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Digital files dealers and prohibition in the context of the French 3 strikes (HADOPI) law

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Abstract

Illegal digital file consumption is widely believed to influence sales of cultural goods. Online piracy is now regulated and prohibited in some countries, especially in France, where HADOPI is a legal authority in charge of Peer-to-Peer (P2P) protocol monitoring. We claim that prohibitions on digital markets share some characteristics of other criminal activities such as those of the drug market. Prohibition of a good or service can lead to the emergence of a black market embedded in a social network. Based on an original and representative 2012 French survey, we show that such a social and offline organisation is observed. Indeed, offline swapping is now the largest way to exchange digital files. We show that offline swapping is embedded in a hierarchical social network where different behaviours are observed. On one hand, there are wholesalers of digital files who provide more than they receive from this offline network and maintain online downloading activity through P2P technology. On the other hand, there are also the “simple” consumers who consume only from offline swapping and never provide files to others. They never use monitored P2P technology because HADOPI acts as a deterrent. Our econometric analysis suggests that this “fear” of HADOPI plays a significant role in structuring this offline swapping network, as the position in the swapping network is driven by the feeling of being threatened by HADOPI.

Key words: HADOPI, social network, piracy, prohibition, offline swapping

0. Introduction

For nearly four years, the French government has attempted to prevent Internet users from downloading illegal cultural digital files. Precisely, a law known as “creation & Internet” has been passed by parliament to set out a public agency in charge of technically monitoring and punishing illegal digital behaviour: HADOPI. When a user illegally downloads or uploads a digital file using Bittorrent protocol, he uses a Peer-to-Peer protocol (P2P). In this case, and only in this case, HADOPI can, upon a right holders request, detect the IP address of the computer that exchanges digital goods and contact the ISP (Internet Service Provider) to

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² For readers comfortable with French, annual report of 2013 activity can be legally downloaded here

identify the owner of the Internet subscription. If some files violate copyright law, the user can be punished, depending on the downloaded quantity and the user's recidivism. By 2013², only one user has been punished at the end of a gradual 3 strikes procedure, and HADOPI claimed that it is a good result, as illegal behaviour could have been dissuaded or stopped. Giblin (2014) proposes an international³ evaluation of graduated response and finds little to no evidence that graduated responses are either "successful" or "effective". Therefore, why such a public Agency?

The starting point is the relationship between illegal and legal consumption of cultural goods. Focussing on the music industry, Peitz and Waelbroeck (2006) analyse the impact of "sampling" effect on sales when piracy exists. The main result is that some illegal activities enable commercial players to obtain higher profits thanks to a "sampling effect". In a nutshell, cultural goods are regarded as experience goods where ex-ante uncertainty about characteristics is strong. Sampling through piracy helps reduce uncertainty regarding some or all characteristics.

Empirical evidence is ambivalent. Some highlight a complementarity effect between offline and online behaviour (Bounie and al, 2006; Smith, Telang, 2010). As predicted, illegal downloading favours the sampling effect and helps consumers to discover characteristics of cultural goods. Others note the substitution between legal and illegal consumption (Liebowitz, 2008; Zentner, 2006, Rob and Waldfogel, 2006). Under budget constraints, what is "stolen" online is not bought online or/and offline. A recent report published by the European Commission (Aguiar, Martens, 2013) and based on the online habits of 16,000 Europeans claims that music web piracy does not harm legitimate sales, the International Federation of the Phonographic Industry (IFPI) argues, however, that this kind of research is "flawed and misleading"⁴. However, if we look carefully at what happens when a prohibition occurs, some other effects can also be observed (Thornton, 1991). It is not only a matter of substitution/complementary debate, it is also a question of monitoring some volatile behaviours that previous studies do not consider.

² For readers comfortable with French, annual report of 2013 activity can be legally downloaded here http://www.HADOPI.fr/sites/default/files/page/pdf/HADOPI_RapportAnnuel_2013.pdf

³ France, New Zealand, Taiwan, South Korea, UK, Ireland, US (Giblin, 2014)

⁴ Music Week, "IFPI slams EU piracy study as 'flawed and misleading' ", march, 20th, 2013.

Put simply, if the government tries to regulate a market by prohibiting goods, informal or black markets often emerge elsewhere. Crime, violence, quality, social cost, mafia, and corruption, among others, are consequences of the black market's existence. To some extent, the total cost of prohibition can be expansive, while the benefits are few and dubious. This paper claims that the regulation of digital markets has consequences such as those we have observed for drugs or other black goods.

Few academic evaluations of HADOPI have been conducted. As far as we know, Danaber et al. 2014 is the most recent empirical work. Focusing on the Apple iTunes store, they show that with HADOPI, French legal sales are a bit higher than in other European countries. From a certain point of view, they do not reject the prevention side of HADOPI nor a substitution effect between legal and illegal downloading. Other work (Dejean, Pénard, Suire, 2010) highlights different issues. Indeed, based on a representative French sample, pioneer results show that the majority of downloaders and pirates are no longer using P2P technology. They prefer consuming digital content such as MP3s or videos via streaming outlets, cyberlockers or newsgroups. In short, they seem to have anticipated the legal threats and changed their behaviour. This conclusion suggests a limited impact of the HADOPI law in an environment where alternative ways to illegally access copyrighted contents exist.

Based on an original 2012 representative French survey, we show that the consumption of illegal digital files is now largely offline and based on USB key, hard drive or mobile device exchange. It makes the cost of monitoring illegal behaviour higher than ever, if not infinite. Secondly, using econometric analysis, we show that the exchange of illegal files relies on a social network where some of users are wholesalers and risk lovers who are still illegally downloading online, whereas others are more risk adverse and are only simple users consuming via offline swapping. Our results show that the threat of the HADOPI can explain part of the position in the offline swapping network. These results, which are newer for digital goods, have been observed frequently within drug and other illegal product markets (Nicholas, 2008). For instance, Kopp (2004) shows that drug networks are embedded in very specific social and hierarchical organisations. In the same vein, Levitt and Venkatesh (2000) show that the higher a dealer is in the hierarchy, the greater the benefits and the risks are. Indeed, topology of many illegal networks (Xu, Chen, 2008) exhibits a strong asymmetry of

roles with few suppliers, whereas simple consumers at the bottom of the hierarchy are numerous. We suspect and find the same signature within the network of digital file “dealers” even if further work on network structure is needed. Wholesalers know the law, but they also know how to circumvent legal threats. They push some digital files inside social networks and in particular to those at the bottom of the network who declare having never downloaded illegal files from the Internet. They consume strictly by offline swapping and reveal a strong aversion to risk.

Contrary to classical black markets, price does not exist in the market we describe. As documented for the Warez scenes and pirate’s behaviour (Rehn, 2004), we suggest that social rewards such as reputation or status are the main pillars of this illegal market. Digital pirates are given a symbolic reward proportional to the files they provide to the social network. Our research does not indicate that this social network is a direct consequence of the prohibition and HADOPI because an informal exchange of cultural goods has been already been observed⁵. However, we show that this social network is structured by some behaviours that are correlated to the perceived threaten posed by HADOPI.

Consequently, it is always difficult to design an efficient law in the context of digital piracy (Bhattacharjee and all, 2006), but it is undoubtedly more costly to regulate or eradicate a complex and hybrid online/offline illegal behaviour network such as the one we observed in France. HADOPI is not efficiently designed and most likely cannot be optimally designed to avoid or prevent the piracy of cultural digital goods. If social cost matters, other methods need to be addressed.

The paper is organised as follows. Section 1 presents HADOPI and the legislative context. Section 2 draws a parallel between black market dynamics and piracy on the Internet. Section 3 proposes econometrics results based on an original database, and Section 4 concludes on the regulation of illegal behaviour in digital markets.

⁵ For instance, in 1980, the major network CBS claimed that illegal exchange of audio cassette tapes killed the profits of music industry. With the help of the RIAA, a large campaign "Home taping is killing music" was launched to put a tax on blank media. The Copyright Royalty Tribunal study published the same year showed that audio cassette tapes users were also the largest buyers of vinyl. Later, it appeared that decreasing sales were largely due to the appearance of a new format and evolving usage, the Compact Disc. (Coleman, 2004). With HADOPI, in a digital era, history repeats itself.

1-HADOPI: some insights

HADOPI is the name of the former administrative agency⁶ created to monitor P2P networks and manages the “three strikes” sanction addressed to pirates. This *ad hoc* authority is part of a law named “creation and internet”, which aims to promote and protect creative works on the Internet. The procedure supposed to deter digital pirates is a three-step process. The first time an individual is caught downloading or sharing copyrighted content on the Internet, a warning email is sent to his mailbox asking him to stop illegally downloading. The second time the presence of the pirate is detected on a P2P network, a certified letter is sent. At the third infringement, the ISP is supposed to suspend the Internet connexion of the pirate. Many criticisms have been made about the first version of the three strikes law. The two major criticisms were first that the IP address (supposed to identify the pirate) is only related to the computer. As a result, those who suffer from the disconnection of Internet access may not necessarily be those who have violated the law. This case would be especially true in situations where children or adolescents can use the same computer as their parents. Furthermore, the IP address can easily be hacked, which can also make it impossible to identify the real pirate.

The second major critic concerns the ability of the three-strike process to disconnect Internet users. This sanction is in contradiction to the “telecom package” reform proposed to the European parliament. This text was supposed to unify EU telecom rules and one of its amendments (voted on in May 2009) says that “*no restriction may be imposed on the fundamental rights and freedoms of end users, without a prior ruling by the judicial authorities*”. For the same reason, the French constitutional council decided in June 2009 that an administrative authority was not empowered to take the decision to disconnect Internet users and thus reject the first version of HADOPI. The law has been changed, and its new version was voted on in September 2009 by the French parliament. In the so-called HADOPI 2, the decision to disconnect Internet users will be made through judicial

⁶ In September 2013, French government announced the abolition of the HADOPI *per se*. But all the missions and in particular the 3 strikes law have been transferred to the stage agency: Superior Council of Audio-visual (CSA), which is in charge of media and content regulation.

intervention. The second major evolution is that users will not be prosecuted for copyright infringement because they neglect to protect their computers from potential hackers. However, the general purpose is still the same: to deter pirates from using P2P networks and only P2P networks.

After 4 years of existence, the assessment of the HADOPI is balanced. On the one hand, almost 2 million first warnings and 186 000 second warnings have been sent to Internet users, while 51 files are waiting for the decision of a judge, suggesting that the HADOPI is the illegal file-sharing watchdog. On the other hand, there is little evidence that Internet users massively stopped downloading and sharing illegal content, as many alternatives exist: streaming, cyberlocker, offline swapping, etc. (Arnold et al, 2014). As a result, many people claimed that the cost/benefit ratio was too high, wasting public money and failing to understand that only the development of an attractive legal offer may deter the use of illegal platforms.

2 – Prohibition, pirates and social networks

2.1 Prohibition and the black market

The stricter the regulation in a country, the greater the impetus is for a parallel economy (Tanzi, 1983). In many countries, drugs, guns, fashion and luxury goods, wine, prostitution and sex are exchanged on black or parallel markets (Bevan and al, 1988). When costs of regulation and monitoring parallel markets increase dramatically, some scholars plead for a new definition of what would be efficient legal threats (Becker, Murphy, Grossman, 2006). One of the reasons, following Becker et al. (2006), is because the design of regulations needs to be based on the elasticities of demand. When demand tends to be inelastic, meaning that addiction is observed, there is greater social cost in reducing illegal production due to the need for greater enforcement efforts. For instance, legal authority can prevent access to a particular good by suppressing a market with prohibition. If demand tends to be inelastic, a willingness to pay can remain positive, and this potential profit is attractive for at least one

supplier, whatever the risk for both sides. Therefore, the emergence of a structured market strongly embedded in a social network is often an indirect effect of regulation, even prohibition. We note that for some users, digital file consumption leads to the same kind of mental pathologies as the ones we observe for drugs or others. Some declare, even if rare, that they experience extreme dependence or addiction⁷.

Alcohol prohibition is a natural experiment of what happens when a law suddenly prevents and punishes the consumption and usage of a good (Zimmerman, 2004). Under prohibition, alcohol began to grow daily as a black good. A parallel market emerged with (black) supply, (black) demand, (black) price and (black) profits, and this market was embedded in a social network that was highly difficult to regulate or monitor (Thorton, 1991; Granovetter, 1985). Moore (1977) reminds us that prohibition of heroin in the New York market discourages “not yet users” from trying the drug but has only a marginal effect on the current user. However, also *“effectively prohibiting heroin (i.e., eliminating all supplies of heroin) is impossible without unacceptable expenditures and intolerable assaults on civil liberties. Hence, regulation is a more appropriate and feasible objective than prohibition”*. Here, the cost of regulation and the cost of prohibition can be very high when taking into account all unexpected social, economic and behavioural effects. Therefore, first we claim that HADOPI and prohibition on the illegal digital market has reinforced the existence of a parallel market for black goods (digital files such as MP3, video content, etc.). Second, we claim that this parallel market is embedded in a social organisation that is very costly to eradicate.

If we look carefully at how black markets are organised, economic agents can belong to distinct categories. Following Kopp (1992), we can identify four types of agents. Along a value chain, there are producers, importers, wholesalers or retailers, and, finally, consumers. The behaviour of each of these actors affects not only the black good price but also the allocation of the value created by protagonists. Levitt and Venkatesh (2000) provide us with a good description of how value and finance are unevenly distributed inside gangs and among drug dealers. Roughly speaking, it is a matter of manipulated risk and quantity, and as documented by Kopp (2004, 1992), the individual profit and risk are positively correlated.

⁷ For instance, a Scottish grandmother was convicted of illegal music sharing online in 2011. She pled guilty but explained to the jury that “it was just an addiction, that was all”. (The Herald Scotland, 11 May 2011).

In the case of black goods such as drugs, the larger the quantity, the higher the penalty in the case of an arrest. Thus, either these individuals love risk or succeed in reducing risk through corruption and/or very good knowledge of the legal system. Indeed, many well-known leaders of gangs and mafia escape the judiciary system with such a circumvention strategy (Kopp, 2004, Thorthon, 1991).

A parallel can be drawn with the digital market. Larsson et al. (2013) studied the correlation between copyright enforcement and fluctuation of online anonymity. Based on a Swedish sample of young users (15-25 years old), the findings indicate that larger proportions of frequent file sharers (or downloaders) also use anonymity services more often than those who share fewer files. In other words, digital pirates might use some circumvention strategies to escape the law and therefore share some characteristics of black good users. Nevertheless, something remains very specific to digital piracy: price does not regulate exchange.

Rehn (2004) explains that the Internet and legal digital markets coexist with a thriving subculture that has developed an economy of its own. Based on an ethnographical study of Warez scene, Rehn shows that piracy and "outsider" behaviour are mainly driven by impure altruism, reputation, competition between pirates' teams and, in a word, by a gift-giving economy. What interests participants and piracy is *"not direct acquiring of specific software but the way in which reputation and status can be obtained through being noticed as a particularly good source of free software. Release groups are ranked according to their ability to release original software before anyone else"* (Rehn 2004). This means that if symbolic rewards substitute to price, both dynamics remain the same. At a constant demand, scarcity of the supply increases the price and the symbolic reward.

Bittorent scenes, where most MP3 files, illegal movies and digital content can be found, share similarities with Warez scenes. In particular, many Bittorent (dark) platforms advertise their content through public websites such as mininova.org (Dejean, Pénard, Suire, 2013). In this context, platforms and then pirates are in competition to promote their illegal content and make it popular. We suggest that offline swapping is based on the same rules where symbolic rewards substitute for price and monetary profit. This is an indirect benefit derived from illegal behaviour.

2.2 Prohibition and digital pirates

Basically, one can reasonably assume that illegal behaviours are rational (Becker, 1968). It means that each user will balance the costs and benefits of piracy before making a decision. The cost of piracy is obviously sensitive to the 3 strikes law and proportional to the digital files downloaded through P2P protocol. However, this threat is more or less credible because some users can perfectly know how this monitoring works and thus how to circumvent it. The individual level of knowledge on HADOPI can help decrease this cost to zero when some of pirates use a Virtual Private Network⁸, for instance. This cost can be strongly diminished if pirates know what kinds of files are monitored⁹. Put differently, the threat is not homogeneously perceived and may not be credible for some pirates. In the HADOPI context, we should observe these differences, meaning that the position in the social network of illegal exchange is a function of perceived threat. We can consider two polar illegal behaviours. First, those who consider HADOPI as a credible threat and because they are risk adverse have stopped using P2P. We name them "simple consumers", which does not mean that they have stopped all kinds of illegal behaviours. "Simple consumers" can still watch movies and series on streaming platforms or, as we explained, by copying files from the hard drive of a friend or relative.

Second, those who perfectly know how to circumvent the threat and consider HADOPI as non-credible are "the wholesalers". They have no fear of the HADOPI and are still downloading illegal content before sharing with their friends in the offline swapping network. This leads to a first research hypothesis that we are going to test in the following section.

Hypothesis 1: The position in the social network of illegal exchange is a function of the perceived threat

⁸ A VPN allows the user to hide the user's personal IP address by giving him a random one. It is, then, impossible for a technical supervisor to know where the illegal behavior is located.

⁹ In fact, right holders pay a price per each file that HADOPI has to monitor. Thus, they tend to prefer popular content like a blockbuster because many pirates share it. From a pirate's perspective, downloading long tail and niche contents is less risky than downloading a recent movie or an album that was just released.

Benefits of illegality are more confused, especially because price does not exist. As previously said, digital piracy is dominated by symbolic rewards and impure altruism. Pirates are passionate and like to receive attention from peers because of what they have done. In a way, these behaviours are not too far from what is observed within open source community and collaborative production (Lerner, Tirole, 2002). Developers produce some line of codes for the community for free, but they expect feedback, comments and symbolic rewards. Piracy behaviour is close to that (Rehn, 2004). Precisely, benefits of illegal behaviour can be direct and indirect. Direct benefits are proportional to the quantity of digital files consumed. One can reasonably expect that individual preferences can explain the amount of cultural goods that people consume. Strong taste for culture can lead to a more intense and frequent consumption of cultural goods (Peterson, 1992). In the context of digital piracy, it would mean that a positive correlation exists between the declared taste for digital cultural goods and intensity of consumption. P2P protocol is a way to access unlimited and various sources of contents. These can be new, niche, or back catalogue that would match perfectly with preferences and cultural tastes. P2P users can keep this stock for themselves and/or for sharing with relatives through offline swapping. Like a drug dealer, they can also address the various demands of simple consumer and heterogeneous tastes. We therefore expect a positive correlation between a higher position in the value chain of offline swapping network and P2P usage. This leads to a second research hypothesis.

Hypothesis 2: Wholesalers keep using P2P and monitored digital channels, whereas simple consumers do not

Another part of the benefit function is trickier to capture. Indeed, it means that asymmetrical exchange between protagonists of the black market is motivated by symbolic rewards, quest for legitimacy or because some users want to show their skills to relatives and peers. Therefore, some users can give larger quantities than they receive because they have access to a huge stock of digital files or because they can find some highly desirable content for others. A drug wholesaler would act in exactly the same way. He manipulates large quantities for personal consumption or to sell. He can offer a variety of products to simple consumers and manipulate the quantity in proportion to their needs.

3. Empirical strategy and data

We use a survey carried out among 2,000 French Internet users in May 2012. The method of quota sampling was used to guarantee that the sample is representative of the whole population of French Internet users. Quotas have been determined based on the age, the socio-professional category, the gender and the size of the urban area. The respondents are part of the access panel of *Harris interactive* and are not subject to systematic reward. Among these Internet users 1,015 are engaged in offline swapping, and they constitute the basis of our empirical analysis. In this survey, Internet users were questioned about their online consumption of cultural goods (music, movies, television series) as well as their feelings about the HADOPI "law". We also ask them whether they consume goods illegally using P2P networks.

3.1 The network of offline swapping

Piracy is often synonymous with using P2P, streaming, cyberlockers or even newsgroups, but a large part (if not the major one) of the illegal content sharing takes place offline. This fact remains highly underestimated in the literature devoted to digital piracy. 51% of our respondents declare that they receive illegal files on a person-to-person basis using USB keys, hard drive or mobile devices. At the same time, only 15% use P2P platforms, 18% use cyberlockers, 29% use streaming websites and 16% use alternative platforms (which are most likely VPNs and newsgroups). In the context of HADOPI, offline swapping is now the most popular way to obtain some illegal files. This result is not surprising because the RIAA made a similar finding in their 2011 annual music survey (Cf Table1).

Table 1: Statistics on the rise of offline swapping activities

	our survey on music and movie consumption, May 2012 ¹⁰	NPD annual music study 2011, mentioned by RIAA
offline swapping	51%	65%
P2P	15%	15%
cyber locker	18%	4%
Streaming	29%	--
others	16%	16%

Note: the large difference in downloading on cyber locker is most likely because our study not only takes in consideration music but also movies. This content is largely downloaded on this platform.

As previously explained, this offline swapping network shares common features with organisations in black and parallel market. Following this analogy, we can expect different behaviours according to the individual's ability or willingness to produce, share and consume what is exchanged in these networks.

In offline swapping activity, people differ depending on what they give and what they receive. We asked them to reveal if they receive more than they give, if they share less than they give or if the quantities are approximately the same. Based on these answers, the following Figure 1 shows the organisation of the offline swapping network and the number of respondents that belong to each category of "sharers". The wholesalers, who are those that give more than they receive, represent 10% of the sample, while the simple consumers, who exclusively received without giving anything, are 27% of people involved in offline swapping. Finally, we define an intermediary position for the respondents who declare that they give but not more than they receive; these "middlemen" are the largest part of the sample (63%).

¹⁰ The sum is over 100% because respondents can declare multiple usages.

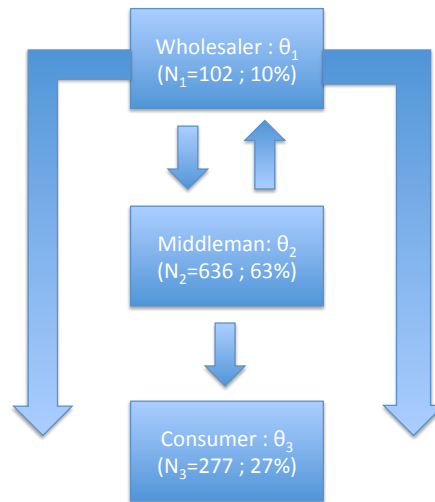


Figure 1 - Network of offline swapping

3.2 Econometric modelling

Our goal is to investigate the impact of the HADOPI "law" on the sharing network of users engaged in offline swapping. To measure how the law impacts the behaviour of users, we use the threat perceived by each individual. This feeling was collected by asking, *"On a scale of 1 to 5, to what extent do you feel threatened by the HADOPI law with 1 being no threat and 5 a big threat"*. Among the 1,015 individuals who are engaged in offline swapping, 60% consider that the HADOPI law does not represent a threat. Only 4% of our sample responded more than 4 on the scale of the threat perception, which prompted us to build a dichotomous variable named THREAT that takes the value of one if the user considers HADOPI to represent a threat (at least 2 on the scale of the threat perceptions) and 0 otherwise.

As hypothesised in Section 2.2, we expect that people who feel threatened by HADOPI are less likely to be at the top of the offline swapping network and conversely are more willing to be consumers who do not take the risk to give some content to others (Hypothesis 1).

To test this assumption, we also built an ordered variable reflecting the position in the offline swapping network. Following the organisation described in Figure 1, the variable named OFF_SWAP goes from 1 to 3, with 1 being a consumer at the bottom of the offline swapping network, 2 representing the middleman and 3 being the wholesaler at the top. Another way to understand the ordered character of this variable is to consider that as users rise in the network, they contribute more to the diffusion of content. Using an ordered

probit specification has some disadvantages, one of the most important being the parallel slope assumption that implies that the effect of an explanatory variable is the same regardless of the category of the dependant variable. In practice, this assumption is rarely true; that is why we will also make a regression for different specification of the dependant variable considering, for example, binary variables with 1 being a specific behaviour in the offline swapping network (wholesalers + middleman/consumers)¹¹.

However, the ordered probit model remains our baseline model, but before addressing the regressions, we should deal with the potential endogeneity issue.

3.3 Dealing with the endogeneity issue

Estimating the impact of HADOPI on the position of users in the offline swapping network can lead to two different biases. First, the causality can be challenged because the position in the network can explain the fear of HADOPI. Indeed, the wholesalers who largely supply the network download content online are more exposed to the sanctions of HADOPI, which is why they are more likely to perceive HADOPI as a threat than those who are only consumers and rely on their friends or relatives to obtain content. The second potential source of endogeneity is the fact that unobserved variables can explain both the position in the network of offline swapping and the perceived threat of HADOPI. For instance, the risk behaviour of Internet users, their “digital” skills or their knowledge of the HADOPI law can be unobserved or only partially considered and thus bias the result of the econometric estimation.

We use the instrumental variable method to control for the potential endogeneity. To be valid, this instrumental variable should satisfy both inclusion and exclusion restrictions. The inclusion restriction means that the instrument should be correlated with the variable suspected to be endogenous (the perceived threat of HADOPI in the model). This restriction can be tested. The exclusion restriction implies that the instrument is not correlated with the main variable of interest (the position in the offline swapping network); unfortunately, this condition cannot be tested and is left to economic discussion.

In the survey, Internet users were asked to evaluate the probability for someone who illegally downloads on the Internet to be caught by HADOPI.

¹¹ See the robustness check in section 3.5.

We think that this variable, named `PROB_DETECTION`, satisfies both the inclusion and exclusion restriction. The former implies that people who think that HADOPI effectively controls the network feel more threatened than those who think that the probability for someone who illegally downloads being detected by HADOPI is low. The exclusion restriction is satisfied if there is no direct correlation between the position in the offline swapping network and the perceived probability of HADOPI efficiency. Stated differently, `PROB_DETECTION` should have an impact on `OFF_SWAPPING` only through `THREAT`, meaning that a change in the position in the offline swapping network is caused by a change in the feeling of being threatened by HADOPI, and this change is (only) the consequence of a variation in the estimated efficiency of HADOPI. The key point of this reasoning is that the estimated efficiency of HADOPI only impacts the choice of being at the top or the bottom of the sharing network because users feel (or do not feel) threatened by HADOPI. We consider this assumption to be reasonable.

However, answering the question of the potential efficiency of HADOPI was difficult because no return of experience was publicly available at the time the survey was conducted¹². The fact that 20% of the sample answered that the probability was 50% (the mode of the distribution) suggests a form of indecision, which is why we prefer building a categorical variable to gather Internet users who consider that this probability is lower than a threshold value¹³. Considering different variables for different values of the estimated probability also enables us to evaluate the non-linear effect of the instrument on the endogenous variable.

3.4 The model

The final model estimated is as follows:

$$OFFSWAP = X\beta_1 + THREAT + \varepsilon_1 \quad OFFSWAP = \begin{cases} 1 & \text{if } 0 < OFFSWAP^* < \mu_1 \text{ (a wholesaler)} \\ 2 & \text{if } \mu_1 < OFFSWAP^* < \mu_2 \text{ (a middleman)} \\ 3 & \text{if } \mu_2 < OFFSWAP^* < \infty \text{ (a consumer)} \end{cases} \quad (1)$$

$$THREAT = X\beta_2 + PROB_DETECT \beta_3 + \varepsilon_2 \quad THREAT = 1 \text{ if } THREAT^* > 0, 0 \text{ otherwise} \quad (2)$$

¹² Even after 3 years of experience, it is difficult to estimate objectively what is the probability of being detected by the HADOPI as this probability varies according to the moment, the file or the network where the illegal activity takes place.

¹³ This threshold value will be challenged in the robustness check part without changing our main results.

with OFF_SWAP^* and $THREAT^*$ being the latent variables of the model. ε_1 and ε_2 are the error terms of the two equations while X is the vector of control variables. This vector is composed of controls for socio-demographical attributes, such as age, education, gender and income. The variable P2P takes the value of one if the respondent has downloaded a file at least one time in a month (music, movies, or television series) on a P2P network. We expect that this behaviour is found in those who are at the top of the offline swapping network. We also control for taste because those who are music or cinema lovers are more likely to feel threatened by HADOPI or even be more engaged in offline swapping activities because they most likely have more content to share. The variable FRAUD is a proxy for individual acceptance of illegal behaviours based on a question originally implemented in the word value survey which ask whether respondents "*find that tax cheating is justifiable*" on a 10-point scale from 1, implying that tax fraud is immoral, to 10, that tax fraud is acceptable. We suspect that being comfortable with illegal behaviour can favour the position of "wholesaler". Finally, we asked people if they have many friends or relatives who download and share illegal content, as we know that the peer effect and social contagion are important determinants of illegal online and offline sharing networks. Table 2 reminds the reader of the different variables.

This econometric specification should be estimated using full information and maximum likelihood, assuming multivariate normality of the error terms. This system of two equations has both ordered and binary explained variables, and the maximum likelihood estimation is highly computationally demanding. Roodman (2009) provides a method to simulate the maximum likelihood estimation in the context of a conditional mixed process regression that is a generalisation of the seemingly unrelated regression when independent variables are not continuous¹⁴. The first stage estimates the reduced form of the model (equation 2), and the second stage estimates the parameters of the structural model (equation 1). The structural model is our main model describing the position of Internet users in the offline swapping network, and the reduced form is the estimation of the perceived threat regressed on the instrument as well as the other control variables.

¹⁴ This method uses the GHK algorithm to estimate a limited-information maximum likelihood and proposes a general tool implemented on Stata software and using.

Table 2 - Variables description

VARIABLES	Details of coding
OFFSWAP	1 if is a consumer (receive but never share), 2 if is a middleman (share and receive) and 3 if is a wholesaler (share more than receive).
P2P	1 if has downloaded a digital content on a P2P network at least one time a month, 0 otherwise.
THREAT	1 if considered that HADOPI represent a threat (at least 2 in a 1 to 5 scale), 0 otherwise.
PROB_DETECT	1 if the estimated probability of being notify by HADOPI for someone who illegally download is less or equal to 30%, 0 otherwise.
MALE	1 being a male, 0 otherwise
AGE24	1 if age [15-24], 0 otherwise
AGE39	1 if age [25-34], 0 otherwise
AGE59	1 if age [35-50], 0 otherwise
AGE+	1 if more than 50 years old, 0 otherwise
EDUCATION1	1 if primary or secondary education
EDUCATION2	1 if first level of tertiary education
EDUCATION3	1 if second level of tertiary education
INCOME1	1 if income makes daily life difficult, 0 otherwise
INCOME2	1 if income makes daily life acceptable, 0 otherwise
INCOME3	1 if income makes daily life comfortable, 0 otherwise
TASTE1	1 if strong taste for music or video, 0 otherwise.
TASTE2	1 if moderate to strong taste for music or video, 0 otherwise.
TASTE3	1 if moderate taste for music or video, 0 otherwise.
TASTE4	1 if no or limited taste for music or video, 0 otherwise
FRAUD	1 if consider that tax cheating can be acceptable
PEERPIRACY	1 if has pirate in their close social network

3.5 Results and comments

The main results are exposed in Table 3. Column 1 is the ordered probit regression without taking into account the potential endogeneity of the perceived threat of HADOPI. Columns 2 and 3 show the estimates of the model described in Section 3.4, which consider THREAT as an endogenous variable. In this specification, the estimated probability of being caught by HADOPI is the instrument.

The first interesting result is the difference between the two regressions. The coefficient associated with the variable THREAT is positive and significant when we do not take into account the endogeneity but becomes negative and remains significant when we control for potential endogeneity bias. This change reinforces our belief that not considering the variable Threat as endogenous hides a false causality between the position in the offline swapping network and the threatened feeling created by HADOPI. As expected, the instrument is significant and negatively correlated with the endogenous variable, meaning that people who think that an illegal downloader has a low probability of being detected by

HADOPI are less likely to feel the threat of HADOPI¹⁵.

Our two main hypotheses cannot be rejected by the results of Table 3 (column 2). Internet users who do not feel threatened by HADOPI share more content in the offline swapping networks and still source from P2P networks. As expected, those who are young also hold the top position in the swapping networks as well as those who have a strong taste for audio/video content. Those in younger generations are more comfortable with digital devices that lower the cost of sharing; they also have full social lives, which promotes opportunities to share digital files through social contagion. This last assertion can be legitimated by the positive effect of having pirates as friends and relatives. The positive and significant sign of the variable FRAUD shows that the behaviour of sharing can be associated with a certain tolerance with respect to illegal behaviour. To some extent, here we suspect a stabilised deviant norm (Becker, 1997) among the youngest generation.

We can also derive interesting insights from the reduced form equation (column 3 in Table 3), as some variables that have a direct and positive effect on sharing behaviour also have an indirect negative one on the same variable because they lead to an increase in the perceived threat generated by HADOPI. For instance, downloading on P2P networks, having pirates in their social network or being young increases the probability of feeling threatened by HADOPI and thus indirectly decreases the ability of being located at the top of the swapping network.

3.6 Robustness check

The aim of this section is to discuss the robustness of our empirical analysis. The first source of weakness can be the choice of an ordered probit and its strong assumption on the parallel slope coefficient. The second source of weakness could be the instrument and the choice of “arbitrary”, considering the value of 30% as the threshold for users who think that HADOPI has a low probability of detecting someone who is illegally downloading.

To address the ordered probit issue, we create a new binary variable that merges the middleman and wholesalers. We named this variable OFFSWAP_1 (take the value of 1 when users are “middleman” or “wholesalers” and 0 otherwise). Even if the offline swapping

¹⁵ Following the recommendation of Wooldridge (2009) we use a simple probit (Table 4) to confirm that the inclusion condition is satisfied.

network is simplified, the main intuition of the model is preserved. OFFSWAP_1 splits the sample according to the “sharing” behaviour, taking the value of one when users share content and 0 otherwise. We re-estimate the model with this new variable using a bivariate probit to address the endogenous variable (Wooldridge 2009). The results are shown in column (4) and (5) in Table 3. Comparing the regression with the three-level ordered and the dichotomous dependent variable show no qualitative difference, suggesting that the result of the ordered probit regression with endogenous variables should be led by the difference between “consumers” and others. It does not seem surprising that in the network we described in Figure 1, the “consumers” certainly have the most “polar” behaviour, refusing to contribute and reporting a strong aversion to the risk of being sanctioned. HADOPI most likely had a greater influence on these users, encouraging them to adopt safe behaviours in the way they manage illegal content.

The second issue that we have to address is the sensibility of our instrument. We arbitrarily chose the threshold value of 30% to create the variable PROB_DETECT used as an instrument in our model. As explained previously, the validity of an instrument is based on the respect of the inclusion and exclusion restriction, so the way PROB_DETECT was built should not be a major concern. However, it is still interesting to produce additional estimates using different version of the instrument. Table 4 exhibits the estimates of the coefficient associated with our main variables of interest (THREAT and P2P) and the instrument. The results are unchanged when we consider that a low estimation of the probability of being detected by HADOPI is 20%, 30% or 40%. Using the continuous distribution of the estimated probability does not change the result. However, when we consider the threshold value of 50%, the instrument is not correlated with the endogenous variable; it fails to control for the endogeneity issue, as the inclusion restriction is no longer satisfied.

4. Discussion and conclusion

In this paper, we have proposed a simple empirical test to evaluate how HADOPI and prohibition reinforce a parallel and unmonitored offline swapping network. As far as we know, these are new results for the consequences of a public piracy behaviour regulation. In particular, we add a behavioural issue to the academic results based on substitution/complementary approach. As observed for traditional black markets, such as

the drug market, we highlight the existence of a hierarchical social network based on the sharing behaviour in the offline swapping network. Basically, illegal behaviours are strongly socially embedded. Some are consumers, others are middlemen or wholesalers. Each type is typified by an online behaviour and attitude toward HADOPI threats.

The limitations of these findings are apparent. Undoubtedly, this social network where illegal exchange are observed existed before HADOPI, but cross-sectional data do not allow us to comment on its structuring. Indeed, we not only know that cultural goods consumption is often socially embedded (Bourdieu, 1979), we also know that many cultural goods such as books, for instance, move from hand to hand (Dalli, Corciolani, 2008). Nevertheless, we give some insight about how this offline social network is organised with different roles in the context of digital prohibition, and as far as we know, this is a contribution to this area of literature.

However, previous results in HADOPI evaluations have shown that many users rationally anticipate what is monitored and therefore modify their practices. P2P is now largely dominated by streaming, which is now dominated by offline swapping. We need to investigate this direction more to understand how piracy behaviour and offline swapping co-evolve with law. In other words, we need to test if a red queen syndrome exists (Van Vale, 1973).

From a regulator's perspective, this research asks questions because legal authorities face increasing, and even infinite, monitoring costs. Indeed, if the government knows who the presumed pirates are and how to monitor them, then costs are proportional to the size of the pirate population and are sensitive to the state of art in technology. If the government does not know whom but knows how, it should monitor and track all the digital users. The cost is very large but finite. However, there is a worst social cost situation, i.e., when the government does not know either whom or how. If our results are confirmed, then HADOPI faces this situation. It knows neither whom nor how, as piracy of digital content takes a very different path and occurs in offline exchange, which is almost impossible to monitor. Thus, an optimal public policy, if needed, should use another method, particularly through development of legal offers and new business models by considering what digital behaviours are.

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Table 3: Ordered probit with and without endogenous variable

VARIABLES	Ordered probit	Ordered probit with endogenous variable		Bivariate probit with endogenous variable	
	(1) Offswap	(2) Offswap	(3) Threat	(4) Offswap_1	(5) Threat
Threat	0.270*** (0.0809)	-1.186*** (0.293)		-0.974*** (0.349)	
Prob_detect			-0.231** (0.0922)		-0.305*** (0.0834)
P2P	0.311*** (0.0840)	0.473*** (0.0787)	0.483*** (0.0883)	0.462*** (0.0968)	0.483*** (0.0898)
Male	0.125 (0.0776)	0.0919 (0.0746)	-0.0138 (0.0910)	0.113 (0.0859)	0.0518 (0.0879)
Age24	0.278** (0.129)	0.456*** (0.122)	0.434*** (0.143)	0.452*** (0.139)	0.463*** (0.145)
Age39	0.331** (0.137)	0.402*** (0.128)	0.285* (0.151)	0.421*** (0.145)	0.312** (0.153)
Age59	0.104 (0.125)	0.123 (0.118)	0.0596 (0.142)	0.0846 (0.129)	0.0783 (0.143)
Age+	Ref	Ref	Ref	Ref	Ref
Income1	0.119 (0.108)	0.161 (0.101)	0.0803 (0.118)	0.185 (0.119)	0.0903 (0.120)
Income2	0.0301 (0.0971)	0.0990 (0.0918)	0.139 (0.105)	0.119 (0.107)	0.139 (0.107)
Income3	Ref	Ref	Ref	Ref	Ref
Education1	-0.210* (0.121)	-0.178 (0.115)	-0.0796 (0.137)	-0.214 (0.131)	-0.0743 (0.138)
Education2	-0.0765 (0.0853)	0.0352 (0.0847)	0.169* (0.0922)	-0.0254 (0.101)	0.160* (0.0936)
Education3	Ref.	Ref	Ref	Ref	Ref
Taste1	0.565*** (0.140)	0.530*** (0.138)	0.224 (0.156)	0.574*** (0.153)	0.242 (0.158)
Taste2	0.424*** (0.129)	0.415*** (0.124)	0.192 (0.146)	0.366*** (0.133)	0.193 (0.147)
Taste3	0.202 (0.131)	0.227* (0.123)	0.137 (0.147)	0.307** (0.135)	0.143 (0.149)
Taste4	Ref	Ref	Ref	Ref	Ref
Fraud	0.0196 (0.0182)	0.0400** (0.0173)	0.0508** (0.0197)	0.0391* (0.0203)	0.0524*** (0.0201)
PeerPiracy	0.428*** (0.0861)	0.477*** (0.0828)	0.336*** (0.0940)	0.514*** (0.0913)	0.338*** (0.0948)
Constant			-1.198*** (0.207)	-0.396** (0.192)	-1.259*** (0.207)
LogLikelihood	-807	-1424		-1143	
AthRho (1_2)		1.267**			
χ^2 for LR test				5.1**	
Observations	1,015	1,015		1015	

Table 4: Simple probit to test the inclusion restriction

VARIABLES	(1) Threat
Prob_detect	-0.264*** (0.0890)
P2P	0.211*** (0.0462)
Male	0.0428 (0.0875)
Age24	0.445*** (0.144)
Age39	0.284* (0.154)
Age59	0.0332 (0.144)
Age+	Ref
Income1	0.121 (0.120)
Income2	0.145 (0.108)
Income3	Ref
Education1	-0.0528 (0.137)
Education2	0.169* (0.0942)
Education3	Ref
Taste1	0.173 (0.157)
Taste2	0.160 (0.146)
Taste3	0.127 (0.148)
Taste4	Ref
Fraud	0.0528*** (0.0200)
PeerPiracy	0.349*** (0.0958)
Constant	-1.382*** (0.213)

Observations 1,015

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Main results with variation in the instrument variable.

	Prob_detect Threshold ≤20%	Prob_detect Threshold ≤30%	Prob_detect Threshold ≤40%	Prob_detect Threshold ≤50%	Prob_detect Continuous variable [0; 100]
<i>Variable in eq (1)</i>					
Threat	-1.176*** (0.241)	-1.186*** (0.293)	-1.219*** (0.244)	1.147*** (0.366)	-1.312*** (0.166)
P2P	0.473*** (0.0786)	0.473*** (0.0787)	0.475*** (0.0781)	0.129 (0.122)	0.477*** (0.0769)
Other controls	x	x	x	x	x
<i>Variable in eq (2)</i>					
Prob_detect	-0.253*** (0.0859)	-0.231** (0.0922)	-0.252*** (0.0907)	-0.0787 (0.101)	0.00282** (0.00133)
Other controls	x	x	x	x	x