The Four P's of Digital Distribution in the Internet Era:

Piracy, Pricing, Pie-Splitting, and Pipe Dreams

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Introduction

The first decade of the new millennium has been the decade of digital distribution for media products. All products that can be digitized have either been affected, or about to be. This includes music, television, movies, books, newspapers, magazines, among others.

Since the early days of the Internet, unauthorized distribution ("**piracy**") has emerged as an important threat to media firms. While piracy is undoubtedly an important threat brought by the Internet – and much of media firms' focus on the Internet concerns the negative consequences of this threat – it is important to note that new technology also brings an opportunity for firms to engage in new strategies. It allows firms to exploit new models of **pricing** that may lessen the blow from piracy. Alternative modes of pricing include bundling, nonlinear pricing, two-part tariffs, and others, that may hold the possibility of raising revenue and possibly benefiting consumers as well. However, many of these new forms of pricing produce revenue that is not readily attributed to particular owners, making it necessary for sellers to create new methods sharing revenue (or "**pie-splitting**").

New private strategies aren't the only responses. Affected industries have mobilized to enact a number of nonmarket responses, including well-documented litigation as well as, recently, efforts to induce Internet Service Providers (ISPs) to prevent the flow of unpaid content through their pipes ("pipe control"). This essay reviews the threats, opportunities, and challenges to media firms that have emerged over the past decade, with alliterative attention to the four P's.

I. Piracy

The appearance and rapid growth of the Napster file sharing service in 1999 served as the "shot across the bow" that vaulted digital distribution – initially unauthorized – to central importance for the purveyors of media products. Text, audio, and video can all be digitized and distributed over the Internet, possibly outside their owners' control.

By all accounts Napster was highly popular, and legal revenue from recorded music declined almost immediately and has not since recovered. For example, worldwide revenue from physical recorded music fell from $37 billion in 1999 to $25 billion in 2007. Worldwide digital revenue has risen quickly since the launch of the iTunes Music Store in 2003, reaching $4.2 billion in 2009.[1] Even including digital revenue, worldwide revenue from recorded music had fallen to $30 billion by 2007. See Figure 1. In the US, the decline in sales of physical recorded music products has been steeper, from $12.8 billion in 1999 to $5.5 billion in 2008. With digital sales, total revenue was $8.5 billion in 2008, a third below its 1999 revenue level.[2]

With the exception of the newspaper industry, which has seen its circulation decline by nearly 20 percent and its ad revenue cut in half since 2000, the other media businesses have not yet seen direct decline, although a number of these industries – notably television programming and distribution, movies, and books – have faced related challenges.[3]

Observers – correctly, in my view – blame "the Internet" for the woes facing media firms. While new technologies have threatened them, the actual effects of these technologies are somewhat nuanced and include some opportunities along with the threats.

[1] See http://www.ifpi.org/content/section_resources/dmr2010.html accessed April 28, 2010.
[2] See http://www.riaa.com/keystatistics.php?content_selector=keystats_yearend_report , accessed April 28, 2010.
[3] See http://www.naa.org/TrendsandNumbers/Total-Paid-Circulation.aspx , accessed May 4, 2010.

1. Theory: The Effect of the Internet

The Internet revolution affects both the demand and the cost structures for the distribution of digitizable services. For tangibility, we'll focus on recorded music, but the discussion is relevant to all media products. Prior to the Internet recorded music was sold on compact discs containing roughly 12 songs for about $15 in the US. These discs had positive marginal costs.

We can analyze the effect of Internet distribution on the market for recorded music via a simple diagram with a demand curve and a marginal cost curve. Prior to the Internet, there is a demand curve representing the distribution of consumers' maximum willingnesses to pay for recorded music (in the form of 12-song CDs). There is also a horizontal marginal cost curve representing the cost of getting a CD to the store (including physical costs of pressing, packaging, and delivery, as well as the royalties contractually due to artists and labels). Prior to the Internet, consumers have no alternative to the labels' recordings of their artists' music, principally on CDs. Music CDs were sold by single price monopolists, who set their price above the marginal cost. As a result, there was some consumer surplus (CS), some producer surplus (PS), and some deadweight loss (DWL).

The arrival of the Internet affected both demand and costs in important ways. We'll return to its effect on demand shortly, after first examining its effects on costs. With the introduction of the Internet, the marginal cost of distribution fell (in principle) to zero. In fact, the marginal cost of legal distribution did not fall to zero, because artists and labels continued to require their royalties; and the labels were slow to create legal services. Having said all that, it is useful to think about both the opportunities and the challenges wrought by the Internet, in parts.

First, consider the effect of the Internet on costs, in particular reducing the marginal cost to zero. Pretend, for a moment, that consumers' willingness to pay for recorded music is unchanged.

With this innovation the area under the demand curve is divided into CS, PS, and DWL. None of it need be allocated to costs of production. If the price remains at its pre-Internet level, DWL now makes up a larger part of the area, PS has increased, and CS is unchanged. Yet, with the reduction in costs, all of the area under the demand curve is now potentially available to buyers and sellers. That is, with pricing schemes more sophisticated than uniform pricing, more – and conceivably all – of the area under the demand curve would potentially be available to sellers. While it would be at best incomplete to suggest that the changes wrought by the Internet were unambiguous good news, the cost-reducing effects of the Internet had the potential to benefit producers and consumers alike.

Of course, changed cost structure is not the only effect of the Internet. More extensively analyzed has been the effect of the Internet-enabled piracy on the willingness of consumers to pay for legal copies of recorded music. And while one can presume that the available of free alternatives does not, on balance, raise demand, nuances arise even here.

Each point on the pre-Internet demand curve represents a consumer's willingness to pay for a particular album of music. If that valuation exceeded the price (roughly $15), then that point would represent a transaction, which would have produced both consumer and producer surplus. If that valuation fell short of the $15, then that point would not represent a transaction. Instead – once zero marginal cost distribution is feasible - the point would be associated with the deadweight loss arising from a situation where willingness to pay exceeds marginal cost but falls short of price.

Piracy reduces sales inasmuch it allows consumers *who would previously have purchased* to obtain products without payment. But to the extent that low-valuation consumers engage in piracy, it would not reduce sales and would instead only turn deadweight loss into consumer surplus. This distinction is important given the large volumes of unpaid music consumption occurring via file sharing networks. Suppose – as has been reported – that volumes of unpaid consumption via piracy vastly exceed volumes of paid consumption from the pre-piracy era. It seems likely that much of this unpaid consumption arises from situations in which the consumer's valuation falls short of the pre-Internet price. (Otherwise, paid sales prior to piracy would have been higher).

We can hold off the bad news only for so long. The availability of unauthorized a la carte music files online is quite likely to depress demand for legal recorded music. We say quite likely because it is possible that file sharing could raise legal demand, via two mechanisms. First, because music is an experience good, consumer sampling of music prior to purchase can allow them to become sufficiently informed about the quality of music to render them willing to pay for it. Sophisticated versions of these arguments are put forth in Shapiro and Varian (1999).

In addition, small-scare sharing can increase legal demand via an argument that recalls the theory of public-goods. Suppose albums cost $15 and that Jim and Susan each attach at value of $8 to a particular album. Alone, neither of them purchases the album, but if they form a music sharing club, they are together willing to buy things they would not purchase alone.

Thus, the appearance of file sharing might, in principle, have stimulated legal demand for recorded music. Despite this theoretical possibility, it seems natural to expect that many of the instances of unpaid consumption arise in situation which, prior to the Internet's file sharing

opportunities, would have reflected paid consumption. So, we have a proverbial empirical horse race. Even if we have a good idea that the "file sharing depresses legal sales" horse wins, we don't know by how much.

2. Evidence on Effect of Unauthorized Digital Distribution

a. Sensible Priors

While theory – and common sense – leave the magnitude of the effect of piracy an empirical question, theory – and common sense – provide some guidance on how to think about effects of unauthorized digital distribution. Piracy's effect depends on a number of factors that vary across media. Piracy's effect may be different in music, movies, television, and books.

First, it may depend on the extent to which unpaid consumption is a substitute or a complement for paid consumption. While getting a song free may stimulate demand for other songs by the same artist, this mechanism for complementarity is likely to work only if the second song is not also available without payment. For most consumers, the version of a song available for sharing without payment is a very close substitute for the version one can buy at, say, the iTunes Music Store.

But this mechanism may function differently for different media. While an argument similar to the music argument may work for movies, television shows are arguably quite different. Suppose that one views an episode of a series via some sort of unauthorized sharing, say at a streaming site or by downloading. While this stolen episode is probably a very close substitute for watching the *same* episode via authorized channels, unauthorized viewing of this episode is very possibly a complement for other episodes, which the consumer might view via

authorized channels. Perhaps more than with music or movies, piracy in serialized video content (e.g. television shows) may plausibly be viewed as stimulant to legal demand.

This logic is not lost on television providers. As with the music industry and Napster, the television industry received its threat from outside, with the launch of YouTube in February 2005. By the end of 2005, a few of the major US television networks had experimented with streaming their programs at their own authorized websites. By the beginning of the fall 2006 television season, most programs were streamed at the networks' authorized sites.

Media also differ in the ease with which material can be distributed, even over the Internet. A typical mp3 file containing a song is small and can be downloaded in seconds. Movies, by contrast, are roughly 5 gigabytes. Even at this writing they remain considerably more cumbersome to download than music. Thus, it is much easier for consumers to acquire large libraries of unpaid music than to do the same with movies. It is worth noting that text files are small, so that by this criterion, books are threatened.

Media products differ in the full cost of consumption, including time. Music is often consumed with divided attention, so users need not entirely forego alternative uses of their time while making use of recorded music. Movies, by contrast, require their viewers' full attention. Hence, even when a movie is obtained without payment, its actual consumption "costs" its user whatever two hours of time are worth over and above what he pays for the viewing. The amount of time available to consumers - particularly undivided time – is quite finite. If a consumer watches an additional movie without paying, given its full cost, it is likely to crowd out paid movie consumption. This concern seems particularly acute for books. Average people read about a page per minute, so that a book of, say, three hundred pages requires about five hours of

time. The point of this discussion is that we should expect effects of file sharing to vary across contexts.

b. Difficulties in, and Approaches to, Studying Piracy

The effect of piracy on sales is inherently difficult to study for two reasons. First, piracy is an illegal behavior and therefore not readily documented in, say, government statistics. As a result, it is difficult to get data on volumes of unpaid consumption, particularly in ways that can be linked with volumes of paid consumption (more on this below). A second and equally important difficulty is the usual scourge of empirical work in the field, i.e. its non-experimental nature. Even if we can observe volumes of piracy, as some creative researchers have, it is difficult to establish the causal impact of piracy on paid legal consumption. The reason for this, in the parlance of empirical researchers, is that piracy is itself a potentially endogenous variable.

The difficulty of observing pirate consumption has led researchers to two broad approaches to the study of piracy. Some researchers, like Oberholzer-Gee and Strumpf (2007) resourcefully obtain data on the volume of pirate Internet traffic, by album, over time. Data on unpaid consumption from Internet traffic have the great virtue of representing actual unpaid distribution. They link these data with information on sales of the same albums via legitimate channels, over the same time periods. This allows them to ask whether the albums being stolen more this week are being purchased more or less this week. Simply stated, if file sharing depresses legal sales, then those being stolen more this week, relative to previous weeks (and relative to other temporal patterns), should be purchased less this week.

The second major approach is to conduct individual-level surveys, surmounting economists' traditional aversion to asking people about their behavior. If respondents report

reliably, then this approach gives rise to information on individuals' volumes of both paid and unpaid consumption. Data of this sort allow the researcher to ask whether those who steal more purchase more (stimulation) or less (sales displacement). Moreover, if the data cover products from different points in time, the researcher can ask the analogous questions over time within individual. That is, one can ask whether those stealing more songs from a particular vintage (relative to other vintages) purchase more or fewer songs from that vintage relative to other vintages.

Regardless of the way that data are obtained, different data structures lend themselves to causal inference on sales displacement to different extents. Define B and S as purchased and stolen music. All empirical approaches examine the relationship between some form of B and S.

Oberholzer-Gee and Strumpf (2007) (OS) have data on B and S for products (albums) over a period of time. Their basic approach is to ask whether a particular album is purchased more or less in weeks when it is being stolen more frequently. On its face this approach would seem highly vulnerable to a concern that whatever changes the popularity of a particular album from week to week would drive both file sharing and purchases. If the unobserved factors affecting popularity affect both purchases and file sharing, then this approach will be biased toward suggesting that file sharing promotes legal sales.

Of course, OS recognize this and employ a clever instrumental variables approach. They note that the availability of pirated music varies – for reasons unrelated to the demand for legal music purchase – with the timing of German school vacations. This gives rise to an instrument for S. Using this approach, they find negligible levels of sales displacement from file sharing.

Another basic approach is to look across individuals, asking whether individuals who steal more purchase more or fewer albums (or songs or movies). An obvious difficulty with this approach is that people who like, say, music may like it both via purchase and file sharing. Then we would see that people with large unpaid libraries also have large paid libraries. But it seems unlikely that this would reflect demand stimulation. The inclusion of observable variables related to interest in music can help with this problem, but unless one can control for the major determinants of interest in music, this approach also seems biased against finding sales displacement.

A related approach is to use panel data on individuals' volumes of purchase and file sharing over time to ask whether people buy more or less in periods when they steal more. This approach surmounts fixed unobservable differences (such as a particular individuals' heightened interest in music).

By now there have been many studies attempting to quantify the relationship between files sharing and sales in music.[4] Most of these studies find that file sharing depresses sales, although typically less than 1:1. My own studies of piracy have employed the survey approach described above. Coauthors and I have applied this approach to music (Rob and Waldfogel, 2006; Waldfogel, 2010), movies (Rob and Waldfogel, 2007; Bai and Waldfogel, 2010), and television (Waldfogel, 2009). Figures 2 and 3 summarize the two main findings from these studies. First, the rate of sales displacement (how much does an instance of unpaid consumption depress paid consumption?); and second, what share of consumption is unpaid?

[4] See, for example, Oberholzer-Gee and Strumpf (2007); Rob and Waldfogel (2006), Zentner (2006), Bhattacharia, et al (2006), Hong (2007), Blackburn (2004), Bounie, Bourreau, Waelbrock (2004), and Hui & P'ng (2003), among others.

As Figure 2 shows, displacement rates are highest for movies in the US college student sample, followed by music – both in the CD and digital song eras. Displacement rates are negligible for video; they also appear to negligible for movies among Chinese survey populations.

As Figure 3 shows, the share of consumption that is unpaid has a rather different ranking. Very little movie consumption among US students surveyed is unpaid. Roughly a third of music is unpaid. The vast majority of movie viewing among Chinese populations is unpaid.

Most of these studies were conducted prior to the development of the iTunes Music Store as a popular –even dominant – music retailer offering digital songs on an a la carte basis. The single study of sales displacement covering the iTunes era finds a nearly identical rate of sales displacement for songs, roughly -0.3.

3. Conclusions on piracy

Most people would say that piracy has caused the woes of the recorded music industry, but virtually everyone would also agree that the music sales displacement rate is far below 1. This indicates that much of what is stolen would not have been purchased in the absence of file sharing. While all piracy benefits consumers, these instances benefit consumers without harming sellers.

It appears that the rate of sales displacement is higher for movies (at least in the US), than for music. This suggests an important threat to the movie industry as technological change

makes movie file sharing easier. Because the full cost of book consumption (including time spent) is high while file sizes are small, the threats to books are potentially quite large.

Despite all the bad news for media firms, the opportunity to sell products which now have zero marginal costs does present some opportunities.

II. Pricing

While most observers would attribute much of the recorded music industry's current woes to piracy, regardless of the cause of the industry's condition, the adoption of new pricing strategies may allow the industry to generate more revenue and profit.

Given new technologies, music distribution has zero marginal costs. Moreover, metering of purchase can be done mechanically. If one were conceiving attractive strategies from scratch, this would seem like a natural environment for using some of the sophisticated pricing tools that economists have long discussed. The tools potentially available provide a vivid contrast to the one-size-fits-all uniform pricing that until recently was virtually the only pricing model used at iTunes. These alternative tools include song-specific pricing, pure bundling, mixed bundling, nonlinear pricing, and two-part tariffs, to name a few.[5] It is well known in theory that these strategies – all of which nest uniform pricing as a special case – can raise more revenue.

In general, it is hard to know how much money uniform pricing leaves on the table because the data needed to evaluate this question – the full distribution of reservation prices across buyers and products – are hard to come by. Usually, researchers estimate some sort of demand system allowing inference about individuals' valuations of various quantities of various

[5] There is a substantial theoretical literature on sophisticated alternatives to uniform pricing. See Stigler (1963), Adams and Yellen (1976), Schmalensee (1984), McAfee, McMillan and Whinston (1989), and Bakos & Brynjolffson (1999).

products.[6] Shiller and Waldfogel (2009) pursues this goal using survey-based direct elicitation of 1000 students' valuations of 100 popular songs at iTunes during January 2008 and January 2009. We describe those efforts here.

The raw facts about valuation distributions are interesting. Song valuations vary substantially both within and across respondents. The median valuation of (each individual's) top 10 songs among these 50 in the 2008 sample is about $20, while the 75th percentile valuation is about double that ($40), and the 25th percentile valuation is around $15. Valuations in the 2009 sample are lower: for example, the median person's valuation of his or her top 10 is around $15. The flattening of each of these curves indicates substantial difference between the valuations of the most highly and least highly valued songs. Analyzed a different way, the vast majority of the variation in the reported valuations arise across individuals, as opposed to songs. A regression of 2008 (2009) valuations on song fixed effects yields an R-squared of 4.0 (5.9) percent. The R-squared from a regression on only individual effects is 40.2 (31.5) percent, and the R-squared with both individual and song effects is 44.2 (37.4) percent.

The correlations of song valuations across persons help to determine the extent to which non-uniform pricing schemes can capture additional revenue. For example, a common intuition from bundling theory is that bundling raises revenue more as products' valuations are less positively correlated. Song valuations in our datasets are positively correlated. With 50 songs there are 1,225 pairwise song correlations. The mean correlation is 0.37 for the 2008 sample and 0.25 for the 2009 sample.

[6] See Chu, Leslie, and Sorenson (2007) for a nice recent example.

Table 1summarizes the change in various components of surplus, relative to their benchmark values under uniform pricing. Based on the 2008 parametric estimates, uniform pricing allows producers to captures 27 percent of surplus, while consumers get 44 percent of surplus, and the remaining 29 percent of the area under the demand curve is deadweight loss. Using the 2009 data gives nearly identical results. The uniform price results provide the benchmark we use for evaluating more sophisticated pricing approaches. For each approach below, we can ask how the components of surplus grow or shrink relative to their values under uniform pricing.

A conceptually simple alternative to uniform pricing across all songs is component pricing (uniform pricing within songs). Interestingly, in light of the clamor to convince Apple to employ song-specific pricing at iTunes, component pricing – using 50 prices rather than one – has little effect on the components of surplus. It raises PS by 3 percent in both the 2008 and 2009 data. It should be noted that these estimates of the benefit of component pricing, while small, overstate the practical benefit of song-specific pricing since in actuality sellers would need to set prices for songs in advance of knowing each song's realized demand.

Another simple alternative to uniform pricing is "pure bundling" (PB), in which the entire group of songs is offered, as a group, for a single price. The optimal 50-song bundle price is $74.25 using the data derived from the parametric approach for 2008 and $36.84 for the 2009 data. Pure bundling raises revenue substantially, by 17 percent relative to uniform pricing with the 2008 sample and by 29 percent using the 2009 sample. These gains to consumers come partly at the expense of consumers: CS under bundling is 15 percent below its value under uniform pricing in the 2008 sample and 5 percent below for the 2009 data. While pure bundling improves revenue – and substantially more than component pricing – the resulting revenue falls

far short of the perfect price discrimination revenue predicted by some theoretical models. The reason for this failure is that tastes are correlated across products, which arises, as Armstrong (1999) notes, "because of income or other systematic differences across consumers."

Another scheme we can explore is the two part tariff with a hookup fee (T) independent of the number of songs purchased and a per-song price (p). Using the 2008 data, the best two-part schemes identified involve (T, p) = ($52.31, $0.48). Using the 2009 sample, the best tariff is ($21.19, $0.37). The two-part tariff achieves results very similar to those achieved with pure bundling - PS, CS, and DWL are almost identical under two-part pricing and bundle pricing.

Two part tariffs are a special case of more general nonlinear prices that vary with the number of units purchased, which we can explore via a parametrization of the price schedule. If t is an index for a song's position in the sequence, then a simple parameterization is $p(t) = \alpha * e^{\beta t}$, where $\alpha > 0$, $\beta < 0$. Using the 2009 data, the associated profit-maximizing prices of the first ten songs are, in order: $8.37, $6.52, $5.08, $3.95, $3.08, $2.39, $1.87, $1.45, $1.13, $0.88, $0.67. The per-song price reaches about $0.10 by about the 30th song in the 2008 data, and by about the 20th song in the 2009 data. The total price of all 50 songs in both datasets is slightly higher than the respective bundle price. Not surprisingly, as Table 1 shows, the nonlinear tariff performs very similarly to pure bundling and two part tariffs.

Finally, we explore discriminatory schemes, the most aggressive of which is person-specific pricing. Person-specific pricing gives substantially more benefit to producers than do the non-discriminatory schemes explored above. They raise revenue by two thirds using the 2008 sample and by half using the 2009 sample. This benefit to producers comes at substantial

cost to consumers: CS falls by a third relative to its value under uniform pricing in the 2008 data and by a quarter in the 2009 data. The gains to producers under person-specific pricing outweigh the losses to consumers, so deadweight loss falls using both samples.

Person-specific pricing may be difficult to implement if it's hard to know each individual's demand curve *a priori*. This raises the question of what revenue improvement third degree price discrimination schemes based on observable characteristics can achieve. It turns out that the effects of price discrimination based on our scant observables (gender, ethnicity, whether a respondent is a resident alien, and age/whether under 20) are small: none raise revenue more than 6 percent, and most accomplish less. Despite the large revenue enhancing effects of individually customized uniform prices, forms of third degree price discrimination that might more feasibly be implemented produce only negligible revenue improvements.

This analysis suggests that sellers can make substantially more money using sophisticated alternatives to uniform pricing. Having said that, it is noteworthy how much of the area under the demand curve remains beyond the reach of sellers even with sophisticated pricing, particularly if restrict attention to the feasible varieties.

Alternatives to uniform pricing for media products are not simply academic at this point. A number of providers sell music as a bundled offering. For example, Rhapsody sells unlimited music via a subscription service, as does Nokia through its Comes with Music phones.

III. Pie Splitting

Despite the clear benefits of bundling to sellers (and perhaps to consumers as well), bundling and related pricing schemes have one significant problem: they generate revenue that is not readily attributed to particular pieces of intellectual property.

Bundled offerings exist, and they employ methods for sharing revenue among component products. For example, eMusic sells a subscription entitling subscribers to a fixed number songs per month for a flat fee of $20. eMusic shares its revenue among songs according to the number of times subscribers download each song. While this sounds sensible, it does create some problems. A consumer makes a decision to download a song if he values that song above zero. Two songs downloaded the same number of times may have, on average, very different value to consumers. Yet, the two songs receive the same proportional remuneration inside the bundle, even though would earn far different revenues if they were each sold on a standalone basis. As a result, the owners of more intensely desired song may have an incentive to keep it out of the service and instead sell it on a standalone basis, say at iTunes.

eMusic is a site selling independent music, most of which is not nearly as popular as songs released on major labels. By some accounts, when independent artists become popular, they withhold their songs from eMusic to avoid this problem.

Cooperative game theory offers some tools that, in principle, can be used to solve the revenue sharing problem. For example, the Shapley value provides a sensible solution to the problem. However, calculating Shapley values requires data on the values of all conceivable song bundles. Shiller and Waldfogel (2010) perform some exercises along these lines using the valuation data described above.

While it may not be possible to calculate exact Shapley values, Ginsburgh and Zang (2001, 2003) outline a simplified Shapley value-based sharing scheme that is easily implemented. For each subscriber, simply divide his or her payments equally among the items used. This is the same as the proportional solution if all subscribers consume the same number of items. If they consume different numbers of units, this method gives greater reward to items that make up a larger share of individuals' consumption baskets. See Shiller and Waldfogel (2010).

If bundled pricing grows in importance – and its benefits suggest that it will – then the revenue sharing problem will also loom more important.

IV. Pipe Dreams

Content industries enlisted the tools of government and regulation to control unauthorized distribution. Litigation was the earliest response, including both litigation against high-profile hubs of unauthorized distribution (such as Napster or, more recently, Pirate Bay), as well as suits against individual file sharers.[7] While there is evidence that the latter had an effect, the effect was not substantial enough to effectively stem the loss of revenue.[8]

[7] For example, In October 1999 RIAA filed a case against Diamond Rio MP3 Player (http://www.law.cornell.edu/copyright/cases/180_F3d_1072.html); in January 2000 RIAA filed a case against MP3.com (http://news.cnet.com/2100-1023-235953.html and http://www.theregister.co.uk/2000/05/05/mp3_com_vs_riaa_judge); in May 2001 RIAA filed a case against Aimster (http://www.nytimes.com/2001/05/25/technology/25MUSI.html?ex=1222228800&en=648721103cb80173&ei=5070); in October 2001 RIAA filed a case against Grokster, KaZaA and Morpheus (http://www.mtv.com/news/articles/1449535/20011003/story.jhtml) and in 2006 they filed a case against LimeWire (http://www.breitbart.com/article.php?id=D8J9PFS00&show_article=1). A list of additional cases is provided at http://info.riaalawsuits.us/documents.htm

[8] See Blackburn (2004).

In the past few years, the industry has mobilized to compel ISPs to filter content, to effectively prevent the distribution of unauthorized content over their pipes. The music recording industry has successfully compelled the leading Irish ISP Eircom to launch a "graduated response" system.[9] They will monitor their pipes and notify offending users, ultimately disconnecting them from the Internet. After some initial legal challenges, France has instituted a similar "three strikes" policy.[10] The US content industry favors similar approaches.[11]

Belgian lawmakers have proposed a different scheme: a flat-rate tax on content for all Internet users. The proceeds would then be distributed to individual IP owners based on the metered use of each file. This is, of course, an example of the revenue sharing problem identified above.

Because technological change is difficult to forecast – and because pirates often change their strategies for unauthorized file sharing – it is difficult to predict the effects of these policies with confidence. But their prospects of reducing file sharing are high enough to warrant discussion.

Suppose that they are successful, in that they re-instate the recorded music demand structure prevailing prior to the advent of file sharing. This would be a welcome outcome for content industries. But it is important to bear in mind that the Internet affected both cost structures and demand. With a zero marginal cost product, both consumer welfare and profits would be served by lower prices (relative to a physical cost world). Firms sometimes explore new strategies only when threatened. Even if pipe control alleviates the threat, it would remain

[9] See Collins (2010).
[10] See Johnson (2009) and Pichevin (2010).
[11] See Martens (2010).

useful for firms (and policy makers) to encourage the exploration of alternative pricing models that can both promote the creation of content as well as the well-being of consumers.

V. Conclusion

The Internet has brought a substantial threat to traditional models for generating revenue from the sale of media products. At the same time, the Internet (and attendant technologies) allow digital products to be distributed at negligible cost. At least relative to depressed levels, it may be possible to raise revenue through the use of sophisticated pricing. New regulatory schemes to control unauthorized distribution via ISPs hold the promise of restoring the pre-piracy demand structure. If the threat of piracy is relaxed, consumer and producer well being will still be served by exploring alternative pricing models for zero marginal cost products.

It is very interesting to speculate on the benefits that new technology could produce for consumers as well. In 2000 Americans spent roughly $50 billion on music, movies, and books. This translates to roughly $35 per household per month. Suppose a household could get unlimited access to media products for a flat fee. If everyone subscribed, revenue would be held constant. Because distribution costs are much lower than in 2000, profits would be substantially higher. Of course, not all households would subscribe. But it seems quite conceivable that one could find a price which would induce sufficient participation to both hold producers harmless at their pre-Internet profit levels while at the same time leaving consumers better off. And of course once they had subscribed, a household would have no incentive to participate in piracy. Working this out fully is a substantial task for another day, but amid all of ominous news about the effects of digital distribution, it is worth noting that a technical change that reduces costs and

enabled bundled sales has a fighting chance to improve the well-being of producers and perhaps consumers as well.

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Figure 1

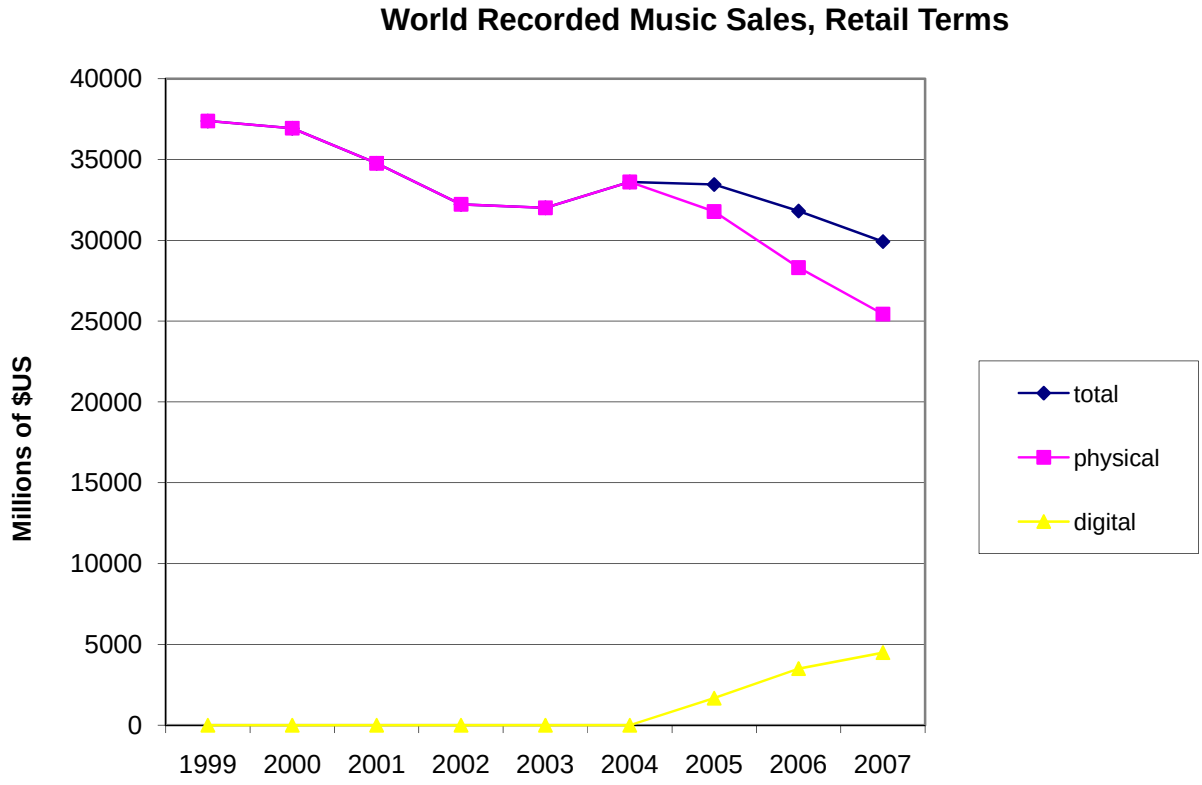
World Recorded Music Sales, Retail Terms
Millions of $US
40000
35000
30000
25000
20000
15000
10000
5000
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
total
physical
digital

Figure 2

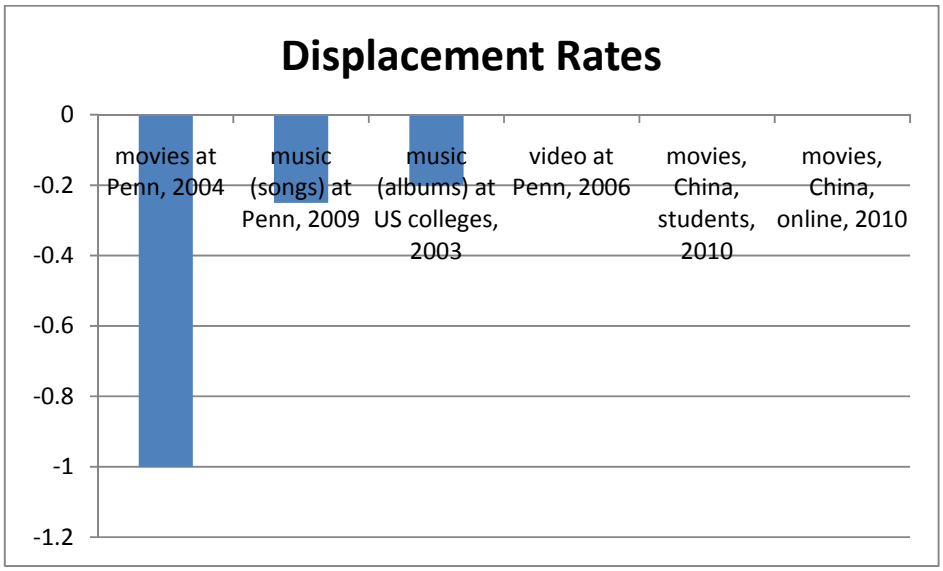
Displacement Rates
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
movies at Penn, 2004
music (songs) at Penn, 2009
music (albums) at US colleges, 2003
video at Penn, 2006
movies, China, students, 2010
movies, China, online, 2010

Figure 3

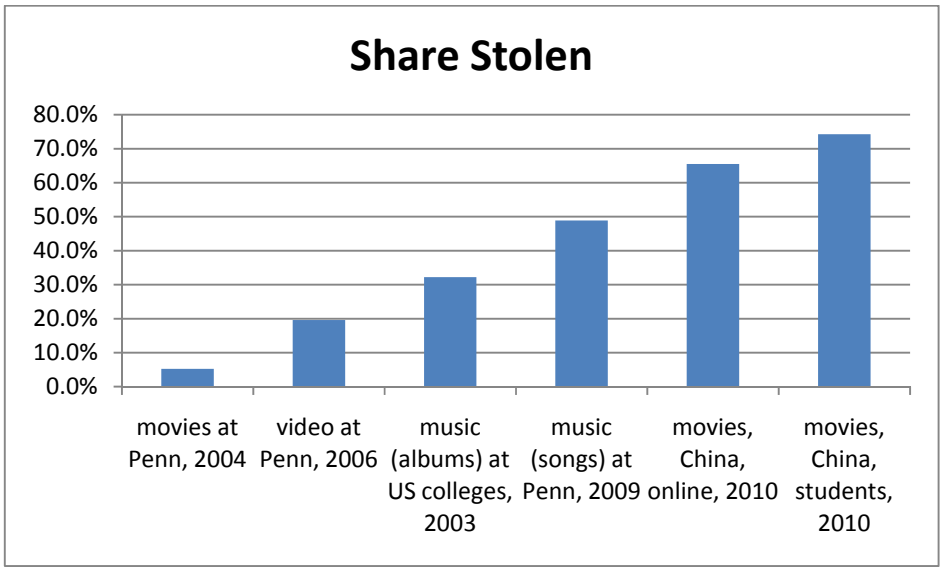
Share Stolen
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
movies at Penn, 2004
video at Penn, 2006
music (albums) at US colleges, 2003
music (songs) at Penn, 2009
movies, China, online, 2010
movies, China, students, 2010

Table 1: Alternative Pricing Approaches using Parametric Estimates

Pricing Method	**PS share**	**CS share**	**DWL share**	**% ΔPS**	**% ΔCS**	**% Δ DWL**	**sample**
Uniform	27.0%	44.2%	28.8%				2008
Component	27.7%	41.7%	30.6%	2.65%	-5.70%	6.27%	2008
Pure Bundling	31.5%	37.6%	30.9%	16.61%	-14.87%	7.27%	2008
Two-Part Tariff	31.8%	39.2%	28.9%	17.97%	-11.27%	0.45%	2008
Nonlinear	31.8%	38.3%	29.9%	17.72%	-13.28%	3.79%	2008
Uniform	28.4%	42.4%	29.2%				2009
Component	29.2%	44.7%	26.1%	2.90%	5.42%	-10.66%	2009
Pure Bundling	36.5%	40.3%	23.2%	28.81%	-5.00%	-20.68%	2009
Two-Part Tariff	36.9%	43.1%	20.0%	30.30%	1.55%	-31.63%	2009
Nonlinear	36.6%	39.5%	23.9%	29.04%	-6.83%	-18.26%	2009