

Music File Sharing and Sales Displacement in the iTunes Era

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Abstract

A growing empirical literature examines the relationship between music file sharing and legal purchases of music, but existing studies examine the period before consumers had attractive legal digital a la carte options. The iTunes Music Store has grown quickly since its appearance in 2003, and digital music now accounts for a third of US recorded music sales. Using a new survey of University of Pennsylvania undergraduates, we ask how music file sharing and sales displacement operate in the iTunes era, when the alternative to file sharing is purchasing individual songs, rather than entire albums. We find large amounts of file sharing in this population. Respondents have more stolen than paid music, but the music obtained via file sharing is, for the most part, low-valuation music which the respondents would likely not have purchased. The rate of sales displacement implied by the relationship between stolen and purchased music across respondents is between -0.15 and -0.3. That is, an additional song stolen reduces paid consumption by between a third and a sixth of song. Perhaps surprisingly, this is about the same as the CD sales displacement rate found for the pre-iTunes era using a similar empirical approach on a similar study population.

A growing empirical literature examines the relationship between music file sharing and legal purchases of music. Most inquiries find large amounts of file sharing activity and small rates of displacement, generally less than a one-fourth reduction in sales per stolen piece of music. An important shortcoming of the existing empirical literature is its focus on the period before consumers had attractive legal digital options. Since Napster's appearance in 1999, digital distribution on the Internet made it possible for consumers to conveniently steal individual songs. Apart from some unsuccessful forays into digital distribution, the music industry's best legal option was a physical CD. The US launch of the iTunes Music Store in 2003 gave consumers a new legal option, a single song available legally for \$0.99. The iTunes Music Store has grown quickly and dominates digital sales. As of 2008, digital music accounted for 32 percent of recorded music sales in the US, three quarters of which were sold at the iTunes Music Store.¹

This paper asks whether the availability of a convenient – and widely adopted – outlet for purchasing a la carte digital songs has affected either the volume of unpaid consumption or the rate of displacement of paid by unpaid consumption. In 2002 a consumer faced a choice between stealing, say, three songs and buying a 12-song CD that contained a few songs he or she wanted bundled with 9 more that he or she did not. Since 2003, consumers have faced a song-by-song choice between stealing and a la carte purchase for about \$0.99.² Using a new survey of University of Pennsylvania undergraduates, we ask how music file sharing and sales displacement operate in the iTunes era.

¹ See the RIAA's 2008 Yearend Shipments, at <http://76.74.24.142/1D212C0E-408B-F730-65A0-C0F5871C369D.pdf>, accessed June 17, 2009.

² After selling songs exclusively for \$0.99, the iTunes Music introduced tiered pricing, at \$0.69 and \$1.29, as well as \$0.99, in 2009. Amazon sells songs at various prices, including \$0.89 and \$0.99. See <http://arstechnica.com/apple/news/2009/01/apple-labels-both-win-with-drm-free-itunes-tiered-pricing.ars>, accessed June 17, 2009.

The paper proceeds in three sections following the introduction. Section 1 provides a simple theoretical framework, describes the historical background, from the appearance of Napster in 1999 to the appearance and growth of the iTunes Music Store since 2003, and makes reference to the existing empirical literature. Section 2 describes the survey data collected for this study, and section 3 presents results on sales displacement as well as the welfare effects of file sharing. A brief conclusion follows.

We find large amounts of file sharing in this population. Respondents have more stolen than paid music. But the music obtained via file sharing is, for the most part, low-valuation music which the respondents would likely not have purchased. The rate of sales displacement implied by the relationship between stolen and purchased music across respondents is between -0.15 and -0.3. That is, an additional song stolen reduce paid consumption by between a third and a sixth of song. Perhaps surprisingly, this is roughly the same as the CD sales displacement rate found for the pre-iTunes era using a similar empirical approach for a similar study population.

I. Background

1. Theory

If music has a positive price – as it continues to, even with iTunes – the music market can be represented by a figure like Figure 1: A downwards-sloping demand curve, showing the distribution of valuations that consumers place on songs, along with a fixed positive price p . Given this setup, the quantity sold is q . The area above the price and below the demand curve is

consumer surplus, pq is revenue, and the area below the demand curve to the right of q is deadweight loss.

The question of whether file sharing depresses sales is the question of whether the songs obtained via file sharing would otherwise have been purchased (along the demand curve with valuations above p). If they are the songs with valuations above the price, then file sharing displaces sales. If they are songs with valuations below the price – and would otherwise not have been consumed – then file sharing does not displace sales. In addition, if stolen songs would otherwise not have been purchased, then file sharing raises consumer welfare without reducing industry revenue (see Rob and Waldfogel, 2006).

File sharing may also shift the demand curve out and can, in principle, stimulate legal purchases, via a few different mechanisms. First, because music is an experience good, it is possible that file sharing allows consumers to sample which, in turn, informs them about what to purchase. That is, sampling may be an inducement to purchase. In addition to the possibility that file sharing overcomes information problems, the sampling of a particular song may stimulate demand for other songs by the artist. Shapiro and Varian (1999) explore these and related arguments.

Second, file sharing can facilitate purchase by aggregating valuations for purchasing entities. If you and I are each willing to pay \$0.60 for a song priced at \$1, neither of us will purchase it alone. If we form a music sharing club, then inside the club, music is a public good. The value of the song to the club is our collective willingness to pay, which exceeds the price, so the club buys the song where each of its members would not have (Bakos, Brynjolfsson, and Lichtman, 1999). Of course, sharing can increase sales via this mechanism only if sharing

remains small-scale. If everyone can share songs with everyone else – the club includes all consumers on earth - then while the club may be willing to buy many songs, the club may also be the only purchaser.

The availability of free a la carte downloads may have changed some consumers' willingness to pay for music. Figure 2 depicts indifference curves and consumption opportunities for a consumer before and after Napster. The lower indifference curve describes the consumer's willingness to pay for legal copies of recorded songs when piracy is not possible. The curve depicted passes through the money endowment $(AOG, \text{songs}) = (100, 0)$ and also passes below $(85, 12)$, so the consumer would be better off paying \$15 to obtain the album than without the album.

When illegal songs appear at a zero price, the consumer's willingness to pay for the closely related legal product is compromised. (Illegal songs are a substitute for legal songs, but not a perfect substitute. Hence the indifference curves for legal music change). The new indifference curve passing through $(100, 0)$ passes above $(85, 12)$, so the consumer does not purchase the album. However, points associated with 1, 2, 3, and 4 songs lie above the new indifference curve, indicating that this consumer would be willing to pay for songs. Thus, the appearance of file sharing technology might have different effects on sales, depending on whether the legal option was a 12-song CD or a la carte songs.

This is of course entirely hypothetical, but the point is that for some range of changes in willingness to pay for legal music, the effect of file sharing on songs and albums may be different. It is easy to think of a circumstance in which file sharing would hurt album sales more than it hurts songs sales.

After Napster but prior to the availability of a legal a la carte option, consumers faced a choice between buying a CD containing roughly 12 songs for \$15 and obtaining songs (illegally) individually at a zero price. To make matters worse for the legal option, of the 12 songs on the CD, typically only a few were known to the consumer prior to purchase.

2. History

Napster appeared in 1999, allowing consumers to share large quantities of stolen music anonymously. The service grew rapidly, attracting the attention of the music industry. The Recording Industry Association of America (RIAA) successfully sued and shuttered Napster in 2000. Other file sharing services that did not rely on a centralized database appeared in its place, and file sharing continued on a large scale. In addition to suing Napster, the industry pursued a demand-based strategy, suing individual involved in downloading and uploading music (Blackburn, 2004; Bhattacharya, et al 2006).

While a few firms appeared selling music legally quickly – eMusic in 1998 and MP3.com in 1997 – the major labels offered digital products more slowly. In 2001 the major labels participated in two significant attempts to sell digital music, MusicNet and Pressplay, that aimed to provide consumers appealing options to unpaid file sharing.

RealNetworks' MusicNet, with participation from three major label owners: AOL Time Warner, Bertelsmann, and EMI, was introduced in 2001. Customers paid \$9.95 per month and could download up to 100 songs to their computers. MusicNet's library included 75,000 tracks in 2001.³ While users could download 100 songs for \$9.95, the songs could not be put on

³ Associated Press, "Labels target Napster fans with for-pay MusicNet," USA TODAY, December 4, 2001. (<http://www.usatoday.com/tech/news/2001/12/04/musicnet-launch.htm>)

portable players or burned to CD, and they expired after 30 days. Consumers were renting rather than buying music, and they could not listen away from the computer.

Pressplay, a joint venture of Sony and Vivendi Universal, was launched in 2001, and it also included significant controls on consumer use of the music. Users were initially allowed 50 downloads and 500 streams. In 2002 Pressplay changed its offering to allow consumers unlimited downloads at a price of \$179.40 per year. Michael Goodman, a senior research analyst at The Yankee Group said, of Pressplay's product liberalization: "[i]t's a recognition that their previous offering didn't resonate with consumers. And it shouldn't have--faced with the choice between unlimited content for free (through file-swapping services) or limited content that people couldn't do much with--it was a no-brainer."⁴

Neither MusicNet nor Pressplay caught on with consumers, apparently because of the limited flexibility users had over the music they purchased. According to a 2002 account of Pressplay and MusicNet in CNET News, the services had: "spent the last seven months trying to persuade consumers to pay for music subscription services instead of downloading them from peer-to-peer services. But to win licenses from the major labels, these services have imposed strict limitations on what consumers can do with their music, which heavily undermines their appeal."⁵

A 2003 account in the UK Guardian summarized the reasons for these services' failure: "Pressplay and MusicNet, its equivalent backed by EMI, Bertelsmann and Warner Music, were launched in an attempt to head off the threat of peer-to-peer services such as Kazaa and Grokster, which allow users to swap pirated tracks over the web. However, they failed to find favour with

⁴ Quotes in this paragraph are drawn from Borland, John, "Pressplay to offer Unlimited Downloads," CNET News, July 31, 2002.

(<http://news.cnet.com/2100-1023-947507.html>)

⁵ See Borland, John, "Pressplay to offer Unlimited Downloads," CNET News, July 31, 2002.

(<http://news.cnet.com/2100-1023-947507.html>)

the public, who were unprepared to pay a set monthly subscription fee for a limited number of tracks with heavy restrictions on the way they could be transferred to CD and portable players.”⁶

Apple’s iTunes launched in 2003 with a large library of tracks sold a la carte for \$0.99, and it grew quickly. iTunes offered 200,000 tracks by May 2003.⁷ Users could listen to songs on their computers or on their iPod portable devices. The iTunes music store had sold 125 million songs by September 1, 2004. They sold their billionth song in February 2006, and they sold their 5 billionth song in June 2008. The iTunes music store accounted for 70 percent of digital music sold worldwide in 2008.⁸

Four years after Napster, the iTunes Music Store offered a legal option appealing enough to draw users away from illegal options. Authorized digital music sales have grown from negligible quantities prior to 2003 to a substantial source of revenue. According to the IFPI, digital revenue grew from \$0.4 billion in 2003 to \$2.9 billion in 2007 (in trade rather than retail terms).⁹ Digital music made up a third of US recorded music sales in 2008.¹⁰

3. Existing Literature

A growing empirical literature examines the effect of file sharing on sales of recorded music. There are three basic approaches. Some studies examine the relationship between file sharing and sales across albums (Oberholzer-Gee and Strumpf, 2007). Others look across countries over time (Hui and P’ng, 2003). Still others look at individuals’ purchase and stealing

⁶ Gibson, Owen, “Napster owner buys Pressplay,” Guardian UK, May19, 2003.

(<http://www.guardian.co.uk/media/2003/may/19/digitalmedia.arts/print>)

⁷ Wilcox, Joe, “iTunes store: More than 1 million sold,” ZDNet News, May 5, 2003. (http://news.zdnet.com/2100-3513_22-129147.html)

⁸ Van Buskirk, Eliot, “iTunes Store May Capture One Quarter of Worldwide Music by 2012,” Wired Magazine, April 27, 2008. (http://www.wired.com/entertainment/music/news/2008/04/itunes_birthday).

⁹ International Federation for Phonographic Industry’s Digital Music Report, 2008, p.6.

¹⁰ See RIAA Year-End Shipment Statistics, at <http://76.74.24.142/1D212C0E-408B-F730-65A0-C0F5871C369D.pdf>, accessed June 17, 2009.

activity, asking whether people who steal more purchase less or more (Zentner, 2006; Rob and Waldfogel, 2006). The latter approach tends to give the largest estimates of sales displacement. Best available estimates vary between 0 and -0.3.

Although file sharing has attracted considerable research interest, to my knowledge all of the studies of the effect of file sharing on legal sales use data drawn from the period before iTunes provided a well-known legal source selling a la carte songs. For example, Oberholzer-Gee and Strumpf (2007) covers September – December, 2001, Rob and Waldfogel (2006) covers the period 1999-2003, Zentner (2006) covers October 2001, Bhattacharia, et al (2006) covers March 2003-March 2004, Hong (2007) covers 1996-2002, Blackburn (2004) covers September 2002 – September 2003, Bounie, Bourreau, Waelbrock (2004) cover May – June 2004 in France, and Hui & P'ng (2003) cover 1994-1998.

The landscape of legal and illegal alternatives has changed substantially since the behavior documented in these studies, and we may have little basis for evaluating file sharing in the iTunes era.

II. Data

In the second week of January, 2009, nearly 500 students in a Wharton undergraduate managerial economics class took an online survey asking them to indicate one of the following statements about each of 50 songs: 1) I do not have a copy, 2) I have a legal digital copy, 3) I have a legal physical copy, 4) I have a “shared” copy, 5) I have access through a subscription service. Respondents were also asked to indicate their willingness to pay for each of the 50 songs. The 50 songs included both the top 25 songs based on iTunes sales at the time of the

survey, plus the top 10 songs that had appeared in a prior survey administered in August 2008, plus 15 songs drawn randomly from those ranking 26-100 at iTunes at the time of the survey. Each student gave responses about the same 50 songs. We received form-of-ownership responses from 328 individuals.

As Table 1 indicates, the most widely held song was Coldplay's "Viva la Vida." A quarter of respondents own a legal copy, and an additional 18 percent have a shared copy. This is one of relatively few songs for which legal ownership is more common than possession of a shared copy.

Table 2 reports average holdings of purchased and shared songs (among the 50 in the sample). Respondents have legal copies of an average of 5.54 songs and shared copies of an average of 6.71 songs. They have access to an average of 1.97 songs via subscription services. Respondents average 19.3 years old, and two thirds are male. Men steal slightly more songs than women in this sample, and women buy more than men. Men have access to more songs through subscription services.

A comparison with a similar survey administered to Penn students five years earlier is instructive. In that survey, Penn students reported having as much unpaid music as paid music. That is, respondents indicated that they had purchased an average of 7.2 from a list of 261 popular albums released between 1999 and the time of the survey in early 2004. They reported having stolen an equal number of albums. Respondents from other universities in that study stole much less, relative to their legal purchases. Respondents from City College of New York had purchased 10.2 and stolen 3.2; respondents from Hunter College purchased 11.1 and stole

1.7, and master's degree students at the University of Chicago purchased 8.2 and stole 2.3 (see Rob and Waldfogel, 2006).

While some students in the current Penn sample only purchase music and others only steal, many engage in both forms of acquisition. Of the 318 respondents who either bought or stole songs on the list, a third (110) did both, 104 only bought, 77 only stole, 37 neither bought nor stole songs (but only had subscription access).

The Penn samples are, of course, not representative of the underlying US population. But studying this population has two advantages. First, this is a highly Internet-connected population familiar with both file sharing and legal digital music. Hence, it is a good population for studying sales displacement and one that might reveal patterns before they are visible in more representative populations. Second, because file sharing has been studied on an analogous population previously, a comparison of the present results with previous studies can isolate the effect of the what's new here, the presence of digital a la carte options on sales displacement.

III. Results

In this section we ask two questions of the data. First, how do the valuations for shared songs compare with valuations of purchased songs? The purpose of the question is to determine whether consumers are downloading high-valuation songs (in which case file sharing would cause substantial sales displacement) or low-valuation songs, in which file sharing might not depress sales. Second, we examine displacement directly, asking whether respondents who possess more stolen songs purchase fewer songs.

Table 3 reports regressions of (log) valuation on a dummy indicating the song was obtained via file sharing. Included in the sample are observations where the respondent possesses the song (either a purchased digital or physical copy or a stolen digital copy). Shared songs are valued \$0.71 (45 percent) less than purchased songs. It is possible that this arises because the particular songs shared are low-valuation songs overall. To address this, we include song dummies in columns 2 and 5. Songs matter: lower-valuation songs are more likely to be possessed as shared copies. But even controlling for song, shared songs are valued \$0.29 (29 percent) less. Finally, it is possible that persons who engage in sharing value music less than persons who purchase. To address this we include both song and person fixed effects in columns 3 and 6. Still, even within person – and controlling for song – respondents value their shared songs at \$0.23 (25 percent) less than the songs they have purchased. These results are similar to results in Rob and Waldfogel (2006), where shared albums were valued about 40 percent less than purchased albums and about 20 percent less in specifications with individual fixed effects. The lower valuation of shared songs suggests that more shared than purchased songs have valuations below their \$0.99 price and, in turn, that stolen songs would be drawn disproportionately from those formerly not purchased. Or, in short, the lower valuation of shared songs suggests sales displacement less than 1:1.

Our data allow us to examine file sharing directly by asking whether persons who have downloaded more of the sample songs have purchased fewer of them. That is, we can run regressions of the form:

$$B_i = \alpha S_i + X_i \beta + \varepsilon_i,$$

where:

B_i = the number of songs purchased by respondent i ,

S_i = the number of songs stolen by respondent i ,

X_i = characteristics of person i relevant to their demand for music,

ε_i = unobserved determinants of person i 's music purchases, and

α and β are parameters.

We are concerned that people who like music like to purchase music and to steal it, which would tend to give rise to a positive relationship between B and S . We have a number of strategies for addressing this concern.

First, our data include two direct measures of interest in music. First, we ask students to report their level of interest in music on a 5-point scale. Second, our data include the size of their music collections.

Table 4 reports regressions of B on S , along with measures of music interest, gender, and age. Column (1) includes all observations, and the coefficient is -0.27, indicating that persons with 4 additional shared songs purchases one fewer. Columns (2) and (3) distinguish by gender, generating larger displacement estimates for women (-0.35) versus men (-0.22). The last two columns distinguish by level of interest in music. Individuals with lower interest in music have a displacement coefficient of -0.22, while those with higher interest have a displacement coefficient of -0.42.

Although these regressions include measures of interest in music, there is reason for concern that unobserved heterogeneity in interest in music would bias the coefficients away from findings of displacement.

One way to address this concern is through the use of panel data, with observations on B and S at various points in time for the same person. Then we could ask whether respondents who experience a larger increase, say, in their stealing experience a smaller increase in their paid consumption. Because the data cover both the current top 25 songs as well as the top 10 songs from 6 months earlier (along with 15 more songs chosen randomly from among the current 26-100), we can implement a panel strategy. Index the three groups of songs by g. Then consider the model

$$B_{ig} = \theta_i + \theta_g + \alpha S_{ig} + \varepsilon_{ig},$$

where the theta's are person and group fixed effects. Theta (i) is the unobserved individual interest in music (common across groups of songs). After accounting for a person's interest in music – which can affect both his interest in buying and stealing music – as well as the differential appeal of the different groups (the group thetas) the approach asks whether people who steal more in a group purchase less from that group.

Table 5 reports estimates. The overall estimate, in column (1), is -0.15 (just over half the analogous value in Table 4). Across the columns, the longitudinal estimates maintain that relationship, i.e. they are roughly half the size of the cross sectional estimates. All are precisely enough estimated to be significantly different from zero. It is perhaps surprising that the longitudinal estimates, which are arguably purged of unobserved individual tastes for music,

suggest smaller displacement than the cross sectional estimates. It is possible that the longitudinal approach introduce measurement error which biases coefficients toward zero.

We conclude this section noting that the range of displacement estimates emerging from this survey is between 3-to-1 and 6-to-1. Perhaps surprisingly, these are roughly the same size as the estimates reported in Rob and Waldfogel (2006) for the pre-iTunes era.

1. Welfare effects of file sharing.

Regardless of which of the above approaches we choose, our displacement estimate below 1 (in absolute value) indicates that much of the music people consume without paying would otherwise not have been purchased. In other words, much of the unpaid consumption represents regions of the area under the demand curve that would otherwise have been deadweight loss (products that would not have been consumed despite having value in excess of its zero marginal cost). Our valuation data allow us to calculate the welfare effects of file sharing more directly.

In the current regime, in which file sharing is possible, consumers purchase an average of 5.54 songs and steal an average of 6.71. Purchased songs have an average valuation of \$2.76. Given a price of \$0.99, the per-song consumer surplus for purchased songs is \$1.77. Unpaid songs have an average valuation of \$2.04, all of which is surplus. Hence, in the current regime, consumer surplus is \$23.49 per person, revenue is \$5.48, and there is no deadweight loss.¹¹

Our displacement estimates range from a third to a sixth. Our higher displacement estimate of -0.28 implies that consumers would buy 7.42 songs in the absence of file sharing.

¹¹ Among the songs either bought or stolen in the file sharing regime there are, by construction, no songs not purchased despite having valuation in excess of marginal cost.

(We obtain this as their current purchases, plus the displacement rate times their current stealing). At \$0.99 per song, revenue would rise to \$7.34. If the average valuation of purchased songs remained at its current level – implying that the more highly valued of the currently stolen songs were instead purchased – then consumer surplus from purchased songs would rise, but consumer surplus overall – which formerly included unpaid songs – would fall to \$13.13. Deadweight loss would rise from zero to \$8.50 per person.¹² See Table 6.

To say all of this another way, using the high end of displacement estimates, file sharing raises per capita consumer surplus by \$10.36. Of this, \$1.86 is producers' lost revenue, and \$8.50 is reduced deadweight loss. At the other end of our displacement estimates (-0.15), we find that file sharing raises per capita consumer surplus by \$11.91, of which \$1.00 is revenue lost by sellers and \$10.91 is reduced deadweight loss.

In this sample, as in most other studies of the effect of file sharing, stolen music reduces purchased music, by between 0.15 and 0.28 per stolen song. But as in some previous studies, the welfare benefit to consumers far exceeds the cost to producers. It should be mentioned yet again, however, that this welfare benefit is only possible if revenue is sufficient to attract production in the first place.

IV. Conclusion

In the past few years, legal digital distribution has emerged as an important music sales channel, currently accounting for about a third of revenue in the US, the bulk of which is sold

¹² If the valuation of purchased songs remains the same, then the valuation of the songs not purchased when file sharing is not possible $(2.04 - 0.28 * 2.76) / (1 - 0.38) = 1.76$.

through the iTunes Music Store. While the availability of a la carte songs through an appealing interface might have been expected to stem piracy, our findings suggest otherwise. First, the level of file sharing exceeds the level of purchased music. Second, the rate of displacement, while far below 1:1, is about as high the level estimated for the period prior to the availability of a legal attractive a la carte option.

Even in the iTunes era, file sharing continues to be popular among a connected population of college students. Students' libraries include more stolen than purchased songs. Our estimates of sales displacement indicate that each unpaid song reduces paid consumption by between a sixth and a third of a song. This is about the same rate of displacement obtained using a similar approach – and a similar sample – before the iTunes era. The iTunes Music store has substantially changed music retailing. But based on this sample of songs and consumers, it does not seem to have changed the effect of piracy.

By construction, file sharing increases consumer welfare from already-existing songs. For our range of displacement estimates, in conjunction with information on the relative valuations of purchased and shared music, the vast majority of the gain to consumers – between 80 and 90 percent – comes from reduced deadweight loss, while the remainder is lost revenue. As mentioned above, however, while the benefit to consumers exceeds the cost to producers, this welfare benefit is only possible if revenue is sufficient to attract production in the first place.

Table 1: Modes of Access and Valuations, by Song

Song	Possess a legal copy	Possess a “shared” copy	Access via streaming	Mean valuation	Median valuation
7 Things - Miley Cyrus	3.60%	6.00%	2.60%	\$0.36	\$0.00
American Boy (feat. Kanye West) - Estell	14.70%	17.30%	3.20%	\$1.37	\$1.00
Burnin' Up - Jonas Brothers	4.20%	4.60%	2.40%	\$0.43	\$0.00
Can't Believe It (feat. Lil Wayne) - T-P	7.00%	10.00%	3.00%	\$1.06	\$0.50
Chicken Fried - Zac Brown Band	1.40%	1.20%	2.40%	\$0.52	\$0.00
Circus - Britney Spears	6.10%	8.10%	2.00%	\$0.71	\$0.19
Closer - Ne-Yo	8.60%	15.50%	3.20%	\$1.04	\$0.50
Corona and Lime - Shwayze	4.80%	7.20%	3.20%	\$0.58	\$0.25
Dead and Gone (feat. Justin Timberlake)	6.80%	9.20%	3.20%	\$1.02	\$0.50
Decode - Paramore	2.80%	2.80%	2.40%	\$0.80	\$0.00
Disturbia - Rihanna	14.90%	18.70%	3.00%	\$1.64	\$0.88
Don't Trust Me - 3OH!3	2.60%	3.20%	2.40%	\$0.49	\$0.05
Eye of the Tiger - Survivor	14.30%	15.10%	2.60%	\$1.42	\$0.85
Fall for You - Secondhand Serenade	5.20%	5.00%	2.60%	\$0.70	\$0.25
Flashing Lights - Kanye West	18.70%	16.90%	2.80%	\$1.50	\$0.75
Forever - Chris Brown	15.90%	17.70%	2.80%	\$1.51	\$0.80
Gives You Hell - The All-American Reject	4.90%	4.00%	2.20%	\$0.62	\$0.20
God Love Her - Toby Keith	1.60%	1.80%	2.00%	\$0.29	\$0.00
Gotta Be Somebody - Nickelback	3.80%	4.60%	3.20%	\$0.83	\$0.20
Heartless - Kanye West	14.40%	15.80%	3.00%	\$1.60	\$0.97
Hot N Cold - Katy Perry	10.10%	14.20%	2.60%	\$1.40	\$0.60
Human - The Killers	7.40%	8.00%	2.40%	\$1.34	\$0.50
I Don't Care (Single Version) - Fall Out	3.00%	2.80%	2.60%	\$0.45	\$0.10
I Hate This Part - The Pussycat Dolls	2.80%	4.80%	2.60%	\$0.68	\$0.00
I Kissed a Girl - Katy Perry	11.80%	18.30%	2.80%	\$1.27	\$0.50
If I Were a Boy - Beyonc	5.60%	9.40%	3.40%	\$1.11	\$0.50
I'm So Paid - Akon, Lil Wayne & Young Je	6.20%	9.20%	2.80%	\$1.42	\$1.00
I'm Yours - Jason Mraz	14.80%	15.60%	3.20%	\$1.01	\$0.40
Just a Dream - Carrie Underwood	2.40%	2.20%	3.00%	\$2.09	\$0.95
Just Dance - Lady GaGa & Colby O'Donis	11.10%	15.80%	3.20%	\$0.37	\$0.00
Let It Rock - Kevin Rudolf & Lil Wayne	11.00%	13.80%	3.40%	\$1.75	\$0.75
Live Your Life (feat. Rihanna) - T.I.	18.00%	16.80%	3.40%	\$1.99	\$1.00
Love Lockdown - Kanye West	14.40%	16.80%	4.20%	\$1.49	\$1.00
Love Story - Taylor Swift	6.10%	7.90%	3.00%	\$0.84	\$0.25
Mad - Ne-Yo	4.80%	8.80%	2.60%	\$0.76	\$0.25
Mercy - Duffy	2.40%	4.80%	2.40%	\$0.62	\$0.05
Paper Planes - M.I.A.	17.70%	22.50%	2.80%	\$1.79	\$1.00

Pen & Paper - The Red Jumpsuit Apparatus	1.40%	1.80%	1.80%	\$0.37	\$0.01
Rehab - Rihanna	6.80%	7.40%	2.80%	\$0.89	\$0.25
Right Now (Na Na Na) - Akon	10.20%	11.60%	3.40%	\$1.21	\$0.75
Shattered (Turn the Car Around) - O.A.R.	5.00%	3.00%	2.80%	\$0.74	\$0.25
Single Ladies (Put a Ring On It) - Beyon	6.30%	9.90%	3.40%	\$0.87	\$0.46
Sober - P!nk	2.60%	3.00%	2.60%	\$0.63	\$0.05
Tonight - Jonas Brothers	1.80%	2.60%	2.40%	\$0.30	\$0.00
Untouched - The Veronicas	2.20%	4.60%	2.20%	\$0.50	\$0.05
Viva la Vida - Coldplay	24.50%	17.50%	2.80%	\$2.22	\$1.15
When I Grow Up - The Pussycat Dolls	5.40%	9.80%	2.80%	\$0.74	\$0.25
White Horse - Taylor Swift	3.80%	4.40%	2.60%	\$0.71	\$0.01
Womanizer - Britney Spears	8.30%	12.60%	2.80%	\$0.91	\$0.50
You Found Me - The Fray	6.00%	6.20%	3.20%	\$0.74	\$0.40

Table 2: Buying and “Sharing,” per Capita

	All	men	women	Low interest in music	High interest in music
Purchased Songs	5.54	5.05	6.42	4.48	7.41
“Shared” Songs	6.71	6.38	7.29	6.82	6.50
Subscription Songs	1.97	2.35	1.30	1.90	2.09
Male	0.64	1.00	0.00	0.62	0.69
age	19.34	19.35	19.33	19.33	19.38
N	328	211	117	209	119

Table 3: Are Shared Song Valuations Lower?

	(1)	(2)	(3)	(4)	(5)	(6)
	value	value	value	Log value	Log value	Log value
shared	-0.7186 (0.2026)**	-0.2933 (0.2432)	-0.2304 (0.2476)	-0.4464 (0.0317)**	-0.2868 (0.0366)**	-0.2460 (0.0362)**
Constant	2.7573 (0.1501)**	2.4338 (0.1955)**	1.4436 (0.8658)	0.4934 (0.0233)**	0.4327 (0.0498)**	0.0163 (0.1211)
Observations	4343	4343	4343	4138	4138	4138
Specification	OLS	Song FE	Song, Ind FE	OLS	Song FE	Song, Ind FE

Standard errors in parentheses. * significant at 5%; ** significant at 1%

Table 4: Shared Song Consumption and Purchase

	(1)	(2)	(3)	(4)	(5)
	All	Men	Women	Low Interest in Music	High Interest in Music
Shared Songs	-0.2786 (0.0429)**	-0.2175 (0.0535)**	-0.3548 (0.0728)**	-0.2208 (0.0464)**	-0.4202 (0.0890)**
Constant	5.0933 (2.9207)	3.4144 (3.3487)	3.9661 (5.3969)	6.7761 (3.2065)*	5.1714 (5.7080)
Observations	328	211	117	209	119
R-squared	0.17	0.15	0.21	0.15	0.17

Standard errors in parentheses. * significant at 5%; ** significant at 1%

Table 5: Longitudinal Displacement Estimates

	(1)	(2)	(3)	(4)	(5)
	All	Men	Women	Low Interest in Music	High Interest in Music
Shared Songs	-0.1468 (0.0350)**	-0.1040 (0.0401)**	-0.2462 (0.0628)**	-0.1104 (0.0393)**	-0.2112 (0.0671)**
Constant	3.2883 (0.1522)**	2.7367 (0.1635)**	4.4235 (0.3036)**	2.6329 (0.1741)**	4.4304 (0.2833)**
Observations	984	633	351	627	357
Number of group(participant)	328	211	117	209	119
R-squared	0.20	0.16	0.30	0.16	0.27

Dependent variable is the number of songs purchased from each type. Standard errors in parentheses.* significant at 5%; ** significant at 1%. All estimates include individual fixed effects and song type dummies (where type refers to: current top 25, last period's top 10, current songs from among current ranks 26-100).

Table 6: Per Capita Revenue and Welfare with and without File Sharing

Regime	Quantity Bought	Quantity Stolen	CS	REV	DWL
Current: file sharing possible	5.54	6.71	\$23.49	\$5.48	\$0.00
<u>possible alternative regimes:</u>					
file sharing not possible (.15)	6.55	0.00	\$11.59	\$6.48	\$10.91
file sharing not possible (0.28)	7.42	0.00	\$13.13	\$7.34	\$8.50
effect of file sharing (.15)			\$11.91	-\$1.00	-\$10.91
effect of file sharing (0.28)			\$10.36	-\$1.86	-\$8.50

Note: numbers in parentheses are the displacement rates used in simulations.

Figure 1: File Sharing

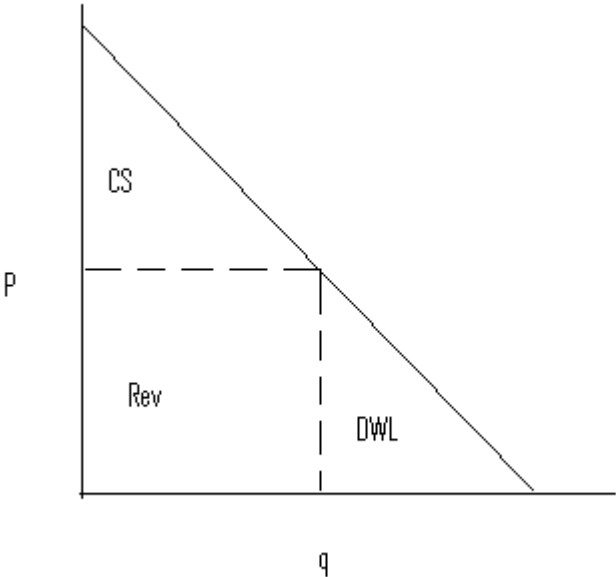
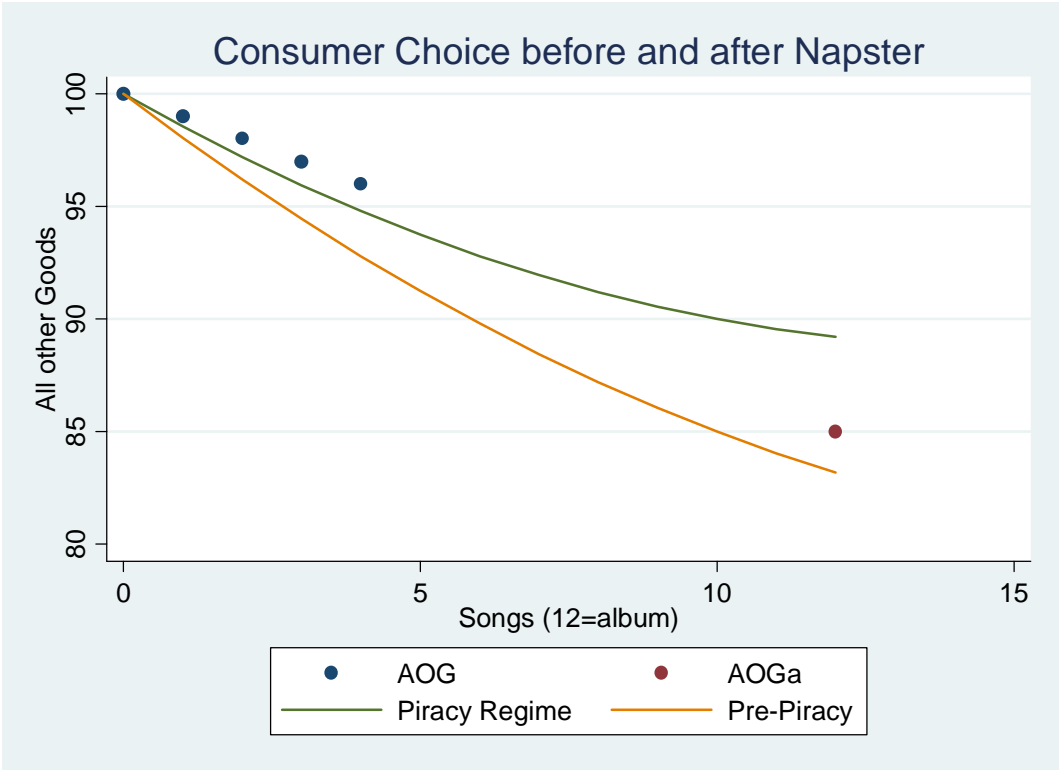


Figure 2



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