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The Economics of Peer-to-Peer

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Introduction

Peer-to-Peer networks boast three characteristics that make them unique. First, they are layered networks conceived and operating in a similar fashion to the Internet. Second, they are completely decentralized, making servers of individual computers at the Peer-to-Peer layer, and acting in the way an ISP acts at the Internet IP layer. Finally, Peer-to-Peer networks are made up of the resources that individual members make available when they use their Peer-to-Peer networks.¹ These networks, which were initially used by individuals to share and download content, including a significant amount of copyright material such as music, are now increasingly used for downloading games, videos, and software.²

In this paper, we focus on the economics of Peer-to-Peer in terms of the impact that Peer-to-Peer innovation is having on the content sector, especially on copyrighted material, and on how the latter has in turn influenced Peer-to-Peer networks. Peer-to-Peer technology makes a server of end-users. In addition, while Peer-to-Peer network service providers may retain some control over their own networks, this control is effectively restricted to the Peer-to-Peer layer as a pure transport and file-sharing layer, and is independent of the content that is shared, at least in the post-Napster era.

In this paper, we study Peer-to-Peer from the perspective of the “commons.”³ Since Hardin’s study (1998) it is best to distinguish between “managed” and “unmanaged” commons. Currently, all Peer-to-Peer networks are “unmanaged” at file-sharing level, which means that the commercial links between individual members of existing Peer-to-Peer communities

and the owners of the copyright material that is being shared have now completely disappeared. Furthermore, institutions that clarify the scope of fair use in everyday practice have not yet been created.

At the same time, experimental economics suggests that this outcome does not automatically create a “tragedy of the commons.”⁴ As the commercial success of new services such as iTunes shows, it is conceivable that many members of those new Peer-to-Peer commons may be willing to shift to commercial Peer-to-Peer networks that incorporate reasonable payments to artists, thus reflecting the expanded use of copyrighted material. The above is also suggested by the willingness of individual users to participate in voluntary programs such as SETI.

However, these experimental results also suggest that the current practice may be becoming routine-like, i.e., that the window of opportunity for that kind of solution may shut in the near future, with consumers increasingly reluctant to diverge from the routines they are developing.

The willingness of members of Peer-to-Peer communities to contribute with access and computer resources to the community is another commons Peer-to-Peer is creating.

Today’s Peer-to-Peer file sharing makes it simple for individuals and their downloaded Peer-to-Peer software to search for, share, and download files from other users on the same Peer-to-Peer system. While a few years have elapsed since court decisions in the USA essentially eliminated Peer-to-Peer networks such as Napster and Aimster, many of the lessons that are relevant to a Peer-to-Peer economic analysis can still be traced back to those two cases.⁵

In 2001, *The Economist* observed that, “[t]he most important lesson of Napster is that people are willing to open their computers to, and share files with, complete strangers – as long as they see value in doing so. In the process, they have shown how really large computer networks can be created rapidly through the piecemeal contribution of millions of individual PCs, each of which functions as a server as well as client” (*The Economist* 2001).⁶

Over the years, the content sector has evolved into the industry we know today. It is, at present, a complex and, generally, highly concentrated sector that is characterized by a range of content types, the major elements of which are the video entertainment and music sectors as well as, increasingly, the gaming one. Through time, the sector has been characterized by the growing role of intermediation and the impact of technology on the ability to produce, access, copy and store content, as well as share and consume it. Technological innovation has revolutionized more than just the ability to access, transform, and consume content. It has redefined the very meaning of access, by copying and storing, sharing, and consuming.⁷

Peer-to-Peer is a new enough activity the alternative object of which that can be associated with the sector's economic analysis needs to be clarified. With the gradual emergence of the Peer-to-Peer institutional setting, the economics of Peer-to-Peer are moving from the economic analysis of the transition process to the economic analysis of Peer-to-Peer as an established communication and processing architecture.

At one end of the spectrum, we could consider the Peer-to-Peer sector in terms of conventional questions such as the demand for content and the role of free-riding. At the other end, economic analysis can help better understand the evolution of the institutional environment. It might help to understand the economic implications of competing frameworks within which Peer-to-Peer might operate.

The kind of questions involved relate to subject matters such as the extent and meaning of copyrights ownership. The Napster court and Aimster cases as well as, more recently, the Ninth Circuit Court's Decision, are all elements of the trial and error process through which society is identifying the context within which Peer-to-Peer will largely be able to operate.

What is the economics of Peer-to-Peer? Everything suggests that Peer-to-Peer's role is of growing significance for the content sector. There is no doubt that this is particularly true for video Peer-to-Peer. After all, this is the fastest growing segment of Peer-to-Peer, which is itself one of the fastest growing sectors in the digital economy. In addition, while the courts have been addressing Peer-to-Peer issues since the Napster Decision, the process is far from being complete: discussions on Peer-to-Peer economics in terms of a stable institutional setting are yet to take place.

The specificity of Peer-to-Peer networks and their historical setting today raise questions about the applicability of many conventional economic tools. This has led us to select an analytical methodology that pays far more attention to the institutions that are developing with the growth of Peer-to-Peer, and to the economic forces that contribute to shape the same institutions. Conventional economic tools generally presume that stability and maturity are characteristics of the sectors that are under study. On the other hand, the process through which institutions take shape is a complex one involving not only economics but also a wide range of other factors.

Nevertheless, it is important to evaluate the economic forces at play in this process, in order to understand the type of scenario that is likely to emerge and the changes it can bring about as new stakeholders compete to set up in the new environment.

One of the main reasons why the understanding of the dynamics that shapes the transformation of the content sector into a mature Peer-to-Peer environment is so important, especially for those who believe in an optimal spontaneous order, is that the outcome is not predetermined as a

unique “optimal” solution. In fact, our hope is that studies such as this one will help improve and streamline the process through which Peer-to-Peer could become established efficiently.

Our analysis helps us focus on intermediation, the functionality that is most affected by Peer-to-Peer, in the emergence of stable and predictable Peer-to-Peer institutions. Indeed, through time, today’s aggregators have built – and now use – intermediation to their advantage. Thus, aggregators have transformed their role from one of mere intermediation into one of ownership and brokerage. Such new functions have exacerbated the incumbency dimension of their position and, with it, the inherent tension that emerges between extracting more rents from existing assets, and developing new assets with new artists.

Our analysis incorporates the rather unique characteristics of economics of the arts and performance.⁸ These dimensions force us to make a distinction between live performances by artists and musical reproductions enabled by technology, in the same way that theater can be differentiated from cinema, or movie-making from movie-viewing.

The stakeholders involved are not simply the aggregators. As one would expect in a time of change, many other stakeholders are jockeying for a role in the emerging environment. Some, like the players from the computer and software sectors, are obvious, as are those who, like Gnutella, are gaining a growing stake in the emerging Peer-to-Peer distribution sector. Less obvious are new intermediaries such as BigChampagne, who are developing new data-gathering techniques to support marketing and other analyses of the sector, and companies such as Tag It, who use their knowledge of the new media to find new ways to help artists take advantage of the media and make themselves known.

One of our conclusions is that Peer-to-Peer, together with other technological changes, may be creating a growing wedge between the objectives of artists, especially new artists, and today’s legacy intermediaries. Such an outcome may make the development of sufficiently fast alternatives to existing Peer-to-Peer networks more difficult.

Technology may spark a transformation in the access and consumption of content, but the process is more complex as society’s response to the technological change takes the form of legislation and/or regulations. The process through which these changes emerge in turn transforms the technology. Once again, Napster illustrates this process in the context of the music industry. For instance, once the Napster decision was announced, the RIAA’s response, which was nothing more than its long-run strategy to refuse to negotiate compromises (whether justified or not) created in practice (and quite predictably) a demand for further technological advances that could bypass Napster’s flaws.

The paper is organized in seven sections. After the introduction, we provide a descriptive overview of the Peer-to-Peer sector in the recording, video, games, and TV industries. The section following defines the economic characteristics of Peer-to-Peer and considers how Peer-to-Peer relates to content. It emphasizes that, with Peer-to-Peer, content owners have, for the first time, lost all channels that link them directly or indirectly to consumers. This analysis helps us identify what makes Peer-to-Peer so different from previous innovations. The subsequent section uses the concept of the commons first formulated by Hardin (1968) to describe the characteristics of Peer-to-Peer and to identify their “unmanaged” dimension at the file-sharing level. It describes how Peer-to-Peer technology is changing the economic institutions. After that, we consider the most likely consumer response to the emergence of Peer-to-Peer and to the failure of the content sector in facilitating the development of credible Peer-to-Peer commercial services, and, subsequently, we highlight the extent to which Peer-to-Peer platforms have evolved technologically in response to institutional factors. We state that the conventional assumption of exogenous technology that economists continue to make in industrial organization is, at best, misleading. In the last section we draw our conclusions.

The Peer-to-Peer Sector

Overview

According to the OECD Information Technology Outlook 2006,⁹ the number of simultaneous Peer-to-Peer users (people who are jointly connected at any given moment) in March 2006 was close to 11.5 million, up from 7.3 million in March 2003. Comparing the growth of Peer-to-Peer users of the popular fast-track networks such as KaZaA with all other Networks (such as eDonkey, eMule, Torrents), two messages emerge: the decline of the number of users of the fast-track networks from the peak of October 2003 and the parallel growth of the number of users of all monitored networks. While the former is attributed by OECD analysts primarily to an increase in lawsuits against users of Peer-to-Peer networks, and to the rise of successful commercial music downloading services such as Apple iTunes, the latter suggests a migration of Peer-to-Peer users to networks that attract less attention from the music industry and related lawsuits.

In terms of geographical distribution of Peer-to-Peer users, the OECD report shows that the United States account for 66%, Germany for 5%, France for 3.5%, and Canada for 3.2%. Weighing the data by population,

Luxemburg seems to be the country with the greatest number of Peer-to-Peer simultaneous users (12% of the population), followed by Iceland, Finland, Norway Ireland, and the United States. On average, 1% of the OECD population is logged on to a Peer-to-Peer network (four times the value of 2003).

The case for displacement, i.e., the migration of Peer-to-Peer users from the Fast Track network to new ones, can also be made by looking at the volume of data exchanged on Peer-to-Peer networks. Each day the equivalent of roughly 3 billion songs or 5 million movies zip between computers, and Internet users around the globe freely exchange a staggering 10 petabytes of data, much of which in the form of copyright protected songs, movies, software, and video games.¹⁰

Peer-to-Peer is also becoming the largest consumer of data on ISP networks, significantly outweighing web traffic and costing an average per year of \$598 million globally, according to Cachelogic, a UK network equipment producer.¹¹

The OECD report, using BigChampagne data, also states that the majority of files traded are audio files. However, video and other files, including software, make up 35% of total files exchanged and their share is on the rise due to higher availability of bandwidth and new DVD and CD burning technologies.

The geographical distribution of these data reveals that the increase in the downloading of larger video and other files is particularly relevant in Europe. Germany has the highest share of video files downloaded via fast-track networks (about 40% of the total), followed by Italy (37%), Belgium (33%), Norway (31%), Canada (30%), and the United Kingdom (29%). According to the OECD analysts, this is partly due to the broad diffusion in Europe of the Peer-to-Peer technology (eDonkey), which is particularly useful for sharing large files (600 MB or more), while in the USA most users rely on Fast Track, which is better suited for sharing smaller files.

The Economic Impact of Peer-to-Peer file sharing

Copyright issues, network costs, and also the commercial opportunities connected to Peer-to-Peer technologies related to new applications of legal file-sharing call for an evaluation of the economic effects of file-sharing.

As far as intellectual property is concerned, the initiatives of the recording industry are motivated by the legitimate objective of protecting their intellectual property. However, as mentioned in Krishnan et al. (2003a), “this legitimate effort [...] can, in some cases, collide with the interests and rights of entrepreneurs attempting to develop novel information sharing

networks, individuals exercising fair use rights associated with legitimately purchased materials, and network operators seeking to protect the privacy of their users.” Furthermore, copyright holders, besides threatening users with fines and lawsuits for illegal sharing, are defining new strategies such as inundating Peer-to-Peer systems with “spoof” files in order to increase Peer-to-Peer users’ cost for searching and finding the music they are interested in.

The network costs that ISPs face to provide Peer-to-Peer network services to their users is becoming an increasingly important issue for the huge consumption of scarce bandwidth and the large transit fees that are currently borne by ISPs to provide such services. In order to optimize Peer-to-Peer networks and cope with rising costs, beside the reduction of the quality of services for Peer-to-Peer services, or more drastic decisions such as the shutdown of Peer-to-Peer networks, some researchers such as Asvanund et al. (2003a,b) suggest the creation of clubs in Peer-to-Peer networks based on common interests or network location proximity.

The issue we wish to focus on in this section is how much of an impact do Peer-to-Peer networks actually have on the sales of associated information products. We will start with the recording industry and then move on to the movie industry.

The Recording Industry

The sales of music CDs have fallen considerably over the last few years. The record industry has claimed that this decline is due to file-sharing. The first question that we need to address is: is there a clear theoretical prediction for such a phenomenon? The causality between file-sharing and record sales is not clear. On the one hand, there is a possibility of a substitution effect between CDs and downloaded files, with a negative impact on sales. On the other hand, there is a debate among economists on the results on the sales of what is called the *sampling effect*, i.e., the possibility of learning from file-sharing about music users would not otherwise be exposed to.

Oberholzer and Strump (2004)¹² claim that “File sharing lowers the price of music, which draws in low-evaluation individuals who would otherwise not have purchased albums. That is, file sharing primarily serves to increase total music consumption.” Liebowitz (2004) claims that, contrary to the common belief of a positive effect on sales, the effects from sampling are more subtle and tend to lead to a decrease in sales in the CD market.¹³ It follows that there is no clear theoretical prediction on the effect of file-sharing on CD sales. However, when we turn to empirical evidence, the uncertainty does not seem to disappear.

The two above-mentioned studies also include empirical results.¹⁴ As these papers follow very different methodological approaches, they can be considered particularly relevant for the investigation of these issues. Liebowitz (2004) states that the file-sharing explanation for the decline of CD sales in the 1999–2003 period is so compelling that only extremely powerful empirical evidence of the contrary would allow this belief to be ruled out. Therefore, he examines other possible explanations for the decline of record sales (price and income changes; changes in substitute/complementary markets, such as DVDs; changes in the quality of the music; and changes in the supply of music). The study concludes that, because the alternative explanations do not appear capable of explaining the sharp decrease in national record sales of CDs, the file-sharing hypothesis must be embraced.¹⁵

The paper by Oberholzer and Strump (2004) to some extent complements Liebowitz's aggregate analysis. Indeed, it uses micro data – i.e., the album sales and the actual downloads of albums based on data collected by OpenNap (a centralized Peer-to-Peer network) and uses it to create a large and representative sample in which individuals are generally unaware that their actions are being recorded.¹⁶ The data on sales are taken primarily from Nielsen SoundScan and from other sources.

The above analysis shows that there is no relationship between the number of downloads of a particular album and the actual sales of the album itself – i.e., file-sharing does not reduce record sales. Furthermore, most people who shared files appear to be individuals who would not have bought the albums that they downloaded and the more popular CDs seem to benefit from file-sharing.¹⁷

All the above-mentioned studies suffer from various imperfections and do not offer strong evidence in one direction or another. This has definitely to do with the fact that the analysis of file-sharing is still in its initial phase. Therefore, the lack of strong evidence convinces us to avoid using these results for policy prescriptions. Furthermore, this lack of evidence can be considered as an opportunity to shift the focus from non-commercial file-sharing to the business potential that Peer-to-Peer applications may have with regard to the digital delivery of services for new business models and the legal digital distribution of music and other applications (Peer-to-Peer is not equal to music sharing!).

The Movie Industry

Movies have been available through online rentals for quite some time. But downloading movies is a comparatively new phenomenon. Movies-download work in two ways. One is file-swapping and free downloads as

in the case of music. Some people gain access to a sneak preview of the movie, copy it, process it and put it up on the World Wide Web where it can be downloaded through networks such as KaZaA.

The other way is offered, as an experiment, by Hollywood film companies for public downloading. However, the movie must be viewed within 24 hours; indeed, after 24 hours the file self-destructs. Furthermore, only old successful films or second-rate new releases are put on offer.

How big is this phenomenon? According to Cachelogic, the exchange of films and software is booming and the vast majority of Peer-to-Peer traffic is made up of files larger than 100 MB. "Many of these are likely to be copies of films, with Cachelogic reporting that 30% of Peer-to-Peer traffic for one ISP was all from a single 600 MB file, which they suspect was a copy of a major film that had just been released."¹⁸

A report from Britain's Informa Media Group stated that selling films across the Internet could develop into an industry worth over \$800 million a year by 2010, but would be worth more than \$1.3 billion if it were not for illegal downloads. Despite the growth of downloads, the study estimated that sales of hard copies of DVDs and videos will remain by far the largest category of film sales: \$2.62 billion in 2010, up from \$804 million in 2003. These data show that although the movie downloading is becoming a fast-growing phenomenon and is already harming the movie industry, the "big bite" from revenues will only come 5 years from now.¹⁹

There are differences in technologies and consumers' behavior that can shape the history of movie downloads differently from the music one. Currently, watching a movie downloaded off the Internet usually means waiting far longer than for an MP3 file to download, as well as accepting lower quality. But with broadband connections, as speed increases, so do the quality and quantity of films available. Compression formats like DivX continue to improve, thus enabling the exchange of higher-quality movies. This offers more opportunities to the movie industry to set up legal downloading services that can satisfy the customers' need to avoid the downloading of poor quality films which could contain viruses.

How does downloading affect the social experience of "going out to the movies"? Can legal downloading help in testing customers' preferences, reducing marketing costs? And what about customers' repeated viewing habits? Is not this behavior different from listening to music and does it not generate different incentives for downloading?

All these issues call for Peer-to-Peer technologies to be embraced by the movie industry.

Peer-to-Peer and Games²⁰

A totally different approach from that of the Music Industry has been followed by the games industry. Games publishers are actually working with Peer-to-Peer networks to sell legal copies of their products alongside the illicit copies. Trymedia, an anti-piracy software firm, offers about 300 legitimate games on Peer-to-Peer networks and has experienced 20 million downloads in 18 months. The global market for legally downloaded games is currently estimated at \$150 million per year, and the figure is poised to double each year.

Peer-to-Peer is seen as a sales channel for games. Companies such as Trymedia, Softwrap, and Macromedia are offering games publishers software that stops games from being copied or limits access to them for a trial period. Therefore, demo versions of the games can be played before buying the product. Peer-to-Peer networks enable the enhancement of the “viral sharing of content between friends” that has always been the biggest promoter for software content. Trymedia’s Zicherman says: “If you can convert 5% of users into legitimate buyers, then you’ll be ahead.” Converting pirates to sales is their goal!

Peer-to-Peer and TV²¹

Atzio technology announced recently the availability of the company’s Peer-to-Peer television technology which enables internet television. Atzio’s legitimate Peer-to-Peer platform is designed to offer subscribers movies and television shows that can be ordered and downloaded for viewing at their own convenience. With Atzio’s distribution model, when a video is released by a content provider, it is packaged for internet distribution, protected by digital rights management technology, and added to the content producer’s online catalog.

The company’s Peer-to-Peer television technology works by splitting large video files into several digital “chunks.” Each chunk is distributed to peers. Each peer then transmits its chunk to another, using a portion of the upstream bandwidth available to each peer. This technology can satisfactorily complement the offering of television networks, studios, and independent content providers.

The Economic Characteristics of Peer-to-Peer

To study the economics of Peer-to-Peer, the way in which Peer-to-Peer relates to content should be taken into consideration. More specifically, the

very nature of artistic content, and how technology has impacted the ways artists deliver their content to the public, should be analyzed. In this section, we study the ways content through the ages has become easier and easier to reproduce. While Peer-to-Peer may not be the last step in this trend, nevertheless, it, breaks with the past because content owners, for the first time, have effectively lost all channels that link them directly or indirectly to the consumers.

With today's Peer-to-Peer services, consumers do not have to go through a store or the Internet to purchase a record or an online service. In addition, the Peer-to-Peer network service provider's business model is to attract as many users as possible in order to justify advertising revenues. What is even more dramatic for content owners is that today's Peer-to-Peer platforms, over which file transfers take place, are economically viable and formally independent of content.

This is because the Peer-to-Peer network service provider's business is a transport platform over which file-sharing takes place through consumers' own initiative. Such a service takes place at a layer below content, i.e., the Peer-to-Peer sector's organization has no element that would naturally link it to the content sector the way television and radio stations do in their broadcasting business.

In a Peer-to-Peer environment, the Peer-to-Peer community that corresponds to a given Peer-to-Peer network becomes the entity that consumes the content that individuals, independent of the community, may have purchased or pirated on a personal basis. While the content, initially, is what individuals have purchased or obtained in other ways, once an individual becomes a member of a Peer-to-Peer community, even of an ephemeral one, that content potentially becomes the community's content.

Economics relates to the exchange of goods and services between individuals. The generic exchange of goods and services is defined here as a "commons."²² Commons are beneficial to society as a whole because they provide the institutional framework for all economic exchanges, hence for trade. Trade makes it possible for people to specialize in different sectors, hence in general to carry out the tasks they are best at, as described by the division of labor.²³ The result is greater wealth within the society. This is achieved not only by the greater efficiency with which labor is utilized, but also through the increased diversity of goods and services people produce.

Trade is an inherent activity of any society, no matter how isolated it might be. In the most isolated society, trade means the exchange of goods and services within that society. Such a form of trade may not be perceived by the community's members as trade. Whatever it may be, trade consists of activities that are typically governed by strict rules and protocols facilitated by routines.

Trade is unlikely to take on more complex forms as long as such communities remain sufficiently small that there is no need for accounting and record keeping. Some of the activities of those societies involve the arts and entertainment, which are integrated within the society through an informal form of exchange and labor specialization that is also governed by laws and protocols.

As societies become larger and develop in the form of multiple communities, trade begins to involve exchanges between growing numbers of individuals belonging more and more often to distinct communities.

As societies grow, there is a parallel need to develop some form of content that is seen as essential to the societies themselves. Typically, the content all societies appear to value above all is their individual history, the history of “the people,” as with the Inuits. At this stage, as history becomes complex and involves too many elements for individuals – even the elders – to remember, societies may select one of their members, typically one of the most gifted, to become people’s history.

In some parts of Africa, that person is the grillot. The grillot develops unique skills to keep the complex record of the society’s history and is rewarded by gifts and various forms of payments that are also governed by laws and protocols. As demonstrated by the grillot, content does not travel in the same way as physical goods and services, and trade in content remains within the boundaries of individual societies or “people.”

In due course, often through the creation of empires, trade and content become so complex that people eventually develop art, sculpture, and, at some stage, writing. This step transforms the availability of content among people because it can now be reproduced. Historically, this step was controlled by the religious and, at times, by the political authorities. This meant that those responsible for content within the society had ways to be paid for their work.

However, the way artists and entertainers were paid in the past already encompassed the great discrepancies we observe today. Suffice it to compare artists such as the three Limbourg brothers and the masterpieces they created for the Duc de Berry with popular entertainers such as Hugo’s Notre Dame de Paris’ Esmeralda.

Gutenberg transformed the reproduction process and made content accessible to an even larger population. The invention of photography, and, subsequently, the phonograph and movie in the nineteenth century further transformed access to content and the works of artists. Around that period, the copyright protection of the works artists produced became increasingly widespread.

Although the process afforded some protection to the artists, it also gave them the responsibility of making sure they could collect the payments, a task that could turn out to be a challenge, as demonstrated by Dickens' experience when he visited the United States.

The radio was the next major transformation in the way individuals could access content. With radio, individuals could listen to music and other forms of content without a direct transaction with the artists or their intermediaries. Copyrights were covered in many places by a flat tax; elsewhere, as advertisers paid to have access to radio listeners, providing a way to pay for whatever copyright fees had been negotiated.

From an economic perspective, radio transformed the relationship between artists and entertainers on one hand and listeners on the other by eliminating the commercial transaction that gave the public access to the artists' work. Effectively, with radio and, eventually, the television, society was returning to a form of commons that dominated ancient societies.²⁴

While the process was different from the ancient times, radio stations were privately owned, artists and entertainers had recourse to have their rights recognized as individual stations, just as individual commons, were centrally managed. They had an owner who was responsible for using copyrighted material for commercial ends, i.e., someone from whom they could collect copyright fees.

The media commodity has the unique characteristic that copyright owners keep the property rights over the artists' work by effectively transferring a license to customers to view and listen to the material.²⁵ That license is becoming increasingly imprecise with the increased flexibility technology allows people to enjoy, hence to consume, the artists' works. This has led to the introduction of the concept of "fair use" that details the terms of the license, i.e., how individuals are entitled to consume the copyright material.

With radio and television, artists found that technology was restricting their ability to select the pricing model of their choice, and that they lost the possibility of charging each individual for listening and/or viewing their creation. However, the change in pricing, where the link between the price customers pay and the specificity of consumption becomes less and less precise, is a general trend, and not a specific characteristic of the media sector. The trend reflects the greater number of ways customer demands can be met; consequently, the need to find new pricing structures that simplify the processing tasks of consumers arises.

Internet radio and, in time, Internet television further expand the extent of the population that can be reached by the technology. That population, now, is the global population of Internet users. Nevertheless, Internet radio

and television leave one dimension unchanged, the community of users. That community is still organized in a centralized manner since it depends on a single entity; the Internet station owner. With Internet radio and television, even with its global reach, artists do not lose the recourse to a single owner.

Peer-to-Peer changes this situation. While there may be, initially, a single platform, the Peer-to-Peer community emerges totally decentralized with each member free to act as they wish. As those communities are open, i.e., anyone can join simply by downloading the software, and as the network is made by the Peer-to-Peer community members' contribution to that particular community, for example, KaZaA, the community that emerges is totally decentralized and has no governance.²⁶

Pure Peer-to-Peer creates what Hardin (1998) defined as "unmanaged" communities. A priori, "unmanaged" communities, i.e., communities that have no governance, should not be sustainable. After all, those are the communities that contribute to the "tragedy of the commons."²⁷

However, the challenge Peer-to-Peer creates cannot simply be reduced to a "tragedy of the commons." A closer look at modern communities points to their complexity. Communities are typically multidimensional, and managed communities deal with some dimensions and leave community members free in terms of other dimensions. For instance, while some religious communities specify foods that members are not allowed to eat, they do not specify how other foods are to be eaten, and nothing prevents a community member becoming sick following an eating binge.

This is the situation that the content industry faces with Peer-to-Peer today. That community has become increasingly layered, with its governance restricted to a subset of layers; layers that have nothing to do with the content sector. A Peer-to-Peer network service provider such as eDonkey can only survive if its members as a group provide enough capacity for the network to function.

Should a community's sustainability be threatened, economists and others are developing algorithms that would create incentives for a particular community's members to contribute access and computing resources.²⁸

Such activities at the layer where community members provide resources to sustain the network do not address the copyright issue. In other words, the sustainability of Peer-to-Peer networks, regardless of the governance under which they are managed, act at a layer that is independent of the exchange of content.

Peer-to-Peer and the Disruption and Changes in Economic Institutions

Peer-to-Peer and the Commons

The way individual members of Peer-to-Peer networks interact with their network has a double “free riding” and “non-excludability” dimension. In other words, it brings us to one of the most basic market failures that Hardin in 1968 called the “tragedy of the commons,” a status that had already been detailed by economists.²⁹ Hardin’s use of the expression “commons” was intentional. It was calculated to highlight a specific market failure, the instability of an economic environment where those two characteristics coexist.

In this section of the paper we consider this failure as well as other sources of market failures. We also consider the ambiguities of the copyright owners with respect to the numerous information asymmetries that are found in the sector as well as an additional market failure at the level of transaction costs. This leads us to adopt an analytical framework that is broader than the conventional market setting, the commons. The rationale is to find solutions to those market failures that are efficient, if not optimal.

The purchase of movies or music from, say, a store, is a transaction. In 1967, when Demsetz began to develop the theory of property rights, he wrote that “[w]hen a transaction is completed in the marketplace, two bundles of property rights are exchanged.” He added that “it is the value of the rights that determines the value of what is exchanged.” While strictly speaking correct, Demsetz’s description illustrates what is for most consumers an inherent ambiguity, namely the actual property rights individuals purchase when they buy a CD or download music through iTunes.

For most people, buying music that way is not essentially different from buying new clothes or buying a picture to decorate a room. In practice, this is related to the concept of usufruct, the right to dispose off something we own, as we want. This is one of the three dimensions of private property, together with excludability and alienability. In most situations, societies recognize those rights but impose limitations on them.

Copyright illustrates the complexity of property rights and the limitations it imposes on those three dimensions of private property. The owner of copyright material has complete control over it as long as the work is not made publicly available. This means in practice that the owner holds the rights of usufruct, alienability, and exclusivity.

The same owner's commercialization of the works through, say, digital copies, creates a unique situation to the extent that, through commercialization, the owner transfers to the customers who purchase online reproductions of the work some rights. In other words, in contrast to the sharing of a copyright work through Peer-to-Peer, where individuals possess a work that they do not own, in the case of a commercial transaction, they own rights (which we will associate here, for simplicity, with a license to use the work).

Carruthers and Ariovich (2004) have observed recently that "what separates ownership from mere possession is the fact that others recognize ownership." However, here even the terminology of ownership leaves ambiguities, and society imposes restrictions on the ways individuals are entitled to use the copyright material.

The so-called "license" a customer purchases has a number of characteristics, some of which need to be highlighted. First, the individual is not generally aware of all the limitations that are associated with the particular purchased reproduction; Second, copyright owners do not make an effort to spell out, at the time of the sale, the restrictions associated with the transfer of the work's reproduction. We can infer from the marketing approach that copyright owners are not generally concerned with the way individuals use such reproductions. Logically, this would reflect the fear copyright owners have that detailing the actual terms and conditions as specified in the legislation would negatively impact sales, and hence the owner's profits. This also means that there are some discrepancies between *de jure* and *de facto* terms and conditions for the use of reproduced copyright material.

De facto, the commercialization of reproduced copyright material differs in a number of ways from the economic concept of the market. For instance, there is significant information asymmetry between the buyer and the seller in terms of the content and the copyrights' terms and conditions. Similarly, the buyer typically has only partial knowledge of the purchased material. On the other side of the coin, it is generally extremely costly for the copyright owner, barring clear abuses, to know how the material will be used in practice; thus, the buyer has room to free-ride, say, by sharing the work with friends.

Beyond that, we have seen that it is in the interest of the copyright owner to keep many questions ambiguous because there are situations when he may benefit from significant externalities by leaving considerable leeway for the way customers actually use the material. For instance, by allowing *de facto* consumers to share the material, the supplier is often able to mitigate one of the information asymmetries identified below.

There are also practical reasons for keeping the enforcement sufficiently vague. Even if a strict enforcement were not to have a dampening effect on demand, i.e., because the demand elasticity is zero, the cost of monitoring and enforcement would make the process commercially unsustainable. The transaction costs would simply be too high. Effectively, the commercialization process, together with legislation, provides a benchmark that serves as a rough reference for the way people effectively use their license.

As an analogy one could think of speed limits. While there may be few cars that abide by the speed limit, this does not imply that the speed limit is not an effective tool for controlling the speed at which people drive.

At the same time, the copyright owner faces the danger of suffering from rivalry since the direct impact (evidently, not necessarily the net effect) of sharing lowers his revenues. We have shown through examples that some of the dimensions that characterize the commercial exchange do contribute to inefficiencies within the market process, including some that result in a market failure. We conclude that it is useful to set the problem within the more general context of the commons.

This status quo is periodically shaken by new technologies, as illustrated by the Betamax decision regarding the ability of making copies of copyright material for private use. Each time, however, it seems that the industry needs to find a new equilibrium. In the case of the Betamax decision, this was facilitated by an eventual balance between the increased ability to access, copy, and often share content on one hand, and the increased demand for easier and friendlier access to copyright content that new technologies had created.

Today, Peer-to-Peer would seem to have shattered that equilibrium in a fundamental manner. In the past, individuals' ability to reproduce copyright material was limited, as was their ability to share it. Today, with Peer-to-Peer, the community of people with whom content may be shared is global. A Peer-to-Peer network gives individual members of the particular Peer-to-Peer community – for example, Gnutella, the ability to digitally store a film or any other form of digital copyright material in such a way that all members are capable of accessing it.

This means that such a work becomes available for all members to download. Effectively, it becomes a public good within that particular Peer-to-Peer community. To fully appreciate the implication of Peer-to-Peer, we cannot look at the community as isolated, but need to consider simultaneously the community of artists and entertainers who produced the material. In addition, we need also to look at the network of intermediaries that facilitates access to the material. This perspective is necessary since those who actually own the property rights over the copyright material have not participated in the creation and management of such networks.

From such an economic perspective, the ability to download those works has the direct effect of lowering revenues for recorded sales. Even though the indirect effect may more than compensate for the direct loss in revenue, this assumption is much more hypothetical than in the pre-Peer-to-Peer days.

Today's Peer-to-Peer networks have created, as we noted earlier, "unmanaged" commons at the level of copyright material, i.e., commons that are potentially similar to those described by Hardin in his 1968 paper. Hardin's commons refer to a specific period in the history of the commons, i.e., when – in the late eighteenth and early nineteenth centuries – they started to be converted through enclosures into private properties.

As Hardin recognized, those commons had existed for centuries, far longer than today's capitalistic system. Hardin attributed the collapse of the commons to the emergence of rivalry associated with population growth. Such an assertion is not supported by a historical analysis to the extent that the commons were never treated by society as an "unmanaged" free good.

Commons were typically a sophisticated social system that dealt with the allocation of resources. Occasionally, such a system also dealt with other dimensions such as social welfare in the form of assistance to lower-income individuals. Those objectives were typically achieved through constraints on the access and usage of the commons that reflected the needs and social status of the various members of the community. Membership in the commons and the associated rights reflected the diversity of the local population and of its economic status. Baumol (1971) describes such a commons in his analysis of entertainment in ancient Athens.

When one considers the commons and the communities relative to which they are defined, membership means both the ability to benefit from the communal system, i.e., the commons, and the need, in general, to contribute resources to that system or to face some rationing system when consuming what the commons produce, or both.³⁰ That was also true in the historical commons with many tasks required to maintain the commons allocated through customs and other systems.

The main difference between the historical commons and today's Peer-to-Peer network communities is that, historically, i.e., throughout the Middle Ages, the commons underwent an evolution which enabled the institutions, customs and routines that appear to be generally sustainable and efficient today were developed over the years. With reference to the commons Hardin studied in 1968, had land not become scarce, there would not have been a need for them at all – therefore, the phenomenon should be studied from that particular perspective.³¹ The original determinants of the

commons had to be based on more conventional economic forces and only through time did complementary factors such as customs and religion emerge, thereby increasing the efficiency of the institution by further lowering transaction costs.

Opportunism, Altruism, and the Efficiency of the Commons

In this section, we study the process through which the commons often achieve efficient solutions in spite of market failures. Those processes are not always necessary to achieve efficiency, nevertheless they highlight results from experimental analysis that have consistently been neglected by economists in favor of assuming pure utility and profit maximization without adequate room for efficient group behavior.

Following Hardin's contribution, the commons has become a generic term that is rarely adequately defined. Free-riding is an inherent problem with the commons as long as all agents act independently and cannot credibly signal to one another that they commit not to act opportunistically.

This is the kind of opportunism that Ostrom (2000) called "rational egoism." This is why the economic literature has assumed away the question. For instance, the commons that is most prominent in economic activities is the government, and economists take the government, in terms of its most elementary functions of providing services to ensure trade, as given. Where economists consider market solutions that internalize some of the government functions, they effectively exclude the prisoner's dilemma, i.e., the danger of opportunistic behavior, without providing an analytical structure that is able to model such an environment.³²

Observations of everyday life demonstrate the inadequacies of building economic analysis exclusively upon rational, opportunistic, profit/utility maximizing economic agents. Such observations are corroborated by experimental results that show that the temptation to free-ride is universal but that it coexists with the ability and willingness of people to cooperate to their mutual benefits.³³ That literature strongly supports the view that people tend to be willing to undertake actions that can be beneficial to the collective as a whole through private, individual steps and without assurance of reciprocity.

The commons are defined as the generic environment within which economic activities take place and markets are best studied as embedded within the commons, essentially, as subsets that emerge once a conventional economic framework is imposed: "[C]ommons... include all economic exchanges, whether market-based, based upon central-planning

allocations, or other arrangements that could be government and/or community-based.”³⁴ Markets are based on the presumption that all players are opportunistic.³⁵ This is not a generic requirement for the commons that accept a diversity of attitudes among members of the society as a possibility.

Interestingly, it is that diversity vis-à-vis opportunism that makes it possible to find governances that support efficient exchange in the context of market failures. Hardin’s (1998) terminology of “unmanaged” commons highlights the limitations of markets since, by definition, markets correspond to Hardin’s “unmanaged” commons.

The commons, just as much as the markets that are embedded within them, are not static concepts. Rather, they are dynamic concepts that evolve through time in manners that are closely associated with property rights.³⁶ Numerous forces bring about changes. For instance, if we consider the restaurant sector, it is easy to observe the way eating habits have evolved in many places, given the growing number of people who choose to go out, i.e., who choose the market place, to eat.

Peer-to-Peer is one of the factors that contribute to those changes. For instance, the demand Peer-to-Peer networks make upon commercial activities that take place outside the marketplace is such that it challenges well-established, customary boundaries. Those activities include the participation of any Peer-to-Peer community in the form of making resources available to all, in an independent fashion of conventional commercial relationships.

The English landed gentry’s success in redefining their property rights was its ability to do away with the historical commons through the enclosure and to translate the change into a system of private property.

We have seen that Peer-to-Peer is best studied in a context that is broader than conventional market analysis, namely the context of the commons. That perspective provides us both with concerns and hopes. Our concerns reflect the “unmanaged” nature of the various Peer-to-Peer commons at the level of copyright material, a concern that is particularly serious since it need not imply that the Peer-to-Peer infrastructure itself is unmanaged, and, even if it were unmanaged, that it is unsustainable.

The more positive note derives from the characteristics of individuals acting in what they perceive as a commons. If artists were able to bypass the attitude of many of the intermediaries, they may well encourage the emergence of an economically viable commons that would also support their own creative efforts.

Disruption in the Institutions

From the very beginning, the unprecedented success of Napster, and the RIAA's judicial challenges erased any doubts about the stresses Peer-to-Peer as an innovation was already imposing upon the institutions of the time. Many determinants contribute to shaping the process of adjusting existing institutions to achieve compatibility with the Peer-to-Peer innovation.

Many of these determinants are of an economic nature and can be studied to gain a better understanding of the way conditions evolve in response to Peer-to-Peer. It is fundamental to understand those economic dimensions if we have to analyze how Peer-to-Peer creates pressure on institutions to evolve and to infer from those changes what is happening to the sector.

We can illustrate the process by looking at how Peer-to-Peer changes the way consumers increasingly perceive access to, and use of, content. Peer-to-Peer raises some questions about some of the dimensions of existing implicit licenses under which people are entitled to use copyrighted material. For instance, the Betamax decision never considered the implications of someone placing a piece of work, for example, a movie, in their own open computer space the way some individuals often play music from their car/apartment in such a way that it is shared by the whole street.

The other lesson relates to the emergence of new possibilities, namely the ability to access almost any kind of content through file-sharing within a Peer-to-Peer community. Such a possibility offers an expanded range of options for consumers, and, consequently, the reference to residual rights regarding the customers' licenses. However, this possibility provides us with information only on what consumers can do, not on what they will actually do with it, and does not inform us about how today's implicit license may restrict what consumers are permitted to do; finally, it does not provide information about what that may mean for artists.

Artists may find it easier to carry out many of the steps themselves, e.g., to publicize and commercialize their works or to call upon new intermediaries. How much easier this will prove probably depends more on technologies that are complementary to Peer-to-Peer than on Peer-to-Peer itself. Hence, to what extent Peer-to-Peer might simplify the tasks that are currently carried out by intermediaries will remain an open question until we begin to appreciate how Peer-to-Peer is affecting intermediation, something that will only come through time as artists gain more experience with the ways Peer-to-Peer makes up for many of the existing services that intermediaries – such as content owners – provide.

Those changes do not address the “unmanaged” nature of the commons Peer-to-Peer creates at the level of copyright material. Those changes are also unlikely to affect all artists in the same measure. For instance, it is reasonable to assume that Peer-to-Peer will lower marketing costs for some artists, or equivalently, increase their reach. It is also reasonable to assume that those artists who use the major content aggregators today to market their works will be better protected from conflict of interests by aggregators. At the same time, it may be that artists, who vie for the top chart, and consequently, depend upon exceptional and costly marketing campaigns and know-how, may not see much change at the intermediation level; when one considers how competitive artists are, that may prove to be the majority.

This is the process through which residual rights associated with the licenses that specify how content can be used and shared are created and evaluated by stakeholders. Once the residual rights are allocated, they regulate what the stakeholders are entitled to and determine how they will fare in a Peer-to-Peer environment. Some of the court decisions help clarify the entitlement of the various stakeholders, i.e., consumers, Peer-to-Peer network service providers, artists and producers, and, evidently, the owners of copyrighted material.

Coase (1960) specifies the relativistic nature of the process, i.e., the extent to which, in the present situation, the balance between the copyright owners’ property rights and the consumers’ *de facto* licenses are specified in a social context in terms of the limitations society (as well as private communities) imposes on the use of those rights.

In most cases, Peer-to-Peer is a disruptive technology, even though there are exceptions. For instance, the recent court decision through which the Betamax principles were applied to Peer-to-Peer illustrates a degree of continuity. However, on the whole, the experience gained with Peer-to-Peer suggests something far more disruptive. To start with, today, consumers are still in a sort of no-man’s-land regarding the way they can benefit from Peer-to-Peer. Consumers also have the option of ignoring Peer-to-Peer and the way it transforms the concept of access to content for individuals.

The alternative for those same individuals is to access content through new Peer-to-Peer services such as KaZaA and Gnutella, or even eDonkey, for instance. The first option means that consumers have to forego new ways to consume content even though there is ample evidence that this would force them to forego options that enhance their utility. The second option means on the other hand a significant level of uncertainty about what would be considered reasonable and, beyond that, the legitimacy of their actions and, in the long run, their legality.

The institutional perspective we have developed here goes a long way in helping us to look at the many conflicts that have arisen since the emergence of Peer-to-Peer from an economic perspective.³⁷ Conflicts such as the numerous court battles RIAA mounted against various stakeholders are playing an essential role in helping clarify the institutions that will support Peer-to-Peer. The perspective also reflects the predictable response by an incumbent to an innovative threat. Most institutions are likely to evolve in response to Peer-to-Peer. Some may disappear while new ones may emerge.

Peer-to-Peer is transforming the content industry, not so much at the production level as at the intermediation level. For instance, consumers still have to find out what is the reasonable use and sharing of content within a Peer-to-Peer community. Other legal issues such as the redefinition of consumers' implicit licenses where the residual rights of different parties overlap – as illustrated by the legality of the RIAA invading Peer-to-Peer systems – may not rely as heavily on the body of legal precedents.

Institutions are complemented by governances which are largely controlled by entrepreneurs and others who create Peer-to-Peer communities.³⁸ Those governances generally take the form of unwritten contracts that regulate the way members (even if they link up only once to the network) and the community leader(s) act within that community.

However, our previous analysis showed that in the post-Napster Peer-to-Peer networks, Peer-to-Peer network service providers' ability to create governance is restricted to the Peer-to-Peer network layer. It is not clear whether those providers could create governances at the copyright content layer level. Such governances could make them vulnerable to legal actions by industry organizations such as MPA and RIAA.

In addition, even if they could do, the potential membership perception and response to such governances and the fact that for the last 5 years consumers have had access to Peer-to-Peer networks that had no governance at the content level, effectively restrict future options. Those conditions imply severe limitations to the range of existing governances for those who create communities.

The other side of the coin is that some entrepreneurs are stimulated to respond to the needs of artists to become innovative and introduce new governance concepts with a view to bypass those challenges. Such entrepreneurs could become able to offer a far superior service to existing Peer-to-Peer networks, to the extent that they could manage the information about, and the access to, copyright material in a far more user-friendly way.

The interdependence between those emerging governances and established stakeholders can be illustrated by the response of the RIAA to Peer-to-Peer and the response of the technology to the RIAA's strategy.

As we will see below, today copyright holders are typically intermediaries who transform the raw content product into something consumers know about and might be willing to pay for. In other words, their function is the added value they provide to the original work of the artists. That added-value component can be significant.

However, the role of intermediation in the content sector is not different to the role of intermediation in other sectors of the economy. Intermediation is a function that evolves rapidly in response to technological changes such as Peer-to-Peer, to the extent that such technological changes make a substantial portion of the intermediation added-value services obsolete.

It is evidently in the interest of copyright owners, inasmuch as they are intermediaries, *ceteris paribus*, to take steps to prevent the drop in value of their past investments in intermediation. This is no different from the attitude horse-drawn carriage owners embraced when they were threatened by newer technologies such as the automobile industry. In the market, such ability is limited both by demand considerations and by new artists' ability in bypassing the old intermediation process.

While the narrow incentive of the content sector is predictable, the strategies followed may not be. There are reasons to believe that the strategies pursued by the content intermediaries have been backfiring. Krim (2004) documents how the activities of the RIAA, such as the way they went after Napster, resulted in a substantial shift in the categories of governance that entrepreneurs select. RIAA's attacks on Napster created strong incentives in the emerging Peer-to-Peer network sector to favor highly decentralized systems such as Gnutella that appeared to be immune, and were eventually so ruled by the courts, to the RIAA's legal attacks.

Institutions and customs are not rigid and unchanging. While they affect economic activities, they also evolve in response to those activities. The emergence of Napster pressured RIAA, and through it, various institutions. As Betamax before, Napster challenged existing paradigms that were conceived for an environment that did not know innovations such as Peer-to-Peer.

The process through which institutions evolve is one in which conflicting forces seek, hopefully, to bring about a social welfare solution. Coase's (1960) social cost analysis provides a benchmark to consider innovations such as Peer-to-Peer and how institutions could adjust to further social welfare. However, it is an analysis that is set in a narrow framework of laws and regulations and we know today that issues such as those raised by Coase are typically addressed at least in part through a more informal and complex set of rules that includes different cultures, customs, and routines. Laws and regulations as well as customs and practices are some

of the dimensions that provide a framework within which economic activities take place. Those are institutions which, whether formal or informal, inevitably shape the way commerce takes place.

Consumers

Introduction

In this section, we consider the likely consumer response to the emergence of Peer-to-Peer as well as to the failure of the content sector to facilitate the development of credible Peer-to-Peer content commercial services. We then treat the characteristics of content services and the ways Peer-to-Peer changes them. Those changes would seem to be fundamental inasmuch as they create a major discontinuity and make the extrapolation from the former environment problematic.

We show that, from the consumer perspective, Peer-to-Peer is transforming the content into a good that is, in and of itself, more attractive to consumers. However, the actual economic impact is still very sensitive to the strategies suppliers have been pursuing. Our best guess is that the rigidity of their position has contributed to the emergence of today's Peer-to-Peer networks, thus creating an even greater chasm between copyright owners on one hand and consumers on the other. The damage to the suppliers' long-term interests may be even greater as the lack of a solution that is satisfactory both to consumers and to the copyright owners may result in the consumers institutionalizing the present Peer-to-Peer file-sharing environment.

Consumers who would have been more ready to support fostering pay services have not received the support from copyright owners that they needed. As it is, results from experimental analysis suggest that those consumers may give up and accept today's free bypass services such as KaZaA or eDonkey.

The owners of copyright content may point to their property rights. They may point to piracy in the USA through the downloading and exchanging of popular music and increasingly of videos, but such an attitude has two fundamental flaws. Firstly, they neglect the business dimension of those rights, namely, that their narrow and rigid interpretation effectively destroys the value of those property rights. It is not good business to enforce copyrights too narrowly.

Secondly, they overlook the most essential dimension of property rights. A property right, if it is not to be imposed by sheer power and ruthless fiat, but rather if it is to be a factor within a democratic society, cannot be

arbitrarily imposed on that society. Rather, it must reflect the society's acceptance of the granting of power that the society's recognition of ownership *de facto* implies. This means that the society must find them reasonable in the long run.

It is that social and political dimensions of property rights that is so often neglected and overlooked in discussions. Narrow approaches to property rights, as expressed, for instance, in Einhorn and Rosenblatt (2004), take those dimensions for granted. Yet Coase (1960) observes that "the rights of a land-owner are not unlimited... This does not come about simply because of Government regulation. It would be equally true under the common law. In fact it would be true under any system of law." Coase's analysis, here, is generic. It is not restricted to the specific case of a land-owner.

Consumer Demand and the Commons

Consumers are involved in the process that will determine a mature Peer-to-Peer environment just as much as members of the industry. Their involvement, with the exception of a very small minority, is not a direct one in which they formulate a strategy in order to shape Peer-to-Peer to best meet their needs. It is, nevertheless, just as powerful an involvement as that of other actors because of the number of those involved and the signal it conveys to other stakeholders. In many ways, the involvement of consumers is the most important of all to the extent that the sector cannot exist and survive without their participation.

Consumers impact the solution that needs to emerge to the extent that they express their dissatisfaction, directly in the market, through political means or other social strategies, or through a combination of those strategies.

To understand how consumers tend to influence the system, one can use an analogy with an object consumers are familiar with, namely, cars. Innovations and technological changes have made cars significantly safer. Roads and highways have also improved. This means that safety as well as speed has increased while the number of cars on the highway has also increased without negatively affecting safety. These trends explain the governments' decisions, in the USA, to allow higher speed on highways.

However, for argument's sake, let's imagine that some interest group that is opposed to this change were to change the speed limit and lower it, for example, to 25 mph everywhere, including on major highways; such a prohibition could be seen as a benchmark. We can easily guess the medium to long-term impact such a new policy might have. It may be that for a while there would be limited support for such a measure, and that the

threat of receiving a ticket might be sufficient for the police to enforce it. However, such a speed limit is inconsistent with today's cars and driving habits. Hence, it is reasonable to assume that, progressively, more and more people would begin to drive at a higher speed. This would complicate the enforcement task of the police to such an extent that it may actually become impossible.³⁹

At that stage, a government would essentially have two courses of action open. It could acknowledge the increasingly dominant trend toward higher speed by allocating fewer and fewer resources to its enforcement, and/or change the law.

Recently, the Belgium Communications Minister attacked Peer-to-Peer. At the end of his speech, in response to questions, he asserted that he was not allocating any resources to address the Peer-to-Peer issue. Alternatively, a government could impose more and more severe sanctions. However, this latter option is unlikely to be chosen because of the impact it may have on the public support. The above analogy underlines the effective power of consumers, even if their power is indirect. It also highlights the extent to which the solutions toward which courts and regulators evolve are bound to reflect, among various determinants, consumers' attitudes, which can be assumed to be endogenous.

To the extent that our analogy has its merits, it has serious implications for the way the content industry is likely to organize itself in a Peer-to-Peer sector. Krim (2004) provides a substantial amount of evidence on the unwillingness of content stakeholders to negotiate a solution that would recognize the demands of other players, including equipment vendors. The present analysis suggests that such a hard-line strategy is most likely to backfire on the content sector, or at least, on today's major players.

We have already indicated that it is reasonable to conclude that the RIAA's hard-line stand, even after the victory over Napster, has contributed to the success of new Peer-to-Peer networks that are largely immune to the RIAA's legal activities. We have also concluded that solutions that do not meet consumer expectations are unlikely to be sustainable. This is not just due to the further negative impact it would have on demand, and, consequently, on Peer-to-Peer profits, but also due to the failure by the industry to acknowledge the expectations Peer-to-Peer has created among consumers.

Those factors should be reinforced by what one would reasonably expect from consumers. Experimental economics does not support the view that the RIAA and others in the sector have expressed, i.e., that consumers who access Peer-to-Peer through networks such as KaZaA would not pay for Peer-to-Peer services even if reasonable services were offered.⁴⁰ The market response to iTunes also contradicts the content

sector's position – even though iTunes offers a much narrower range of services than KaZaA. In other words, empirical observation confirms what experimental economics suggests.

Everyday observation provides plenty of evidence that the content sector has taken a rigid position in the last decade or more when negotiating with other stakeholders; such a result is confirmed by Krim (2004). This has meant that it has stalled efforts to develop strategies that acknowledge the emergence of Peer-to-Peer. Given the consumer response to that innovation, this also means that the content sector has undermined the emergence of Peer-to-Peer commercial solutions.

There is now extensive experimental literature that has identified key segmentations in communities in general regarding the willingness of subsets of the population of communities to allocate their own, personal, scarce resources to social tasks that do not benefit them directly and that may never benefit them individually.⁴¹

The experimental literature also considers the social dynamics among the members of communities where members differ in terms of their willingness to contribute, at least initially, to the social welfare. Depending on the external conditions, i.e., on the response members receive from outside the community, those who are willing to look for a social solution may be able to win others over to their view. That way the community may be able to create a sustainable commons with broad support from the members of the community.

That same literature shows that, where the outside world is not supportive, social dynamics may eventually discourage those who are looking for a social solution. At that stage, those will begin to join those who are looking exclusively for their own selfish good and the community is likely to become the kind of “unmanaged” community Hardin described in 1968.

The latter outcome would pose a serious problem for copyright owners since it would mean that members of society in general would begin to take for granted the piracy Carruthers and Ariovich (2004) observe.

The Content Commodity

Some innovations do not really change the nature of the commodity itself but simply lower the cost of production and little else. Innovations generally change the commodity that is offered to consumers on the market. Sometimes, innovations transform the commodity to such an extent that any extrapolation from the commodity in the pre-innovation phase to describe the new commodity does not make sense. This appears to

be the case with Peer-to-Peer, where consumers who have experienced content delivered through such networks are unwilling to go back to the old access methods.

In the video environment sector, the previous assertion might be somewhat premature. Nevertheless, features such as the instantaneous availability of an exhaustive video catalog in the major networks that rely exclusively upon their members for content availability, are very important. At least in a sector such as the music industry, consumers appear to respond to the availability of that feature. In this respect, it is certainly a characteristic that needs to be incorporated in business models.

The attractiveness of the complete catalog may sound surprising when one observes that most consumers listen almost exclusively to a small number of hit records that typically comes from the selection made by the major labels. It may be that the option to listen to any piece of music at any time is nevertheless important to consumers even if it is rarely used. It may also be that the availability of music from independent artists, videos from different producers, and, potentially, from producers worldwide is valued highly by consumers. Inasmuch as this characteristic facilitates access to content apart from the most requested by the public, it may be viewed as threatening by those who control it. Yet, it may help contribute to increase the overall demand that may benefit even those who do not provide that expanded content.

Peer-to-Peer's ability to allow artists to bypass copyright owners may pose a more serious threat to established content owners. However, even that issue is full of ambiguities inasmuch as most artists, directors and producers will still need someone to advise consumers regarding what they are likely to want to look for at the major labels, as was illustrated in MP3.com.

The change in the commodity seems to follow closely what users are able to consume – for example, a video – with minimal time and geographic constraints. The information consumers have about their options is another dimension that affects the sector's growth. These options also affect the product that users consume. All in all, these changes should make the product more attractive to consumers, and, consequently, lead to an increase in overall demand. However, the business problem may not be that simple. Today, those who own content are major players with major stakes in the sector and substantial market and political power. In addition, they are likely to be those most affected by the changes Peer-to-Peer is bringing about.

Peer-to-Peer Innovation, Technology, and Business Strategies

The Technology: Exogenous or Endogenous?

In this section, we consider the extent to which Peer-to-Peer platforms have evolved technologically in response to institutional factors. It is not possible to assert unambiguously how the Peer-to-Peer fight has transformed Peer-to-Peer technology. After all, we cannot observe and compare multiple parallel technological paths. Nevertheless, adopting a “best guess” criterion, the conclusion is that the RIAA’s victory over Napster and other networks such as Aimster, together with its unwillingness to negotiate intermediate solutions,⁴² created strong incentives for entrepreneurs to favor a new generation of Peer-to-Peer networks.

That new generation was conceived to eliminate the technological elements, such as the centralized catalog, that had led to the demise of the first generation of Peer-to-Peer networks in Courts. In that respect, it is not unreasonable to conclude that the copyright owners’ strategy may have largely backfired making it that much harder to develop a Peer-to-Peer network that could meet reasonable industry demands while responding to customer demands that became apparent through Napster and other cases. In addition, such policies by copyright aggregators have led Peer-to-Peer network operators to take a layered approach with respect to file transfer in order to build business models that are also immune to challenges by copyright owners.

Individuals, especially economists, have a tendency to vest technology with unique powers. That force means that technology is largely conceived as the external and exogenous instrument of change. This perspective implies a world largely static in the absence of technology. We would like to challenge this concept of change in our environment, a concept that imposes an artificial, *ex ante* dichotomy between technology and institutions.

It is a natural reflex in today’s society to look at technology as an inherent and independent force that is continuously shaping, reshaping, and transforming the environment within which we live. However, this formulation is essentially passive, leaving us to “passively accept” what happens around us. In this vision, technology happens outside our influence and is independent of our economic activities; it also imposes on us an inherently dynamic force that takes us out of our routines. This is the cornerstone of most industrial organizations and, to the extent that it is not a crucial dimension of our analysis, it is a very elegant manner to simplify the analysis.

However, in this paper, technology and its impact on the sector is not the sole factor that needs to be studied. It is equally likely that the technology path depends on the institutions – especially on the response of the copyright owners to the technology itself. In this respect, the conventional assumption of exogenous technology that economists continue to make in industrial organization is at best misleading.⁴³ Such a perspective does not even address the time dimension of technological change or the interdependence of technologies and innovations.

From the perspective of technology, innovations challenge consumers, entrepreneurs, venture capitalists, and others and inspire them to do things in new ways. For economists, this reflects nothing more than the constant tension that is naturally felt between the need to innovate and create new paths and the need to protect and draw benefits from the assets that past innovations continue to convey to us.⁴⁴ A key dimension within this tension is the distribution of asset ownership among the stakeholders. A natural analogy consists in comparing a population of young and old people. It is safe to assume that younger people will not have accumulated a significant quantity of assets, in contrast to older people, i.e., that they have less sunk capital to protect. Subsequently, given the emergence of an innovation that effectively undermines the value of existing assets, the younger people will seize the innovation to build up their assets while the older generation can be expected to take steps to defend the existing technology.

In a Peer-to-Peer environment, the paradigm relates to those who are in a position to achieve a breakthrough by thrusting their new talents and approaches towards arts and entertainment on the market. The paradigm contrasts with the attitude of those who have already branded their product and whose focus is to consolidate that brand, i.e., the works for which they are already known. Established artists, such as Picasso, who continue to break new ground even after they are established are unusual. The norm would rather be established artists such as Salvador Dali.

In the same vein, Peer-to-Peer innovation came from young people, especially when considering Napster's Sean. The opposition to Peer-to-Peer has all the decorum of the established order. No one has painted the transition from the new path-breaking youth to the established older person in a more brilliant style than Jacques Brel with "les Bourgeois."⁴⁵

Peer-to-Peer appears to many as the instrument today's new entrant uses to challenge what has become today's establishment. As in most of these innovations, established stakeholders create a picture of Barbarians at the gates when talking about the onslaught of new artists. Few have the vision of Leonard Bernstein who, when talking about Janice Joplin, noted that before he could not imagine someone making art from yelling but that he had learned that he had been wrong.

Those responses are there again in the Napster and Aimster challenges. Those were painted “ex post” as nothing more than steps taken by “con-artists” whose only goal was to cheat the owners of copyright material from their revenue requirements, to use an established expression in the regulated industries such as telephony.

It is not the object of this paper to identify the precise motives of the stakeholders enacting the Peer-to-Peer saga, nor to judge between the merits of the entrants versus those of the legacy. The objective is rather to understand those inherent tensions that naturally emerge between the two groups and the economic forces that buttress them and, finally, to understand how those groups often use technology as ammunition in this battle.

Intermediation and the Historical Ownership of Copyrights

In the first instance, the cost of the inputs can only be lowered by decreasing the earnings of the artists and such earnings, as Baumol had noted in 1965, are already exceptionally low when compared to those of others in the society. In principle, this could be contrasted by increasing the audience for whom the artists perform. However, Baumol (1971) suggests that this is unlikely to happen. He also adds that, to the extent that there is a trend, it would be the other way round, i.e., with audiences that do not increase proportionately with the overall population, and that often decrease.

We conclude that the content equation that impacts the sector as well as the digitalization of the content and its distribution, as with Peer-to-Peer, contains one element that cannot be reduced any further, regardless of technological changes. The division of labor does not apply to the contribution of artists any more than it applies to many people in the medical profession. This technological and organizational characteristic is unique to artists and performers and to a few others such as medical doctors. This has meant and will continue to mean low pay and low earnings as already documented by Baumol (1965).

Artists are nevertheless able to reach through the reproduction of their work and, in recent years, through their digitalization, ever larger audiences, a process that has not stopped since Guttenberg and the printing press. The process is not just a matter of reproduction, but it also involves other functions that may entail tasks such as billing, production, and financing.

That process in economics is called “intermediation” and it involves intermediaries who facilitate the task of artists in such areas as billing, reproduction, and distribution. The point of differentiating the artists’ works from the contribution of intermediaries is that innovation and technological change are the factors that are constantly transforming the

intermediation process. This means that intermediaries need fewer and fewer resources and incur in less and less costs to provide services to artists.

The intermediation process is essentially different from the process through which artists create and perform. Throughout history, technology – together with the division of labor – has transformed intermediation, eliminating an increasing number of tasks that mediators used to perform. While the division of labor cannot be applied to artists and their creative process as we know it today, it does apply to intermediaries as it applies to any other sector of the economy. This means that, through innovation and with an ever-growing market, it has been possible to decrease the human labor input, and, consequently, reduce costs.

The consumers' response has been to increase consumption of entertainment and works of art. The technological process tends to be straightforward for consumers. Consumers are very leery of complexities. The same does not hold true for the supply side. On the supply side, innovation and its realization through technological change can be ruthless, with little regard for even the best-run businesses, as Christensen (2000) demonstrated so effectively.

Peer-to-Peer continues the trend that has dominated the sector and is reinforcing the transformation of the sector brought about by the convergence of digitalization and telecommunications.

Peer-to-Peer has demonstrated its capacity to build a bridge between individual artists and their public. What the sector has yet to develop is an approach that meets at the same time the needs of artists and those of their public. The complexity of the task results from a number of factors, over most of which artists have little control.

For instance, as noted above, innovations such as Peer-to-Peer impact artists and intermediaries in completely different ways. There will probably always be a role for intermediaries but that role is shrinking and shifting at the same time. This means that legacy intermediaries such as the aggregators need to redefine themselves, a step that is almost impossible for established firms.

The technological changes have a major impact on intermediation and its *raison d'être*. The reason for that is that intermediation emerged largely in response to the way technology was transforming the general public's access to the creative works of artists. The outcome is that intermediaries have been the most vocal stakeholders in this technological process.

Their ability to gain a disproportionate amount of attention in the fight to know which stakeholder gets what as technology disrupts the environment within which content is consumed has been greatly helped by their ability to aggregate existing copyrights among a small number of very large players.

Copyrighted commodities have unique characteristics relative to conventional economic analysis. A further analogy can help us understand better the economic meaning of those characteristics. Perfect competition in a partial equilibrium context, as it is conventionally presented,⁴⁶ is a zero-profit environment where any deviation from the equilibrium is instantly corrected through arbitrage. Instantaneous adjustment means that all transaction costs are reflected in the vertical organization of relevant sets of activities. It is the internal organization of multiple activities that establishes the possibility that some vertically integrated firms may emerge in a competitive environment.⁴⁷

It is important to stress that we are still in the widget economics' paradigm. The optimality of this model is built on conditions such as the instantaneous identification of arbitrage opportunities by all parties. Evidently, it is not just the identification of arbitrage opportunities that is instantaneous. The stakeholders all respond instantaneously, which means that they never extract any rents from arbitrage. One of the dimensions of the constraints on the system is the fact that all such processes basically happen independent of time in such a way that economic decisions and strategies have no duration.

This is also the framework that is commonly used to study the economy of copyrights.⁴⁸ In this framework, there is no room for court cases such as Napster and venture capitalists never end up in front of a court since this would be irrational in a world of perfect knowledge. The law is perfectly known and judges, just like entrepreneurs and other actors, are automats with unchangeable, efficient decisions. Perfect competition means, as Sengupta (2001) reminds us, a world where “[p]erfect institutional order... is fully predictable behavior [resulting in the] complete absence of individual freedom.”

An alternative to the neoclassical framework is the modeling approach proposed by the Austrian School. In that world, economic actors are not automats and the outcome of their actions is not pre-determined. Thierer (1994) observes that “[c]ompetition... is a dynamic process of constant entrepreneurial adjustment to market signals. The market is never at rest; today's monopoly could be tomorrow's competitive market...” This model is essentially different from the model of perfect competition used to study widgets. Here, we lose the idea that competition could ever be perfect.

In this Austrian world, economists have to rely on a different concept to achieve competitive efficiency, namely, the spontaneous order.⁴⁹ At the same time, they are unable to establish the efficiency of the outcome, either in the short or long-run. The outcome is based on a belief: “... [E]conomists with allegiance to the Austrian School of economics, such as

Dominick T. Armentano (1990), F.A. Hayek (1948), and Israel M. Kirzner (1973), believe that not only are answers to the questions about natural monopoly wrong, the questions themselves are improperly formulated.”⁵⁰

Whichever way we may choose to model the way stakeholders interact with one another – be it neoclassical, Austrian, or other – the idiosyncratic dimension of art and entertainment works is the cornerstone of the analysis of the copyrights market. Yet, at the same time, this is also the characteristic that is the most ignored by economists. The sector cannot be reduced to the economic activities defined in terms of a stock comparable to the stock of power plants in the public utilities sector or the stock of air routes in the air transportation sector.

At the same time, it is just as misleading to reduce the dimensions of the sector’s economic activities to the study of flows, the way one would treat most industrial sectors, for example, the computer sector. Such simplifications may be adequate in some limited circumstances when the objective is to study specific problems that can be safely treated from a partial equilibrium perspective. For instance, the label may be carrying market studies to explore how best to classify – for positioning and commercialization purposes – and then to present an artist such as, for example, Melissa Auf der Maur.⁵¹ However, such simplifications are certainly not appropriate for policy purposes in the context of Peer-to-Peer.

An artist, for example, a singer like Melissa Auf der Maur, produces the antithesis of the “widget” commodity. Each work is “hand-crafted.” Artists such as Auf der Maur, create and develop their pieces and then rework them until they are satisfied with the quality of the work to be released. It is a process that has more in common with the wine maker who spends whatever time it takes to develop and transform the juice of grapes into a wine with depth and bouquet.

In the same manner, Auf der Maur, like so many artists, puts her time and energy in months of work to become what she believes is her creation, what she wants others to hear. She crafts each song, each album, individually, one at a time, taking her time as required in a similar fashion to the way artisans worked in the past.

It is in this context that one must look at the contribution of the aggregators. The glamorous image they like to convey is the image of “l’enfant terrible,” an image that conveys the idea that they work extremely hard to search for, discover, and transform blockbuster artists in such a way that the public will worship them. The image suggests the high risk inherent to their job as aggregators – i.e., the need, the time, and the expense of going through hundreds and thousands of artists so that they can discover “the Beatles,” the artists and their work – to show the world how essential their role is.

Their role is not all that glamorous. Through consolidation they have gained the ability to manage huge portfolios of artists. Given the size of the library already in existence, and given the continuous flow of additions, aggregators are able to benefit from a demand for intermediation that organizes and processes information to the extent that it makes the decisions by potential customers, i.e., it actually lowers transaction costs.⁵²

That type of strategy has enabled them to use their size to shield themselves effectively from many of the risks of failure that individual artists and small intermediaries would face. The outcome is their ability to gain control over a significant share of copyrighted material. In the same process, they begin to act as an insurance company. The strategy also creates a pool to artists who may hate the process and who may dream to “make it” without the aggregators, but who also dream to be able to sign in as members of that select group the aggregators manage. It is their market concentration and their ability to integrate those various intermediation functions that largely protect them from competition.

Their most visible role, at least from the perspective of the outside observer, is to intermeditate between the artists and the public. They organize the works of artists, pushing some and keeping many behind, preparing a select menu of products for consumers, the way many restaurants develop special menus. To return to the example of Auf de Maur, they position her work within categories of music content.

The above is a process that makes it easier, by lowering the transaction costs for the general public, for people to get a sense of the kind of music Auf der Maur produces, and whether or not they may be interested in exploring her work further. Given the inability of individual consumers to sample and evaluate all the music that is available today, this step will generally streamline the search process. It is a process that facilitates linking Auf der Maur with those who are likely to be interested in her music. It is also a process that can help steer away those who are unlikely to consider such music because, for example, they are exclusively interested in country music.

Today’s economic studies largely ignore the complex market structure within which intermediation takes place; hence, they ignore the determinants of economic efficiency both at the content creation level and at the intermediation level.

As a result, their conclusions about the efficiency of existing institutions, and especially about the efficiency of those aggregators, have no foundation since those factors that are ignored are those that would make it possible to say something about economic efficiency and social welfare.

As observed previously, by treating the processes of content creation and production on one hand and of intermediation on the other, as all being inside a single black box, the scope of economic analysis has been reduced, and its ability to address key policy issues eliminated. More seriously, such studies sidestep fundamental economic issues such as the treatment of fair use in a Peer-to-Peer world and the impact of the high concentration among aggregators on the economic efficiency of the sector, as well as on the ability to foster competition through technological change and innovation.

One of the proper social concerns with the industrial organization of the sector is its impact upon the creation of new content by artists. As we can see by the disaggregated analysis we have outlined above, where we consider the unique characteristics of the content creation activities, the failure to treat separately content creation and production on one hand and intermediation on the other means that those analyses cannot consider the impact of alternative institutions on the creative sector.

We have just reviewed some of the factors that contribute to the unique idiosyncrasy of copyrighted content, namely, individual works produced by entertainers and producers to expand an ever-changing film, music, and entertainment library. Individuals and small firms produce those works and bear most of the risk by putting on the hat of an entrepreneur and contributing to various functions that are required to ensure the success of their endeavor. Those functions include creators and producers of film, music, and other digitalized forms of content.

This characteristic of content, namely the alternative categorization of outputs, has limited meaning in terms of the individual consumer's willingness to pay. That willingness to pay will itself depend upon factors such as the way the individual is likely to learn about the specificity of the artist's work and the context within which this happens.

The consumer's willingness to pay is a direct function of the marketing and distribution system. Some artists may be inherently good at positioning their works in the mind of the public. After all, this has to have been the case with Salvador Dali as described by Riding (2004), or, earlier Caruso. Some such as Oprah Winfrey and Georges Lucas are also exceptionally good at managing their assets. However, this cannot be generalized. This heads towards a need for a range of intermediation services between artists, entertainers, and consumers. In an Internet era, such intermediation may take the form of services of firms such as Music Dish to help publicize the works of artists.

Historically, intermediation functions have become increasingly consolidated in today's major content aggregators such as the major labels in the music industry. The transfer of ownership has emerged as the

dominant financial characteristic of today's intermediation, at least among the more successful artists.

The services those aggregators provide vary across media with various levels of integration across those media. For instance, while a substantial portion of the risk associated with new production is provided through separate channels, in the music industry the aggregators generally integrate most functions. Intermediation continues to evolve through time.

The two dimensions that are key in shaping the role of intermediation and the social, legal, and institutional context within which artists produce and consumers "consume" the entertainment commodities are the ability of aggregators to manage their market power and the constraints new technologies such as Peer-to-Peer may impose on their exercise of market power.

The Artist's Work as a Product and Intermediation

Technological innovations such as Peer-to-Peer impact the content sector in two ways. Firstly, they impact the value of accumulated copyrights assets that are largely in the hands of aggregators. Secondly, they impact the costs for and benefits of those who create new content. The large concentration of the control of copyrights assets in the hand of a small number of aggregators has reinforced their incentive to act as incumbents who concentrate their resources on creating an environment that is friendly to their market position. Trivially, this also means that this process is at the expense of innovation, flexibility, and adjustment to institutional constraints.

The concentration in the ownership of copyrights can only take place in the intermediation activities. Individual artists would not be able to manage their benefits with the kind of concentration we observe today unless they could cumulate the intermediation role. However, there is no clear benefit in such a step. As we suggested earlier, the benefit of concentration would appear to go completely to the intermediates.

Today's intermediation process creates ambiguities about the content market, about what the products that are commercialized to end-users might be, and about the ways the market can be expected to react in response to consumer and technological pressure. One of these ambiguities has its roots in the economic concepts of stocks and flows. Those concepts are typically neglected in today's economic analysis, if not altogether ignored.⁵³

In the technology theory of the firm, one works on the basis of a technology that specifies the stock of capital and its organization as well as the flow of capital. Where the process is in equilibrium, i.e., where there are no external forces on the system's internal equilibrium, then the stock

dimension of the model can be taken as a parameter. Such a hypothesis makes it possible for us to work solely with the flow of capital. Today's economic literature on copyrights is built upon that implicit hypothesis.⁵⁴

The main source of ambiguity is the confusion today's intermediation creates between the stock of content that is controlled by the aggregators, and the flow of new content that may be – but need not necessarily be – intermediated. It may be appropriate to ignore the stock and focus exclusively on the flow in a static world where the economy produces widget. Whether or not this is the case in a static, stable world, it is hard to conceive how it could ever be optimal in the dynamic world of content. This is a world where each individual's new work has to compete through its unique entertainment characteristics, i.e., through product differentiation, with other new works.

As existing copyrighted material is largely in the hands of aggregators, it is also obvious that the flow, i.e., the stream of new works artists are producing, has also to compete with existing copyrighted material. If there is no change in technology or in the institutions, then there is no strong reason to be uncomfortable with the system. On the other hand, if there are changes, then the attractiveness of the current range of intermediation that aggregators are offering to artists may not have the attractiveness it had prior to the change.

It could be that the economic rationale artists have been using to trade intermediation services for their copyrighted material may not be desirable any more. It could just as well be that artists would be better off pursuing a different course. The idea that the Internet in general and Peer-to-Peer in particular justify essentially different strategies for artists and entertainers is in fact the position taken by new firms such as MusicDish.⁵⁵ Such firms are redefining intermediation and, as a result, changing the relative balance in the market power of the artists and the content owners.

There are several reasons why new technologies may directly affect the aggregators and the artists, and the artists' willingness to pay for the services aggregators provide is straightforward. For instance, as far as the creation of art and entertainment content are concerned, technology does not impact heavily the contribution of artists. However, it does strongly impact the contribution intermediation can make to promoting those works. It is obvious that the internet and, more recently, Peer-to-Peer, have a very significant impact on marketing, distribution, and retailing costs; hence it impacts the value of the services aggregators can offer.

There is another way in which a change in technology can impact aggregators in a different way from artists and content creators. Intermediation is the means through which aggregators have been able to gain control over the artists' copyrighted material and those assets are creating a unique

source of market power. The implication is that, today, aggregators have become above all the managers of copyright assets; hence, they have been increasingly concerned about the way innovation might undermine the value of their assets. From that perspective, new content creation may contribute as a revenue source to their intermediation function. However, it could also dilute the value of their present assets and threaten their market power.

Conclusion

In this paper we study Peer-to-Peer from the perspective of the commons. Although the “commons” have been mostly associated with publicly-held properties, the notion applies to all exchange regimes. Likewise, a new market like online music creates a commons jointly owned by consumers, hosting firms, record companies, and musicians.

Good institutions and governance create incentives to achieve efficiency, while their neglect can result in a “tragedy of the commons.” For example, music copyrights are a commons that have been disrupted by several subsequent innovations: the record, the radio, and, today, Peer-to-Peer.

The paper suggests that this outcome can be avoided. It is conceivable that many of the members of these new Peer-to-Peer commons may be willing to shift to commercial Peer-to-Peer networks, as the commercial success of new services such as iTunes shows. Furthermore, the willingness of individuals to participate in voluntary programs such as SETI also points towards the possibility of avoiding such an outcome.

Viewing exchanges as a commons can improve regulation and business strategy, and can guide entrepreneurs in promoting new markets. For coordination to succeed, the rules and norms of this commons must encourage cooperative behavior. Markets are based on the presumption that all players are opportunistic. This is not a generic requirement for a commons that recognizes diversity of attitudes among members of the society as a possibility. Interestingly, it is this diversity vis-à-vis opportunism that makes it possible to find governances that support efficient exchanges in the context of market failures.

Consumers play a key role in facilitating the emergence of credible Peer-to-Peer content commercial services. Peer-to-Peer is transforming the content into a good that is, in and of itself, more attractive to consumers. However, the actual economic impact is still very sensitive to the strategies suppliers have been pursuing. Our best guess is that the rigidity of their position has contributed to the emergence of today’s Peer-to-Peer networks creating an even greater chasm between copyright owners and consumers.

The owners of copyright content may point to their property rights. First, they neglect the business dimension of those rights, namely that a narrow and rigid interpretation effectively destroys the value of those property rights. It is not good business to enforce copyrights too narrowly. A property right is not to be imposed by sheer power or ruthless fiat but rather if it is to be a factor within a democratic society, it cannot be arbitrarily imposed on that society. Rather, it must reflect the society's acceptance of the granting of power that the society's recognition of ownership *de facto* implies. This means that the society must find it reasonable in the long-run. It is this social and political dimension of property rights that is so often neglected and overlooked in discussions.

Looking at the extent to which Peer-to-Peer platforms have evolved technologically in response to institutional factors, the paper concludes that the RIAA's victory over Napster and other networks such as Aimster, and its unwillingness to negotiate intermediate solutions, created strong incentives for entrepreneurs to favor the new generation of Peer-to-Peer networks. This new generation was conceived to eliminate the technological elements, such as the centralized catalog, that had led to the demise of the first generation of Peer-to-Peer networks in courts. In that respect, it is not unreasonable to conclude that the copyright owners' strategy may have largely backfired making it that much harder to develop a Peer-to-Peer network that could meet reasonable industry demands while responding to customer demands that became apparent through Napster and other such networks. In addition, such policies by copyright aggregators have led Peer-to-Peer network operators to take a layered approach with respect to file transfer in order to build business models that are also immune to challenges by copyright owners.

The need for additional research to design incentives to encourage a stronger cooperative behavior among the different players is highly recommended.⁵⁶

Notes

We thank Loretta Anania and Fabrizio Balassone for their helpful comments. The views here expressed do not represent the positions of the organizations the authors belong to, but only the authors' personal standpoints.

1. Bourdeau de Fontenay and Bourdeau de Fontenay (2002).
2. Peer-to-Peer networks are essentially software designed, and their parts are largely provided by those who use the network (Bourdeau de Fontenay and Liebenau 2004).
3. The analogy here is to the "common lands" in the Middle Ages in England, where anyone could let their sheep graze. Not all such environments are subject to the infamous "tragedy of the commons." If there is enough open space and a good enough legal or customary rules managing individual action, a commons can survive without rapid exhaustion.
4. Ostrom (2000).
5. Liebowitz (2004).
6. The Economist, "Profit from Peer to Peer."
7. An excellent discussion of the role of intermediation in the music and movie industries in the USA is available in Fisher (2004), "Promises to keep," Stanford University Press, Chap. II.
8. Baumol (1965,1971).
9. OECD INFORMATON TECHNOLOGY OUTLOOK (2006).
10. "File sharing activity doubles." The Seattle Times, July 13, 2004.
11. "Films Fuel Online File-Sharing," World Entertainment News Network, July 15, 2004.
12. "The Effect of File Sharing on Record Sales – An empirical Analysis" March 2004 – working paper.
13. "Peer-to-Peer networks: Creative Destruction or Just Plain Destruction," July 2006, working paper. In particular he claims that: "The effect of sampling (more music-listening services at constant CD prices) is to lower the price of music-listening services. The net effect should be to lower the revenues generated by music-listening services. With a price per CD that is independent of the sampling effect, this implies that the quantity of CDs will fall due to sampling," p. 9.
14. To date, there are overall five empirical papers that tackle this issue: Martin Peitz and Patrick Waelbroeck (January 2004), "The Effect of Internet Piracy on CD Sales: Cross Section Evidence," CESIFO Working Paper No. 1122; Alejandro Zentner (April 2006), "Measuring the Effect of Online Music Piracy on Music Purchases," Ph.D. Dissertation in progress, Princeton University; Eric S. Boorstin (April 2004), "Music Sales in the Age of File Sharing," Senior Thesis, Princeton University. But those by Liebowitz (2004) and Oberholzer and Strumpf (2004) can be considered to be the leading ones. The former for comprehensiveness and the latter for the specific data sets used for the analysis.

15. At the Cato Conference on The Economics of Peer-to-Peer in Washington of June 2004, Strumpf, while commenting on the results from Liebowitz's paper, argued that correlation does not imply causality and that Liebowitz's indirect approach based on time series does not help in this case. Indeed, he asked "how do we explain that in the last 9 months, while file-sharing was slightly increasing, the sale of CDs were up to between 7 and 10%?"
16. The other studies previously mentioned used proxies to estimate the number of downloads such as the share of internet users and different units of analysis such as sales of sound recording in different countries (Peitz and Waelbroeck; Zenter) or different cities in the USA (Boorstin). According to Liebowitz's paper, the ones that use the countries run into heterogeneity problems while Boorstin runs into specification problems.
17. According to Liebowitz (2004), there are two potential problems with Oberholzer and Strumpf's paper. First, we are not sure whether using records as the units of observation can enable us to infer the impacts on the entire industry as opposed to the impacts on individual records (i.e., if it can be shown that a given set of albums was not affected by file-sharing, it may be difficult to say that the entire music industry will not be affected by file-sharing). Second, the model runs in specification problems in the use of instrumental variables necessary to take into account the serious simultaneity problem due to the fact that popular songs are, at the same time, the ones purchased and downloaded the most.
18. "Peer-to-Peer booming as users swap large files," ZDnet UK, July 14, 2004.
19. "Movies in the digital age," MIT Communications Forum, April 8, 2004.
20. See "Peer-to-Peer Gaming: Guerrilla gameplay," New Media Age, September 23, 2003.
21. See: "Atzio Technology Announces Arrival of Legitimate Peer-to-Peer Television," Tech-News, August 31, 2004.
22. Commons have typically been defined in the literature in a much narrower sense. Faulhaber and Farber (2003) define it as "an asset available for the use of all, with common restrictions governing use restrictions for all," using the FCC Part 15 spectrum rule as an example. In general, the "common restrictions" they refer to could be any form of restriction, including price restrictions as in the case of toll highways or the tolls charged historically for lighthouses (Coase 1974). Further on, they differentiate "a property right regime from a commons... [in terms of] (i) scarcity and (ii) transaction costs" (208). They do not elaborate upon those points even though, excluding some of the commons Hardin (1998) called "unmanaged," commons have associated property rights even though they can be private at the level of an individual or at the level of a community, or still, public as with the FCC Part 15 spectrum. They point out correctly that property rights will make it easier to deal with transaction costs, but this has nothing to do with ownership characteristics. For Frischmann (2001), the Internet is a commons. Frischmann (2004) summarizes the current literature by concluding that "'commons' ... means that the resource is openly accessible to all within a community regardless of their identity or intended use... the antithesis of private property and

an alternative to government ownership or control....” In his analysis, he uses “‘open access’ and ‘commons’ interchangeably to mean that the resource is openly accessible to users regardless of their identity or intended use.” We have not generalized the terminology gratuitously. Rather, it is our observation that one of the main characteristics of a commons is to provide sustainable and viable solutions to market failures. That perspective highlights the benefits of looking at a commons as the broad context within which to study economic exchanges, i.e., the benefit of looking at markets as a subset of a commons (Bourdeau de Fontenay and Liebenau 2004).

23. Smith (1776) and Yang (2001).
24. Baumol (1971).
25. We use here the terminology of license rather than of property right that is used in economics to avoid to have to detail every time the actual property rights that are sold by the copyright owner to the individual. The license is used as a generic term to describe those very circumscribed property rights; hence it is used to avoid ambiguities in the discussion.
26. Krishnan. The lack of governance is illustrated by the inability of such communities to protect themselves from actions such as the RIAA’s spoofing.
27. Hardin (1968).
28. Asvanund et al. (2003a,b), Li et al. (2003), Chu et al. (2004), Dewan and Dasgupta (undated), Garcia-Martinez and Feldman (undated), Krishnan et al. (2004), Kung and Wu (undated), and Ionescu et al. (2004).
29. Demsetz (1967).
30. Currently, the lack of participation of a substantial fraction of the population of a Peer-to-Peer network community does not seem to threaten the viability of the community itself. This may not be true anymore in the near future as video Peer-to-Peer becomes increasingly important. This is an unknown factor that will have to be addressed at the time.
31. The commons appear to take forms other than markets primarily where there are market failures as in the problem Hardin (1968) studied. In particular, historically many of the commons were designed to provide for economic exchange where there was both a lack of excludability and also rivalry. In addition, the commons were typically organized in a way so as to lower transaction costs, including where, as in Sengupta (2001), transaction costs overburdened the system to the extent that they were not only inefficient but also resulted in a market failure.
32. Coase (1974).
33. Ostrom (2000).
34. Bourdeau de Fontenay and Liebenau (2004). Transaction costs would seem to be the primary factor that differentiates the subset of markets from the more general commons. Markets are used where the size of transactions is sufficiently large in relation to transaction costs. Where market-based transactions – as with local telephone calls – are very small and can easily be swamped by transaction costs, and/or where people show a clear preference for simpler pricing schemes, then pricing strategies evolve away from “marginal pricing”-based criteria to more generic, commons-like criteria as with flat-rate

telephone pricing. The same can easily happen where the product's characteristics invite moral hazard as with Coase's (1974) lighthouses. The reason is simple. It reflects an attempt to bypass the market failure of neoclassical pricing through a broader contractual strategy. Those broader pricing strategies can resolve the neoclassical market failures.

35. Bourdeau de Fontenay and Liebenau (2004).
36. Barzel (1997).
37. We need to underline that we are not considering here the efficiency of the process. This is because our analysis does not permit us to consider the efficiency of the search and the convergence characteristics of the existing process.
38. Ionescu et al. (2004).
39. One of the arguments used in Canada to deregulate small satellite antennae was that the enforcement of a consumer level of those antennae was effectively impossible.
40. Ostrom (2000).
41. Ostrom (2000).
42. Krim (2004).
43. Technology is assumed to be endogenous in a number of other fields in economics, e.g., in economic growth. There are even segments of the industrial organization literature, such as the study of patent strategies, where such endogeneity is natural and fundamental. In addition, it was central to the classics such as Adam Smith (Stigler 1951). We have also demonstrated in Bourdeau de Fontenay et al. (2004) how its neglect in regulatory economics results in a causality reversal, a basic flaw in today's analysis.
44. Demsetz (1966).
45. Brel, Jacques. "Les bourgeois," words and music by J. Brel and J. Corti (1962). (accessed November 2004, <http://www.paroles.net/nix/poster/11798>).
46. Van Cayseele (undated).
47. Coase's (1937) conditions under which it is unambiguously efficient for a Coasian firm to be vertically integrated are particularly difficult to meet. When a Coasian firm chooses to carry out simultaneously both an intermediate activity and the activity that produces the final commodity, the action of that firm must not impact on the efficient functioning of the intermediate market. In other words, other firms' decisions to maintain their disintegration must not be affected, and the relative merits of vertical integration and vertical disintegration must remain unchanged.
48. Einhorn and Rosenblat (2004).
49. Bowles (2004).
50. Thierer (1994).
51. <http://www.aufdermauer.com>
52. It is evident that we use the terminology of transaction costs in a very heuristic manner. Such a heuristic approach is, for good or for bad, the characteristic of today's institutional economics. It is a heuristic approach that appears, at least, on the surface, to clash with much of today's literature. With roots in Coase (1937) and the Chicago School, it dominates much of today's

new institutional economics, and survives in Williamson's work. An empirical economic analysis of Peer-to-Peer requires more solid foundations. For instance, it would have to push much further the tally of the sector's vision, the key factors that we have aggregated under the label of transaction costs (Spulber 1999). In a setting as the one we are considering here, we do not believe that more precise definitions would seriously impact our conclusions.

53. Georgescu-Roegen (1967).

54. Einhorn and Rosenblat (2004).

55. <http://www.musicdish.com>

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