

Digital Rights Management: White Knight or Trojan Horse? □

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Digital Rights Management: White Knight or Trojan Horse?

The consequences of DRM for consumers, firms
and society

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Abstract

Due to its ability to solve all main problems associated with digital goods, Digital Right Management is the favourite option used by companies to tackle piracy. The aim of this article is to discuss the consequences of DRM for consumers, firms and society. The rationales of DRM are discussed and the expected benefits for firms are presented. It is shown that the advantages brought by DRM to firms go beyond what would be needed for an efficient provision of digital goods. In contrast, consumers are likely to see few benefits in DRM. This article demonstrates that even a standard DRM system is unlikely to improve social welfare. The article concludes with some public policy and corporate strategy recommendations.

Keywords:

Digital Right Management; Digital Goods; Piracy; Excludability; Durability; Sampling

JEL Codes:

D21, D23, L11, L15, L50, L82, L86, O3

Introduction

The recent EU policy agenda aims at making EU “the most dynamic and competitive knowledge based economy in the world, capable of sustainable economic growth with more and better jobs, greater social cohesion and respect for the environment”. In order to achieve this goal it is important to ensure that the existing policies encourage innovation and growth.

One of the fast growing and innovative industries, especially since the appearance of the digital goods, is the content industry. However, the growth and viability of the companies in this industry are seriously undermined by the extent of consumers piracy, which seems to be, in addition to innovation, the main characteristic of this sector. One of the most common solutions to fight

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against piracy and enforce intellectual rights is the introduction of Digital Right Management (DRM) technologies.

The purpose of Digital Rights Management is to help content creators protect the content from uncontrolled use and distribution. DRM systems work in such a way that any action of the consumer that is not explicitly authorised by the producer is, by default, prevented. As such, these systems allow to prevent the copying, sharing, as well as the simultaneous use of digital goods. Furthermore, DRM systems make the anonymity of consumption impossible since they require a formal identification before protected digital goods can be consumed. Supporters of DRM believe that DRM can provide a secure distribution of digital content. As a side effect, DRM can allow the firms to gain some additional strategic advantages (switching costs, consumers lock-in, barriers to entry, absence of second-hand market, collection of information on the consumers' behaviour) and can also help the firms appropriate extra revenues (DRM allows the firms to charge the consumers several times for the usage of the same digital goods at different locations e.g. home, work, car).

The opponents argue that DRM is not very effective in preventing piracy, but can prevent the legitimate users to take the full advantage of the digital media. The Foundation for a Free Information Infrastructure notes that DRM can act as a trade barrier. There is also a view that DRM can prevent future historians from recovering the necessary data due to the variety of technology required to read the data. Finally, the DRM opponents state that DRM infringes private property rights and very often restricts users activities. The other problem associated with the DRM is that, since there is no standard for DRM and no compatibility between the existing systems, it causes additional problems for the consumers, the firms and eventually for the society.

The aim of this article is to discuss the consequences of DRM for consumers, firms and society. First, the rationales of DRM are detailed. This is followed by an analysis of the strategic advantages created by DRM and the possible limitations. The issue of the impact of DRM on consumers is then assessed. Finally, this article conducts an in-depth study of the consequences of DRM on social welfare and recommends some policy changes as well as some improvements of the DRM strategies of firms.

1 The rationales of Digital Right Management

Digital goods are goods that are distributed in digital format (i.e. encoded in binary form, as a succession of 0s and 1s). Nowadays, most entertainment goods (such as music, movies, computer games and books) and also a large number of professional tools (software, documentation, stock pictures) are digital goods.

Due to their digital nature, all these digital goods have a common characteristic: they are replicable. Indeed, digital goods can be copied without loss of quality or information. Therefore, a copy of a digital good is a perfect replica (a clone) of the original. As a consequence, digital goods are independent from the medium used to distribute and store them. More precisely, the binary form used for encoding them ensures that these goods can be transferred from one medium to another without loss of quality or information.

The digital nature of digital goods has important consequences in regard to the economic characteristics of these goods. First of all, their replicability makes

digital goods both public and durable. Secondly, the economic value of digital goods lies in the content embedded in these goods. As this content is either information, culture or entertainment, digital goods are experience goods.

These three economic characteristics are expected to lead to important challenges for the firms that produce digital goods. First of all, the publicness of digital goods is likely to lead to a free-riding behaviour of consumers. The inability of firms to exclude consumers leads to a wide piracy phenomenon and, thus, undermines their ability to make profits.

Secondly, the potentially infinite durability of digital goods deprives firms from the large amount of revenues they used to enjoy because of the renewed purchase of consumers. It is important to note that sales are further decreased by the universality of digital technology and the perfect replicability: consumers are now able to use the same unit of digital good with various devices: Hi-Fi, computers, MP3 players, etc., whereas before the advent of digital technology, several purchases could be required in order to obtain an optimal quality (e.g. consumers could be led to purchase both a vinyl and an audio tape of the same album).

Finally, the fact that most digital goods are experience goods makes consumers reluctant to purchase these goods before they are able to experience them and determine their value. As a consequence, firms have to supply consumers with samples of the digital goods. If they do not do so, consumers may be encouraged to conduct their own sampling activity by pirating. In this case, they are very unlikely to be willing to pay for a legitimate version of the digital goods once the good has been experienced. However, providing consumers with samples is not always an easy option. Indeed, firms need to ensure that the consumers are only able to consume the sample a small number of times, as otherwise consumers will probably decide against purchasing the product. For some digital goods, it may be possible to offer as a sample a truncated/stripped down version of the digital good (as it is often the case with electronic books, films and software). Nevertheless, such a strategy may cause consumers to underestimate the value of the digital good, thereby reducing their willingness to pay. In addition, the value of some digital goods, such as music, is unlikely to be revealed by partial sampling, and may even require repeated trials.

2 Digital Right Management systems

The purpose of Digital Rights Management is to help content creators protect their products from uncontrolled use and distribution. The DRM protection is embedded into the digital good itself and consists of encrypting the digital good, which can therefore not be consumed without being decoded first. The DRM tags embedded in the file contain precise information about the owner of the file and the rights of usage this owner has. For example, in order to be played on a computer or on a media player, a music file protected by DRM would have to be activated. The activation is made by contacting a central server on the internet. The consumer is then asked to identify herself, and this information is compared with the owner's information included in the file. If the authentication is confirmed, the computer receives a key allowing to decode, and play, the music file. In addition to the decoding key, data containing instructions about potential restrictions may be transmitted to the computer. Indeed, DRM

systems allow to restrict the number of times the music file is activated, so that consumers cannot consume the same music file on more than one computer at the same time, it can also prevent the file from being copied/transferred, or exported, more than a certain number of times.

The most popular (in terms of usage) DRM technologies, at the time of this writing, is FairPlay which was created by Apple and is used by its products and services, such as iPod, iTunes and iTunes Store. The files protected by FairPlay can only be played on authorised computers and at most five computers may be authorised at the same time. Consumers can, however, burn their music files on CDs which will have legal, but not physical restrictions. Yet, a particular playlist can only be burnt up to seven times, though the overall number of burns is not limited. The main issue related to FairPlay is that, because of Apple's refusal to licence its technology, songs purchased from iTunes Store will only play on Apple's iPod media player (although they play on any Windows or Mac computer) and the only DRM protected songs compatible with iPod are the ones purchased from the iTunes Store. Despite these limitations, this technology is the most used one, certainly owing to iPod's 80% market share in the market for portable media players. Since the introductions of films, video clips and TV programmes on the iTunes Store, FairPlay technology is also available to protect video content.

Other DRM technologies are much less popular and are (by order of importance): Microsoft's PlayForSure, RealNetworks' Helix, Sony's ATRAC. These three DRM systems are able to protect both audio and video files. These technologies allow to establish similar restriction as Apples FairPlay. For example, both Helix DNA, used by RealNetworks, and Windows PlayForSure, used by Napster, allow the file to be played simultaneously on at most three computers and unlimited number of burns, provided that a particular playlist is not burnt more than five times. Sony's ATRAC DRM technology also allows three simultaneous computers to be authorised, but only five burns per file.

Both Microsoft and RealNetworks licence out their technologies. There are still, however, some restrictions. Microsoft PlayForSure only functions on Windows (which leaves aside computers running other operating systems, such as Mac OS or Linux/Unix) and RealNetworks Helix has to be used in conjunction with their Real's content distribution server. Like Apple, Sony has refused to licence out its ATRAC technology and is, to this day, the sole user of this system. Microsoft recently adopted a similar approach, since they developed a new DRM technology (used by the new portable media player Microsoft Zune) that have decided not to licence out.

3 Digital Right Management as universal solution

Although Digital Right Management systems were primarily developed as a solution to piracy (and thus addressed the problem caused by the publicness of digital goods), these systems also provide an answer to the difficulties caused by durability and uncertain *ex-ante* value of digital goods.

With regard to the publicness of digital goods, DRM enables to increase the excludability of digital goods, and thus to reduce (or eliminate) piracy. Since

DRM protection requires an authentication for the digital good to be consumed, a consumer able to obtain a pirated copy of the good is unable to consume this digital good unless it is activated. Since the activation is granted by firms only, this means that DRM restores the excluding capability of firms.

In terms of durability, DRM allows the firms to control the life span of digital files. It is indeed possible to restrict the consumption to a fixed amount of time. Although firms do not usually sell “short-lived” digital goods, DRM also created the possibility to rent digital goods instead of selling them. Without DRM, renting is obviously not a feasible option, since the consumer would still be able to enjoy the digital good (or a copy of this good) even without paying the rent. DRM enables firms to set up a time period after which the good will not be playable anymore unless the authorisation is granted. This ability to rent is extremely important for firms. Indeed, the main consequence of durability is that it reduces the market power of the firms and lead them eventually to sell at the price equal to marginal cost (Coase, 1972; Stokey, 1981; Bulow, 1982, 1986).

In regard to durability, DRM also allows to make digital goods, which are potentially infinitely durable, as obsolete as the hardware used to play/execute them. Indeed, DRM systems are such that the consumption of a protected digital good is authorised on a particular piece of hardware (a computer, a portable media player, etc.) that is identified by a unique number. If this hardware is replaced by a a new one, and the digital goods stored on the old hardware are transferred by consumers onto the new hardware, these will require a new authorisation in order for the goods to be played. Firms are thus able to charge consumers each time they change their hardware is made. As such, DRM prevents digital good from having a higher durability than hardware. Since most electronic devices have a life expectancy of at most three years, DRM systems ensure a constant and sustained demand for digital goods instead of a constantly decreasing one, as it is the case with durable goods.

Finally, DRM makes it possible for the firm to use sampling for digital goods. First of all, sampling is made possible since firms can set-up a free trial period of the digital goods, enough for the consumers to assess the value of the goods, after which the consumption is made impossible without authorisation (and payment). In addition, DRM enables firms to design fine-tuned sampling: since DRM requires a formal identification of consumers, a per-user sampling system can be designed. This ensures that the trial period, the length of which is based on the tastes of each consumer, is long enough for the consumer to fully assess the value of the product, but short enough to keep the incentive to purchase the product.

All the economic characteristics of digital goods tend to lead to a decrease of the demand for legitimate digital goods. Because of its ability to enforce excludability and to make renting and sampling practical, DRM allows to restore the demand for legitimate digital good. In addition, since DRM enables fine-tuned sampling and expand the marketing options; it is even likely that they will *in fine* lead to an increase of the demand for legitimate digital products.

Also, since DRM permits to solve three of the main problems faced by the producer of digital goods at once, it is nowadays the preferred option and is used by a majority of producers/distributors.

4 The additional benefits of Digital Right Management

In addition to the ability to return to a normal level of demand for legitimate digital goods, otherwise undermined by the economic characteristic of these goods, DRM provides additional benefits¹ to the firms.

The additional benefits of DRMs for firms are detailed in Figure 1, according to their position in terms of two dimensions: (i) whether they are embedded in either individual entities or systems and structures and (ii) whether they are embedded in market or non-market relationships. The first box includes benefits that are embedded in individual entities and are market-related. Similarly, Box 2 also lists market-related benefits embedded in systems and structures. The non-market domain is covered by Boxes 3 and 4. Box 3 includes non-market related benefits embedded in individual entities, while in Box 4, non-market benefits embedded in systems and structures are listed.

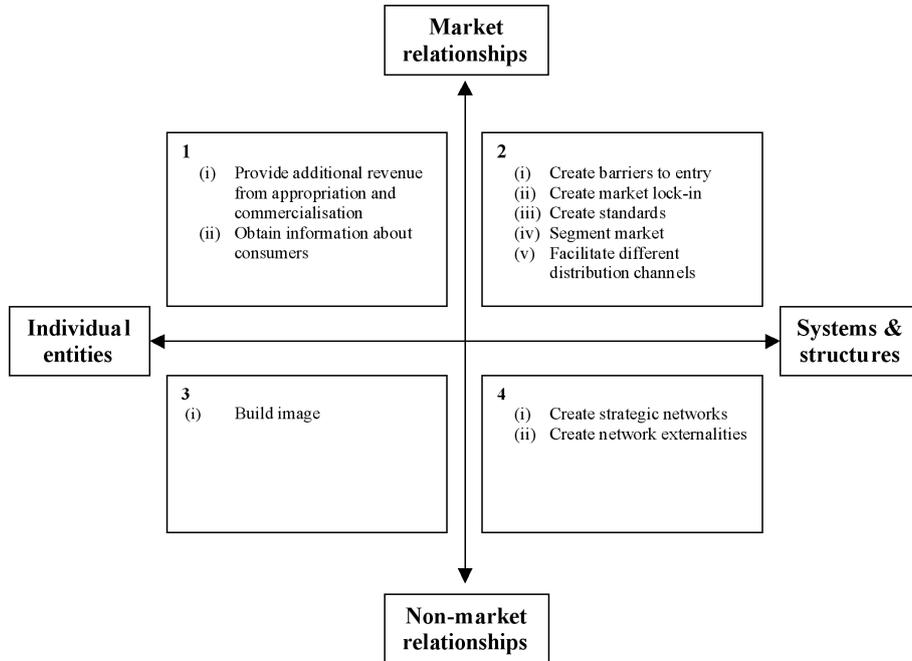


Figure 1: Additional values of Digital Right Management for firms

- Market relationships and individual entities (Box 1)

(i) *Provide additional revenue from appropriation and commercialisation*: One of the main arguments of the proponents of DRM is that it

¹This benefits are referred to as additional because, on the contrary to the benefits mentioned in section 3, which basically allow the firm to return to a “normal” situation, they allow the firms to obtain some additional strategic advantages, in terms of market segmentation or barriers to entry, which lead to increased market power.

helps protect the copyright, and avoid illegal distribution and therefore helps companies earn money that would have otherwise been lost due to illegal distribution. The question is of course whether first of all everyone who downloads digital goods for free would buy these digital goods if they had to pay²³ and secondly how effective DRM actually is against the possible illegal distribution. However, despite the problems and costs associated with DRM, it helps generate money both for the creators and the distributors of digital goods. For online music stores it is also a way to ensure that the cost of establishing and maintaining a store is covered. Also, thanks to DRM, independent artists can bypass the music distributors and distribute their music online. DRM will ensure that their music is not later redistributed illegally. By using this distribution channel, independent artists can receive a higher payoff than a usual 10-18%⁴ from the retail sales when they have an agreement with the distributors.

(ii) *Obtain information about consumers:* DRM is an easy way to conduct marketing research and collect data which can be used by companies for purposes such as market segmentation, price discrimination and dynamic pricing. Indeed, DRM systems remove the anonymity of consumption (since authentication is required for consumption to take place), and allow firms to know which digital good was consumed, when and how often and by whom. Consequently, very elaborated pricing strategies can be devised. For example, consumers who listen to a certain group/artist on a regular basis could be charged a standard price when a new album is released, whereas those who are not familiar with this group/artist could be offered a discount to encourage the purchase. E-business companies have been already using cookies for this purpose, however cookies can be easily disabled (in addition, cookies only collect data on browsing and purchasing, not on consuming), whereas as long as the DRM protection is in used, it is not possible for consumers to prevent firms from collecting information.

- Market relationships and systems and structures (Box 2)

(i) *Create barriers to entry:* DRM creates several types of barrier to entry. First of all, among the distributors of digital goods. It is indeed unlikely, nowadays, that a creator of digital good would allow a company to distribute its digital goods if this company did not use DRM. Therefore, a company willing to enter the market of distribution of digital goods would have to either develop its own DRM system, which is a high fixed cost option, or licence in a DRM system from another company. Either way, this creates barriers to entry. Likewise, DRM creates barriers to entry among the creators of digital goods. Indeed, major media companies were able to secure deals with providers of DRM systems, while independent creators may find it more difficult and more costly (due to their small size)

²“BSA or BS?”, The Economist, May 19th 2005.

³See Ziemann (2002).

⁴<http://www.iaje.org/article.asp?ArticleID=122>

to do so. In addition, DRM makes it harder to enter the digital music players market as the digital players need to support at least one of the existing DRM standards. However, licencing is not only costly, it is sometimes impossible (neither Apple, nor Sony licence out their DRM systems to hardware manufacturers; Microsoft recently adopted a similar strategy with the DRM system of its Zune media player). Hardware manufacturers may thus be forced to develop their own DRM system. Finally, DRM creates barriers to entry towards competitors on the illegal market. Indeed, an illegal producer would have to remove the protection from the digital good in order to be able to create pirated copies.

- (ii) *Create market lock-in*: DRM can help companies lock consumers in. This strategic advantage derives from the incompatibilities between DRM systems. To this date, there is no standard among DRM systems. Moreover, none of the major DRM systems are open systems and thus have to be licensed, which consequently slows the adoption of a *de facto* standard⁵. The absence of standardisation of the DRM systems can be easily understood from the perspective of the creators of these systems. It is important to note that most of the providers of DRM systems also provide products which are complements to digital goods (Apple supplies iPod media players, Microsoft supplies Windows and the Zune media players, Sony supplies Walkman media players and RealNetworks supplies digital goods steaming servers). Incompatible DRM systems create switching costs for the consumers and protect the market of the complement: a consumer who bought music from Apple's iTunes Store will not be able to consume this music after switching to another media player; a consumer that bought music from Microsoft's MSN will not be able to play this music on a PC with Linux or on a Mac, etc. In addition, Rayna (2006) demonstrates that DRM systems can lead to a switching cost loop between the protected digital goods and the complementary product, each product increasing the switching costs for the other one. In this case, a market lock-in may appear.

DRM systems, thus, allow the developers of the system to gain important market advantages. By locking consumers in, the developers ensure the existence of a strong demand for both digital goods and complementary good.

- (iii) *Increase bargaining power*: The high switching costs and the market lock-in created by the DRM systems give the owners of these systems a strong bargaining power that they can use against both the consumers and the producers of digital goods. The incompatibilities of DRM systems places the producers of digital goods in a disadvantageous position. Although it does not reduce the demand for digital products⁶, it may lead to reduced profit for the producers of digital

⁵The only company in a position to give raise to a standard is, at the moment, Apple (its FairPlay DRM system is the most widely used). However, Apple has so far refused to licence out its DRM technology, hindering thereby the establishment of a standard.

⁶Even though it might still be argued that the incompatibilities between the systems, and the expected lock-in may lead the consumers to defer their purchase until a clear winning standard is available.

goods because of the higher margin obtained by the owners of the DRM systems.

- (iv) *Create standards*: DRM is a technology with certain interoperability issues. One way to solve these issues is to agree on a certain standard. Obviously a company, whose technology is chosen for a standard will obtain a competitive advantage and dominate the market.
- (v) *Segment markets*: DRM gives companies the possibility to prevent consumers from taking advantage of the universality of digital format. Indeed, firms can restrict, through the DRM systems, the usage of digital goods. For example, firms may only allow the consumers to listen to a music file on one particular computer. In this case, consumers willing to consume the digital good on another computer, on a portable media player, or on their mobile phone may be asked to pay an additional fee. Even if firms allow multiple usage, each new potential way of consuming music is, by default, forbidden. Although, it is possible to play the unprotected digital goods (e.g. MP3 files, CDs) on any compatible hardware, the situation is different with the protected digital goods, as they are by default not allowed to be played on the new hardware, unless authorised.
- (vi) *Facilitate different distribution channels*: DRM is expected to provide companies and independent artists with cheaper and more convenient distribution channels, especially in comparison to the traditional distribution channels, such as CDs or DVDs, which are very costly and prone to bottlenecks. Apple, among others, offers a special package for independent artists allowing them, for a fee, to use the iTunes Store and Apples FairPlay DRM system.
- (vii) *Prevent second hand markets*: Another additional benefit for firms provided by DRM is that it prevents second-hand markets. Indeed, consumption of a good protected by DRM requires a formal identification of the consumer. The identification is embedded into the digital good and cannot be altered by consumers. The consequence of this is that the property over the digital good cannot be transferred directly to another consumer: it necessarily requires the intervention of the firm managing the DRM system. Currently, none of the DRM system allow such a change of ownership. The only solution to re-sell a protected digital good is thus to supply one's identification with the digital good. However, since the identification is based on a password created by the consumer and linked to this consumer's account, consumers are unlikely to do so. If they did, the new owner could use this identification for other purposes than consuming the digital good that was sold second hand. For example, the new owner could use this identification to pretend being the other consumer, thereby gaining access to digital goods she did not pay for. This, of course, could prevent the consumer that sold the digital good from consuming other digital goods she legally purchased⁷.

⁷Another example is the DRM system used by the company eReader to protect the electronic books they sell. The identification system they use requires to input, as a password, the full credit card number of the card that was used to purchase the book. There is no doubt

- Non-market relationships and individual entities (Box 3)
 - (i) *Build image*: As any IPR, DRM adds credibility to company's products. It gives the legal rights to the owners of these technology to distribute the digital goods, therefore consumers believe that the distributed digital goods is genuine and virus free. It is quite important, however, for the creator of digital goods that this technology remains safe and is not cracked. If a DRM system gets some bad publicity because it has been cracked, music creators may be reluctant to use it for distribution purposes, and thus all the distributors using this technology may be at risk.
- Non-market relationships and systems and structure (Box 4)
 - (i) *Create strategic networks*: The current DRM market situation, where distributors and hardware manufacturers use different and incompatible DRM technologies, does not look favourable, at first glance, for creating strategic networks. However, apart from Apple and Sony, who refused to licence out their DRM system, the other players, such as Microsoft and RealNetworks, were able to create strategic networks with online music stores and/or hardware manufacturers who use their DRM technology. Although, at the moment, none of the major players were able to create a universal standard on their own, a standard will necessarily arise, either from the industry, or from governing bodies. In both cases, creating strategic network is vital since it increases the chance of either being the future industry standard, or to be chosen as a template for the creation of a standard designed by governing bodies.
 - (ii) *Create network externalities*: Due to incompatibility issues, DRM systems are sources of network externalities. The more a DRM system is popular among consumers, the more digital goods will be provided using this platform, and the greater the number of compatible devices will exist. This, in turn, causes the DRM system to be even more popular. On the contrary, a non-popular DRM system has a lot of chances to remain unpopular (and to become even less popular).

Moreover, some of these benefits can be combined to create additional strategic advantages. For example, extensive information obtained about consumers (1(ii)) can be used in conjunction to the barriers to entry (2(i)) and the ability to segment markets (2(v)) to design accurate and efficient price discrimination. Likewise, the building of image (3(i)) and the creation of strategic networks (4(i)) are expected to lead to strong network externalities (4(ii)) that can ultimately lead to the creation of a standard (2(iv)).

5 Limitations of Digital Right Management

Although DRM provides firms with important advantages, it also has some important limitations. First of all, only a minority of digital goods is nowadays

that very few consumers would be willing to give up this information in order to sell an e-book on the second hand market.

protected by DRM, and for any digital good protected by DRM, it is still possible to purchase the same digital good in an unprotected format⁸.

The second important limitation, which is linked to the previous one, is that all existing DRM systems have been cracked, and patches allowing to remove the protection can be downloaded on the internet. Even if that were not the case, as long as protected digital goods can be transformed in an unprotected format (it is the case with most DRM systems since they allow to burn the downloaded protected digital goods on CDs or DVDs) piracy is made possible. Ultimately, the rule of thumb is that as long as it is possible to see or to hear a digital good, it is possible to copy it (for example, many computer programmes are nowadays able to intercept the video and/or audio signal sent by the computer to the monitor and/or to the speakers when a protected digital good is played, and to create an unprotected file from this signal).

A third shortcoming of DRM is the absence of standard and the incompatibilities between DRM systems. This is indeed likely to slow the adoption of DRM protected digital goods by consumers, since they are aware of the switching costs created by DRM.

Also, DRM may be helpful in creating a market lock-in, but not necessarily sufficient. Although once a few music files of a particular format have been purchased by a customer it is very likely that this customer continues purchasing files in the same format, this does not necessarily mean that a lock-in position has been achieved. Indeed, online music stores offering DRM protected files are far from being the only source of digital media. In most cases, customers already have a library of digital goods which consists of CDs/DVDs or downloaded files from pirate networks. If the number of DRM protected files is marginal, the cost of reformatting or even repurchasing these files will be marginal as well and this only leads to weak lock-in.

Supplying a complementary good, such as Apple's iPod, Microsoft's Windows (and recently Zune), Sony's Walkman, may improve the strength and effectiveness of consumer lock-in. However, even in this case, some additional conditions are required for firms to be able to effectively lock consumers in⁹. Although Apple has been, to this respect, very successful, Microsoft and Sony have failed, so far, to create a significant market lock-in.

6 Digital Right Management and consumers

From the consumers' point of view, DRM decreases consumers welfare, because it enables firms to charge a price above marginal cost. Although consumers may anticipate that this short-run loss of welfare may be later compensated by an increase of welfare caused by an increase in the quality and variety of the goods supplied¹⁰, the restrictions usually imposed on the consumers by the DRM systems make it likely that consumers will avoid, as much as possible, consuming protected digital goods.

First of all, DRM can remove some of the characteristics that are normally associated with digital goods. DRM makes protected digital products inferior to the non-protected ones, for instance e-books or protected audio files can not

⁸The consequences of this are discussed further in Section 6

⁹These conditions are discussed in Rayna (2006).

¹⁰This argument is discussed in Section 7.

be lent and it might be not possible to make a backup copy. In addition, as discussed in sections 3 and 4, DRM systems remove the ability to resell digital goods and reduce their universality and durability.

This is likely to have important consequences, since consumers still have a possibility to access digital goods, legally or illegally, that are not protected by DRM. For example, Audio-CDs are not protected by DRM. In contrast to a protected audio file, the content of a CD can freely be transferred to many devices (computers, portable media players, etc.). The consumer is able to lend the CD, to make backup copies of the CD. The good is thus infinitely durable and fully universal. Regardless of the new standards and new devices being created in the future, the owner of a CD is certain to be always able to consume the music recorded on this CD. When the consumer is not willing anymore to consume this particular CD, it can be sold on the second hand market.

Likewise, there are important differences between the films protected by DRM and the films distributed on DVD-Video. Although DVD-Video cannot, theoretically, be copied (popular software still allow to easily bypass the copy protection), they can be lent and resold. Their durability is also high, and they can be used on any compatible device. Similar examples can be found for most digital goods.

This lack of features, in comparison to unprotected digital goods, means that consumers are unlikely to be willing to pay as much for protected digital goods as for unprotected ones. As a matter of fact, protected digital goods are often sold at a cheaper price than unprotected ones or than their physical equivalents. Nevertheless, in addition to the loss of value created by the presence of DRM, digital goods sold online often have additional differences with the other digital goods. For example, music and movies sold online are heavily compressed, which causes a sharp decrease in quality, as opposed to the same good being distributed on a CD or DVD. This means that, for consumers, digital goods protected by DRM may have much lower value (since they have fewer features and a lower quality) than the equivalent unprotected ones. Yet, the difference in price between these two types of digital goods is often rather small¹¹.

It could still be argued that protected digital goods bring extra value to the consumers because of their fast online access and their low transaction cost. Although this is undeniable, consumers also have access to unprotected digital goods that have similar features: pirated digital goods. These digital goods also are available online for a low transaction cost. In addition, they are available for free. Moreover, their determinant feature from the consumers' point of view is that they do not have any of the restrictions created by DRM.

Thus, consumers are facing a dilemma. If they want to access digital goods online, they can either choose DRM protected files, which are legal, but have a low value due to the restrictions of DRM, and a comparatively high price; or they can download pirated digital goods, which are illegal, but have no restrictions, and are available at no cost. It can even be argued that law-abiding consumers are, in a way, "punished": although they do pay for their digital goods, the digital goods they obtain have fewer features and involve tedious authorisation

¹¹At the time of this writing, the DVD-Video of a very successful movie, such as Disney's "Pirates of the Caribbean - Dead Man's Chest", is sold at \$18.99 on Amazon and is available for download on the iTunes Store for \$14.99. Moreover, a significant number of recent albums are available as Audio-CD at a lower price than their DRM-protected equivalents on the iTunes Store.

process. In contrast, consumers who decide to pirate obtain full featured digital goods, for free.

Another important consequence of the presence of DRM for consumers is the absence of secondary market. Indeed, digital goods are, for most of them, experience goods: their value is, for consumers, uncertain and only becomes known after at least one episode of consumption, and even sometimes only after many trials. The durability of digital goods usually makes up for this uncertainty. Since the digital good is durable and can be sold on the second-hand market, the consumer is able to recover at least part of her initial spending if the goods is revealed to be unsatisfactory or not to her taste¹². However, the absence of second hand market removes this possibility and increases the potential loss of consumers who are thus expected to be even more reluctant to spend money on digital goods that they did not experience. Thus, by preventing the existence of secondary market, DRM makes the existence of sampling even more critical.

Unfortunately, in spite of the great potential improvements brought by DRM in regard to sampling, little has so far been done by firms to take advantage of this feature. Regardless of the type of digital good, the samples offered by the firms are very much alike what existed before the introduction of DRM. For example, the iTunes Store offers 30 seconds sample for music; films samples still rely on trailers/teasers of 30 seconds to one minute; software samples are still either limited in time or in terms of features. Despite of the fact that DRM makes it possible to personalise and tailor sampling for each consumer and each type of digital good, the same sampling strategy is used for all consumers and all digital goods.

Since one of the main motivations of consumers for downloading pirated digital goods is sampling, chances are that unless a proper sampling strategy is used, consumers will be even more incited to pirate.

Overall, it is important to note that DRM is expected, due to the lack of features of protected files, to the increased risk brought by the absence of second hand market and to the insufficient sampling, to increase consumer piracy. This is indeed a paradox, since the very goal of DRM is to reduce piracy.

7 Digital Right Management and society

From society's point of view, the challenge raised by DRM is quite similar to the usual trade-off between static cost and dynamic efficiency that applies to any good protected by intellectual property right. The three particular characteristics of digital goods (they are public, durable and experience goods) all cause the competitive market price for digital goods to be extremely low, thereby leading to underprovision of digital goods. By allowing firms to fully exclude consumers, to reduce the durability of digital goods, and to allow adequate sampling, DRM permit firms to charge a price significantly higher than the marginal cost of producing digital goods. Although the positive economic profits are expected to provide firms with sufficient incentives to produce digital goods, hence solv-

¹²However, the durability reduces the risk taken by the consumer only if the preferences of the consumers are very heterogeneous. The more homogenous they are, and the greater the risk that if a good reveals itself as being unsatisfactory for one consumers, it is also of a low value for the other consumers.

ing the underprovision problem, the high price tag of digital goods excludes consumers, who would have otherwise found worthwhile purchasing the goods, from the consumption of digital goods. Thus DRM may solve the problem of underprovision of digital goods, but this comes at a cost: underutilisation will appear, and the role of governments is to ensure that the level of protection of digital goods is such that the right trade-off between these two issues takes place.

Nevertheless, the additional benefits presented in Section 4 show that the advantages gained by firms due to the presence of DRM go beyond what is needed in order to achieve an efficient provision of digital goods and provide firms with strategic advantages which lead to high market power (and thus high market distortion).

The first important problem for governments is the multiplicity and incompatibility of DRM systems. Indeed, there is no universal standard for DRM. The DRM standards are set by manufacturers on individual basis. In other words, DRM has a very low (or non-existent) level of interoperability as digital good protected by a particular DRM system can only be decrypted by hardware of software compatible with this DRM system. For example, a song purchased on the iTunes Store and protected by the FairPlay DRM mechanism can only be played on media players that embed the FairPlay technology and cannot be used with media players embedding Microsoft's PlayForSure DRM System. Thus, not only could consumers be forced to use a particular piece of software (e.g. iTunes, Real Player) or a specific device (e.g. iPod, Walkman), but this software or device may not be compatible with their computer (for example, PlayForSure only works on Windows, FairPlay works both on Mac and Windows, but none of them work on Linux). As DRM only allows compatible files to be played by a certain technology, it might lead to anti-competitive and even monopolistic behaviour. Furthermore, as there is no interoperability between DRM technologies, the switching costs are high and consumers are often locked in one particular DRM technology. The current situation is quite different from the other industries, where special bodies ensure that established standards are not only based on self-interest.

The issues associated with interoperability, in general, have been of vital importance over decades now. Companies constantly release new technologies and thus create a need for standards; if not for the common protocols and data it would have been impossible to exchange data, and therefore information, using new technologies. One way to achieve interoperability is through standards. Standards make coordination and cooperation easier as they create similarities between otherwise different organisations (Brunsson and Jacobsson, 2002). They can be used as external points of reference when there is a need to assess the performance or quality of a product or a service (Leiss, 1995). Moreover, (Zhu et al., 2006) discuss the excess inertia phenomenon when older standards prevent the shift to new standards through creating switching costs. The issue of the switching costs introduced by incompatible DRM technologies is even more crucial, since switching costs are considered to be even more important in networked environment (Arthur, 1996; Shapiro and Varian, 1999; Hax and Wilde II, 1999). Moreover, switching costs are higher when there is no interoperability and consumers need to switch between different standards and lower when consumers switch within one standard, therefore consumers are

more locked in the same product or service when there are several competing standards.

Interoperability can be increased, and switching costs decreased, if the same DRM technology is adopted by several market players. Unfortunately, none of the major DRM systems is universal enough to lead to a large adoption. There is thus a strong need for an universal DRM technology.

Marlin Developer Group, which includes members from the electronics industry, is currently attempting to develop a universal DRM technology that could act as a standard. Sun Microsystems adopted another approach. Sun's Project DReaM aims at developing common protocols that would make the exchange of content between different DRM platforms possible. DReaM's project actually goes beyond interoperability since it also aims at providing an open source, royalty-free, DRM technology.

Thus, besides the question of whether the concept of DRM can improve social welfare, it is clear that a minimum requirement for DRM to be socially desirable is the existence of a standard and open DRM system. Open and universal standards such as the ones developed by the W3C (World Wide Web Consortium, organisation in charge of the standardisation of the technologies used on the Web, such as HTML, CSS, etc.), played a determinant role in the development, growth, and adoption of the internet. The absence of standards makes the market environment less competitive and therefore customers are offered less choices in terms of products compatible with a certain standard and in terms of payment packages.

However, even assuming that a universal DRM system exists, the positive effects of DRM on society are quite arguable. Indeed, the assumed positive effect of DRM lies in its ability to prevent piracy. Nevertheless, piracy is always possible as long as non protected digital goods are available. Not only is it still the case nowadays, but it is even likely that it always will be. So far, all DRM and anti-copy systems have been cracked and consumers have been able to remove the protection from protected digital goods. In addition, it takes only one leaked unprotected copy of digital good to start a whole stream of piracy. DRM is expected to hinder piracy by preventing consumers who purchased digital goods from sharing these goods with other consumers. However, as long as other unprotected sources are available, it is quite arguable that DRM has any effects on piracy at all. In fact, there is currently no empirical proof that the introduction of DRM a few years ago had any effect on consumer piracy. Quite on the contrary, piracy rate has kept increasing.

The fact that DRM has not made the access to pirated digital goods more difficult, means that the pirated digital goods still have, from the consumers' point of view, the same value as before the introduction of DRM. On the contrary, as discussed in Section 6, the restrictions introduced by DRM are likely to have reduced the value of legal digital goods. If only these two types of digital goods (unprotected/pirated and protected/legal) were available, the introduction of DRM would undeniably have decreased social welfare, since the situation of pirating consumers would be unchanged, while that of law abiding consumers would worsen due to the lower value of digital goods. In addition, resources would be used to develop and maintain the DRM system.

However, at the moment, non-DRM-protected digital goods, such as Audio-CDs, are still available to consumers. As mentioned above, these goods have a greater value than protected digital goods, since they are full-featured, but are

also expected to be sold at a higher price. In this case the introduction of DRM is nothing more than a hidden form of versioning. By offering DRM-protected at a lower price than unprotected digital goods, firms attempt to capture additional consumer surplus through second degree price discrimination. The goal is to lure the consumers with a medium reservation price for digital goods (e.g. consumers who were either pirating or not consuming, but, in any case, were not buying legal unprotected digital goods), into purchasing digital goods. However, such a strategy is successful in increasing the demand for digital product only if consumers with high reservation price (e.g. consumers that were beforehand paying for legal unprotected digital goods) are put-off from consuming DRM-protected digital goods. Hence the restrictions and lower quality introduced. DRM protected digital goods are “value-subtracted versions” (Shapiro and Varian, 1999).

Although second degree price discrimination is not, *per se*, expected to decrease social welfare, the small number of version offered (three) makes it unlikely to allow for a social welfare improvement. Furthermore, the introduction of lower quality digital goods is, in the case of DRM, not neutral since (as it is often the case with information technologies) introducing value-subtracted versions is actually costly. Indeed, the cheaper option for firms would be to distribute full-featured legal digital goods. DRM systems are costly to develop and to maintain, especially once taken into account the actions of hackers that force DRM systems developers to upgrade their systems on a continuous basis. Although value-subtracted versions may allow firm to obtain higher profits, the cost of development and maintenance of DRM systems (to which the time and efforts spent by consumers to break these protections should be added) and the fact that DRM leads, at best, to a gross second degree price discrimination, makes DRM systems (at least in the way they are developed and used nowadays) wasteful and socially undesirable.

A final source of concern is that DRM creates privacy issues that have to be dealt with. Not only DRM technology is used to collect personal information, but very often it does so without the knowledge of the parties concerned. This characteristic of DRM undermines ethical values and expectations of the public.

Conclusion

The digital goods industry is, nowadays, one of the most dynamic industry. The viability of the companies in this industry may be, however, at risk due to the main economic characteristics of digital goods (the fact that they are public, durable and experience goods) which all tend to decrease the price at which digital goods can be sold. As a consequence, firms producing digital goods may not have enough incentives to provide a sufficient quantity, quality and/or variety of digital goods, or to invest in research and development. There is thus a risk that the dynamism of this industry, which has, over the past few years, taken a growing importance in the economy, may be reduced.

This article showed that Digital Right Management is, *a priori* a very interesting concept, since it is supposed to solve at once the three main problems associated with digital goods. Indeed, DRM enables firms to fully recover their excluding power (thereby making digital goods private), to reduce the durability

of digital goods and to use sampling (thereby making the true value of the good known to consumers).

It was also demonstrated that DRM provides firms with additional strategic advantages. These additional benefits go beyond the ability to return to a normal market situation, and allow the firms to obtain increased market power and adopt anti-competitive behaviour. In this article, a typology of the additional benefits of DRM is built based on whether these advantages are market or non-market, and whether they relate to individual entities or systems and structures.

Although DRM theoretically provides firm with important advantages, it has, in practice, serious limitations. Among them, the fact that many non-protected digital goods are available to consumers is certainly a crucial one. This article also emphasises that all DRM systems have so far been eventually “cracked” and that consumers are able to remove the DRM protection. To this respect, consumers are shown to have very little incentives to favour DRM protected digital goods over non protected ones. In fact, the restrictions introduced by DRM strongly decrease the value of digital goods, making protected digital goods very poor competitors in comparison to unprotected digital goods (both legal and illegal).

From a social point of view, it is shown that, although DRM may, in theory permit, an efficient provision of digital goods, the absence of standard among DRM systems and their incompatibilities is likely to decrease social welfare even further. In addition, as long as unprotected digital goods are still available, DRM is unlikely to prevent, or even diminish piracy. In fact, it is demonstrated that the introduction of DRM is not expected to increase social welfare, even in the case when one standard system exists. The main effect of the advent of DRM is that it provides firms with the ability to price discriminate consumers. However, since this price discrimination requires a costly reduction of the quality of digital goods, it is obvious that it is expected that DRM systems are wasteful and socially undesirable.

Overall DRM helps companies to strengthen their market position. DRM can be a useful tool to create corporate value, however, as any tool it may have a destructive power as well. The problematic issues associated with DRM, such as anti-competitiveness, privacy, etc. make it very challenging for companies and governments to balance corporate and public interests.

In terms of public policy, it is clear that the establishment of a standard and universal DRM system is a minimal requirement. Other social (and corporate) improvements could be brought by rethinking Digital Right Management. It is thought that DRM more often stands for Digital Restrictions rather than for Digital Rights Management. “R” should stand for rights, not for restrictions. Instead of stripping digital goods of their distinctive positive features, firms using DRM should instead increase the value of protected digital goods. So far, law abiding consumers are punished for their honesty: the digital goods they pay for have less features than pirated digital goods. Such consumers should, on the contrary be rewarded. It is clear when examining the current DRM policies used by the firms that they do not use DRM to its full potential, but merely as a way to capture additional surplus from honest consumers, who end up paying for pirating consumers. DRM is a very powerful tool, and it could enable firms to achieve near-first degree price discrimination. But this would certainly require a complete rethinking of firms marketing and pricing strategies.

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