Economical aspects of software piracy

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Abstract:

Software piracy is a very frequent topic for several decades already. The manufacturers fight with pirates for their "rights" and the countries fight the pirates to enforce their copyright law. The Business Software Alliance spend millions to send threatening mails to most SMEs in the Czech Republic and the company's spokesmen are lamenting on huge profit losses from piracy. Especially the countries in the former Soviet block and China are always mentioned as the main violator of copyrights. We are presented the estimations of losses from piracy activity that reaches up to billions of Czech crowns. Are the anti-piracy activities justifiable or something else behind it? No doubt that violation of copyright law or any other intellectual rights is an illegal act which should be punished. Nevertheless, several studies showed that certain amount of software piracy helps companies to raise the revenues through the network externalities. These studies were firstly published at the beginning of 90's and may omit some today aspects of the software market and the fact that the high-speed and broadband internet connection is spreading widely and the development of peer-to-peer network unleashed the wave of pirate software exchanges. The goal of this article will be to examine the factors of software piracy and to discuss whether the mentioned model conclusions are still valid. At the beginning author will provide introduction into the computer software protection industry and provide information both from anti-piracy agencies and end-user point of view.

Computer piracy:

The basics of computer privacy and intellectual property protection are not the main scope of this article; however brief introduction into the problems of copyrights is essential for further understanding. I will mention the fundamental ideas of copyright protection, patents and software protection, in order to make this article understandable for non-expert readers. Let's start with describing several problems that the computer piracy has to deal with. According to Wikipedia[1] software piracy is "*the unauthorized use of copyrighted material in a manner that violates one of the copyright owner's exclusive rights, such as the right to reproduce or perform the copyrighted work, or to make derivative works that build upon it.*" Business software alliance[2] distinguishes five types of common software piracy: *End User Piracy* (company employee reproduces copies of software without authorization), *Client-Server Overuse* (too many employees on a network are using a central copy of a program at the same time), *Internet Piracy* (software is downloaded from the Internet*), Hard-Disk Loading* (reseller loads illegal copies of software onto the hard disks to make the purchase of the machines more attractive) and *Software Counterfeiting* (illegal duplication and sale of copyrighted material with the intent of directly imitating the copyrighted product). Computer piracy exists since the time when the removable media, such as floppy disc appeared. At that time the piracy hasn't been a huge problem because the illegal activity were pursued locally and required physical exchange of floppy disks, CDs or other hard media. But, as the Internet access continually gets easier, faster and less expensive, software piracy does the same. It becomes easier, faster and less expensive. The Internet allows products to move from computer to computer, with no hard media transaction and little risk of detection at any distance in a fraction of seconds. This fact is confirmed by raising value of loss income caused worldwide by pirates. While BSA estimated that in 1996 the losses were $15.2 billions, nine years later, in 2005, BSA estimated [4] losses amounting to $34 billion in worldwide due to software piracy. These numbers are alarming and the fact that 35 percent of the software used nowadays is illegal forces many companies to think of unbreakable anti-piracy protection while governments are trying to enforce their copyrights law in order not to be labeled as a piracy supporting country. Needles to say almost all countries - including those with alarming percentage of piracy rate such as Vietnam (92% in 2004 [20]) - are quite successful in their fight against computer piracy during last 3 years. Yet the amount of losses is continuously rising - it is caused by rising revenues from software industry. Global piracy does not concern only the less developed countries. According to [19] the high income countries (e.g. Hong Kong) have sometimes higher rate of piracy than countries with lower average income. This shows that the economic rationale for software piracy must be extended to include the role of cultural mores, attitudes and law enforcement.

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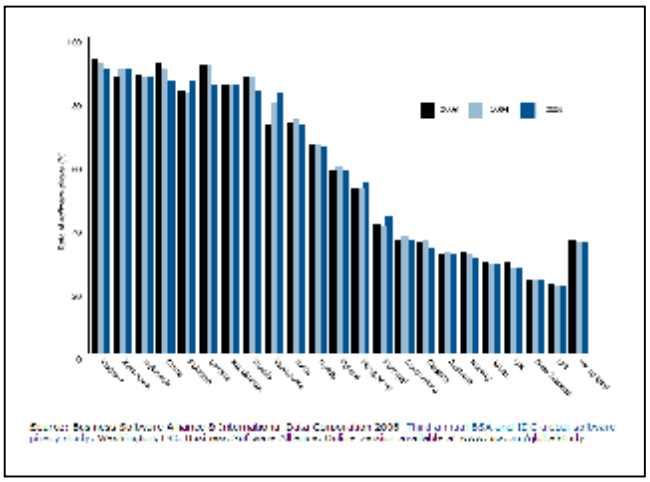
[1] http://en.wikipedia.org/wiki/Software_Piracy

[2] http://www.bsa.org/



Pic. 1 Rates of software piracy in selected countries in 2003-2005

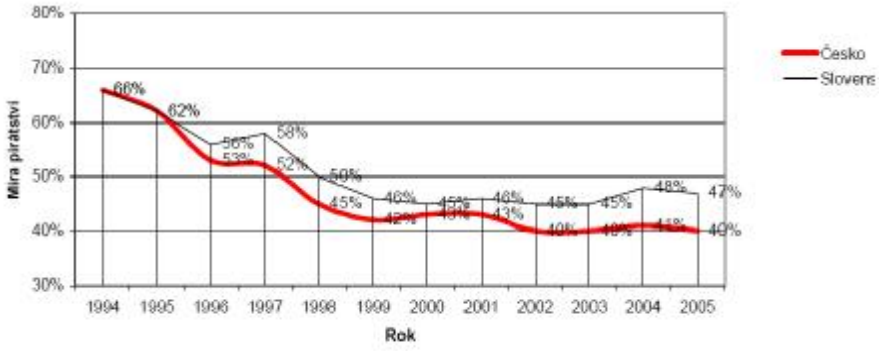
From Pic 1 and Pic 2 and above mentioned facts it is obvious that on one hand the ratio of pirated software is slowly decreasing, *while the software companies revenues and losses caused by piracy are rising.* We can only guess how BSA or governmental policies influence the piracy, or whether is the decreasing rate a sign of well-developing countries and their economies. There are opinions that the vendors have capitulated to software piracy [9] and to author knowledge there isn't any anti-theft protection that would not be breached.

Negative affects of software piracy

Software piracy has many negative economic consequences: local software industries crippled by competition with pirated software from abroad, lost tax revenues and jobs from lack of a legitimate market. In December 2005, IDC[3] and the BSA released their study [1] on the economic benefits of lowering piracy. In this study, IDC stated that decreasing piracy by 10 percentage points over four years would add more than 2.4 million new jobs and almost $70 billion in tax revenues to local governments worldwide. Most of that new employment and most of an additional $400 billion in GDP would be added to local economies. This is because, according to IDC, for every $1 in software sold, there is at least another $1.25 in services sold to design, install, customize and support that software. That software and those additional services then drive approximately $1 of channel revenue. Most of the additional services or channels revenue goes to local firms. Piracy trends Whether piracy goes up or down is the result of a complex equation that includes education and enforcement, new users coming into the market, easier access to pirated software, and external factors such as shifting political conditions. Issues such as culture, institutional effectiveness, and

[3] http://www.idc.com/

even geography are considered to have an impact on the ability of countries to decrease piracy. Particularly over the Internet and peer-to-peer (P2P) networks is putting upward pressure on piracy rates. Already over 60 percent of Internet traffic is driven by P2P downloading which unambiguously shows the level of piracy on Internet. Next section acquaints the reader with some issues in software protection. Both hardware and software protections are mentioned.



Pic 2: Piracy in the Czech Republic. Source:BSA

Software protection

There is a simple business rationale for copy protection: creating such instrument to make the media harder to copy and distribute. *Copy protection* refers to the technology used to attempt to frustrate copying.

Enterprise Digital Rights Management (**E-DRM** or **ERM**) [14] refers to the use of DRM technology to control access to corporate documentation (Word, PDF, TIFF, AutoCAD files, etc), rather than consumer playable media. The technology usually requires a Policy Server to authenticate user's rights to access certain files. Beyond the existing restrictions imposed by copyright law, most DRM schemes are able to enforce additional restrictions at the discretion of the content's publisher, which may or may not be the same entity as the copyright holder. The drawback is that is requires permanent LAN or Internet connection.

System like *DIVX* [11] (DVD rental system restricting copying of the media), *CSS*[4] (preventing DVDs to be played on computers), *Product activation* (certain type of authentication where the product has limited functionality unless it registered and obtained unique activation key) and *Digital watermarking* (not preventing creating copies, but storing certain hidden information allowing to track the person who purchased the product) lead to denying certain usage rights, annoying user who legally bought the product and requiring user to pay additional costs to receive the full usage rights (phone or internet activation, time spent filling in forms) or to use the

[4] http://www.dvdcca.org/css/

product (necessity of special DVD player for DIVX DVDs). Windows XP activation used to be a nightmare for users without internet connection. After installing and or replacing some parts the product must have been activated or reactivated [12]. There were cases that people better used an illegal copy that does not require activation over phone even though they bought their Windows legally. This kind of protection is referred to *BTO vulnerability* [5], creating the pirated version "better-than-original" and creating a disincentive to buying an original. BTO vulnerability presents the serious danger of software protection and in can play important role in decision whether buy or steal computer software.

Patents

Patent laws are very tightly connected with the software copyright protection. What follows is a brief description of patent system and the costs it requires. Patents and copyrights are inseparable parts of software industry. They are forms of "immaterial property" that grant their owners exclusive control over the production and sale of a specified product. The problems of intellectual property protection by granting a patent had been discussed by many authors. There are many kinds of intellectual works and not all can be covered with same arguments. This paragraph will focus on those arguments that can put together with software, or more broadly - computer products.

While some, such as lawyers Benassi and Gillespie [1] argue that issuing patents "foster innovation", others argue that the costs the system requires might exceeds the benefits it provides [18] There is no doubt that inventors are motivated by "wealth-maximization reasoning", i.e. the gains provided by a patent must be greater than the cost spent by the inventor. In other words, the inventor will engage in innovating activity only if he expects to make a profit. It is assumed to be the reason behind the patent protection system: to provide assurance that the inventor's effort will be rewarded (by granting a time period of sole usage rights). These are arguments of the inventors. Unfortunately this system has many opponents who claim that the costs can be greater than the benefits brought by usage right protection. The most important costs are stated also in Kinsella [18]. They are legal expenses (salaries for patent attorneys (either for lawsuit or examination of existing patent prior to registering one)), administrative expenses (patent maintenance fees, litigation costs, insurance etc.) and the most obvious economic cost that "in order to create incentives for the production of inventions that otherwise would not have been developed, patents create monopoly privileges over inventions that would have been developed even without the incentive."Each potential patent means either a risk of a lawsuit or better avoiding making the product out of fear. Twenty-year production monopoly means diminishing the incentives for new patents… "[8] The fact that not all discoveries and innovations are patentable shed another light on the problem of economy of patents and intellectual property.

Network externalities

Network externalities occur when the value of a product or service increases with the cumulative number of purchasers [21]. *"Each additional purchase raises the value to*

existing users as well as the expected value to future adopters. Packaged software exhibits positive network externalities in that the value of a product to an individual user increases to the degree that other people also use it "[1]. Hence new users will prefer more popular software to less popular one. Warren [21] also presents an example of network externality: Ownership of a landline phone, with a single device in a network that has no value, while the more subscribers are connected the more valuable is the ownership of a landline. Gandal in [13] provided evidence on spreadsheet software market that network externalities have significant effect in this industry. In computer software industry the more the software is used the greater is the chance to exchange the files and obtain a support either from professionals or experienced users. For the manufacturer there are positive externalities of increased product value, increased bugs report, user feedback and a promotion through online discussions and forums. The more feedback the manufacturer get, the sooner he can release a new version which means higher incomes through upgrades. In [7] it was mentioned that there are another two important types of externalities. They are "word of mouth" (the more the product is used the more information is available and customers search costs are reduced) and "learning by doing" (similar to achieving economies in scale, i.e. the more products are shipped out the more effective the production processes are). Together with observation in [3] where authors made a research on spreadsheets industry and found out that one percent increase in product's installed base was associated with 0,75 percent increase in its price. These two evidences undoubtedly speak for the certain level of piracy. Of course there are many authors defending conventional opinions such as [9] who believe that converting pirates into buyers would lower the prices, simplify the license agreements and encourage vendors to enter new foreign markets. Detailed consequences were described in separate section. There are no statistics how much pirates would actually buy the products or how many of them would join the growing community of GNU/GPL[5] users. Almost each commercial product used by ordinary users (for home and office purposes) has a freely accessible substitute licensed under Open Source. Either it is operating system (MS Windows is the worlds most pirated software [10]), that can be replaced by e.g. Linux distributions, word processing (MS Office are widely used without licenses even on a governmental level while the Open Office are almost unrecognizable from Word, Excel and PowerPoint GPL software) or graphic editors (PhotoShop vs. free Gimp). Before discussing the economic model, a viable technology for software protection is described together with restrictions coming along with some current technologies.

Limited software piracy: the Model

The remaining of this article will focus on a model describing the fact that the manufacturers may permit limited piracy to boost their sales and their product values. This model was published by Slive and Bernhart in 1998 [15]. Let's start with the description of the main features. The paper identifies two features (network externalities and price discrimination) of the software market that together lead the

[5] GNU General Public Licence: http://www.gnu.org/copyleft/gpl.html

manufacturers to overlook certain level of piracy. Previous chapter dealt with the first feature, while the second can be characterized as the willingness of users to pay for the software and probability of being caught along with carrying the responsibility of the criminal offence. There are two main distinct groups of users: *home and business user*s. The business users are easier to monitor and the penalties for piracy can be much higher. Authors of the analyzed model stressed *that tolerated piracy is a type of price discrimination where the manufacturers sells some of the software for zero price* and together with network externality it allows them to earn a positive marginal revenue from a product. Slive and Bernhart also speak about two countervailing forces: when the piracy increases the number of paying customer decreases, while the increasing piracy increases the value of the product (through the network externalities):

> *"If it is possible to increase the number of people who are pirating by a large margin while decreasing the number of paying customers only slightly, an increase in piracy may increase the software manufacturer's profits. Hence, if network externalities are sufficiently great, it might be profit maximizing for the software companies to tolerate a limited piracy by home users in order to increase the demand for software by business customers."*

The assumptions of this model are that network externality exists only for business home users thus have no benefit from large users group. Second assumption is manufacturers can impose piracy cost on home users. These costs are independent on number of users. The key features are that network externalities and piracy cost are greater for business customer. This assertion is justified by the assumption that if the network externality is sufficiently great, the software manufacturers will wink at piracy of certain consumer groups.

The model is further divided into cases when a) the piracy costs are lower than the price ($Z_H^* < P^*$) and b) when the piracy costs exceeds the purchase price ($Z_H^* >= P^*$), such as OEM software, freeware etc.

The authors deduced two formulas for maximizing profit for a) and b) case.

a) $$p_p^* = \begin{cases} \dfrac{m(1+q(1-m))^2}{4(1-qm)} & if\ q < \dfrac{1}{1+m} \\ qm & \text{otherwise} \end{cases} \qquad (1)$$

b) $$p_{NP}^* = \frac{(1-c+qmc)^2}{4(1-qm)} \qquad (2)$$

From these functions, one can easily deduce the optimal network externality θ^* *by subtracting* $p_P^* - p_{NP}^*$.

c) $$q(c,m) = \frac{1 - c - \sqrt{m}}{\sqrt{m}(1 - m - \sqrt{mc})} \quad (3)$$

Where q represents the *network externality* with values from interval 0 to 1, m is a *measure of business consumers* in percents and c is a parameter of the linear *enforcement cost function.*

The analysis of model presents a result that there *"exists a critical level of network externalities θ* such that the firm earns greater profits from permitting home consumers to pirate than from preventing piracy (assuming that $\theta > \theta$*)"* As a function of the marginal enforcement cost and the fraction of business consumers, θ* is given by the formula (3).

Model drawbacks: In economic models government has a special role and so it has in this case. Government behaves like business as to the licensing policies, while in my opinion the network externality is almost insignificant (see Table 1). Government also presents a special case in right of recovery to software piracy. Following lines will try to prove that the assumption of home users not profiting on the network externality was not completely correct. Needles to say that modern era of broadband connection did not affect the model. It only further decreases the piracy cost, but also the manufacturers cost.

Home users and network externality: In case of troubles, home user will probably seek for a help between the people he/she knows. The more the product is used the higher the probability of finding someone who can help me anytime. The companies won't hesitate to call manufacturer's customer support which they received with their product. At this point the network externality effect for businesses is suppressed. For file exchange is the network externality undoubtedly key prerequisite. In order to exchange data, the user base must be broad enough. After-market sales are also created by a special plug-ins and extensions of the product which meet the special requirements of the customer. Needs of companies are more specific than the customer's and government one. Regarding the training, another source of profit, the companies and governments and companies won't be reluctant to invite well-paid specialist even if they would be only a few in the country. They also apply the economies of scale when lecturing whole company. Home users will probably seek some smaller, local training center, or individual classes at affordable price (given by competition = the more people use the product the more can give classes). Manuals are of the same type as training. One special book will be unavailable and expensive, while common software book can be found in each newsagent. It seems that the government has small benefit from the network externalities while the user has the greatest utility. This article purpose was to point out that excluding home users from network externality utility and omitting the government with its special features are drawbacks of the presented model. Nevertheless the conclusions made by authors are valid and there is certainly a value of network externality which – when exceeded – enables manufacturers to wink on piracy.

Tab1: Advantages of network externality for each group of users

	GOVERNMENT	BUSINESS	HOME
hotline / support	-	-	+
file exchange	+	+	+
extension	-	+	-
training	-	-	+
manuals	-	-	+

Conclusion

This article presented a strong argument for accepting a certain level of piracy. The argument is called a *network externality*. Although it is not obvious from the section which explains this phenomenon, there are legal ways leading to an existence of network externality for a software product as well. Manufacturers already realized this fact and they introduced licensing policy called OEM (Original Equipment Manufacturers). Under this licensing policy the software is distributed only with a new computer for a very low price or even for free, to come closer to the case when costs of piracy exceeds the product price. It is necessary to say that this policy is smart because most of people who just bought their new computer can be inexperienced and to start with the bundled software will be the easiest way for them, while they will create a part of the network externality. Another smart step to spread the user base is to distribute "Lite" version for free, while the "Pro" version under commercial licenses. The distinction between these two versions – if wisely chosen – can be small as far as the function is concerned, but important in functionality (e.g. printing, exporting, etc.).

The higher the product value the larger the secondary market (i.e. after-market) sales are. Manufacturers who are afraid of losses from high piracy should focus on the secondary market sales. They can perform activities leading to creating products connected with their software that cannot be pirated and bring them profit at the same time. These activities can be issuing of certificates for professional tutors and consultants, prepaid customer support, special hardware equipment or at least make use of the growing user base and try to persuade them to upgrade to new version for affordable price and collect feedback from them.

All the papers from late 90's describing the topic of network externalities mention that spreadsheet Lotus 1-2-3 has often been credited as an application that started the initial growth of the personal computer. It allowed users to perform financial and

scientific modeling without any programming knowledge. According to [15] it was the most pirated software at those days. Its format became an industrial standard and I would not be afraid to say that it proved the existence of network externality in computer software. At the same time it showed that the network externality itself cannot ensure future life. Nowadays, hardly any user heard or even uses the 1-2-3 spreadsheet. It is out of scope of this paper to investigate why this software ended with old computers at the waste disposal.

It is apparent that piracy will exist as long as the computers can exchange files. This article shown, that certain level of piracy can be beneficial in the following ways: They are mainly the network externalities created by a huge user base, which can be beneficial both for manufacturer (raising product value, feedback, after-sale market) and for business users (assuming that they have bought their version legally) through possibility of home work, savings of expenses for lectures and training. On the side of manufacturers there should be visible effort to persuade business clients to use their products legally. At this point they have law enforcement system at their disposal. The punishment for software piracy is stiff and one can be put in jail. The effort of turning a pirate into a regular user can be very complicated with home users – it can be easier for them to switch to a free open source product, while creating extra costs in file converting and possible data losses for their employers, while loosing user means decreasing the value of the product

Nevertheless it was shown that putting enormous effort into anti piracy policy can be ineffective. In my opinion, one of the crucial problems is not only legal unawareness of public, but also the fact that most of people have very limited computer knowledge. This is the gap that should be filled by governmental support: to inform and encourage people to get familiar with open source software. The public is not aware of the fact that the document written in MS Word can be opened and edited in Open Office Writer which provides the same functionality for free without risking being punished by a fine or jail. Put prevention to the first place and repression at the second should be the right way to force people behave consciously and responsively.

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