1987, pp. 34-43.

³⁸See Besen (1986), *op. cit.*, footnote 33, p. 7.

³⁹The inability to practice perfect price discrimination among users can produce imperfections in markets for intellectual property.

A simplified form of price discrimination is two-tiered pricing, in which producers are able to segment their customers into two classes and maximize profits by charging each a different price.⁴⁰ Looking at the effect of photocopying on the number of scholarly journals purchased, Liebowitz has examined journal publishers' ability to indirectly appropriate copiers' true valuation of originals through higher subscription prices to libraries and institutions. He concluded that publishers can indirectly appropriate revenues from copiers who do not directly purchase journals. Since copying may have different effects on other media, however, case-by-case empirical investigation of the institutions and markets involved may be necessary.⁴¹

Price Discrimination, Resource Allocation, and Variety

The inability to charge different classes of consumers different prices for a good in intellectual-property markets means that the prices consumers pay need not reflect their actual valuations of the good: some value the

good more, and will be willing to pay more. Those who do not value the good at a given price will not consume it. If they could be offered a lower price reflecting their valuation, however, then they would purchase it and both producers and consumers would be better off. Moreover, the decoupling of prices and valuations makes resource allocation — decisions about what to produce — more difficult and markets less efficient.⁴²

Besen's analysis for the 1986 OTA report noted that where there are many producers of competing types of intellectual property, the resulting market structure is one of monopolistic competition: firms will have some control over the prices they can charge because their products are differentiated (e.g., music by different recording artists or groups). When firms are unable to charge different consumers different prices, however, there may be either excessive or insufficient variety.⁴³ Under these conditions, when private copying serves to reduce the variety of products being offered, it does not necessarily reduce the efficiency of supply or make consumers worse off.⁴⁴

⁴⁰See Walter Y. Oi, "A Disneyland Dilemma: Two-Part Tariffs for a Mickey-Mouse Monopoly," *Quarterly Journal of Economics*, February 1971, pp. 77-94. Oi describes how Disneyland's (then-) prevailing policy of charging separate admissions and ride prices could be optimal for a profit-maximizing monopolist. This was possible because customers varied in their tastes and could be divided into two groups, based on their valuations of going on a large number of rides.

⁴¹S. J. Liebowitz, "Copying and Indirect Appropriability: Photocopying of Journals," *Journal of Political Economy*, vol. 93, No. 5, 1985, pp. 945-957.

⁴²See Besen (1984), op. cit., footnote 29, pp. 1-4. See also Stanley M. Besen, Willard G. Manning, Jr., and Bridger Mitchell, "Copyright Liability for Cable Television: Is Compulsory Licensing the Solution?" (Santa Monica, CA: The Rand Corp., February 1977). The authors note that congressionally mandated compulsory licenses for some uses (such as cable retransmission) are less efficient than requiring negotiations through full copyright liability. This is because consumers' willingness to pay for programs is perceived only indirectly by program suppliers.

⁴³Where it is possible to charge copiers and noncopiers different prices, the interests of these groups of consumers could be decoupled (Besen (1984), op. cit., footnote 29, p. 19). As a practical and marketing matter, however, this has not yet been tried for recorded music.

⁴⁴See Besen (1984), op. cit., footnote 29, pp. 4-5. Entry (new firms, new products) will be profitable when new entrants can attract enough consumers from the incumbents to cover their costs, even if these exceed the value that consumers place on the additional variety. If excessive variety is being offered and if private copying then causes producers to decrease the variety of products offered, the result may be to increase the efficiency of supply and make consumers better off. Conversely, if firms selling at a single price find it more profitable to "duplicate" products of their rivals than to offer more differentiated products, then insufficient variety will be offered, even without copying.

Brennan notes that the measure of how well copyright works should be the correspondence between the values listeners place on copyrighted works and the costs of providing them; the system should give incentives for works for which consumers collectively would be willing to cover the costs. He also notes that copyright is not intended to subsidize works that consumers would not financially support; if subsidization is socially desirable, then means other than revenues from home-copying fees should be used.⁴⁵ Brennan also suggests that policy regarding home taping should not be directed toward correcting any general perceived flaws in copyright.®

ANALYZING THE ECONOMIC EFFECTS OF HOME COPYING

The three economic analyses of home copying conducted for OTA all include a cost-benefit framework. Two of them, by Johnson and Mannering, use the survey data to work within this framework to provide some quantitative assessment of the effects of home copying on stakeholders. Each of the three looks at a different part of the home-copying puzzle: Katz considers implications for the profits of producers and distributors of originals; Johnson considers the determinants of copying and purchasing originals; and Mannering uses consumers' purchase/taping choices to examine hypothetically the short-term effects of a home-taping ban on producers' revenues and consumers' welfare. None of the analyses gives the complete picture of the economic effects of home copying; taken to-

gether, however, they cast doubt on the premise that eliminating home taping would be an unambiguously good move by Government or industry.

Home Copying and Its Economic Effects

The contractor report by Michael Katz⁴⁷ focuses on the theoretical effects of home copying on producers' profits but does not estimate them. According to Katz, both the market for recorded music and the market for electronically recorded visual images fall into the *hardware-software paradigm*—products are interdependent, produced and sold for use as components of hardware-software systems. Simplifying somewhat, stakeholders in these markets fall into five general classes, each affected differently by home copying:

- . *Consumers:* Home copying has two broad sets of effects on consumers, one direct and one indirect. The direct effect—if the availability and prices of hardware and software are freed, independent of copying—is to make more choices available to consumers. Those who copy benefit from this effect, those who do not are unaffected. The indirect effect recognizes that the collective actions of home copiers may affect the supply of hardware and software—contrary to the assumption above. One possible indirect effect, when copying serves to reduce the variety of available software and increase prices, would be negative.⁴⁸ The net effect on an individual consumer

⁴⁵ Brennan, *op. cit.*, footnote 18, pp. 99-100.

⁴⁶ T. Brennan, The George Washington University, letter to J. Winston, OTA, Apr. 24, 1989 (enclosure).

⁴⁷ Michael L. Katz, "Home Copying and Its Economic Effects: An Approach for Analyzing the Home Copying Survey," contractor report prepared for the Office of Technology Assessment, Mar. 9, 1989 (Springfield, VA: National Technical Information Service, October 1989).

⁴⁸ Another theoretically possible effect is positive, when copying stimulates the supply of *software* (see section below on demand effects).

is the sum of the direct and indirect effects. When the indirect effect is a reduction in variety, coupled with an increase in prices, the net effect on the home copier depends on the balance between this loss and the gain from making copies. Consumers who do not copy experience the indirect effects and may be hurt through the actions of others. If, however, the indirect effect is to cause more and varied goods to be produced, then consumers who do not copy also benefit.⁴⁹

Software Producers: The economic effect of home copying on producers depends on whether home copying stimulates or dampens the demand for originals. Either case is theoretically possible. For audio recordings, the industry could be characterized by: 1) a creation stage in which there are a large number of firms producing similar, but not identical, products, and 2) recording, manufacturing, and wholesale distribution stages (typically performed by an integrated recording company) in which the number of firms is small and firms are aware of the mutual relationships of sales, production, investment, and advertising plans. In the creation stage, the recording company in effect invests in a lottery by channeling its resources to particular songwriters and artists. In such a market, the effect of reduced demand is to lower the expected returns from coming up with a “winner” and thus, to lower the expected return from entering the industry. Therefore, if home copying does lower demand, then there are likely to be

fewer firms in the creation stage of the industry, and fewer new products offered. In the long run, however, the firms would be expected to earn a competitive rate of return, with or without home copying. Because of the structure of the recording, manufacturing, and wholesale distribution stages the effect of copying on them can be extremely complex, but lower demand is likely to decrease profits.⁵⁰

- *Retail Software Distributors:* The effects of home copying are somewhat similar to those discussed for the software producers’ creation stage (above). If copying stimulates the demand for originals and entry is easy, there should be more retail distributors and higher employment in this sector; if it depresses demand, then there should be fewer distributors and lower employment.⁵¹

Retail distributors’ interests diverge from those of software producers in some important ways. First, distributors may profit from being able to sell originals used to make copies, even if total sales of originals are reduced (e.g., if the distributor rents videocassettes or broadcasts album sides). Second, if some distributors are paid by manufacturers on a unit volume (rather than dollar volume) basis, their interests may diverge: if copying results in fewer originals being sold at higher prices, manufacturers may not be significantly harmed, but distributors would be if their profits were based on unit sales, rather than dollar volume.

⁴⁹See Katz (1989), *op. cit.*, footnote 47, p. 2.

⁵⁰See Katz (1989), *op. cit.*, footnote 47, pp. 2–4.

⁵¹Katz’ classification of “retail distributors” includes several groups who provide the product to the final consumer – e.g., retail record stores, video rental stores, radio stations, etc.

- *Hardware Producers and Distributors:*

The effects of home copying are largely the same for these groups, which are treated together here. The direct effect is that the greater availability of software (via copying) will make the hardware-software system, hence the hardware, more valuable. If indirect effects on the supply of software (see above) are positive, hardware producers and distributors will also gain. If, however, indirect effects on software supply lead to a reduction in the supply of originals, the value of the systems and its hardware will be adversely affected. Similar considerations arise when copying increases the price of software. This reduces consumers' willingness to pay for hardware since the two system components are used jointly.⁵²

Analyzing Possible Effects⁵³

According to Katz, estimating the relative strengths of the effects of home copying on the above stakeholders reduces to answering two fundamental questions:

1. What are the lost profits of producers and distributors?
2. How is the supply of software affected?

The first question cannot be answered fully without extensive proprietary data from individual firms for a number of years. These would be needed to model competition in pro-

ducers' and distributors' markets and firms' responses to changes in demand and to calculate price-cost margins (to determine profits).⁵⁴ The difference between software producers' profits with and without home copying depends critically on the nature of competition in the industry, and how the prices and quantities produced respond to changes in the demand for originals; the latter is a question that producers themselves can best answer.

Katz notes that producers' cost data are needed to estimate the effects of copying on producers' *profits*, rather than revenues. The relevant cost is the total *marginal cost*—the extra cost of producing an additional unit – of the record, tape, or CD, including all levels in the production/distribution chain. Without these data, and price data, Katz concludes that there is little that can be said about the magnitude of the economic harm to producers, except for loose bounds (like foregone revenues under some pricing assumption, as in Mannering's analysis).⁵⁵ Katz notes that the number of copies made is "almost certainly" an upper bound on the decline in the demand for originals at a given price, but that using this quantity to estimate foregone revenue can yield a "very loose" upper bound on harm.⁵⁶

For the second question – how the supply of software is affected, one would need to play out various scenarios based on the effects of copying on producers' profits.

⁵²See Katz (1989), *op. cit.*, footnote 47, p. 4-5.

⁵³See Katz (1989), *op. cit.*, footnote 47, pp. 5-7.

⁵⁴Johnson and Mannering use simplifying assumptions to deal with these questions.

⁵⁵The RIAA disagrees with this point, considering that the revenue effect is the salient one. (H. Rosen, Recording Industry Association of America, Inc., letter to OTA, May 2, 1989, enclosure with comments on draft chapter 8, p. 1.)

⁵⁶See Katz (1989), *op. cit.*, footnote 47, pp. 5-7.

In their analyses, Johnson and Mannering make simplifying assumptions to partially circumvent this dilemma. As tables 11 and 12 in this chapter show, different assumptions about the substitution of copies for originals yield a very broad range of revenue effects.

Effects of Home Copying on Demand for Originals⁵⁷

Katz discusses households' decision processes and consumers' tastes as determinants of the extent of copying, while taking into account the monetary costs of copying, as well as the time required to make copies or obtain originals, and the perceived quality of copies relative to originals.

Katz notes that, because copies cannot always be substituted for originals and because originals are needed to generate copies, copying has a very complex effect on the demand for originals: when copying is feasible, originals are worth more because they can be used to generate copies. Moreover, even if copies could always be substituted for originals, an increase in the availability of copies might stimulate the demand for originals. This would be counteracted by effects that would suppress demand, including demand for multiple units of an original.⁵⁸

Katz concludes that, taken together, these effects produce a "twist" in the demand for originals: consumers' willingness to pay for early units of an original rises (the original can be used as a source of copies), but demand for later units falls (copies serve as substitutes for originals). This twist is what makes it so difficult to assess the effect of the change in demand on producers' profits—different assumptions about market structure and demand yield disparate results, depending in part on the producers' ability to influence

prices, the relative efficiency of home copying compared with the cost of producing originals, the producers' ability to appropriate the consumer's full value of originals, and the producers' ability to charge different prices to different classes of consumers (e.g., by discounting multiple purchases or bundling formats like CD/cassette).⁵⁹

Katz also notes that – in theory, at least – copies and originals could be used jointly, rather than as substitutes. If so, then lower costs of copying might be expected to stimulate sales of originals somewhat, by enhancing consumers' expected benefits from purchasing originals. One benefit might be the free-sample effect: a copy might be a low-risk way to try a new piece of software, and considerations like ethics, the desire to get liner notes, or a desire for higher quality might then induce the consumer to buy an original. Also, copies might provide software in an otherwise unavailable form: consumers could make customized or selection tapes, could time-shift broadcast material, or could copy the material from one format to another to place-shift. Copying might stimulate consumer purchases of hardware, which in turn would increase the demand for original software, which would lead to additional sales. Finally, copies might generate benefits relating to the fact that consumers value a hardware/software system more, the more popular that system and compatible ones are. Economists refer to these benefits as "network externalities."⁶⁰

⁵⁷See Katz (1989), *op. cit.*, footnote 47, pp. 7-17.

⁵⁸Katz (1989), *op. cit.*, footnote 47, p. 9.

⁵⁹See Katz (1989), *op. cit.*, footnote 47, pp. 9-1b, for specific examples of how profits with home copying can be higher or lower than those without, depending on the assumptions about the marginal costs of copying and producing originals and the firm's choice of pricing strategies.

⁶⁰A larger user base can increase the amount of information available about the system, make free samples more available, enhance the image of a popular product, etc. See Katz (1989), *op. cit.*, footnote 47, pp. 15-17, for more discussion.

Home Copying and the Demand for Originals

The contractor paper by William Johnson⁶¹ is concerned with the effects of home copying on the market for originals, from a positive, rather than normative, perspective. Therefore, Johnson examines the effects of copying on sales of originals, but does not examine whether restrictions on home copying are warranted. Johnson develops a theoretical framework to estimate the effects of private copying and uses data from the audio portion of the survey done for OTA to estimate some of the determinants of home audiotaping and of purchasing original recordings. His results provide some support for the notion that an individual's choice between copying and buying originals is affected by the value of his time – higher values of time raise the number of purchases of originals and reduce the extent of copying. Although Johnson attempted to use these estimates to assess the effect of copying on the purchase of originals, he concluded that the precision of his estimates did not permit him to approximate the extent to which copies were substituted for originals.

A Simple Model of Private Copying⁶²

Johnson bases his model on an individual's cost-benefit trade-off for buying versus copying a particular work. He assumes that copies and originals are equivalent in use, that both purchasing and copying of the same work takes place, and that most individuals engage in some copying and some purchasing. The

presumed specification of a consumer's valuation of the use of a particular work (in the form of either an original or a copy) depends on particular attributes of the work and on attributes of the consumer that are observable (e.g., age) and unobservable (e.g., tastes). The consumer's cost of obtaining a copy of that work depends on a factor that is related to the particular work and copy, on his value of time, and on unobservable factors that are specific to him but, in general, constant across all works.

In this model, a consumer will buy an original of a particular work if his valuation of the work exceeds its price and buying is cheaper than copying for him. On the other hand, if his valuation exceeds the cost of copying the work and the sale price exceeds the copying cost, he will copy rather than buy.⁶³ Therefore, the producer/seller of a particular work faces demand that will clearly decrease as the price of the work rises—consumers will buy fewer originals, make more copies, and use originals less intensively in copying.

A more interesting question is what the model predicts about the demand for originals if the cost of copying shifts. If the cost of copying drops for all consumers, there may be little effect on the demand for originals when their prices are low. For “moderate” prices of originals, the effect may be substantial, with many consumers substituting the cheaper copies for originals. At high prices for originals, the model suggests that the effect of cheaper copies may be to raise the demand for originals, primarily for their use as a source of copies.

⁶¹William R. Johnson, “**Estimating** the Effect of Copying on the Demand for Original Creative Works,” Contractor report prepared for the Office of Technology Assessment, Mar. 3, 1989 (Springfield, VA: National Technical Information service, October 1989).

⁶²See Johnson (1989), op. cit., footnote 61, pp. 2-9.

⁶³Remember that the copying cost includes time costs and difficulty of access to originals. In this retelling, getting the work at the least cost – i.e., saving money – is the decision criterion because copies and originals are assumed to be perfect substitutes.

In Johnson's model, some consumers buy, others copy, others do neither. In a given population, the number who copy will depend on the distribution of the components of consumers' costs and valuations. There may be additional demand for originals as sources of copies, but this will decline as prices rise and consumers economize in the use of originals. Moreover, an extra copy will tend to create a demand for less than one additional original.

If a hypothetical ban on copying were imposed, the demand for originals would shift. In theory, at a given price consumers might buy either more or fewer originals than they would have bought were copying possible. In the face of consumers' responses to a copying ban, producers might raise or lower their prices for originals. Determining the difference between producers' sales and revenues in copying versus no-copying scenarios to measure their losses due to copying requires considering these two effects. The first effect can be predicted from the response of demand for originals to the cost of copying. This allows estimation of the net (positive and negative) effect of copying on the demand for originals when price is held constant. Because the price effect is not included, this will understate losses due to copying. Omitting the second effect always leads to understating the loss (or overstating the gain) copying causes to producers of originals.

Data Analysis and Estimation

Johnson uses data from observations of copying and purchases taken at one point in time to measure differences in individuals' copying costs. The simple model, described above, is extended from individual decisions about a single work to consider a large number of differentiated works. Johnson specifies an individual's expected demand for purchases and for copies as functions of the ranges of prices of original works, of his costs of copying, and of his valuation of works, as well as of observable and unobservable personal attributes.

Johnson focuses on the audio portion of the survey data, particularly the sections on pur-

chase and ownership of originals and on copying and stocks of copies.

Purchase and Ownership-Johnson calculated daily purchase frequencies from responses to the "most recent purchase" sequence of questions (survey questions 30-37). The average frequency for the whole population seemed too high, however: at 0.039 per day, it would imply a yearly purchase frequency of 14 sound recordings per year. Industry shipments data seem to correspond to a much lower rate — perhaps 3.5 or 4 sound recordings per year per person over the age of 10.⁶⁴ Johnson notes that the frequency estimation is extremely sensitive to the few observations of very recent purchases, so "telescoping," or reporting a more recent purchase than was the case, may have caused a large upward bias; this could also have occurred for estimates of copying frequency.⁶⁵

Johnson has two ways of addressing this problem. First, he uses alternative measures of purchase and copying behavior, such as the stock of recordings and the number purchased in the last month. Second, since a similar effect seems to occur for his copying estimates, he assumes that estimates of *substitution* between copying and purchases would be unaffected by equal proportional biases in copying and purchasing behaviors.

To at least partially mitigate telescoping, Johnson constructed a second variable representing the *number of purchases last month*; the mean value (0.59) implies an annual purchase rate of about 7, which is smaller than the daily frequency implies but still larger than national sales figures. The survey data on *stocks* of recordings do seem in accord with past sales figures, however. For example, Johnson finds that the per-person stock of CDs (3.8) is the same order of magnitude as

⁶⁴See Johnson, Op. cit, footnote 61, pp. 9-10. He uses 1986 RIAA shipments data, based on 200 million people, aged 10 or older in 1986.

⁶⁵The method used by OTA in ch. 6 to estimate overall copying and purchasing is less sensitive to these effects. Aggregating Purchasing or copying into categories like "past week" or "past month" reduces sensitivity to individual data points and to telescoping, there the estimates based on the "last time" and "stock change in last month" are in closer agreement.

total accumulated sales of CDs in the United States. Per-person stocks of other recordings were 19 45-rpm records, 37.5 LP records, and 21 prerecorded cassettes.⁶⁶

Copying and Stocks of Copies—Johnson also calculated daily taping frequencies from responses to the (most recent) broadcast taping and prerecorded taping sections of the questionnaire.⁶⁷ As before, the estimates of taping frequencies seemed excessively high — the mean daily rate of broadcast taping was 0.023 and the mean daily rate of taping from prerecorded material was 0.036. This would yield a combined rate of 0.059 per day, or 21.5 per year — roughly 50 percent higher than the estimated purchase rate of sound recordings. Johnson notes, however, that these estimates from self-reported data are not compatible with industry sales figures for blank tape, and seem to be as inflated as the estimates of self-reported purchase frequency.⁶⁸

Johnson's estimate of the average number of *tapes made in the last month* is about 0.58, for an annual average of 7. As was the case with purchase behavior, these data imply lower rates than the frequency data, but still higher than aggregate sales would indicate. Johnson finds that the estimate of the average *stock* of home copies (from responses to question 29) is 13.8 tapes per person, which is of the same rough magnitude as past accumulated blank-audiocassette sales.⁶⁹ Of these copied tapes, most (an estimated 10.7) were

copied by the current owner. In overall stocks of recordings, the stock of copied tapes is about one-quarter the size of the stock of LPs, and about two-thirds the size of the stock of prerecorded cassettes. Given the rate of copying and the size of the stock of copied tapes, it is somewhat surprising that in the “last-listening” section of the survey, only one-tenth of the respondents reported that they were listening to a copied tape. Johnson speculates that this finding might indicate that people copy music they are less interested in — and perhaps less likely to buy— which would be consistent with the survey finding that copied tapes (especially those made from records or other tapes) are regarded as being of somewhat lower quality than prerecorded cassettes.⁷⁰

Time Spent Making a Copy— Items in survey question 45 ask about the time devoted to making the last home tape, and the amount (if any) the copier would have been willing to pay someone else to make that tape. Johnson found that the mean copying time was slightly more than 2 hours; he considers this an upper bound to the time cost because all of this time need not have been lost to other activities. The question on willingness to pay for a copy was only answered by 66 individuals who said they would consider paying someone else to make the tape for them, so that the results, which show an average willingness to pay of \$6.63,⁷¹ may be unreliable.

⁶⁶Johnson (1989), op. cit., footnote 61, p. 109.

⁶⁷A copy of the questionnaire is in appendix B (see questions 43 and 44).

⁶⁸The International Tape/Disc Association reports sales of some 387.5 million blank audiocassettes in 1987, or about 2 per person over the age of 10. Since the survey data indicated that about 80 percent of copies are made using blank tapes, Johnson infers that the average copying frequency should be around 2.5 per year.

⁶⁹About 11 blank tapes have been sold per person since 1980 (Johnson (1989), op. cit., footnote 61, p. 11). Remember that a “tape” is not necessarily equivalent to an “album.”

⁷⁰Johnson (1989), op. cit., footnote 61, pp. 11-12. See ch. 6 of this report for stock data.

⁷¹At an average wage of \$10/hour, this would imply that the true time cost of taping was 2/3 of an hour. (Johnson (1989), op. cit., footnote 61, p. 12)

Empirical Estimates of Copying and Purchasing Behavior

Johnson concluded that the best variables to use to depict current copying and purchasing behaviors are the frequency variables described above: despite their apparent inconsistency with aggregate industry data, if the degree of bias is the same for everyone, then estimates of the determinants of that frequency at one point in time will be unbiased, except for a proportionality factor.⁷²

Dependent and Independent Variables—Johnson's specification has demands for copies and originals depending on income, relative prices, and demographic variables (used as surrogates for tastes).⁷³ Income effects are captured by household income and demographic variables. Relative prices are more difficult to capture. Because the price of originals does not vary significantly in the cross-section at one point in time (as opposed to time-series data over several years), the price effects must focus on copying costs. For these, several measures are possible: the amount of time reportedly taken up to make the copy; the willingness to pay someone else to make the copy; and proxies for the value of time, in-

cluding employment status and earnings. Johnson found that the performance of proxies for the value of time in the estimates was more in keeping with the predictions of his model than the other two measures, which were plagued by smaller numbers of responses. Table 7-1 presents all the variables used in the analysis, with descriptive statistics and sample sizes.

Results of Estimation –Johnson estimated⁷⁴ measures of purchasing and copying, with employment status as proxy for the cost of copying.⁷⁵ Tables 7-2 and 7-3 show the results using three measures of original purchases (daily frequency, purchases last month, and stock of prerecorded cassettes) and employment status to capture the cost of copying. Tables 7-4 and 7-5 show estimation results for the three measures of copying behavior (daily frequency, taping last month, stock of copied tapes).

These coefficients in tables 7-2 through 7-5 show the sensitivity of the dependent variables (daily frequency, etc.) to each of the independent variables (employment status, etc.) when controlling for variations in the others.⁷⁶ For example, employment status and gender (male) both have similar positive

⁷²Although the variables representing purchases or copies made in the last month seem to have the virtue of reducing the telescoping problem, these variables are less reliable than the frequency ones. It is less desirable to use the stock variables because they are much more influenced by past, rather than current, behavior (e. g., stocks of LP records do not reflect current LP purchase rates). (Johnson (1989), op. cit., footnote 61, pp. 12-13.)

⁷³But direct estimation of the substitution between copies and originals is not possible because the demand for copies is not independent of the demand for originals. Johnson finds that copying is positively related to original demand in the sense that those who copy more also buy more originals. (Johnson (1989), op. cit., footnote 61, p. 13.)

⁷⁴Three-stage least squares and Tobit estimators were used. The system of equations estimated were appropriate pairings of purchase and copying variables (e.g., purchase frequency with copying frequency, etc.). For more information on these techniques, see Takeshi Amemiya, *Advanced Econometrics* (Cambridge, MA: Harvard U. Press, 1985).

⁷⁵Johnson also tried using the other two measures for the cost of copying to help explain purchasing/copying frequencies, but these estimates were less successful. For purchasing frequency, none of the estimated coefficients was statistically significant. For taping frequency, only one coefficient in each of the estimations (the age coefficient in the one using copy time, and the gender coefficient in the one using willingness to pay) was significant. Johnson notes that, in part, the unsatisfactory results for the alternative measures of copy cost may be due to the smaller numbers of respondents for the time-to-copy and willingness-to-pay questions. Also, variations in copy time may reflect variations in the quality of the copy, rather than in the true cost of acquiring it. See Johnson (1989), op. cit., footnote 61, p. 16.

⁷⁶The figures in parentheses are the coefficients' t-statistics. Depending on the number of coefficients being estimated and the number of observations, an absolute value oft near 2 (or more) generally indicates that the estimated coefficient values are statistically significant. Note that many of the coefficients are not statistically significant – i.e., the hypothesis that their true value is zero cannot be rejected at the 95 percent confidence level. The sign of a coefficient indicates whether its effect is to increase or decrease the likelihood of purchasing an original, the stock of originals, etc.

Table 7-1. -Variable Description and Statistics

Variable	Description	Mean (standard deviation)	Valid observations
Daily purchase frequency	Daily rate of purchasing recordings	0.039 (0.421)	1,433
Daily taping frequency	Daily rate of taping	0.059 (.0265)	1,140
Original tape stock	Number of prerecorded cassettes owned	20.69 (23.9)	1,366
Stock of copied tapes	Number of home-recorded cassettes owned	10.99 (20.3)	1,376
Purchases last month	Number of 45s, LPs, CDs and prerecorded cassettes bought last month	0.059 (2.5)	1,501
Taping last month	Number of audiocassettes taped last month	0.056 (2.5)	1,501
Employed	= 1 if employed 0 if not	0.563 (0.496)	1,501
High school	= 1 if education 12 years or more but not college graduate = 0 if not	0.555 (0.497)	1,501
College	= 1 if college graduate 0 if not	0.192 (0.394)	1,501
Nonwhite	= 1 if nonwhite 0 if not	0.155 (0.362)	1,501
Male	= 1 if male 0 if not	0.480 (0.500)	1,501
Age	Age in years	39.2 (19.0)	1,491
Income	Annual household income (\$1000)	33.3 (23.7)	1,120
Copy willingness to pay	Willingness to pay for copy (cents)	663 (499)	66
Copy time	Time to make last copy (minutes)	133 (292)	393

SOURCE: Johnson, 1989

effects on the size of an individual's stock of originals (see table 7-2); being male has a statistically significant positive effect on daily taping frequency; and age has a significant, but smaller, negative effect (see table 7-5).

The coefficient estimates in tables 7-2 through 7-5 were obtained by using employment status as proxy for the relative cost of

copying. The mathematical specification Johnson uses would allow him to approximate the substitution of copies for purchases of originals by the ratio of the coefficient on employment in a purchasing-behavior equation and the same coefficient in a copying-behavior equation. But no statistically significant ratio can be constructed.⁷⁷

⁷⁷See Johnson (1989), op.cit., footnote 61, pp. 8-10, 16-17. There are six such ratios. The numerators of four and the denominators of the other two are not statistically significant, so one cannot conclude with confidence that they are significantly different from zero.

Table 7-2. -Tobit Estimates of Original Purchases
(asymptotic absolute t-statistics in parentheses)

Independent variable	<i>N</i> = 895		
	Daily purchase frequency	Purchases last month	Original stock
	(1)	(2)	(3)
Employed	-0.017 (.72)	-0.265 (.31)	4.47 (2.08)
High school	2.17 (1.106)	2.17 (1.85)	797 (2.91)
College	0.055 (1.41)	2.24 (1.55)	6.60 (1.88)
Nonwhite	-0.031 (.98)	-0.684 (.61)	-426 (1.49)
Male	0.030 (1.38)	2.17 (2.79)	(2.03)
Age	-0.0056 (8.91)	-0.179 (7.34)	-0.418 (7.72)
Income	0.002 (4.88)	0.012 (78)	0.137 (3.23)

NOTE: Sample restricted to persons 16 and older
SOURCE: Johnson, 1969

Table 7-3.—Three-Stage Least Squares Estimates of Original Purchases
(asymptotic absolute t-statistics in parentheses)

Independent variable	<i>N</i> =895		
	Daily purchase frequency	Purchases last month	Original stock
	(1)	(2)	(3)
Employed	-0.0022 (0.14)	-0.201 (112)	322 (189)
High school	-0.0013 (0.067)	0.187 (832)	574 (2.69)
College	-0.0021 (0.083)	-0.040 (0.138)	4.33 (1.56)
Nonwhite	-0.0022 (0.104)	0.074 (0.309)	3.64 (160)
Male	0.022 (3.85)	0.514 (2.97)	3.64 (221)
Age	-0.0024 (2.66)	-0.022 (5.11)	-0.227 (5.42)
Income	0.0024 (3.85)	0.002 (0.55)	0.096 (280)

NOTE: Sample restricted to persons 16 and older
SOURCE: Johnson, 1989

Table 7-4. -Tobit Estimates of Taping Behavior
(asymptotic absolute t-statistics in parentheses)

Independent variable	N=895		
	Daily taping frequency	Taping last month	Stock of copied tapes
	(1)	(2)	(3)
Employed	-0.073 (1.55)	0.376 (0.33)	-0.943 (0.38)
High School	0.052 (.86)	-1.17 (0.87)	1.52 (1.52)
College	0.0012 (0.015)	-2.54 (1.38)	7.32 (1.80)
Nonwhite	0.1606 (2.84)	4.51 (383)	7.12 (2.22)
Male	0.173 (3.96)	2.53 (2.54)	2.69 (2.69)
Age .,	-0.016 (11.5)	-0.285 (7.98)	-0.605 (9.44)
Income	0.002 (2.42)	0.027 (1.36)	0.094 (1.91)

NOTE: Sample restricted to persons 16 and older
SOURCE: Johnson, 1969

Table 7-5.-Three-Stage Least Squares Estimates of Taping Behavior
(asymptotic absolute t-statistics in parentheses)

Independent variable	N=895		
	Daily taping frequency	Taping last month	Stock of copied tapes
	(1)	(2)	(3)
Employed	-0.055 (261)	0.112 (0.60)	-1.14 (078)
High School	0.015 (059)	-0.492 (213)	3.43 (1.89)
College	-.024 (0.707)	-0.452 (1.50)	4.92 (2.08)
Nonwhite .,,	0.037 (1.32)	0.523 (2.12)	4.56 (2.36)
Male	0.059 (287)	0.456 (2.56)	4.45 (319)
Age	-0.0025 (477)	-0.026 (5.73)	-0.227 (6.36)
Income	0.0005 (1.17)	0.0019 (0.526)	0.042 (142)

NOTE: Sample restricted to persons 16 and older
SOURCE: Johnson, 1969

Therefore, Johnson concludes that the estimates do not permit an approximation of the substitution of copies for purchases of originals. However, Johnson finds that they do shed some light on the determinants of copying and purchasing behavior. In particular, Johnson concludes that:⁷⁸

- Income raises the demand for both copies and purchases.⁷⁹
- The value of time affects both copying and purchases of originals; a high value of time induces consumers to copy less and buy more.⁸⁰
- Controlling for other variables, copying is more prevalent among the young, non-whites, and males. Copying is more concentrated among the young than is purchasing.⁸¹

Consumer Welfare and Audio Home-Copying Restrictions

The contractor report by Fred Mannering⁸² estimates econometric models of consumers' purchase/taping choices and uses them as a

basis for determining the change in consumer welfare as a consequence of an audio home-copying ban.⁸³ Mannering's report provides a framework for a cost-benefit analysis of such a ban. His detailed analysis of the economic consequences of such a ban leads him to conclude that, at least for the short term, the ban's costs to the public outweigh its benefits to the recording industry, its workers, and artists.

While the scenario of a ban on home audiotaping might seem unrealistic, it can be used to explore possible differences between the levels of industry revenues, consumer welfare, and net social welfare in the present environment (with home audiotaping) and in a hypothetical world without taping. That is, it provides a means for estimating hypothetical short-term changes in recording-industry revenues *absent home taping*, under various assumptions about the extent to which taping displaces sales of recordings.⁸⁴ The primary contribution of Mannering's analysis is that it focuses attention on consumers' valuation of homemade tapes and thereby, *for the short term*, on the hypothetical decrease in consumers' economic welfare, *absent taping*.⁸⁵

⁷⁸See Johnson (1989), *op. cit.*, footnote 61, pp. 15-16 and 17.

⁷⁹The income coefficients for daily frequency and stock (but not last-month behaviors) are positive and statistically significant.

⁸⁰The employment coefficient for daily taping frequency is negative and significant but employment does not raise daily purchase frequency. The employment coefficient for stocks of originals is positive and significant; it is imprecisely estimated for stocks of copies. Therefore, it is difficult to find a substitution of copies for originals in the daily frequency data, and the stock data do not allow a definite conclusion concerning substitution.

⁸¹When other things are held constant, males are more likely to copy and buy. When other things are held constant, being nonwhite raises the frequency of copying and stock of copies; the effect on purchasing may be negative, but the coefficients are imprecisely estimated. Age exerts a very strong (and statistically significant) negative effect on all variables, with the effects on taping being larger than those on purchasing. The size of the reported stock declines rapidly with the individual's age, particularly for copied tapes.

⁸²"Consumer Welfare and Audio Home Taping: An Empirical Assessment," Fred L. Mannering, contractor report prepared for the Office of Technology Assessment, Feb. 13, 1989 (Springfield, VA: National Technical Information Service, October 1989).

⁸³For example, this "ban" could be the result of technological copy-protection.

⁸⁴These calculations are similar to the method that Townsend & Greenspan used for the RIAA studies, except that they indicate how different interpretations of the OTA survey data can support a range of values for the displacement rate, and produce a range of hypothetical revenue changes, rather than a single value.

⁸⁵Mannering's analysis is somewhat a mirror image of the recording industry's analyses: instead of estimating hypothetical losses to the recording industry due to home taping, he estimates the hypothetical gains to the industry and losses to consumers' welfare if taping were eliminated. The welfare loss to consumers is a monetary valuation of consumers' loss in satisfaction, without any loss in actual income, after a taping ban. Neither the Townsend & Greenspan nor the HRRC analysis reported any estimates of consumers' benefits from home taping.

Mannering notes that banning home audio copying has generally been promoted on the grounds that consumers' copying significantly reduces the recording industry's revenues, jobs, and royalties. But Mannering notes that many other factors must be considered in assessing the true economic consequences of a possible ban on home audio copying. Arguably, the most significant of these is that consumers will be less well off as a result of the ban, since it would eliminate the choice of an important audio format — home copies. To assess the magnitude of this loss, one would have to answer the following question:

How much would consumers have to be compensated after the ban to have them as well off, in terms of satisfaction, as they were before the ban?

Mannering's study focuses on obtaining a monetary measure of this hypothetical compensation by using data on consumers' choices of listening formats from the "last-listening" section of the survey (questions 9-28).

In their comments on Mannering's contractor report and on a draft version of this OTA report, representatives of the recording industry objected vehemently to this basic approach and the assumptions of this type of analysis. According to RIAA:

"...This analysis turns the home taping issue on its head. It assumes without explanation or documentation that consumers are or might be entitled to some form of compensation upon a ban of home taping. We object to the notion that revenues associated with the enjoyment of copyrighted music are 'up for grabs' and that they should be distributed away from copyright holders in favor of home

tapers and the hardware industry based on a detached 'consumer welfare' analysis."⁸⁶

By contrast, representatives of the consumer electronics and blank-tape industries considered Mannering's general approach the proper one to take. They noted, however, that because Mannering estimated hypothetical lost recording-industry revenues (that HRRC also considered to be overstated), he consequently understated society's hypothetical net loss from eliminating taping. According to HRRC:

"The paper by Fred Mannering adds an important dimension to the evaluation of home taping by focusing attention on the magnitude of welfare benefits to consumers of the home audio tapes they make... [but]...[t]his calculation *understates* dead weight loss. Only the profits of the industry and rents paid to copyright holders [not revenues] should be netted against consumer welfare effects to calculate dead weight loss."⁸⁷

This difference in views reflects the continuing and fundamental disagreement among stakeholders as to the legal status of home audio copying. Those who interpret the ambiguous state of the current law to mean that home taping is a violation of copyright quite reasonably view it inappropriate to consider lost "benefits" to which they contend consumers were never entitled. Those who interpret the current law to mean that home taping does not violate copyright will consider that such benefits should properly be taken into account in setting policy.

Disagreements of this sort underscore the ambiguity of the current law. Given that ambiguity, OTA considers it reasonable to examine the effects of home copying— or a copying

⁸⁶H. Rosen, RIAA, letter to J. Winston, OTA, May 2, 1989 (enclosure with comments on draft ch. 8, P. 4).

⁸⁷Gary J. Shapiro, Robert S. Schwartz, Steven R. Brenner, HRRC, memo to OTA with comments on economic issues, May 1, 1989, pp. 17-18.

ban—on consumers' welfare, industry revenues, and society's economic welfare. The last section of this chapter will present Mannering's calculations and other examples to illustrate the range of possible effects supported by the survey data.

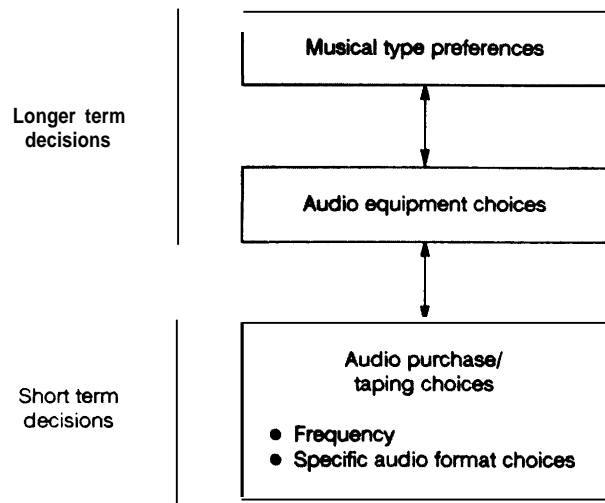
Analysis

Mannering's empirical analysis focuses solely on the consumer's choice between purchasing an original format (record, cassette, CD) and making a tape at home, on the basis of the format the consumer last chose to listen to.

The Audio Format Decision-Making Process⁸⁸—Mannering relates the effect of a home-taping ban on consumer welfare to each consumer's decision-making process in choosing among audio formats (records, prerecorded cassettes, copied or "made-tapes," or CDs). This decision-making process ultimately determines the value that consumers place on having the "made-tape" format as an available choice. The choice of a specific audio format is the last of three complex, interrelated, and time-variant decision processes (see figure 7-1):

1. *Musical type preferences*—classical, country and western, soul, heavy metal, rock, etc. These preferences evolve from cultural, social, and economic influences, and play a key role in the choice of audio equipment and in specific purchase/taping decisions since certain types of music tend to benefit more from use of higher-quality formats and audio equipment. In turn, musical-type preferences are influenced by consumers' existing stocks of audio equipment.
2. *Audio equipment choices*—CD player, car tape deck, stereo record player, etc.

Figure 7-1. - Overview of the Audio Format Decisionmaking Process



SOURCE: Mannering, 1989

Aside from the effect of musical-type preferences and socioeconomic, consumers' expectations about the frequency and purpose of equipment use are important factors in their choice of audio equipment.

3. *Purchase/taping choices*—frequency (the number of purchases and/or tapings made in some time period) and specific formats (records, prerecorded cassettes, CDs, or made-tapes). This choice differs from the other two, which are really much longer-term decisions. The purchase/taping choice is short-term in nature, and is the one audio-related decision that a taping ban would *immediately and most significantly* affect. Although the longer-term choices above influence the purchase/taping choice, other factors like format price, availability and use of substitute media (e.g., a car radio instead of a car tape deck), con-

⁸⁸See Mannering, *op. cit.*, footnote 82, pp. 2-4.

sumers' socioeconomic conditions and tastes, and expectations of usage (e.g., choosing a CD in anticipation of frequent play) also are significant.

General Study Approach and Limitations⁸⁹ – To comprehensively model the interrelated long- and short-term choices detailed above would require extensive panel data on the behavior of the same cross-section of consumers over time.⁹⁰ Absent such data, Mannering focuses only on the consumers' *short-term* decisions between purchasing or taping audio recordings. He uses a carefully constructed, cross-sectional survey of audio-related behavior to develop and estimate models to assess how a copying ban would affect social welfare. His necessary focus on consumers' short-term decisions imposes some limitations on subsequent welfare computations.⁹¹

The first types of limitation are *model limitations*. Because the model does not explicitly account for longer-term choices, Mannering cannot assess the effects of an audio home-copying ban on consumers' choices of audio equipment and musical-type preferences.⁹² Furthermore, he cannot estimate the changes in purchase prices of various formats that are likely to occur after such a ban.⁹³ Thus, his model must assume that consumers' musical type preferences and audio equipment stocks, as well as purchase prices, remain constant in the face of a home-copying ban. The effect of

this assumption on welfare estimates is ambiguous, primarily because industry pricing of recordings and audio equipment is not predictable. Another modeling concern arises from the interrelationship between the frequency of audio purchase/taping choices and the specific formats chosen. This interrelationship results from the fact that the frequency is, in part, a function of the satisfaction the consumer derives from specific purchase/taping format choices. Given this, frequency and individual choices should be modeled jointly, but this was not feasible. Therefore, estimates of changes in welfare require assumptions as to how the frequency of purchase/taping decisions will be affected by a home-copying ban.⁹⁴

The second types of limitations are survey *limitations* related to the "most-recent-listening-experience" approach taken in the survey. Consumers were asked to recall their most recent listening experience to determine the musical selection/format they listened to at that time, as well as the length of time they had owned that specific item. This creates two concerns. First, purchase/taping decisions that occurred many years ago are problematic – consumers may have had different musical tastes and stocks of audio equipment. To mitigate this, Mannering uses only purchase/taping decisions made during the year preceding the survey. Second, the "most-recent" approach is likely to uncover past purchase/taping decisions that resulted in format

⁸⁹See Mannering, *op. cit.*, footnote 82, pp. 4-7.

⁹⁰Ideally, these data would cover a period of years to ensure proper specification of the interrelationships among choices; they would be costly to collect.

⁹¹Modeling the longer-term choices of musical-type preferences and audio equipment requires socioeconomic, taste, and audio inventory information at the time such decisions were made, which may have been a number of years ago.

⁹²Without the home-taping option, consumers may adjust their audio equipment stocks, and perhaps even their musical type preferences (e.g., toward discounted types, in an effort to hold their audio budgets constant).

⁹³Estimating such price shifts would require a model that includes industry price behavior and consumer purchasing behavior to predict equilibrium format prices after the ban.

⁹⁴One would expect that the ban would lower the frequency because the taping alternative would be eliminated. Since at least some additional purchases are likely to be made, however, the net frequency will approach pre-ban levels.

choices that tend to be more heavily used. To the extent that usage and format are interrelated, some bias will be introduced in estimating the purchase/taping choice model and the subsequent changes in welfare.⁹⁵

Survey Results—Of the 1,501 completed survey interviews, 517 respondents provided data that Mannering could use in his analysis since they reported they had listened to recorded music they had acquired in the past year. In table 7-6, Mannering summarizes the statistics of these respondents, whom he divides into two groups – those having only record and tape audio equipment (400 respondents) and those having record, tape, and CD equipment (117 respondents). This segmentation reflects significant observed differences in purchase/taping behaviors.

Table 7-6 begins by presenting, for the last listening experience, the percentage of respondents choosing each of four formats: LP, prerecorded cassette, made-tape, and CD. Mannering's estimation results indicate that prerecorded cassettes are the preferred format among non-CD owners, whereas CDs are the preferred format among CD owners. For non-CD owners, the made-tape option is the least preferred; for CD owners, records and made-tape options are least preferred.⁹⁶ Comparing CD and non-CD owner format inventories (from survey question 29), Mannering finds that, on average, CD owners have larger

inventories of all formats; they also have substantially higher purchase frequencies, as indicated by the reported number of purchases in the last month. This suggests that individuals choosing to own a CD tend to be more active audio consumers. The socioeconomic comparison of the two groups offers few surprises: Mannering finds that CD owners tend to be younger and are more likely to have full-time employment and higher income than their counterparts who do not own CDs.

Econometric Framework and Estimation Results⁹⁷—Assuming that respondents select the purchase/taping format option that provides the most satisfaction, Mannering used a multinomial logit choice model of individuals' format choices.⁹⁸ He specified the format choice as a function of the format choice itself, the price of the format, the consumer's income, his existing format inventories, his stock of existing audio equipment, and other socioeconomic conditions (e.g., employment, education, etc.).

Mannering's estimated model fit the data well. Tables 7-7 and 7-8 show the estimation results for those who do not own a CD player and those who do, respectively. Most were statistically significant, as indicated by the t-statistic. Furthermore, Mannering was able to conclude that consumers viewed the prerecorded cassette and made-tape options as distinct.⁹⁹

⁹⁵This type of bias could be eliminated via standard econometric procedures for interrelated discrete/continuous choices. But these could not be used without a more extensive cross-sectional sample than this data set contains.

⁹⁶While "records" include LPs, EPs, and 45s, Mannering finds that LPs/EPs are the dominant choice among a majority of respondents. A relatively small number of people use 45s, but they tend to be relatively frequent purchasers with large inventories.

⁹⁷See Mannering, *op. cit.*, footnote 82, pp. 9-15.

⁹⁸For a description of logit models, see D. McFadden, "Econometric Models of Probabilistic Choice," in *Structural Analysis of Discrete Data with Econometric Applications* (Cambridge, MA: MIT Press, 1981); and K. Train, *Qualitative Choice Analysis: Theory, Econometrics, and an Application to Automobile Demand* (Cambridge, MA: MIT Press, 1986).

The method is somewhat analogous to a regression where the dependent variable – i.e., the format choice – is discrete, rather than continuous. A particular advantage is that the model can be shown to be consistent with utility-maximizing behavior.

⁹⁹Mannering used a specification test developed by Small and Hsiao. See Mannering (1989), *op. cit.*, footnote 82, p. 15; and K. Small and C. Hsiao, "Multinomial Logit Specification Tests," *International Economic Review*, vol. 29, No. 3, 1985.

Table 7-6.-Sample Summary Statistics (averages unless otherwise noted)

	Non-CD owners	CD owners
Percent choosing LP 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 CD format	—	51.27
Annual household income (dollars)	32,140	40,120
LP inventories	43.2	60.5
Prerecorded tape inventories	26.1	34.4
Made-tape inventories	14.7	29.1
CD inventories	—	27.6
Percent with car tape deck	74.3	86.3
Percent white/nonwhite	85/15	87/13
percent male/female	38/62	58/42
Age (years)	34.6	30.5
Education (years)	12.6	12.7
Percent with full-time employment	49	61
Number of LP, 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

SOURCE: Mannering, 1989

For the non-CD group, Mannering found a preference against made-tapes, relative to the record format option; this could reflect the time investment required for made-tapes.¹⁰⁰ Format price, relative to household income, had a highly significant negative effect on the probability of selecting a format. The total inventory of all formats was found to have a significant positive effect on the made-tape format choice that may have reflected the fact that active audioconsumers tend to have high usage rates of the made-tape option. The car tape deck indicator variable has the expected

sign (positive), with those consumers having a car deck being more likely to select tape formats (prerecorded cassette or made-tape).¹⁰¹ Finally, the sound-quality indicator (from survey question 14) demonstrates that those consumers in the non-CD group who considered that sound quality was extremely important were less inclined to select the prerecorded cassette option. This tends to support the popular notion that prerecorded cassettes offer inferior sound quality when compared with records or even made-tapes recorded from CDS on high-grade audiotape.

¹⁰⁰The non-CD group's slight relative preference for prerecorded cassettes over records was not statistically significant.

¹⁰¹In addition, whites were more likely to select tape options.

Table 7-7.-Multinomial Logit Estimation Results for Individuals Not Having a CD Player in Home or Car (t-statistics in parenthesis)

	Estimated coefficient
Constant for prerecorded tapes	<i>0.366</i> (1.0297)
Constant for made-tapes	-2.92 (-5.638)
Format purchase price (in dollars) divided by annual household income (in thousands of dollars)	-2.327 (-3.471)
Total record and tape inventory, defined for made-tape option only	0.0059 (1.76)
Car tape deck indicator (1 if have car tape deck, 0 otherwise)	0.7427 (2.59)
Race indicator defined for tape options (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 observation	400
Log-likelihood at zero	-439.44
Log-likelihood at convergence	-272.37

SOURCE. Mannering, 1989

This result is particularly interesting because the explicit survey questions about the perceived quality of various formats (question

Table 7-8.- Multinomial Logit Estimation Results for Individuals Having a CD Player in Home or Car (t-statistics in parenthesis)

	Estimated coefficient
Constant for prerecorded tapes	13351 (3 28)
Constant for made-tapes	-1012 (-1 .37)
Constant for compact discs	0 728 (1 .096)
Format purchase price (in dollars) divided by annual household income (in thousands of dollars)	1618 (2.00)
Sound quality indicator variable defined for prerecorded tape option only (1 if sound quality extremely important, 0 otherwise)	-0582 (-1 37)
Race indicator defined for compact disc option (1 if white, 0 otherwise)	1211 (1 91)
Classical music indicator defined for compact disc option only (1 if listen to classical music, 0 otherwise)	(
Full-time employment indicator defined for made-tape option only (1 if employed full time, 0 otherwise)	1 166 (1 54)
Number of observations	117
Log-likelihood at zero	162.20
Log-likelihood at convergence	12929

SOURCE. Mannering, 1989

15) and quality as a motivation for taping (question 45j) did not yield this result for the sample population as a whole.¹⁰²

¹⁰²Remember that Mannering's subsample of 517 (out of a possible 1,501) all had listened to recorded music they had acquired in the last year.

For the CD group, Mannering's coefficient estimates are broadly similar in terms of interpretation to those for the non-CD group. For this group, Mannering found on average a preference for prerecorded cassettes to records.¹⁰³ As with the non-CD group (and, as expected) the signs of the price/income variable and the (prerecorded cassette) sound-quality variables were negative. Mannering again found that race was a significant factor—perhaps as a proxy for other environmental/taste effects – with whites more likely to choose the CD format, when other things were held constant.

Mannering found that the classical music indicator showed that individuals who had chosen classical music (survey Q. 17) tended to select the CD option, apparently to take advantage of the CD's superior sound quality. Finally, he found that the employment indicator suggested that individuals with full-time employment have a preference for the made-tape option.¹⁰⁴

From these estimation results, Mannering calculated how consumers' choices of various formats would respond to increases in prices of the formats relative to annual income. He

reports these choice-probability elasticities in table 7-9 for respondents who do not own a CD player and in table 7-10 for those who do. All the elasticities have absolute values of less than 1;¹⁰⁵ Mannering concludes that these low elasticities most likely reflect the habitual use of formats and the significance of the longer-term factors of musical-type preference and audio-equipment stocks. Interestingly, the absolute values of the choice-probability elasticities for both of the tape format options (prerecorded cassette and made-tape) are smaller than for the LP records and CD options. This means that the shift in preferences away from one of the tape format choices would be smaller than the analogous shift away from the LP or CD option.¹⁰⁶

Consumer Welfare Effects of a Home Copying Ban¹⁰⁷—To determine the change in consumer welfare resulting from a ban on audio home copying, Mannering uses "*compensating variations*"—measures of how much money a consumer would have to be given after the ban, to be as well off in terms of satisfaction as before the ban.¹⁰⁸ He weighted these measures by consumers' reported purchase/taping frequencies.¹⁰⁹ This calculation yielded

¹⁰³Estimated coefficients indicating preferences for CDs relative to records and against made-tapes relative to records were not statistically significant.

¹⁰⁴The coefficient was not statistically significant at the 95-percent level. Mannering speculates that it may reflect the practice of custom taping for use in a car tape deck during the work commute.

¹⁰⁵Elasticity is defined as the percentage change in one variable with respect to a 1-percent change in the other. For example, the (non-CD) choice probability elasticity with respect to LP purchase price/household income (table 7-9) implies that a 1 percent rise in the price/income ratio will give roughly a 0.6 percent decrease in consumers' probability of choosing records in a purchase/taping decision (for the CD group (table 7-10) the decrease would be about 0.4 percent).

¹⁰⁶Furthermore, for CD owners, the made-tape choice was more inelastic than the prerecorded cassette choice. For non-CD owners, the made-tape choice was the more elastic. This contrast may reflect CD owners' option to make tapes from CDs.

¹⁰⁷See Mannering, op. cit., footnote 82, pp. 18-23.

¹⁰⁸Remember that the RIAA considers that because home taping infringes copyright, no compensation is due. (H. Rosen, RIAA, op. cit., footnote 86.)

¹⁰⁹See Mannering, op. cit., footnote 82, pp. 19-20. For details of the technique, see K. Small and H. Rosen, "Applied Welfare Economics with Discrete Choice Models," *Econometric*, vol. 49, 1981.

Table 7-9.—Choice-Probability Elasticity Estimates for Individuals Not Having a CD Player in Home or Car (t-statistics in parenthesis)

Elasticity with respect to:	Elasticity
LP purchase price (in dollars) . . . divided by annual household income (in thousands of dollars)	-0.592
Prerecorded tape purchase . . . price (in dollars) divided by annual household income (in thousands of dollars)	-0.214
Made-tape purchase price (in dollars) divided by annual household income (in thousands of dollars)	-0.312
Total record and tape inventory, . . defined for made-tape option only	0.346

SOURCE: Mannering, 1989

Table 7-10.—Choice-Probability Elasticity Estimates for individuals Having a CD Player in Home or Car (t-statistics in parenthesis)

Elasticity with respect to:	Elasticity
LP purchase price (in dollars) divided by annual household income (in thousands of dollars)	0.385
Prerecorded tape purchase price (in dollars) divided by annual household income (in thousands of dollars)	-0.332
Made-tape purchase price (in dollars) divided by annual household income (in thousands of dollars)	-0.221
CD purchase price (in dollars) divided by annual household income (in thousands of dollars)	-0.416

SOURCE: Mannering, 1989

a frequency-weighted average compensating variation of \$1.62— imposing a ban would result in a consumer-welfare loss of \$1.62 for each purchase/taping decision. This estimate assumes that the total number of purchase/taping decisions remains the same after the made-tape option is eliminated, and that the other options are unaffected by the ban.

This technique cannot account for the effects of long-term changes in musical-type preference, equipment stock, purchase/taping frequencies, or use of alternative media. Although the direction of the estimate bias induced by these effects is not clear, most of the excluded effects are longer-term in nature. This suggests that the compensating variation obtained under these assumptions will be a reasonable portrayal of actual short-term impacts— say, over the first year after the ban.¹¹⁰

The average *frequency-weighted* probability of selecting the made-tape option is 15.8 percent.¹¹¹ This implies that the consumer values each made-tape at \$10.25 ($\$1.62/0.158$)—a reasonable value given the current prices of records, prerecorded cassettes, and CDs, and the unique characteristics of made-tapes (potentially superior sound quality, option to combine songs by more than one artist, ability to customize by selecting only desirable songs, etc.). To understand the implications of this value, consider the average consumer making 10 purchase/taping decisions. On the basis of the 15.8 percent probability, this consumer can be expected to make 1.58 made-tapes per 10 purchase/tapings. Using Mannering's compensating-variation calculation indicates that in the short term — for example, during the first year after a taping ban— the consumer would have to be paid \$16.20 ($\1.62×10) to be as well off as before the ban.

¹¹⁰ This technique could also be used to evaluate other policies that might restrict, rather than eliminate home taping.

¹¹¹ Note that this is higher than the unweighted percentage choosing the made-tape option as indicated in table 7-6. This reflects the fact that the consumers in the sample with higher probabilities of choosing the made-tape option also have higher purchase/taping frequencies.

Estimating Hypothetical Industry and Consumer Effects Absent Taping

Previous analyses have not presented estimates of the economic effects of home audiotaping on consumers. Although the recording industry only considers lost revenues to be relevant for policy,¹¹² consumer effects are important when considering society's economic welfare. This section will evaluate three types of hypothetical effects:

- the change in recording-industry revenues (i.e., retail sales of albums or the equivalent), absent home taping,
- the change in revenues from blank-tape sales, absent home taping,
- the change in consumers' economic welfare, absent home taping, based on Mannering's estimates of the compensating variation and consumers' valuation of homemade tapes.

Calculations will use 1987 price and sales volume figures, consistent with the time period of Mannering's estimates. The hypothetical change in net economic welfare, absent home taping, can be estimated by combining the industry-revenue and consumer-welfare effects. This estimate will roughly approximate the net effect, because changes in industry profits and rents (i.e., recording and blank-tape industry profits and royalties to performing artists and copyright holders), rather than industry revenues, should be used. We are unable to obtain industry data with which to estimate price-cost margins, thus revenues are used. For illustrative purposes, a "ballpark" range for recording industry profits and rents will be provided, based on the 40-percent figure that

Greenspan presented in his testimony. OTA considers that this is an upper bound for recording-industry profits and rents.

The estimates in this section select a broad range of plausible values for the industry and consumer effects, but do not attempt to account for the fraction of music tapings that are fair use or are done by amateur or professional musicians, composers, etc.

On the basis of the number of home tapes assumed not to be made, we can use Mannering's compensating variation and the \$10.25 valuation of homemade tapes to estimate the hypothetical short-term decrease in consumers' economic welfare absent home music taping. On the basis of the assumed number of tapes that would not be made and the assumed sales displacement and/or sales stimulation effects of taping, the hypothetical short-term effects on recording-industry revenues can be estimated. Similarly, if blank tapes were not purchased to make home tapes, the hypothetical effects on blank-tape revenues can be estimated.

The same starting point –i.e., the number of blank tapes sold in a given year — can be used to produce a broad range of estimates. Calculations of this sort are necessarily inexact, since they rely on sequences of assumptions and approximations. Moreover, even the premises used to approximate the industry and consumer effects are subject to dispute.¹¹³ For a chosen framework, various approaches to interpreting and using survey and industry data are possible. Often, several alternatives are equally plausible, and the choice is subjective. Thus, analysts can disagree as to the "preferred" calculation.

¹¹²See above. This point was emphasized in the RIAA comments on a draft of this report.

¹¹³For example, depending on one's perspective as to the legal status of home taping, one might prefer a net-economic-welfare framework, as opposed to a focus only on recording-industry revenue effects. As we have seen, RIAA favors the latter approach, while HRRC favors the former.

Tables 7-11 presents ranges for the estimated industry, consumer, and net economic effects absent all home taping. Table 7-12 presents estimates absent home taping from prerecorded sources only. These examples show broad ranges of values, but the end points should not be interpreted as maximum or minimum values.

The calculations in table 7-11 are based on a range of conclusions about the hypothetical effects of a ban on home taping that the same set of survey data and other sources can be "shown" to support. The starting point for these is the number of blank tapes sold in 1987. The calculations are based on:

- Mannering's value for made-tapes,
- estimated 1987 average retail prices of \$7.80 per album-equivalent and \$2.45 per blank tape,
- a 1983 Audits and Surveys finding that 84 percent of blank tapes are used to record music, and
- the 1988 OTA survey finding that 79.6 percent of tapings use new blank tape.

The variations, a dozen examples in all, differ according to:

- whether an attempt is made to correct for business use of blank tapes,¹¹⁴
- how much sales-displacing material is assumed to be on each tape,¹¹⁵
- how the OTA survey questions on displacement are interpreted and/or dis-

counted to produce the displacement rate, and

- whether the ability to make home tapes is assumed to stimulate some purchases of prerecorded music.

The three variations categorized under (A) in table 7-11 follow the calculations in Mannering's contractor report, which considered the effects of a ban on music taping from both prerecorded and broadcast sources. Mannering used industry sales data from 1987 (the last year that complete data were available at the time of writing), along with some earlier survey results to augment the OTA survey.¹¹⁶ The sales data indicated that industry shipments of prerecorded formats reached an annual rate of 637 million album-equivalents in 1987, while roughly 388 million blank audiocassettes were sold. Mannering concluded that if as the 1983 Audits and Surveys results indicated, roughly 84 percent of blank tapes are used to record music, then some 326 million blank tapes were used to record music in 1987. Since the OTA survey data (question 43g) suggested that 79.6 percent of tapings used nonblank (preused) tapes, Mannering calculated that about 409.5 million blank and nonblank tapes were used to make home music tapes. On the basis of the OTA survey data, he also estimated that home tapes contained an average of 1.63 album-equivalents of material (questions 44d-44i).

From responses to survey questions 451 and 45n, Mannering determined that (for those respondents asked these questions), a net of about 4 of every 10 albums taped would have

¹¹⁴According to the HRRRC, some 10 percent of consumer purchases of blank tapes are for business use. Therefore, they argue, these are presumably not used for music taping and blank-tape sales should be adjusted accordingly. (Gary J. Shapiro et al., op. cit., footnote 87, p. 26.)

¹¹⁵Mannering estimated that home tapes contained on average 1.63 album equivalents. The HRRRC argues that consumers might not purchase all the recorded material on a home tape, if taping were not possible. (Ibid., p. 22)

¹¹⁶Audits and Surveys, "Home Taping in America," op. cit., footnote 11; A. Greenspan (Hearings on S. 1739), op. cit., footnote 9; International Tape/Disc Association, "Report on 1987 Blank Audio Cassette Sales" (New York, NY: ITA, 1988); Recording Industry Association of America, "News Release of Apr. 19, 1988 on 1987 Industry Shipments"; Warner Communications, Inc., "1981 Estimate of Loss Due to Home Taping," op. cit., footnote 11.

Table 7-11. — Hypothetical Changes Absent Home Music Taping (All Sources) — Short Term Only

Recording industry	A		B		C		D	
a. 1987 blank tape sales	388 M		388 M		388 M		388 M	
b. base (home use)	100%		100%		90%		90%	
c. % used for music taping	84%		84%		84%		84%	
d. # of blank tapes used	326 M		326 M		293 M		293 M	
e. % of music taping on blank tapes	79.6%		79.6%		79.6%		79.6%	
f. # of blank & non-blank tapes used for home music taping	409.5 M		409.5 M		368.5 M		368.5 M	
g. # of album-equivalents per home tape	1.63		1.0		1.0		1.0	
h. assumed sales								
i. # of displacing album-equivalents	38%	21%	38%	21%	38%	21%	38%	21%
j. average 1987 price per album-equivalent	254 M	140 M	156 M	86 M	140 M	77 M	140 M	77 M
k. hypothetical gross recording-industry displacement change	\$ 7.80	\$ 7.80	\$ 7.80	\$ 7.80	\$ 7.80	\$ 7.80	\$ 7.80	\$ 7.80
l. assumed sales	\$1981 M	\$1092 M	\$1217 M	\$ 671 M	\$1092 M	\$ 601 M	\$1092 M	\$ 601 M
m. 1987 shipments (album-equivalents)	0%	0%	0%	0%	0%	0%	2%	2%
n. # of lost sales (album-equivalents)	—	—	—	—	—	—	637 M	637 M
o. hypothetical recording-industry revenue stimulative change	—	—	—	—	—	—	13 M	13 M
p. hypothetical net recording-industry revenue change	\$1981 M	\$1092 M	\$1217 M	\$ 671 M	\$1092 M	\$ 601 M	\$1092 M	\$ 601 M
q. 40% as hypothetical net change in profits and royalties	\$ 792 M	\$ 437 M	\$ 487 M	\$ 268 M	\$ 437 M	\$ 240 M	\$ 396 M	\$ 200 M

(Continued on next page)

Table 7-11.–Hypothetical Changes Absent Home Music Taping (All Sources) – Short Term Only (continued)

Blank-tape Industry			
r	# blank tapes assumed not purchased for music taping (1987) (see item d above) . . .	326 M	293 M
s	1987 average price per blank tape	\$2.45	\$2.45
t	hypothetical revenue change absent music taping	-\$799 M	-\$718 M
Consumer welfare			
u	# of home music tapes not made (see item f above)	409.5 M	368.5 M
v	consumer valuation (per tape)	\$10.25	\$10.25
w	hypothetical consumer-welfare change absent music taping	-\$4197 M	-\$3777 M
x	Range of net economic welfare change (based on industry revenues) .	43015 M	TO - \$4440 M

NOTES:

a From industry sales data, International Tape/Disc Association (ITA), 1988

b According to the HRRC, about 10% of all consumer tape sales are for professional (not home) use

c From Audits & Surveys data, 1982

d $d = a \times b \times c$

e From OTA survey data, 1988

f $f = d/e$

g The 163 figure comes from OTA survey data, 1986 The HRRC argues that consumers might not purchase all the material on the made tape

h Various interpretations of OTA survey data, 1988 Mannering used the 38% and 21% figures, the HRRC suggested an alternative discounting yielding 5.4%

i $i = f \times g \times h$

j Calculated by Mannering from RIAA Market Research Committee data, 1988

k $k = i \times j$

l OTA survey does not yield a measure of this rate directly For sake of illustration, a 2% rate is assumed OTA data indicate that, for 44% of recent purchases, individual had heard selection from album or by the artist on

m Album-equivalent shipments from RIAA data, 1988

n $n = l \times m$ o $o = n \times \$(7.80)$ p $p = k + o$

q Townsend & Greenspan (1985) suggested that 40% of gross revenues went to company profits and royalty payments

r See (d)

s Calculated by Mannering from ITA data, 1988

t $t = -(r \times s)$

u See (f)

v Estimated by Mannering, 1989

w $w = (u \times v)$ x $x = p + t + w$

Table 7-12.-Hypothetical Changes Absent Home Music Taping From Prerecorded Sources - Short Term Only

Recording industry	E			F			G			H		
a total blank & nonblank tapes used for home music taping	409.5 M			409.5 M			366.5 M			366.5 M		
b. # of album-equivalents per home tape	1.63			1.0			1.0			1.0		
c. % of music taping from prerecorded sources	57%			57%			57%			57%		
d. assumed sales displacement rate	36%	21%	5.4%	36%	21%	5.4%	36%	21%	5.4%	36%	21%	5.4%
e. # of displacing album-equivalents	154 M	80M	80M	89M	49 M	13 M	80M	44M	11 M	80 M	44M	11 M
f. hypothetical gross recording-industry displacement change absent taping (@ \$7.60 ea)	\$1131 M	\$624 M	\$ 156 M	\$694 M	\$362 M	\$ 101 M	\$624 M	\$343 M	\$ 86 M	\$624 M	\$343 M	\$ 66 M
g. assumed sales stimulation rate	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%	2%
h. 1967 shipments (album-equivalents) . . .	-	-	-	-	-	-	-	-	-	637 M	637 M	637 M
i. # of lost sales (album-euivalents) . . .					-	-	-		.	13 M	13 M	13 M
j. hypothetical recording industry stimulative change absent taping . .							-	-		-\$101 M	-\$101 M	\$101 M
k. hypothetical net recording-industry revenue change absent taping	\$1131 M	\$624 M	\$ 156 M	\$694 M	\$362 M	\$ 101 M	\$624 M	\$343 M	\$ 66 M	\$523 M	\$242 M	-\$ 15 M
i. 40% as hypothetical net change in profits and royalties	\$452 M	\$ 250 M	\$ 62 M	\$278 M	\$ 153 M	\$ 40 M	\$ 250 M	\$ 137 M	\$ 34 M	\$209 M	\$ 97 M	-\$ 6M

Table 7-12.-Hypothetical Changes Absent Home Music Taping From Prerecorded Sources – Short Term Only (continued)

Blank-tape Industry		
m. # of blank tapes assumed not purchased from prerecorded sources (57% of tapings)	186 M	167 M
n. 1967 average price per blank tape	\$2.45	\$2.45
o. hypothetical revenue change absent music taping	-\$456 M	-\$409 M
Consumer welfare		
p. # of home tapes from prerecorded sources not made	233 M	210 M
q. consumer valuation (per tape)	\$10.25	\$10.25
r. hypothetical consumer welfare change absent music taping	-\$2366 M	-\$2152 M
s. Range of net economic welfare change (based on industry revenues)	\$1713 M	-\$2576 M

NOTES:

a See item f in table 7-11

b See Item g in table 7-11

c OTA survey data, 1988

d See item h in table 7-11

e $e = ax \cdot b \cdot cxd$ f $f = (\$7.50) \times e$ See item j in table 7-11

g See item l in table 7-11

h RIAA data, 1988

i $i = g \cdot xh$ j $j = (\$7.80) \times i$ k $k = f + j$

l See item q in table 7-11

m See item r in table 7-11, m = 326 M or 293 M times 57

n Calculated by Mannering from ITA data, 1988

o $o = -(m \times n)$ p $p = (0.57 \times a)$

q Estimated by Mannering, 1909

r $r = -(p \times q)$ s $s = k + o + r$

been purchased if home taping were not available.¹¹⁷ Only those respondents who answered “yes” to Q.45i—indicating that they thought they *could have purchased a recording with the same material, if they had wanted to*—were asked these “sales-displacement” questions. For the entire population, after accounting for perceptions about the availability of a prerecorded version, a net of about 2 of every 10 albums taped would have been purchased if home taping were not an option. Mannering presented calculations using both values.¹¹⁸ Some reviewers have subsequently argued that even the lower value greatly overstates the displacement rate that could be most plausibly inferred from the survey data. Drawing on the market research practice of halving the undiscounted “take rate” indicated by responses to questions like the two above, these reviewers suggested that a better assumption would be a 5.4 percent sales displacement rate.¹¹⁹ The “true” rate can be very confidently bounded by 0 and 40 percent. For each set of variations in table 7-11, hypothetical revenue increases have been calculated using displacement rates of 38, 21, and 5.4 percent.

Since fewer blank tapes would presumably be sold, absent home music taping, blank-tape revenues would decrease. Table 7-11 calculates this hypothetical revenue loss using an

estimate of \$2.45 for the average 1987 retail price.¹²⁰

Short-term consumer-welfare losses (i.e., in the first year) are based on the 409.5 million blank and nonblank tapes that will no longer be used for the made-tape option, valued at \$10.25 per foregone made-tape (see rows u-v of table 7-11). These estimated consumer losses exceed estimated industry revenue gains from the ban and produce a net economic loss to society.¹²¹

For the calculations in variation (B) of table 7-11, each made-tape is assumed to contain only one album-equivalent of material. In variations (C) and (D), the base of blank-tape sales is reduced by 10 percent to account for business use of blank tapes, under the assumption that these are not used for music taping. Also, variation (D) assumes that some sales of recordings are stimulated by the ability to make home tapes from them. Because the OTA survey does not allow this effect to be measured directly, a nominal value of 2 percent was selected for illustrative purposes; actual values may be higher or lower.

Note that the twelve variations used as examples produce a very broad range — by over a factor of 30— of hypothetical recording-industry revenue changes absent home audiotaping. These variations do not, however, alter

¹¹⁷ A net of 38 percent of taped albums were reported as would-be purchases. Respondents indicated that nearly 5 of every 10 roped albums are would-be purchases, but that one of these 5 would displace another purchase, leaving the net effect at nearly 4 out of 10. This is roughly the same figure reported by Warner Communications in 1982 and used in the Townsend & Greenspan analyses.

¹¹⁸ Mannering considered that the upper bound is the more reasonable one, because prerecorded formats could reasonably act as a substitute for a customized home tape, even if the material is not exactly the same (e.g., the custom tape might delete or add a single song, compared with an album).

¹¹⁹ Shapiro et al., *op. cit.*, footnote 87, pp. 25-27.

¹²⁰ Mannering determined the unit **tape** price from the 1984 figure (\$2.24) as reported by Greenspan and adjusted it to 1987 price levels by assuming an annual tape price inflation rate of 3 percent.

¹²¹ Table 7.11 approximates this as the sum of recording- and blank-tape industry revenue changes and the change in consumer welfare. Strictly speaking, industry profits and rents, not revenues, should be used. Therefore, table 7-11 overstates the industry effects.

To provide some perspective as to the magnitude of this loss, Mannering estimated that for net industry revenue gains (the sum of changes in recording- and blank-tape revenues) to exactly balance consumer welfare losses, the average consumer would have to receive only \$2.88 (as opposed to \$10.25) compensation to forego a made-tape choice, under the assumption of a 38-percent sales-displacement ratio. For a 21-percent ratio, the consumer would have to value the made-tape at only \$0.71, less than the price of a blank tape.

the qualitative result, which indicates a consistent lost in consumers' economic welfare and in society's economic welfare. Furthermore, blank-tape revenues decrease throughout.

Table 7-12 summarizes calculations similar to those in table 7-11, except that it only considers music taping from prerecorded sources. The OTA survey indicated that some 57 percent of home audiotapings are from prerecorded sources (see ch. 6). In table 7-12, although blank-tape revenues decrease throughout, the losses are smaller because fewer sales are lost. Consumers' economic welfare losses are smaller because only 57 percent of home tapes are not made; similarly, the net economic loss to society is smaller than in the examples in table 7-11.

Thus, although home taping may reduce the recording industry's revenues, a ban on home audiotaping would be even more harmful to consumers, and would result in an outright loss of benefits to society, at least in the

short term, in the billions of dollars.¹²² The longer-term consequences of such a ban are less clear, and would depend on how the recording industry's profits were invested, how additional revenues would affect creativity, how recording companies chose to price their products, what new technologies were developed, and how consumers' tastes changed. **In the long term, the net effects on society's economic welfare might be positive or negative.**

Mannering's analysis suggests that the social costs of a home-taping ban can be significant in the short term, but that the range of possible effects is very broad. Moreover, the long-term effects are ambiguous, depending on responses by the recording industry and society's valuation of any additional works that are produced, absent home taping. The possible net effects (on industry and consumers) must be given careful consideration in policy formulation. **It is potentially misleading to base policy on an estimate of one of several harms or benefits.**

¹²²Even ignoring effects on blank-tape revenues, the loss to society from a ban would be in the \$2-\$3 billion range (depending on the sales-displacement rate used).