On the competition between Proprietary software Piracy and Free software*

Heger Attaya
CEPN, University of Paris Nord
attaya.heger@edu.univ-paris13.fr

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It is easier for our software to compete with Linux when there's piracy than when there's not. Bill Gates. [1]

Abstract

Publishers of proprietary software confront both the phenomenon of piracy *illicit competition* and competition from free software. In this paper we show a formal model of a software monopolist in which it is optimal to tolerate some piracy in order to maintain a large user base and network effects against free software. The optimal anti-piracy actions depend on network effects of the proprietary and free software alternatives and on the type of piracy. It is useful to distinguish between sophisticated *active* and casual *passive* pirate users.

Keywords: Illicit competition, tolerance of piracy, free software competition, active piracy; passive piracy.

*Free here means the same as Free/Open Source Software (F/OSS). Piracy here means the same as copyright infringement. Some groups object to the term piracy which suggests that copyright violation is criminal; see for example the Free Software Foundation's online list of confusing words.

[1] The Economist, Piracy: the Silver Lining (July 19th-25th, 2008 ed. pp.23).

1 Introduction

The legal software market includes proprietary software and free or open source software (F/OSS) whose source code is generally licensed to be open. Commercial publishers of software often keep it proprietary, usually meaning they retain intellectual property rights (ownership) and keep the source code secret.

This definition of market *de facto* excludes an important dimension, the common use of illegal copies or pirated software. The risk of illegal copying or piracy can be considered from an economic point of view as a form of *illicit competition.*

This illicit activity is generally perceived to be at the expense of the proprietary software industry, and software publishers try to reduce it.

A literature shows that piracy can have effects on usage and on innovation incentives. Bae and Choi (2006) modelise prove that these effects depend on the nature of piracy cost (reproduction and degradation costs). Jaisingh (2009) show that a piracy policy in monopoly market can reduce the net investment into the quality of the product .

Dyuti Banerjee (2004) analyzed the commercial copyright piracy and shows that the socially optimal penalty may be found only if the government and the monopolist both enforce the copyright.

Novos and Waldman (1984) and Johnson (1985) examined effects of increased copyright protection on social welfare. They suggest that publishers of proprietary software and the governement need to take severe actions on software piracy. For Novos and Waldman (1984) an enforcement of property rights decreases the social welfare loss due to underproduction and increases the social welfare loss due to under-utilization. Poddar (2005) shows that in case of industrial piracy the optimal policy for the proprietary software developer is to protect its software even if the network effects are strong. Shy and Thisse (1999) and Slive and Bernhardt (1998) show however that it is profitable for the publisher of proprietary software to allow some piracy in order to increase network externalities among customers. For Slive and Bernhardt (1998) in presence of significant network externalities for the software, it may be profitable for the software manufacturer to tolerate piracy by home consumers. This can increase the demand for the software by business users. Shy and Thisse (1999) show that when network effects are strong, unprotecting is an equilibrium for a noncooperative industry. They analyze piracy policies in a price-setting duopoly industry selling differentiated software and show that increasing network effects make software more attractive to consumers, and generate a competitive effect for software market.

This paper shows how piracy affects the current market, by changing the strategic effect between free software and proprietary software.

The objective is to model and explain why a producer of proprietary software can optimally *allow* a certain degree of piracy for his software in

case of F/OSS confrontation on the market. By *allowing* we mean that it is not a strategic choice but a choice constrained by the control costs. In addition we consider two different types of pirates (passive and active) and show that piracy is allowed when the F/OSS confrontation is high and the number of active pirates is big.
In 2008, piracy occurred at a high level in France, where the piracy rate[2] is estimated at 45%. It was estimated that the revenues that would be obtained if all piracy were prevented. was 2,9 billion Euro.[3]

Here we analyze piracy only of proprietary software. Piracy is also possible with free software, e.g. by removing the reference to the F/OSS license within the code and implicitly copyrighting it improperly.

On the basis of software markets study, we shall identify firstly, the various forms of piracy and what extent they are affected by piracy phenomenon (countries, and users' types). Secondly, we shall identify the software market and its main features. We shall analyze finally, the implications of piracy in current business strategies.

2 Presentation of piracy

2.1 Significance and Typology

Software piracy is defined to be a *malpractice or violation of intellectual property rights*. The French **Intellectual Property Code** defines piracy in its article L.122-4: *Any representation or reproduction complete or partial made without the assent of the author (...) is illicit.* In the Intellectual Property Code, acquiring or purchasing software is not form of ownership (that is, appropriation of property rights) but rather an acquisition of some rights to *use* it.

We identify five types of piracy:

- **Counterfeiting and Industrial piracy**

  Is the reproduction of unauthorized copies of software in such a manner to be identical to legal copy. Pirated versions are engraved on CD-R and supplies with documentation and license. They are afterwards sold on Internet.

- **Corporate piracy and Internet infringement**

  According to a study made by a private cabinet the International Data Corporation (IDC) [4], the number of individuals in the world having access to the Internet reach to 1.2 billion people. This number increased

[2]The piracy rate is the total number of units of pirated software deployed in 2008 divided by the total units of software installed.

[3]Sixth Annual BSA-IDC, 2008. Data on piracy are not precise nor robust, but the key incentives and forces to be modeled are clear.

[4]http://www.idc.com/france/ on 2008

in one year to 135 millions among which 100 millions in emerging countries (or emerging markets). Some platforms became exchange points where users *illicitly* shared proprietary software protected by the intellectual property rights (Emule, eBay, peer-to-peer, Local Area Network ...).

- **Home piracy**

  According to the same study IDC published by BSA,[5] 45% of the software installed on microcomputers in France had no license. This piracy shows different forms:

  - Abuse of license: installing a program on several computers when it is licensed only for one.[6] This occurs mostly among individuals and small and medium firms.
  - Exchanging copies of software under license.
  - Commercial use of non-commercial software.
  - Copying software with the aim of installation or distribution.
  - Getting an updated version without having a previous legal copy.

- **Reseller piracy or the Hard-disk loading**

  This occurs when hardware sellers install a non-authorized copy on a computer system. It is an illicit copy of a software on the hard disk of computers.

- **Unrestricted client access infringement**

  This misuse occurs when an organisation copies proprietary software to a LAN (Local Area Network) used simultaneously by several employees and in violation of the terms of the license agreement. The organisation has to control the number of copies and users to be sure that the number of users is limited to the number authorized by the licence.

2.2 Frequency of piracy

The Sixth Annual BSA study on piracy rates in 110 countries found that in two countries out of five it exceeded the rate of 90%, and in more than half it exceeded 70%.

[5] The Business Software Alliance (BSA) is an industry lobbying group of software vendors such as Microsoft, Apple, IBM, HP, Adobe systems. It is based in Washington DC and present in more than 80 countries.

[6] Licences are usually for one computer, or by paying more users may install it on more than one computer.

The same report found that piracy rate reached 61% in Asia and 66% in Central Europe. In European Union it was about 35% and in North America 21%.

This phenomenon is complex to analyze due to a number of variables such as the use of the software, the retail chains selling it, and the duration of its relevance. A study carried out by the industry group SIIA[7] indicates that the most pirated software by professional users in particular companies was: *Symantec Norton, Adobe Acrobat*, and *Adobe Photoshop*.

To understand the piracy phenomenon, we focus on some specific countries where the piracy rate is between the highest and lowest one.

As Figure 1 shows, piracy rate varies dramatically from one country to

8.png

Figure 1: Highest and lowest piracy rate in the world

another. The highest rate is located in Georgia with 95% and the lowest in United States with 20%. This variation may be explained partly by cultural differences between these countries and partly by differences in anti-piracy laws.[8] This disparity can also be explained by the different degree of development between countries by comparing the piracy rate and the *Human Development Index* (HDI).[9]

The HDI combines three dimensions:

- The *Life expectancy* as an index of population health and longevity.
- The *Knowledge and education* measured by the adult literacy rate and gross enrollment ratio.
- The *Standard of living* measured by the natural logarithm of Gross Domestic Product (GDP) per capita at purchasing power parity.

We show in the following table the two last components of the IDH for a chosen countries. We draw from two reports: the *Human development reports* (2008) and the report of the BSA-IDC (2009).

[7] Software and Information Industry Association Antipiracy Report, 2007

[8] The last report of the BSA (2009) adds to this list the supplementary factor of the financial crisis.

[9] Human Development Index data 2005.

Country	**Piracy rate**	**GDP per capita index**	**Education index**
United states	20%	1	0.837
Japan	21%	0,959	0.946
Germany	27%	0,949	0.948
Canada	32%	0,97	0.914
France	41%	0,954	0.883
Brazil	58%	0,74	0.872
Turkey	64%	0,74	0.812
Senegal	79%	0,482	0.394
China	80%	0,703	0.991
Ukraine	84%	0,705	0.971
Venezuela	86%	0,7	0.982
Georgia	95%	0,587	0.953

Figure 2: Piracy rate and IDH components

We propose to explain the relation between first piracy and the *GDP per capita* and second piracy and the *Education level*. The following figure associates the piracy rate and the GDP per capita for each country cited.

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Figure 3: Piracy rate and GDP per capita index

As seen in Figure 3 a higher GDP per capita correlates to a lower piracy rate. This negative correlation between piracy and the degree of development measured by GDP per capita indicator could be explained by the fact that developed countries have the necessary institutions to apply anti-piracy laws (*institutional enforcement*).

But the development level does not explain totally the piracy phenomena. Some developed countries with strong institutions presents a high piracy rate, e.g, France with 41% piracy rate. What we introduce here is that piracy phenomenon could be explained by other factors that institutional enforcement. The new idea submited that piracy can be explained by the different skills of users who practice piracy. We assume that the education index of a country can improve the skills of pirates.

2.3 *Active pirates vs passive pirates*

We propose here a classification of pirates according to their technical skills.

The highest development rate of a country, the lowest the piracy is.

Classics studies in piracy show that there are generally two types of users, individual and professional ones.

It is easier to detect professional pirates than the individual ones and sanction them.[10] J.Slive and D.Bernhardt said in this sense (1998, p. 889): It is far more difficult to catch and punish home consumers who pirate than delinquent firms.

The report published by the *BSA* (2009) demonstrates the importance of individual pirates in the installation and the replacement of former versions (often pirated) by new pirated versions.

The same report demonstrates also that organisations like the professional users, the academic and the administration staff often use versions pirated on their new hardware because of the variety of their suppliers who are not still the same.

This classification of pirates excludes *de facto* the important dimension of pirates skills.

In fact, individual pirates can be considered dangerous if they possess high skills.

We assume that *knowledge* can improve the skills of software users, proposing other explicative factor of piracy than the GDP per capita indicator, mesured by the relation between education index and piracy. In

3A.png

Figure 4: Piracy rate and Education index

comparison with the previous graph, this one shows globally two distinct results.

On the one hand, we observe a negative relation between education and piracy. This expected result is observed in developed countries like Japan, USA or France where institutional enforcement is high.

On the other hand,we identify a positive relation between piracy and education. For this positive relation, we distinguich mainly countries whith low GDP per capita. It is the case of Georgia whith high education index (0.914) and highest piracy rate in the world (95 %). But it is also the case of China, Venezuela, Brazil, Ukraine, and Turkey. In these countries where

[10] Via some costs of repression that can sometimes be very high. The industry group SIIA fined an unnamed British business 250,000 in 2007 for using pirated software.

GDP per capita is low and implicitly *institutional enforcement* is weak, the increase of education level can improve the technical capacity of users to pirate software.

But we notice for the case of Senegal that piracy rate which is high (79 %) is associated to a low education index (0.394).
This opposition can be explained by the fact that it exists two type of pirates. One with high skills (active pirates) and other with low skills (passive pirates). The first thanks to their skills practice actively piracy and diffuse pirated versions towards the second. In case of Senegal, we can say that the piracy is a result not only of the absence of institutions but also of the existence of high number of passive pirates.
We therefore distinguish between:

- **Passive pirates** do not possess enough technical skills to pirate software. They obtain pirated versions from their acquaintances or via exchange forums. In general, passive pirates practice certain type of piracy like the **download**, the **piracy by user** and the **misuse of server**.

- **Active pirates** are competent in decoding and updating pirated versions. They are generally the diffusion platforms of pirated software towards the passive pirates. Active pirates can be considered as the origin of the **industrial imitation** and the **piracy by buyers**.

The group of the active pirates is certainly smaller than the passive one. And it is generally more long-lasting in the piracy because of their independence and their learning strong (*lock in effect very weak*). Their use of pirated software can be sustainable and applied simultaneously with legals software and free software applications (see figure 8).

Active pirates are also moreover more difficult to detect as more costly to control.

We retain so that it is easier for a publisher to control piracy when is done:

- in a professional environment by the active pirates for its own use.

- in all environment by a passive pirate given the limits of his technical skills.

For a publisher, to capture pirates and integrate them in legal sphere represents a big challenge. As the anti-piracy action can be costly but profitable as legal demand of proprietary software increase and free software substitution risk decrease.

3 Double competition in software industry

Two facts characterized the software market. The oligopoly structure of the market and particularly the double competition aspect between:

- free software and proprietary software.
- and between piracy and proprietary software.

We speak here about three spheres: proprietary sphere, F/OSS sphere and piracy one.
Another fact is the characteristics of the software market itself which is particularly different from hardware one. *No physical market* for software offers where prices and products descriptions are presented. But the conditions of a real competition such as distribution modes, marketing strategies and control of market...do exist. As an example, the PC's market. There are three main types of Operating System: Windows as a leader, Mac OS X and Linux.
These facts don't affect the continuous progress of the proprietary software market that reached the 140 million euro in France in 2008 (Figure 5). The estimated growth rate of proprietary software sales in France over the 10 year was about 160,96 %(INSEE, 2009). It looks on the graph like the pro-

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Figure 5: Proprietary Software Sales in France

prietary software sector is growing fast. It would be see also that the growth is over the same period for piracy and F/OSS software. These three spheres are growing in terms of users and sales (for proprietary and F/OSS sphere). William Brian Arthur (1989) showed that the economy, over time, can become *locked-in* by *random* historical events to a technological path that is not necessarily efficient and not easy to change by standard tax or subsidy policies. We will see that lock-in tendency in case of proprietary software can change thanks to a competing-technology of F/OSS.

3.1 Substitution by free software

Free software grows both in terms of users and in terms of sales. As an example, for the most users, Open Office is an excellent alternative to Microsoft Office. Free software has different way of generating profit (Raymond, 2000b) as for example:

- Sell hardware with F/OSS as Apple does.

- Distribute F/OSS and sell service as Red Hat does.
- Sell accessories for F/OSS as documentation (OReilly and Associates).
- Sell to other developers a brand that certifies that their open source technologies is compatible with all others who use the brand, as Sun's StarOffice does.

According to a private study by Pierre Audoin Consultants[11], the market of the free software and Services in France represents in 2009 not less than 1.5 million euro with a 50 % growth rate in 2008 (figure 7). Today there is

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Figure 6: F/OSS Sales in France

doubtless more free software substituting proprietary software on Windows platforms than on Linux (for PC). According to the site *Framasoft*[12] from 1541 free software programs on mars 2011, 1298 of them turn in Windows, 1128 in Linux and 709 in Mac OS X. Most of these programs have versions for more than one operating system. This fact is established when we look back on the year 2010. On the other hand, for certain programs, there is no

F/OSS turning on	**Year 2010**	**Year 2011**	**New F/OSS created**
Windows	1256	1298	42
Linux	1084	1128	44
Mac OS X	682	709	27

Figure 7: Distribution of F/OSS running on different platforms

alternative open source and thus no substitution risk. As for example the games, which are mainly proprietary software and subject to piracy. The subdivision of the market is in this case closed with *lock-in* effect imposing Windows *de facto* as a standard OS to both users and producers of hardware.

Nevertheless, this doesn't exclude the fact that free software can replace the proprietary software in some domains (specially server).

[11] https://www.paconline.com/pac/pac/live/pac_ france/notre_ offre/rapports/fr_ 05_ offresprestations/fr_ 05_ opensource/index.html on 2007

[12] http://www.framasoft.net/rubrique2.html

The most appropriate term describing relation between the proprietary software spehere and the free software one is the user competition or migration risk.

However, in the free software sphere, price competition is not an appropriate model. The main drivers in the free software sphere are quality, common practices and innovative products. Indeed, there is at present no study or no solid statistics to confirm this *established fact*. And the competitive dynamics still more present in the proprietary software sphere than in F/OSS one.

3.2 Substitution by illicit competition

Properties of the digital electronic goods facilitate piracy of them. The *non-exclusive* and *non-rival* character of software facilitates the sharing of these goods and the behavior of *free riders*.

Slive and Bernhardt consider piracy as a form of price discrimination in which the publisher sells some of the software at a price of zero. In some models, under these conditions the equilibrium of the market is not optimal and an implementation of anti-piracy laws (copyright) can lead a net decrease of the social welfare.

Piracy incents producers to decrease productions and investment, which then reduces the social welfare by the under-consumption by authorized users.(Novos and Waldman, 1984)

We aim to show in this paper that in the context of piracy, competition becomes dynamic between proprietary software and free software. High levels of piracy create competition for free software especially in developing countries. For example, in China, pirated versions of Windows compete with the legal copies of Linux. The piracy can also result in more usage of free software if publishers apply an *anti-piracy* policy. This occurred when the publisher of anti-virus application *Norton* applied anti-piracy policy and lost market share in favor of the free software *Avast*.

The most important point is the effect of piracy which changes from one country to another. In some countries, piracy is the dominant form of distribution. It is most extreme in *Georgia* where the piracy rate was estimated to be 98% in 2008.
The survey across 110 countries done by the *Business Software Alliance*(2009), found that only 44% of the installed software on personal computers are properly licensed proprietary software, 41% were pirated versions, and the remaining 15% were free software.

3.3 The *New Competition* model

We model a software market in which there are two kinds of agents: a single developer/publisher and many users. The developer can publish proprietary

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Figure 8: Distribution of Software Installed on Personal Computers

or free software programs. Users vary in their skills and their specific needs which software can satisfy.

Three types of software exist in the market: proprietary software, free software and pirated software.
The competition between these depends on users' choices which are influenced by several factors:

- the original software price.
- the usefulness of the original software and willingness to pay it measured by its networks effects.
- the penalty in case of piracy.
- the usefulness of free software software and willingness to pay it measured by its networks effects.
- the costs substitution in terms of relearning and technical skills.
- the usefulness of the software pirated.

We represent the software market by an equilateral triangle including the three spheres.
The following graph (Figure 9) shows the distribution of users between the

11.png

Figure 9: The new Competition Model on software market

three competing software types:

- legal competition between proprietary software and free software,
- illicit competition between proprietary software and pirated software.
- substitution risk of pirates users by free software in case of strong anti-piracy policy.

We indicate that these three risks depend of the users' number or the networks effects of a given software.
This representation allows the determination of proportion of each type of software (proprietary, free software, or pirated). The arrows indicate the direction of the users moving from one software type to another. In response to an anti-piracy policy, pirates can choose free software alternatives or proprietary software depending on its usefulness, their skills, and the penalty.
We assume now that inside, user's population is diffused and the total of software proposed in the market is denoted by N.

$$N = N_1 + N_2 + N_3$$

where:

- N_1 the total number of proprietary software installed.
- N_2 the total number of free software applications installed.
- N_3 the total of pirated versions installed.

n_i is the total of software used by user i. The user i can use simultaneously the three types of software:

$$n_i = n_1 i + n_2 i + n_3 i$$

where:

- $n_1 i$ the total of proprietary softwares installed by the user i.
- $n_2 i$ the total of free software applications installed by the user i.
- $n_3 i$ the total of pirated versions installed by the user i.

The user "**i**" decision can either:

- to buy the proprietary software at a given price. This decision results from a tension between the proprietary software's price and the expected cost of piracy.
- to pirate the proprietary software. Which depends of the pirate's skills and of the software's usefulness. The piracy decision still negative function of the penalty but it is a positive function of the software's price and the usefulness of the proprietary software.
- or to learn how to use the free software solutions.

For one user i located on the triangle his coordinates $[\frac{n_1 i}{n_i}, \frac{n_2 i}{n_i}, \frac{n_3 i}{n_i}]$ express his using of each type of software which allow us to determine his user's type.

The point **A** will be considered as the average point from which we establish the risk for an editor of proprietary software. The coordinates of the point A are $[\frac{N_1}{N}, \frac{N_2}{N}, \frac{N_3}{N}.]$.

The problem that arises for an publisher, is to distinguish the risks.

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Figure 10: Spatial Competition Model

4 Confrontation and an Anti-Piracy Policy

Given the importance and the complexity of the piracy phenomenon, which adds the risk of substitution by free software, publishers were pushed to the implementation of new policies.

An Anti-piracy policy or action requires costs averagely high.

The main idea shown in this paper is that anti-piracy action can have two effects on the future of the proprietary software:

- by reducing its network effects,
- and by increasing the probability of its substitution by the other solutions in particular by the free software ones.

In what follows, we will identify for a given publisher the different risky situations. For this we will establish first a matrix of risks. We will focus then on situation of confrontation with free software and piracy. The optimal anti-piracy action will be different from the one applied in classic situation of piracy.

4.1 The Risky Matrix

As showen in the section 2, we represented the New Competition model by a triangle. The comparison between the installed software of the user **i** $[\frac{n_1 i}{n_i}, \frac{n_2 i}{n_i}, \frac{n_3 i}{n_i}]$ and the average (A) $[\frac{N_1}{N}, \frac{N_2}{N}, \frac{N_3}{N}]$ determine the risky situation for an editor.

The editor faces:

- on the one hand the free software substitution risk. Measured by the comparaison between the number of free software installed $\frac{n_2 i}{n_i}$ and the average $\frac{N_2}{N}$: If $\frac{n_2 i}{n_i} > \frac{N_2}{N}$ there is a high confrontation of free software.
- and on the other hand the piracy risk. Measured by the number of pirated version installed $\frac{n_3 i}{n_i}$ and the average $\frac{N_3}{N}$: If $\frac{n_3 i}{n_i} > \frac{N_3}{N}$ there is a high confrontation of piracy.

We relate the different risky situations for a publisher by the following matrix that articulate two axes:

	piracy risk (P)	the absence of piracy risk ($\bar{P}$)
free software risk market share (F)	x	y
absence of free software risk ($\bar{F}$)	z	w

The notation x,y,z,w denotes different situations of risk for an editor of proprietary software:

- Situation z: $(\bar{F}+P)$ is a situation where the using of pirated software is considered superior to the average. The user i is a pirate as the number of installed software are almost pirated and superior to the average: $\frac{n_3 i}{n_i} > \frac{N_3}{N}$.

- Situation x: **(F+P)** is a *situation of total risk* for an editor. There is a double risk of free software and piracy competition. The users i is a free software one as $\frac{n_2 i}{n_i} > \frac{N_2}{N}$ and in the same time he is a pirate $\frac{n_3 i}{n_i} > \frac{N_3}{N}$.

  This situation concerns especially the active pirate. The active pirate with his high skills is enable to use simultaneously free software alternatives and to go on to piracy if his usefulness of the proprietary software is high.

- Situation y: $(F+\bar{P})$ is a situation where the using of free software software is considered superior to the average ($\frac{n_2 i}{n_i} > \frac{N_2}{N}$). This situation concerns especially new products with high potential that can attract pirates. Pirates can so stop to pirate proprietary software as their usefulness decrease.

- The last Situation w: $(\bar{F}+\bar{P})$ is a situation of zero risk. There is no risk to pirate proprietary software or to substitute it with free applications. The user i is located on the triangle with coordinates $[\frac{n_1 i}{n_i}, \frac{n_2 i}{n_i}, \frac{n_3 i}{n_i}]$ near to the point **A** $[\frac{N_1}{N}, \frac{N_2}{N}, \frac{N_3}{N}]$.

On the existing literature about piracy, an editor of proprietary software used to confront piracy. He takes actions sometimes expensive which increase the networks effect of his software.

What we identify here is the new situation where editor has to rethink his actions against piracy because there is a risk of substitution of the free software. We discuss in what follow this two types of actions.

4.2 The *piracy tolerance* action on both confrontation with piracy and free software Risk

A classic action against piracy is software protection with different control costs, depending on *institutional enforcement* and specific factors (culture, technical means....).

For a given level of skills and a certain usefulness, we model the piracy phenomenon as occuring if the expected piracy cost is much low than software's price.

The anti-piracy action will take the form of formal rules or enforcement by governments[13] or by international alliances as the BSA (Business Software Alliance), the SIIA (Software and Information Industry Association) or the IFPI (International Federation of Phonographic Industry).

The real conditions pushing user **i** to become a pirate is that software engendered on the one hand a high utility and on the other hand its price is high. The utility implies a strong learning effect and network effects which increases with the number of the consumers using the same software.

The costs of control and the potential efficiency depends also on pirates type. It s known that the control costs and fines are higher in case of the professional pirates but it is difficult to identify them if they are *active pirates*.

The piracy decision depends on the pirate type:

- For an active pirate: if his usefulness of the software is high, he still pirate it as his skills are high too.
- For a passive pirate: if his usefulness of the software is high, he will buy it legally. Inversely, if his usefulness is low, the pirate will prefer to use free software alternative.

For a publisher, it will be more question to integrate as legal users the passive pirates as their number is important and their skills is low.
This classic policy can not be adopt in situation of double risk where proprietary softawre confront both piracy and free software.

Because the substantial control costs and the free software substitution risk, a publisher can be obliged to leave segment of his market unprotected. As to allow a positive correlation between pirated and proprietary software which *in fine* could encouraged the adoption of future versions(*Shy and Thisse, 1999*).

The strategy of the producer is so the not repression of piracy but the *tolerance* of it.
The main research issue to be tackled in the course of this presentation consists of defuse the idea that *tolerant piracy* strategy can be developed in two situations.

In a situation of weak learning effect in case of new product. In such situation, the publisher can allow the temporary piracy of his software, in order to encourage the use of his software and the increase of its networks effect.

[13]For example, the Haute Autorit pour la diffusion des uvres et la protection des droits sur internet (Hadopi), law introduced on 2009 on France for *promoting the distribution and protection of creative works on the internet* as a means to regulate internet access

And in a situation of great network effects that makes control difficult. It corresponds to mature software. In this sense Microsoft found that piracy of Windows has helped give it huge market share (90%) in China. ***Although about three million computers get sold every year in China, people don't pay for the software. Someday they will, though. And as long as they're going to steal it, we want them to steal ours. They'll get sort of addicted, and then we'll somehow figure out how to collect sometime in the next decade.*** (B.Gates).[14]

Pirates may cease pirating the proprietary software if the free software becomes more useful.

In this case, publisher admits that action against piracy is resulting less. As it would be very expensive to control and to repress piracy in particular *active pirates*. Specially that the fines applied to the *passive pirates* are generally individual and low. The *tolerant piracy* policy is in this case not a strategic choice but an evidence limited by the software's networks effect and the control costs.

The *tolerant piracy* policy consisting on monopolizing potential markets. The idea is that *tolerant piracy* establish at T time can allow at T+1 a *lock-in* situation as a result of the *learning by doing*. In fact, to attract potential users, a publisher can tolerate a certain degree of piracy necessary to create *lock in* effect. He can so create acquaintance through the use of *home-made* products and by encouraging learning effects of the software. The application of this policy can take the form of proposing freeware or shareware.

Tolerant piracy policy can increase the usefulness of one software that *in fine* can limit the risk of substitution by free software alternative. It is the case of *Adobe Acrobat* the second most pirated application in the world. *Adobe* still pirated but preferred to free software alternative. In a way, it becomes a standard and even free software applications integrate it legally like *LaTeX*.[15]

The case of *Adobe* still a good illustration of *tolerent piarcy* policy. Its publisher in order to confront piracy, has firstly offered *Adobe reader* as shareware and then as freeware. This fact has establish *Adobe* and its derivatives products as a standard.[16]

Tolerant piracy can so be organized in a situation where publisher estimates that the software is engendering learning effects necessary for its adoption. The losses are estimated weaker than the potential profits (seen the selling is not at the maximum). But this action become an establish fact when it becomes difficult to control the diffusion of the proprietary software.

[14]Said in public comments in 1998, according to Fortune magazine.

[15]Free software text editor created by Leslie Lamport in 1985.

[16]Graphics applications like InDesign, Acrobat, Photoshop, Illustrator and Flash, Adobe Premiere Pro, After Effects.

5 Conclusion

The dynamics of innovation software markets sometimes means that software is pirated at once after its distribution. And sometimes even before its diffusion.

To confront piracy phenomena, publisher have to decide between to control or to allow piracy by making arbitration between control cost and potential benefits.

But for a publisher, the classic anti-piracy decision seems to be more difficult to take on free software substitution risk presence.

A publisher has so to develop a mixed policy to confront both free software competition and piracy risk. The *tolerant piracy* action can be adopted to increase the software's networks effects and in same time to reduce the substitution risk by free software.

It seems evident that for an user, the decision to move from proprietary software to free software one, depends firstly on its usefulness, secondly on the substitution costs (essentially for the passive pirates) and finally on the anti-piracy policy quality.

The complexity of piracy phenomenon is forcing publishers of proprietary software to dig a distance between them and the pirates. By constantly proposing new products or new versions which can shift the interests of the pirates. The new versions can sometimes be technically weaker than the former ones. The innovation dynamics could be so considered as an action to face the *illicit competition*. But it can also be considered as incentive to piracy in particular if pirates are actives with high skills.

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