SOFTWARE COPYRIGHT ENFORCEMENT STRATEGIES FOR UKRAINE

by

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Abstract

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Software piracy is the issue of concern in many countries across the globe. Nevertheless, in Ukraine the scale of copyright problems became so large after 10 years of independence that is has resulted in anti-Ukraine trade sanctions. This thesis analyzes the possible strategies to reduce the piracy in such a way that as to lessen the harmful effects on the Ukrainian software consumers but still be effective. Several theoretical approaches are highlighted in the work, two of them in considerable detail. A simple diagrammatic framework for studying the market for software product in the presence of piracy is built, and used to identify the effects of changes in the values of software price, piracy costs, number of consumers and consumers income on the losses from piracy. A cross-country empirical analysis of the joint effect of the level of computerization, Internet access, consumers prosperity and policy factors on the losses from software

piracy is performed. This analysis reveals many corresponding dependencies, and shows that Ukraine may expect severe difficulties while improving its software copyright protection regime. Policy advice on the anti-piracy activities for the case of Ukraine is offered, taking into account theoretical and empirical findings.

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GLOSSARY

Software Piracy. A set of activities, which violate the rights of software copyright holder, including illegal copying, reproduction or usage of illegally copied or reproduced software.

Broad-Based enforcement. A strategy aimed to increase the costs of software piracy for all users.

Targeted enforcement. A strategy aimed to increase the costs of software piracy only for large institutional users.

Demand Network Externalities. The raise in product valuation caused by the increase the number of product users.

BSA. Business Software Alliance. Non-profit organization of leading software producers which strives to fight against software piracy by providing and gathering information on the issue.

IIPA. International Intellectual Property Rights Alliance. Non-profit organization which monitors the intellectual property rights environment in different countries and makes policy advising on the issue.

TRIPS. Trade-Related Aspects of Intellectual Property Rights. The agreement adopted during the Uruguay round trade negotiations that provided worldwide standards of temporary intellectual property protection.

GATT. General Agreement on Tariffs and Trade

Chapter 1

INTRODUCTION

According to the sixth annual report on computer piracy of Business Software Alliance (BSA 2001), Ukraine is in the list of most serious copyright offenders being the leader in the European region. The negative consequences of the piracy of such an extent are bad image of Ukraine in the international community and deceleration of domestic software market development due to unbearable competition between potential domestic software producers and software pirates. Anti-Ukraine sanctions were imposed on January 20 2002 which because of the intellectual piracy, making the issue even more important. Intellectual piracy of such a scale may be a substantial obstacle on the Ukrainian way to the WTO. International Intellectual Property Rights Alliance 2002 Special Report explicitly states about Ukraine: "the failure to provide effective enforcement is a breach of the U.S. trade agreement and any eventual WTO accession" (IIPA 2002). The example of China, which was accepted to the WTO despite its intellectual piracy problems comparable to the Ukrainian, should not encourage the Ukrainian decision makers since Ukraine does not possess the economic and political power that China has. Despite the traditional tolerance of the phenomena of software piracy in Ukraine, the means of anti-piracy enforcement should be considered in term of Ukraine's development strategy. There are two main strategies for the anti-piracy activities that are highlighted in the literature:

- broad-based enforcement
- targeted enforcement.

While the former strategy aims at all users of pirated copies, increasing the cost of bootleg copies production and copying, the latter aims at the large institutions which are more easily identifiable as users of pirated copies. Due to the fact that anti-piracy means lead to losses of consumer welfare, the natural question of less harmful and more effective anti-piracy strategies arise. The main goal of the current research is to highlight the ways of identifying the appropriate strategy for Ukraine.

During the creation of this paper, there was a history of recent relevant activities taking place in the country. On June 5, 2000 the Action Plan concerning optical media production regulation was formally announced in a joint statement made by ex-US president Bill Clinton and Ukrainian president Leonid Kuchma. This seemed to be an important step on the way of the enforcement system development, since the majority of the pirated production in Ukraine is distributed on the optical media. Moreover, there is a significant export of pirated production from Ukraine. Pirated production with Ukrainian origins was found in more than 16 countries of the world including Eastern and Western Europe countries, CIS countries, Australia, New Zealand and United States (IIPA 2002). The action plan assumed the stop of production of optical discs until the proper licensing schemes introduction, establishing of production process regulation including the Source Identification Coding of media and adjustment of the Ukrainian copyright law in order to make it comparable to the modern copyright regimes acting in developed countries.

This plan could be considered as partly implemented. Indeed, on July-September 2001 the copyright law and criminal law amendments adopted earlier by parliament went into force. This improved the situation with sound recordings, but other kind of intellectual property still were not protected well despite the fact that criminal responsibility was introduced for the intellectual property rights violations. IIPA analysts point out the two reasons of the failure of those amendments to effectively deter piracy (IIPA 2002). First, according to the Ukrainian legislation the significant material harm has to be caused by the property rights violation in order to enact the penalties. The very term "significant material harm" is not defined well hampering the application of the new legislation. Second, the monitoring and policing system does not work well enough simply to use criminal sanctions against the violators of property rights.

The situation with optical media production also remains complicated. Due to the strong lobby against the adoption of corresponding regulation acts, the optical media law was adopted only in January 2002 under direct threats of sanction imposition from U.S. The lobbyists used the arguments mainly based on the premise that strict production regulation combined with the corruption in the regulating authorities will raise optical media production costs in Ukraine up to the point where producers will exit the market. This strong pressure led to the adoption of a law that left considerable freedom for producers. The corresponding implementation decree was signed on January 30, 2002 without any significant additional restrictions for optical media producers. On February 7, 2002 the law was finally signed by President Kuchma, finishing the process of more than one and half year of Action Plan implementation. This law was considered as deficient by U.S authorities. Ukraine was accused of failure to implement the Joint Action Plan and became a target of trade sanctions on January 23, 2002 five days after the Optical Disc Licensing bill was adopted by Ukrainian Parliament.

The police started to act on the issue of software piracy before the law was passed. The author questioned several people from computer-related business that anonymously provided information about the police activities. Armed with the imperfect intellectual property legislation that declared software piracy outside the law, but did not provided exact descriptions of corresponding legal procedures, police forces started to raid institutional users such as internet cafes, game clubs, hardware retailing firms and other non-government organizations involved in different kinds of computer business. If pirated software was discovered installed on the computers, all hardware became subject to immediate confiscation. The legal reason for such a procedure was explained to be the expert examination of hardware involved in the crime. However, due to unsettled legislation, the term of this expertise as well as the consequent procedures, is not fixed. This opens up rent-seeking possibilities for the policemen. Indeed, the questioned businessmen confirmed, that the "fix up" possibility existed; however the size of the bribe for the hardware rescue was told to be extremely high.

Meanwhile, the pirated software markets still flourished and no price increase was noticed. This indicated that no harming actions were performed directly on pirated software producers and distributors, because the demand hardly went down enough to compensate for the possible supply contraction that might be expected in case of successful anti-piracy activities. From the theoretical point of view, this situation is very close to the case of targeted enforcement, however, with some reservations. Since the police decreased the costs of action, raiding only the institutions with very high probability of illegal software discovery, the coverage of the activities hardly was wide enough. Moreover, the state organizations, which in most countries are very active (if not most active) software users, were not subject of the check.

It was too early to speak about the consequences of these actions for the moment of thesis completion, however some firms already switched to the licensed commercial software or to the freeware packages.

The theoretical analysis is one of the possibilities to assess the possible result of anti-piracy actions. During the last few years a number of mathematical models for the economics of software piracy and enforcement have been developed. However, they produce different results concerning the outcome of anti-piracy activities. For example, the Chen and Png (1999) argue, that extensive monitoring leads to the decline of total surplus (copyright holder's and consumer's) producing ineffective outcome. On the other hand, Harbaugh and Khemka (2000) claim that both sides can benefit from extensive enforcement.

In order to formulate the proper enforcement strategy it is essential to study the question in dynamic prospective. The factors that change over time and influence the software piracy situation have to be taken into account. Theses dynamic factors are also in focus of this research.

The theoretical part of the thesis includes the investigation of both Chen&Png and Harbaugh&Khemka models and the extension of the latter.

The data for cross-country analysis includes the software piracy rates estimated by the BSA, country data provided by World Bank, and legislation and enforcement indices calculated from the IIPA report.

Chapter 2

LITERATURE REVIEW

Intellectual piracy and copyright enforcement has become a subject of intense economic research only recently; it is hard to find an article on this issue dated earlier than 1980. Despite the young age of this field of study, it already hosts a number of controversial points of view. While the majority of researchers agree on the general questions such as reasons of piracy and the economic mechanisms involved the welfare implications of this phenomenon as well potential outcomes of different anti-piracy activities are still a matter of dispute.

It is widely reckoned that there is a conflict between the consumer and the copyright holder, i.e. piracy in any case harms the producer. However, Takeyama offered a theoretical framework, which allows consumers' and producers' interests to coincide (Takeyama 1994). The author studied the effect of the demand network externalities on the welfare outcome of illegal copying. The results acquired have shown not only the possibility of increase of copyright holders profits as an illegal copying result, but also a potential Pareto improvement in social welfare. All three parties involved, including producers, users of illegal copies and legitimate copies buyers could benefit from piracy in this case. Such a conclusion undermined the standard measures of the harm to producers and society from illegal reproduction of intellectual property. These measures usually do not take into account the possible demand network effects and thus was claimed to be overestimated. The author also suggested a possibility of the long-run gains from illegal copying even if the firm's short-run profits are less than that without copying. Such a not obvious conclusion rested on the potential price increase that could take place after the distribution of the product and an increase in valuation of the product by the legal users. In this case, the presence of copying could be a mean of achieving long-run strategic goals by the firm. Unfortunately, author's research disregarded the analysis of different anti-piracy activities. While Takeyama implicitly assumed the potential harm from the anti-piracy enforcement in the presence of network demand externalities, the analysis of corresponding welfare effects was left out of scope of research. However, Takeyama's model offers an important benchmark view that has to be taken into account during the development of anti-piracy policy. The idea that the piracy could be beneficial for software producer is also supported by the Slive and Bernhardt (1998). They viewed piracy as a form of price discrimination when producers sell certain amount of software for zero price. Since the dominating majority of bootleggers have low willingness to pay for software, the losses from this action are not significant. However, in the presence of significant network externalities this could dramatically increase the demand for software by business users. Thus, the situation when the limited piracy is allowed is beneficial for all parties.

Other studies explicitly analyzed the effects on different anti-piracy strategies. One of such papers focused on the trade-off between monitoring and pricing (Chen and Png 1999). The offered model assumed the costs of copying and a penalty for copying to be exogenous, while the product price and the monitoring intensity were determined by the optimizing software producer. The authors also have studied welfare implications of different enforcement scenarios. The main results obtained were that while a publisher could use pricing and monitoring as substitutes in its overall strategy, the two activities had quite different welfare implications. An increase in monitoring reduced the expected benefits among illegal users who were not on the margin of copy/buy decision. The authors have drawn a conclusion, that pricing is more socially preferable as a piracy-management tool, therefore, the society should encourage publishers to use less enforcement. The paper contains also important comparative statics results. An exogenous increase in the penalty for copying led to the increase in both optimal price and monitoring rate. An increase in the costs of making copies led to the price increase and monitoring reduction. The results were claimed to be "fairly general". The only binding assumptions mentioned were the systematical dependence of the potential user's choices among buying, copying, and not using, on user's benefit from the item. A direct application of this model's conclusions to the Ukrainian case means that any broad-based enforcement activities provided by the government will lead to the significant decrease in the consumers surplus, since a lot of consumers will be shifted out of the market and the rest will suffer from the price increase. However, other implications could be acquired by the utilization of other models.

Harbaugh and Khemka (2000) arrived at different theoretical results that have other policy implications. Under the settings of this model, it was possible to derive the existence of a limited range of extensive targeted enforcement that could lead to increase in both producer's profits and consumer surplus. The enforcement from this range was strong enough to increase copyright holder's profits but not so extensive, that low-value consumers who would never buy a legitimate copy at the monopoly price were prevented from buying an illegal copy. Within this range, the legal users benefited from more extensive enforcement, because the copyright holder lowered the price in order to capture new customers. In order for those gains to exceed the losses to consumers, who were forced to switch from the illegal copy to the legal one, bootleg copies should be "sufficiently poor substitutes". The authors claimed that even if legal and illegal copies are close substitutes, the mentioned optimal enforcement range still exists. If the firm is allowed to determine the amount of resources, devoted to enforcement, Harbaugh and Khemka's model allows the possibility of inefficiently low enforcement. This result also differs from the Chen and Png

(1999), where the firms choose inefficiently intense monitoring. Harbaugh and Khemka concentrated on comparison of the targeted enforcement and broad-based one. They found out, that if enforcement targets at restricted number of high-level buyers, the outcome would be more piracy than in case of no enforcement at all. They claimed, that "for a reasonable class of demand functions" any targeted enforcement, calculated to maximize some combination of copyright holder's profits and consumer surplus will always lead to more piracy. However, this conclusion was based on the assumption, that the firm competes with bootleggers when it is more profitable than maintaining the monopoly price. Thus, as applied to Ukraine, this model does not rule out the possibility of effective piracy reduction through targeted enforcement, since software copyright holders do not compete with the retailers of illegal software. Leaving aside the distinguishing between targeted and broad-based enforcement, Harbaugh and Khemka's model, contrary to the Chen and Png's model offers extensive enforcement as a good remedy to piracy problem.

In spite of the differences in three models mentioned above, they all lack the empirical support for their results. This makes the practical application of corresponding policy recommendations a very difficult task and an empirical testing of those models an essentially important research topic. Unfortunately, the data for such testing is very specific and will require significant effort to collect.

It is already possible to find works that try to fill the empirical gap in intellectual piracy researches. One such attempt was done by Holm (2000). He applied a contingent valuation method to study the willingness of research subjects to pay for original software in the presence of software piracy. He used a sample of 330 Swedish students. The results acquired confirmed the point that illegal copies and originals are not perfect substitutes. However, the majority of subjects refused to pay the retail price for the original. The author managed to estimate a demand schedule for the original software packages. The price elasticity of piracy was found to be quite low for most price intervals. This had an important implication for the anti-piracy policy, showing the probable inefficiency of price cuts as an anti-piracy activity. The subject sample used by the author was very limited and specific to make generalizations, but it casts some shadow on the Takeyama's and especially Chen and Png's models.

Some research attention was also paid to the international institutional settings that regulate the intellectual property rights issues on the world - wide level. Gaisford and Richardson (2000) analyzed the TRIPS agreements as compared to the GATT. They argued, that "TRIPS agreement represents a dramatic break with GATT tradition involving symmetric new concessions and asymmetric levels of final protection"(Gaisford and Richardson, 2000). This makes the TRIPS agreement harmful for the developing countries since the adoption of the duration of intellectual property protection equal to the patents duration in developed countries is hard to implement. It also partly shifts research and development costs from developed countries to developing ones, which will create additional burden. The authors pointed out that developing countries would comply to TRIPS agreement only under direct threat of trade sanctions and even this threat may not be sufficient to compel developing countries to provide effective intellectual property rights enforcement. In authors opinion, the good remedy for the TRIPS agreement will be to abandon the symmetric levels of final protection. They argue "if the agreement were re-opened to provide a scale of minimum standards related to a country's development status, developing countries would find that they are better off with, rather than without, the TRIPS agreement" (Gaisford and Richardson, 2000). The TRIPS imperfections are highlighted further in Gaisford et al (2001). A game-theoretical approach was used in this work to show that trade sanctions is not the perfect mechanism for support of intellectual property protection provision. Only infinitely large penalty could completely eliminate the piracy. Thus, this work rises the question of the search for alternatives to the trade sanctions mechanism for international protection of intellectual property.

While the majority of the works on intellectual property rights enforcement mainly focus on the influence of the enforcement policy environment on the relevant behavior of producers and consumers, this thesis also pays attention to other factors that need to be taken into account during the formulation of software copyright enforcement strategies. These factors, such as economy growth or computerization of the country may have significant effect on the extent of piracy and, thus, results of anti-piracy activities. Failure to take those factors into account can lead to the shortsighted solutions to the piracy problem that will fail to deal with the situation in the long run.

Chapter 3

THEORY

It will be helpful to start the theoretical part of the work with brief outline of the two existing models in order to reveal the key assumptions and to attempt to shed the light on the reason of difference in results the models produce. Then the simple diagrammatic framework based on the modification of the Harbaugh and Khemka model with particular focus on the dynamic aspects of software piracy is presented.

Chen and Png Model (1999)

This model assumes a single software publisher in the market. He sets the price p for his legitimate product. Producer is aware about the presence of piracy and may monitor and use enforcement against the users of illegal software. The cost of monitoring with rate μ is $C_M(\mu)$. There are positive and increasing marginal costs of monitoring, so $C'_M(\cdot) > 0$ $\quad C''_M(\cdot) > 0$. The costs of software production are assumed to be zero. There is a distribution $\Phi(v)$ of potential software users, who have different valuation of software v. They all are risk neutral. Each user faces a choice between three options: buying the legal product, copying the software and risking to undergo enforcement action or not using the software at all. The net benefit of the potential user in case of legal purchase is $v - p$. In case of abandoning from software usage, the net benefit for the user is 0. If the user chooses to commit the act of piracy, he will incur the cost k and will be detected with probability μ. In case of detection, the software is seized and the user has to pay a penalty f (which is exogenous). So, the net expected benefit from use of pirated copy is $(1-\mu)v-\mu f-k$. All users maximize their net expected benefit from choosing among three alternatives. In case of equal values the user is assumed to prefer legal version to illegal and buying or copying to not using. From the maximizing behavior of users the authors derive and proof the following quite natural proposition: "the demand for copying is increasing in the price of the legitimate product, and decreasing in the monitoring rate, cost of copying and penalty of copying".

The producer maximizes his profits, that is, revenues from sale less the monitoring costs. If we define the copying/buying threshold valuation as v_2, the producer's profit function is $\Pi = p[1-\Phi(v_2)]-C_M(\mu)$. The producers will maximize his profit by choosing the variables p and μ. The following proposition about the producer's behavior is derived and proved: "An increase in the penalty for copying will lead the publisher to increase both price and monitoring rate. An increase in the cost of making copies will lead the publisher to increase the price, but reduce monitoring". Finally, the authors deduce and proof the following proposition that is the key theoretical result of their work: "Provided that the publisher's monitoring rate is positive, the price and monitoring rate can be reduced in a way that would rise welfare without affecting the publisher's sales". This means that the lower price can substitute the monitoring and the monitoring has much more negative impact on social welfare. Chen and Png notice, that such a substitution might reduce the publisher's profit. However, they assert that in case of possibility of the lump sum transfer there still will be a way to make a Pareto-improvement by reducing simultaneously price and monitoring.

Summarizing, it is important to note that the type of enforcement used in this model is broad-based. Indeed, the change in enforcement variables reduces the expected benefits from using the counterfeit software for all users, with no regard to their valuation v. So the conclusion about the high enforcement as an inferior way to deal software piracy in comparison with price reduction indicate the possible problems with broad-based enforcement.

Harbaugh and Khemka model (2000)

This model explicitly compares the broad-based enforcement with the targeted one. The Q buyers choose to buy a legitimate copy, to use a pirated copy or not use the copy at all depending on their valuations $v^l(q)$ and $v^b(q)$ of legitimate and bootleg copies correspondingly (q denotes the buyer with q th highest buyer value of either copy). It is assumed that $v^l(q) > v^b(q) > 0$ for all q except the final buyer Q for whom $v^l(Q) = v^b(Q) = 0$. The market for bootleg copies assumed to be competitive with zero marginal costs, which implies zero equilibrium prices in the absence of enforcement. Enforcement creates a cost c, which implies that benefit from the bootleg copy is $v^b(q) - c$. Consider the marginal buyer q^b, for whom the valuation of the bootleg copy equals the costs imposed by the enforcement. The copyright holder therefore faces the two-section inverse demand function. He can charge no more than $v^l(q) - \left(v^b(q) - c\right)$ to consumers with high valuation and not more than $v^l(q)$ to consumers with low valuation. Analytically the inverse demand function is

$$p(q,c) = \begin{Bmatrix} v^l(q) - \left(v^b(q) - c\right) \text{for } q < q^b, \\ v^l(q) \text{ for } q \geq q^b \end{Bmatrix}.$$

If copyright holder can act like a monopolist, he will produce the output q^m, where $q^m = \arg\max\left\{v^l(q)q\right\}$. If he competes with the bootleggers, producer's profit-maximizing output will be $q^c = \arg\max\left\{\left(v^l(q) - \left(v^b(q) - c\right)\right)q\right\}$. Decreasing marginal revenue condition is assumed to hold over both sections of the demand curve in order to guarantee the uniqueness of q^m and q^c. Which amount producer will sell depends on the extent of enforcement. If c is high enough to ensure that $q^b \leq q^m$, than the copyright holder will produce q^m. Otherwise he will choose q^c or kink amount q^b depending on the profits they generate. Authors finish their model of broad-based enforcement by proving the following proposition: "More intensive broad-based enforcement (i) raises the legitimate copy price and decreases consumer surplus if the marginal revenue curve is steeper than the demand curve and (ii) always increases copyright holder profits and reduces piracy."

If the targeted enforcement takes place, only the highest value buyers undergo enforcement. In Harbaugh and Khemka model of targeted enforcement the intensity of enforcement is not considered. Instead, they assume that the enforcement extent q^e ensures that all users with high valuation $q \leq q^e$ must purchase from the copyright holder. This means that producer can charge $v^l(q)$ for quantities less than q^e. For quantities higher than q^e the producer competes with unrestricted pirated copies market. Recollecting zero marginal costs and competitive nature of the bootleg copy market, the copyright holder can charge no more than $v^l(q) - v^b(q)$. The inverse demand function is then $p(q, q^e) = \begin{cases} v^l(q) \text{ for } q \leq q^e, \\ v^l(q) - v^b(\text{q}) \text{ for } q > q^e \end{cases}$. Profit-maximizing quantities are again $q^m = \arg\max\{v^l(q)q\}$ for monopoly case, but $q^c = \arg\max\{(v^l(q) - v^b(q))q\}$ in competition since now low value bootleggers do not face enforcement.

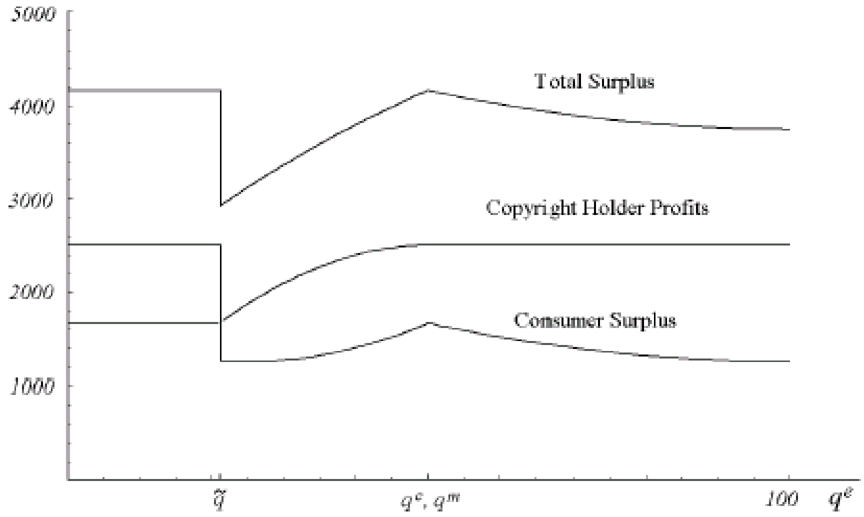

Figure 1. Profits, surplus from targeted enforcement with extent q^e.
Source: Harbaugh, Khemka (2000)

Harbaugh and Khemka have shown the existence of the efficient range of enforcement meaning that the extent of enforcement which lies in this range leads to higher consumer surplus or copyright holder profits than less extensive enforcement. Figure 1 shows the changes in producer's, consumer's and total surpluses as a function of the extent of enforcement. As enforcement extent q^e grows, initially producer will continue to follow the competition strategy, since the number of enforced users is not high enough to produce monopoly profit greater then competitive one. When the level of enforcement reaches $\tilde{q}$, producer switches to monopolistic strategy and increase prices. In the range $\left(\tilde{q}, q^m\right)$ there is no conflict between the producer and consumers, since as the enforcement level increases, producer lowers the prices to capture new customers. Both producer profits and consumer surplus increase in this range. However, the further increase of enforcement extent will harm consumers, since producer will maintain the optimal profit - maximizing quantity q^m, but buyers with low valuation will loose the ability to buy bootleg copies, but will not buy the legal copy.

The authors proved the following proposition: "More extensive enforcement in the efficient range (i) lowers the legitimate copy price, increases copyright holder profits and reduces piracy generally and (ii) increases consumer surplus if q^e is sufficiently close to q^m or bootleg copies are sufficiently poor substitutes for legitimate copies".

Software Piracy in dynamics

Since the problem of software piracy does not have the quick solution and the extent of piracy is determined not only by the consumer preferences, firm behavior and enforcement, it is useful to determine additional important factors that may as well change over time and change the effect of anti-piracy activities.

One of the main sources of pirated software is Internet. If the Internet connection is fast enough, the user can download the software with disabled copy protection mechanisms even not leaving his work place. So, the Internet availability in the country may have the important influence on the software piracy.

Another channel of bootleg copies distribution is the direct exchange between software users. The larger is the concentration of computers in the country, the easier is to find the partner to perform the exchange of bootleg copies. Computerization also increases the profits of institutional bootleg copies distributors such as illegal CD retailers because of the increasing demand for the media with illegal products. However, computerization could also change the software valuation pattern because of the changes in composition of software users pool. It could also lead to the increase in valuation of the software products due to demand network externalities effects.

One more factor is the budget of the software users. The changes in the budget may increase the piracy if consumers will spend the additional income on acquiring the illegal software. However, consumers may also switch to the legal software, which was unaffordable before the price increase.

In order to take into account the factors listed above, the simple diagrammatic framework will be offered, following the spirit of Harbaugh and Khemka model (2000). It is hard to model the influence of the Internet access availability, so this will be left out of the scope of this model, but it will be accounted for in the empirical part.

This model concentrates on the consumers' behavior and assumes producer to maintain fixed price of product p. This assumption seems to be reasonable in the case of small country importing the software (this is exactly the case of Ukraine). For example, in case of Ukraine, the monopolistic software producers do not compete with bootleggers. They maintain the price that they offer on the world market and use the political pressure to increase the enforcement efforts. Thus, this model can give useful insights despite of its simplicity.

Assume there are a total of Q individuals interested in possessing of the software product. Let's sort them by there valuation of software in descending order. The corresponding numbers, assigned to individuals are numbers from 0 to Q. The function $v_l(q)$, $q \in [0;Q]$ represents the valuation of q^{th} individual. Individual *0* has the highest valuation, while individual Q has zero valuation. The (inverse) demand function faced by the software producer is, thus, $v_l(q)$. So, in the absence of piracy, the revenue of producer on this market will be $pv_l^{-1}(p)$ where $v_l^{-1}(p)$ is the demand function.

Let's introduce the bootleg software now. It is valued lower by the consumers, so $\forall\ q \in (0;Q)\ v_b(q) < v_l(q)$, only for the last buyer *Q*: $v_b(q) = v_l(q) = 0$. The bootleg copies are costly to acquire and their users must also bear costs of enforcement. For simplicity the probabilistic aspect of enforcement is not considered. The total costs of bearing the enforcement and acquiring the bootleg copy is denoted as *c*. Consumers, thus, have to choose between purchase of legal copy and illegal one. Individual q will buy a legal copy, if $v_l(q) - p \geq v_b(q) - c$, and buy a bootleg copy otherwise.

If for user q^* $v_l(q^*) - p = v_b(q^*) - c$, then we assume that each buyer $q \leq q^*$ will use a legal copy, and $q \in (q^*; v_b^{-1}(c))$ will use a bootleg copy. This assumption simply states that for the users with higher valuation of software the difference between valuation of legal and bootleg copies is larger than the valuation difference of low end users. The case of linear demand functions is depicted on the Figure 2.

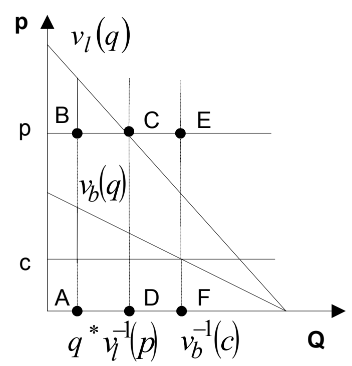

Figure 2. Software market in the presence of piracy

The lost producer revenue due to piracy is the area ABCD. However, the methodology used by BSA to calculate the losses from piracy reports the revenue lost as the value of the software that is used in the country, but was not bought from the legal retailers. In terms of the Figure 2 this number is ABEF. This means that there is a significant upward bias in BSA estimations of losses from piracy. The reason of this bias is the fact that BSA does not account for users, which use software only because of piracy and will not use it if enforced. However, as these numbers are used for policy decisions, we will study the behavior of losses from piracy according to BSA. In order to make the numbers comparable across countries the variable of interest will be the losses from piracy per personal computer (that is, per user of software). On figure 3 the number of interest is $\frac{S\ \ ABEF}{v_b^{-1}(c)} = L$.

Now the reaction of this variable to the changes of other variables will be described. First, the case when the piracy cost c changes is described. Figure 3 depicts the situation when the cost of piracy changes from c_0 to c_1.

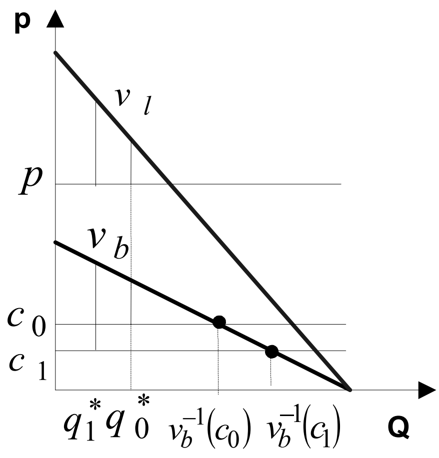

Figure 3. The effect of piracy costs change

First, before the piracy cost change the losses from piracy per user are $L_0 = p\left(v_b^{-1}(c_0) - q_0^*\right) / v_b^{-1}(c_0) = p\left(1 - \frac{q_0^*}{v_b^{-1}(c_0)}\right)$. After the costs drop, the number of indifferent user q^* decreases from $q_0{}^*$ to $q_1{}^*$. This means that the number of legal copies users also decrease. Simultaneously, the total number of users increases from $v_b^{-1}(c_0)$ to $v_b^{-1}(c_1)$. Thus, the new value of losses per user is $L_1 = p\left(v_b^{-1}(c_1) - q_1^*\right) / v_b^{-1}(c_1) = p\left(1 - \frac{q_1^*}{v_b^{-1}(c_1)}\right)$. Since $\left(v_b^{-1}(c_1) > v_b^{-1}(c_0)\right) \wedge \left(q_1^* < q_0^*\right)$ we can conclude that $L_1 > L_0$. As the costs of piracy drop, the losses from piracy per user increase and vice versa.

Now consider the situation when the producer decided to change the price, for example, to lower it from p_0 to p_1. This situation is depicted on Figure 4.

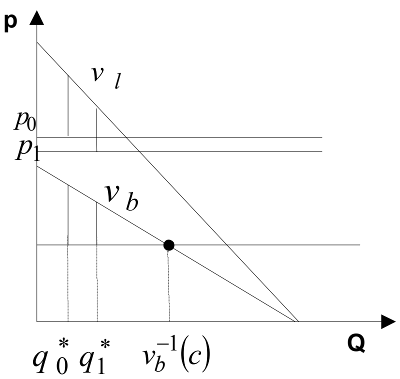

Figure 4. The effect of the software price change

After the price drops the position of the indifferent buyer shifts to the rights. Thus, number of the users of legal software increases. Under assumption that prices never drop sufficiently low to stop everybody from making illegal copies, the number of total users stays at the level of $v_b^{-1}(c)$.Thus, number of users of pirated copies decreases. Here $L_0 = p_0\left(1 - \frac{q_0^*}{v_b^{-1}(c)}\right)$ and $L_1 = p_1\left(1 - \frac{q_1^*}{v_b^{-1}(c)}\right)$. Since $(p_1 < p_0) \wedge (q_1^* > q_0^*)$ we can conclude that $L_1 < L_0$. As the price of legal copies decrease, the losses per software user decreases and vice versa. Note, that if the demand for the legal software is elastic, producers will collect more revenue as a result of price decrease. If it is unit elastic, the producer's revenue will not change and finally, if the demand is inelastic, the revenue will drop after the price decrease.

Let's assume now that the computerization occurred in the country of interest meaning that the number of potential software users increases. Two cases will be considered: the case when the increase is mainly in the high-valuation part of the demand curve and the case when new users are distributed uniformly across the valuation scale. The case when new users go to the low-end of the demand curve will not be considered since in this case the losses from software piracy per user obviously increase.

The number of high-valuation software users can increase if, for example, the computerization occurred as a result of business technology adoption. Both demand curves in this case make a parallel shift to the right. This situation is depicted on Figure 5.

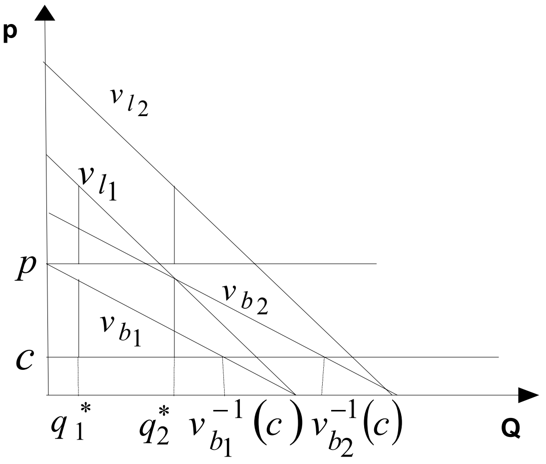

Figure 5. The effect of computerization in case of high valuation users number increase

As a result of the parallel shifts of both demand curves the number of users of legal copies increases from q_1^* to q_2^*. Simultaneously the total number of users increases from $v_{b_1}^{-1}(c)$ to $v_{b_2}^{-1}(c)$. The number of users of bootleg copies stays the same. It becomes obvious when the parallel demand curve shifts are illustrated by the axis shift, as on Figure 6

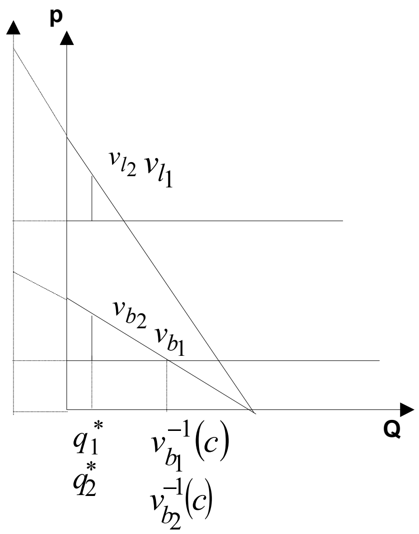

Figure 6. The effect of computerization (axis shift illustration)

This figure clearly illustrates that the whole increase in the total number of software users goes to the legal part. Thus, the number of bootleggers stays the same and so does total losses from piracy. However, since the total number of users increased, the losses per user decrease. Computerization that goes to the high-end part of the demand curve leads to the decrease in the losses per computer user.

The situation is different when the new users are distributed uniformly across the valuation scale. In this case, the demand curves will not make the parallel shift, they will only skew as shown on Figure 7.

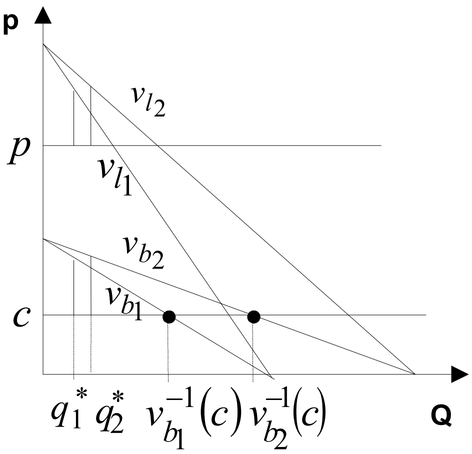

Figure 7. The effect of computerization in case of uniform distribution of new users

The situation will be more complex, than in previous case. The number of legal users will increase but not as much as a number of total users. Therefore, the number of bootleggers will also increase. The total losses from piracy will increase, but the change of the losses per software user is ambiguous. Indeed, before the computerization the losses per software user were $L_1 = p\left(v_{b_1}^{-1}(c) - q_1^*\right)/v_{b_1}^{-1}(c) = p\left(1 - \frac{q_1^*}{v_{b_1}^{-1}(c)}\right)$. After the computerization the value becomes $L_2 = p\left(v_{b_2}^{-1}(c) - q_2^*\right)/v_{b_2}^{-1}(c) = p\left(1 - \frac{q_2^*}{v_{b_2}^{-1}(c)}\right)$. Since $\left(v_{b_2}^{-1}(c) > v_{b_1}^{-1}(c)\right) \wedge \left(q_2^* > q_1^*\right)$, the change in L will depend on the relative magnitude of the changes in the number of legal users and the number of total users.

All the analysis above assumed that users were able to afford the software (either legal or illegal) they prefer. Now it will be instructive to assume back the budget constraints and look at the effect they have on our variables of interest. For the sake of exposition simplicity the quasilinear preferences are assumed. As Varian (1992) shows, in this case the reservation price for the discrete good (and software is the discrete good) does not depend on the consumer's income. Let $B(q)$ represent the part of user's q income he is ready to spend on the software purchase. If we assume that this proportion is constant for each users then the changes in users income will be proportionally transferred to the $B(q)$. Figure 8 shows the valuation (reservation price) lines for legal and bootleg software together with prices and budget constraint lines. The budget constraint lines are drawn in a way, that users with high valuation of software have higher incomes. This conforms to reality, since the high- valuation users usually are the businesses and institutions, which can usually spend more on software. However, the conclusions that will be drawn do not depend on the particular form of the $B(q)$.

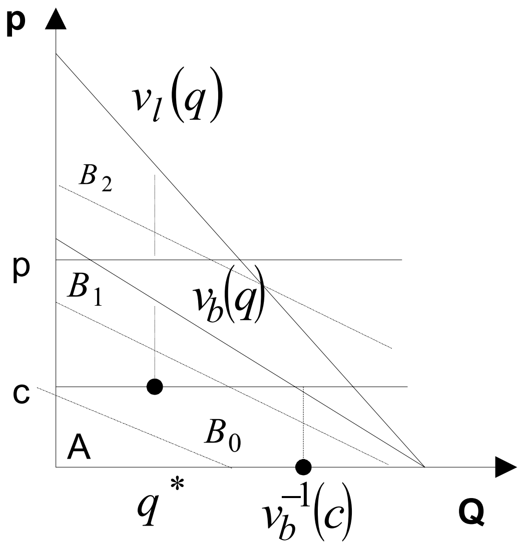

Figure 8. The effect of budget constraints change

Assume that initially the budget constraint line is B_0. No user can afford the software, neither legal copy nor the bootleg one because of this tight budget constraint. As the $B(q)$ line moves outward to B_1 representing the increase of consumers income, the high-end users will start to acquire the software. Despite the fact, that users $q \le q^*$ prefer to buy the legal software as the previous analysis shows, they can not afford it and acquire the illegal copy, which they can afford. Thus, initially the increase in consumers income leads to increase in number of total users, but that increase is due to the rise of piracy. So, the losses from piracy per user will jump from zero level to value *p,* since all of the users will be bootleggers on this stage. As the shift of $B(q)$ outwards continues, at some stage it will cross the *p* line and the high-end users will buy the licensed software instead of bootleg one.

Now the three cases are possible. If the $B(q)$ curve is above the point ($v_b^{-1}(c)$, c) when it crosses the *p* curve, then the consequent outward shift of $B(q)$ will not lead to increase of the number of total users and only the substitution of illegal software for legal one will take place. This will lead to decrease in the losses from piracy per software user. When the level of income above (q^*, *p*) to is reached (like B_2), all of the users $q \le q^*$ will use a legal copy, and $q \in \left(q^*; v_b^{-1}(c)\right)$ will use a bootleg copy. The further increase of income will change nothing on the market for this software.

In the second and third case $B(q)$ curve is below the ($v_b^{-1}(c)$, c) when it crosses the *p* curve. This means that the further shift of $B(q)$ will lead to increase in the number of total users which will be equal to the increase in the number of legal users, so the number of the bootleggers will stay constant. On this stage the losses from software piracy will also decrease, but less rapidly than in case 1. The behavior of losses per user during the further movement of $B(q)$ will depend on the slope of this line. If it is flat enough, that it comes above point ($v_b^{-1}(c)$, c) before it comes above (q^*, p), then the following changes will be the same, as in case 1. Thus, there will be further decline in losses per user. However, if $B(q)$ is steep enough to come above point (q^*, p) before it comes over ($v_b^{-1}(c)$, c), then the following outward shift of $B(q)$ will hold the number of legal users constant, while increasing the number of total users and, thus, the losses per software user.

The exact behavior of the losses will, of course, depend on the shapes of the valuation and budget constraint lines. But if many markets for different kinds of software and total losses on all markets are considered, the general pattern will be the same as one studied here. As income rises, the losses from piracy per user will initially increase, but then decrease. In case where steep budget constraint curves will be on the majority of markets with high software prices, the third case behavior will occur and further income rise will bring increasing losses from software piracy. However, the most important finding here is actually the first two cases, since they seem to be more probable than the third one. In any case if budget line shifts outwards, initially the losses per capita should increase and then decrease. Only on the next stage the uncertainty arises. It also worth noting, that relaxation of the quasilinear preferences assumption will bring some complication to the analysis but will not change the general result.

Chapter 4

EMPIRICAL ESTIMATIONS

Data Description

The most important piece of data for this research is the cross-country software piracy rates and software revenue loses data set (Business Software Alliance 2001). The data set contains the numbers for approximately 90 different countries for the period from 1995 till 2000. The methodology used by BSA to calculate these numbers is based on the differences between the estimated demand for new software and legal supply of new software. The demand is estimated from the confidential data about PC shipments to each country. This data was provided by the BSA member companies. Taking into account the differences in the levels of technological acceptance between countries, BSA managed to determine the number of software applications installed per PC shipment for three different software tiers. Then, an estimate of total installed software was calculated. The legal supply data was also provided by the member companies of BSA under the non-disclosure agreement. The differences between the numbers of software applications installed and legally shipped is the estimate of pirated software applications number. BSA provides those estimations as a percent of total software installed. By using the average software package price information, the legal and pirated software revenues were calculated. These calculations have taken into account the differences between pricing of different software categories.

Another data used in empirical estimations were obtained from the World Bank web-site. The countries of interest were the ones included in the BSA report. The values of GDP, population, number of personal computers per thousand people and number of web sites in the country per 10000 people were acquired for the years1996-1999.

The last data set used in the research is the Historical Summary of Selected Countries' Placement for Copyright- Related Matters on the Special 301 List (IIPA 2002) and Chart of Countries' Special 301 Placement (1990-2002) and IIPA Special 301 Recommendations (IIPA 2002). This report contains information about around 100 countries that had problems with copyright-related matters during the period of 1990-2002. IIPA's special 301 list is reconsidered every year and includes the problem countries with a qualitative mark ("placement") that reflects the level of copyright problem severity. While making this marking IIPA puts attention on the compliance of the legislation and enforcement extent in the country to the world standards rather then on the level of piracy in the country. So, this marking could be used for creation of the appropriate variable to reflect the policy factor mentioned above. The ranking is done according to the 6-point scale: "Priority Foreign country", "306 Monitoring list", "Priority Waiting List", "Waiting List", "Other Observation", "Not on the list". Here Priority Foreign Country means the highest severity of the copyright problems and Not on the list mean that country does it's best protecting copyright property rights in terms of legislation and enforcement.

The final data set used for the empirical estimations was comprised as a panel data including observations for 54 countries for years 1996-1999 giving 216 observations in total.

Model specification

The estimations are aimed to determine the factors that influence the copyright holder losses from piracy and to indirectly determine the effect that the computerisation of the country and facilitation of the access to Internet have on the losses from software piracy.

As a representative index which accurately reflex the extent of software piracy in the country and simultaneously can be easily compared across countries, the software revenue losses per personal computer $lpps_{it}$ was calculated as $lpps_{it} = \frac{\text{Total software revenue losses from country}_{it}}{\text{Number of personal computers}_{it}}$, where i states for the country and t for the year. It was preferred to the BSA piracy rate since $lpps_{it}$ takes into account the possible difference in the average software price used in BSA calculations. It worth noting that these differences most probably come from the software users preferences, since there was no noticeable price discrimination across countries.

The first explanatory variable used was GDP per capita $GdpC_{it}$ to control for the effect the prosperity of average person in the country causes on the extent of the illegal software use. If the bootleg copies are considered the poor substitute of legal software or even inferior good, than it is reasonable to expect the switch from the bootleg copies to legal software as GDP per capita grows. Otherwise, the amount of illegal software per PC used should not change significantly as GDP per capita grows.

The second explanatory variable was number of computers per capita $CompP_{it}$. It has complex effect on the extent of software piracy. From the one hand, the increased concentration of computers (and software) leads to the demand network externalities effect, which raises the valuation of software and could lead to the decrease of piracy. From the other hand, larger number of computer users increases the probability of finding the source of bootleg copy in the person of institutional pirate such as illegal CD retailer or plain computer user. Moreover, as the diagrammatic analysis above shown, if computerization increase the number of users mainly in the high-end part of the valuation curve, the decrease in losses from piracy per computer should be expected.

Third explanatory variable was used to control for the easiness of the Internet access. Since the number of the internet hosts in the country obviously reflects the level of Internet access, the index $f_{it} = \dfrac{\text{Number of internet hosts}_{it}}{\text{Number of personal computers}_{it}}$ was used to control for this factor.

As a proxy for the policy factors (legislation and enforcement) the IIPA marking was used in regressions. The variable Enf_{it} was created where 0 value corresponded to the "Not on the list" marking and 6 corresponded to the "Priority foreign country" marking. So, the variable could be more accurately called a "Copyright policy problems" index.

To control for the time effect (which could come, for example, from general software pricing trends), the time dummy variables D1997, D1998 and D1999 were included.

The summary statistics for the data could be found in Appendix A. The data set used in this research is presented in Appendix D.

Since the panel units in our case are countries, the fixed effect model is most appropriate (Veerbek 2000).

The fixed effects model was used to make the estimations:

$$lpps_{it} = a_i + \alpha_1 \cdot GdpC_{it} + \alpha_2 \cdot GdpC_{it}^2 + \beta \cdot CompP_{it} + \gamma_1 \cdot f_{it} + \gamma_2 \cdot f_{it}^2 + \eta \cdot Enf_{it} + \\ + \varphi_1 \cdot D1997 + \varphi l_2 * D1998 + \varphi_3 * D1999 + \varepsilon_{it}$$

The quadratic term were included for $GdpC_{it}$ to control for the non-linear dependency described in theory part. The specification with the additional cubic term was also attempted. Since the form of the relationship between losses from piracy per computer and the level of Internet access is unknown, the quadratic term was added to control for non-linear dependency.

Since the number of periods in the data set is small (only 4 periods) the autocorrelation problem was not topical. However, it was natural to expect different error variances in different countries, so the heteroscedasticity was accounted for.

The results of pooled least squares estimations are presented in Appendix B. As could be seen, heteroscedasticity test rejects the hypothesis of constant error variance for all observations. The hypothesis that error variance does not depend on the country is also rejected. Therefore, the Generalized Least Squares model with cross-sectional weights is required to take into account the error variance difference between the cross-sectional units.

Results Analysis

As could be seen from estimation results (Table 1), the IIPA enforcement policy problems index is statistically significant at the 5% level. The positive sign of the *Enf* variable shows that the higher is the IIPA index, the more losses from piracy per personal computer occur. This result shows that the institutional environment that IIPA takes into account while assigning ranks to the problem countries indeed matters for the software piracy. The other conclusion that could be cautiously drawn from this empirical finding is that applying the enforcement practices that are already used in the world could help Ukraine to deal with its piracy problems.

Table 1. GLS estimations results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F?	0.507514	0.106845	4.750017	0
F?^2	-1.16792	0.320052	-3.64917	0.0003
COMPP?	0.165289	0.025269	6.54123	0
GDPC?	1.02E-05	1.87E-06	5.469253	0
GDPC?^2	-1.45E-10	3.10E-11	-4.66874	0
ENF?	0.0025	0.001266	1.975127	0.0493
D1997	-0.02127	0.001555	-13.6812	0
D1998	-0.03539	0.002386	-14.8338	0
D1999	-0.04167	0.0033	-12.6272	0

The positive sign of the *Compp* variable is much less optimistic finding. It indicates that the increasing computerization leads to more losses from piracy. As the theoretical analysis shows, this may indicate that either computerization during the years in focus occurred mainly as the increase in the number of low-valuation users or the computerization indeed shifts down the costs of acquiring the bootleg copies of software significantly enough to overcome any theoretically possible negative effects on piracy. Figure 9 depicts the level of computerization for four different countries, including Ukraine.

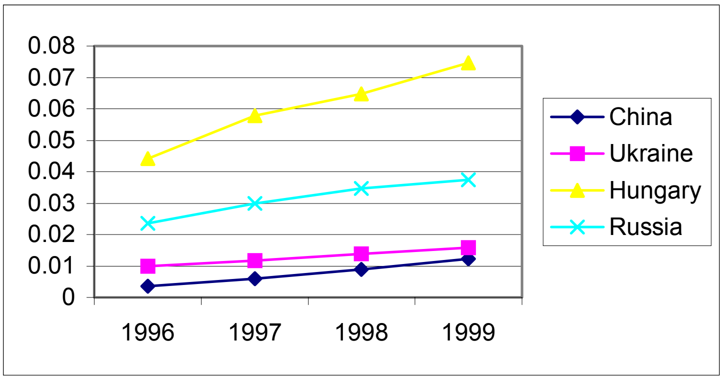

Figure 9. Number of personal computers per capita. Source: World Bank database, authors calculations.

The figure shows that Ukraine has low level of computerization even in comparison with not highly developed countries. It could be also seen that there is almost linear increasing trend of the computerization variable. It is hard to find any reason for the computerization level to decrease. Most probably, this trend will persist and may even become steeper in future, as the economy of the country will grow and information technologies become more popular and available. Thus, the upward pressure on the losses from piracy should be expected, as the level of computerization in Ukraine will rise.

The level of the Internet availability f has a more complex influence on the losses from piracy. As Table 1 shows, both f and f^2 are highly significant. This non-linear dependency is shown on the Figure 10.

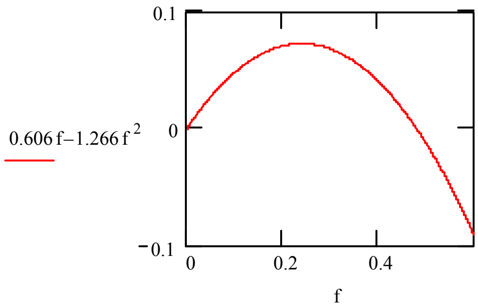

Figure 10. Influence of Internet availability on losses from piracy per computer

The sound explanation of this dependency requires additional research, which is beyond the scope of this work. However, it is possible to offer the following preliminary explanation. Initially the rising availability of Internet pushes down the costs of acquiring the bootleg copies. Thus, as more people download the bootleg software from Internet, the losses from piracy increase. However, at some point, the level of Internet access became so high, that every user willing to download the bootleg copy of software can easily do so. Any further expansion of Internet availability can not make the obtaining of illegal software more easy. According to the empirical estimations made in this work, the value of f where Internet availability has the maximum positive influence on piracy is $f_{max} = 0.2/2.6 = 0.21$. The values of f for Ukraine and some other countries is shown on the figure 11.

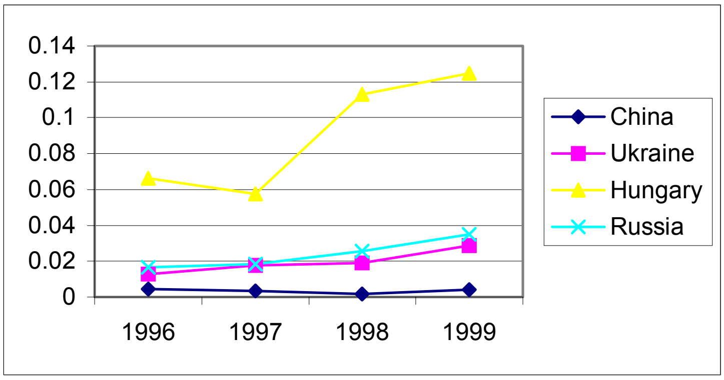

Figure 11. Number of Internet hosts per personal computer. Source: World Bank, authors calculations.

It is clear, that the value of *f* in Ukraine was far below the f_{max} value. It also has a clear rising trend. Thus, in the near future as the Internet will become more available in Ukraine, the losses from piracy due to the bootleg copies downloaded from the Net should be expected to rise.

GDP per capita influence on the losses from piracy is also non-linear. Indeed, both in the specification where only linear and quadratic term of GDP per capita were included (see Table 1) and when cubic term is added (see Appendix C) the linear term has positive coefficient and quadratic term has negative coefficient. This supports the theoretical conclusion, drawn above from the simple diagrammatic analysis. As GDP per capita grows, it initially has the positive influence on the losses per capita and then drives them down. For the cubic dependency the extremum points could be calculated as follows (Mathcad commands shown):

$$f(x) := 1.93 \cdot 10^{-5} x - 5.83 \cdot 10^{-10} x^2 + 5.65 \cdot 10^{-15} x^3$$

$$\frac{d}{dx} f(x) = 0 \text{ solve}, x \rightarrow \begin{pmatrix} 27732.530453386961553 \\ 41058.030018589439627 \end{pmatrix}$$

The value of GDP per capita where the losses per personal computer stops increasing and start decreasing is around USD 35000 for quadratic specification ((1.02/2*(1..45))*10000) and around USD 28000 for cubic specification (see calculations above). Without the additional effort to check which value is more precise, it is possible to say that Ukraine which had a GDP per capita value of around USD 600 in 1999 is far to the left of the point where economy growth will stop to push the losses from piracy per personal computer up. Thus, as Ukrainian economy will grow, the upward pressure on the losses from piracy per computer will occur.

Finally, the time dummy variables should be explained. As the Table 1 shows, ceteris paribus every year the losses from piracy per computer were decreasing in the period from 1996 to 1999. The most simple explanation would probably be that time dummies captured the change in software prices, that decreased during the years in focus. But this is most probably is not the case. Fagin (1999) reports the real prices for main Microsoft products for the period from 1990 until 1990. As figures 12 and 13 show, it is hard to say that the prices for Microsoft products decreased in those years.

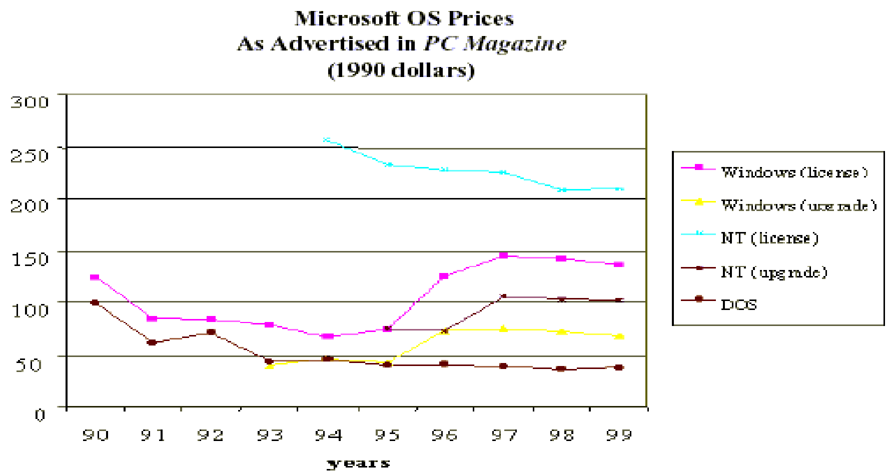

Figure 12. Microsoft OS prices. Source: Fagin (1999)

The Microsoft products are the most popular software in the world, so this data contradicts the hypothesis about the price decrease. The explanation of the time dummy variable coefficients thus requires additional research.

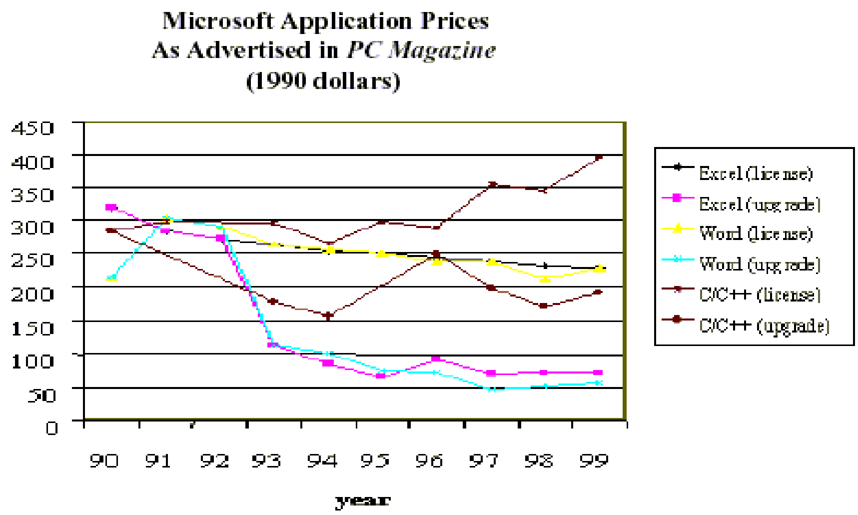

Figure 13. Microsoft applications prices. Source: Fagin (1999)

However, one of the factors that may partly explain the values of the dummy coefficients is that there is an increasing number of users who switch to the Linux platform. According to Don Yacktman (1998), the estimated number of Linux users was around 8 million in 1998 (see figure 14). The trend of the users number is clearly upward, so in 1999 the number of users most definitely increased further. Those users mostly come form the low-end of the software valuation curve and, thus, switching from the use of pirated commercial software to the free open-source solutions they decrease the number of losses from piracy per computer. This hypothesis requires additional verification and other explanations of decreasing coefficients of time dummy variables could be sought in further research activities.

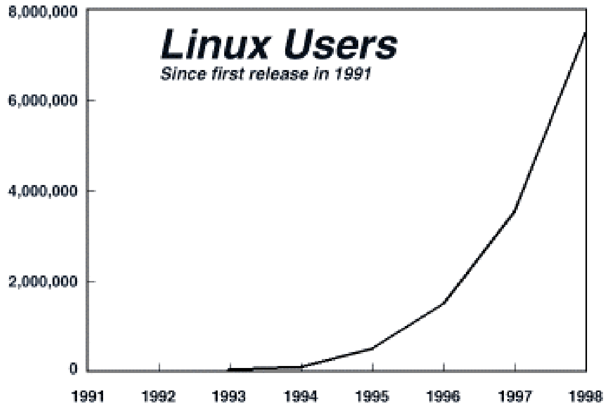

Figure 14. Number of Linux users. Source: Don Yacktman (1998)

Chapter 5

CONCLUSIONS

As empirical estimations show, Ukraine is currently far to the left of the "maximum piracy" points both on income and Internet hosts concentration axis. The location of these maximum points is based on the non-linear dependence results reported above

Therefore, the growth of economy and increasing Internet availability will create significant downward pressure on the piracy costs. Computerization of the country will also make a contribution to the increase in the losses from piracy.

Using the broad-based enforcement will be very costly under these circumstances, since downward pressure on the costs of piracy will require increasing effort to keep those costs high enough to hold piracy on the level, acceptable by the international community. Moreover, broad-based enforcement is harmful for the low-end buyers and fights piracy at the cost of reducing the product consumption as was shown in the models used in this paper. In case of successful broad-based enforcement, the majority of the Ukrainian home users will lose the ability to use the commercial software, which will not bring significant additional profit to the copyright holders and may even reduce the valuation of the software by the legal users due to the demand network externalities. Therefore, broad-based enforcement activities such as optical media regulations and actions against the domestic pirated software retailers should not be the focus of Ukrainian software copyright enforcement strategy. Ukraine should put the attention not to the production or domestic trade of optical media with pirated products, but to the export of illegal production from Ukraine. The export of illegal media is the major concern of copyright holders since the losses from piracy on Ukrainian software market are most probably lower than the losses from presence of exported pirated products on foreign markets. In case of successful decrease of illegal media export Ukraine would be able to save the optical media production industry in the country while protecting itself from future trade sanctions.

In contrast to the broad-based enforcement, targeted enforcement effectiveness does not depend much on the costs of acquiring the pirated software. Targeted enforcement by its nature is able to prohibit usage of pirated software by users with high valuation even when the obtaining of pirated software is costless. These kind of anti-piracy actions will not significantly reduce the software consumption, since almost all institutional users can afford to buy the legal software. Moreover, targeted enforcement could be efficient in the meaning of maintaining the pre-enforcement level of total surplus. Of course, computerization will require increasing effort to police the appearing new institutional users, but those additional efforts will be significantly lower than in case of broad-based enforcement. Thus, Ukrainian policy-makers should consider the targeted enforcement as a most appropriate tool to fight the software piracy. However, the corruption in Ukrainian police could hamper the effect of targeted enforcement efforts.

Taking into account all the factors mentioned above, software copyright holders should not expect the quick improvement of software copyright protection environment in Ukraine. Therefore, they should consider the option of competing with software pirates, since the theory shows that in case of severe piracy this may lead to the higher profits, than maintaining the monopolistic price. In order to avoid re-export of cheap licensed software from Ukraine they can use software localization, since the software with Ukrainian user interface would be unusable by the overwhelming majority of foreign users.

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APPENDIX A: DESCRIPTIVE DATA STATISTICS

Stata commands are also shown

. summarize f compp lppc gdpc enf d*

Variable	Obs	Mean	Std. Dev.	Min	Max
f	216	0.049438	0.050819	0.00112	0.310183
compp	216	0.134167	0.139198	0.0016	0.5105
lppc	216	0.054422	0.032438	0.006783	0.196391
gdpc	216	11953.8	11489.84	405.7059	41840.4
enf	216	1.324074	1.14793	0	5
d1997	216	0.25	0.434019	0	1
d1998	216	0.25	0.434019	0	1
d1999	216	0.25	0.434019	0	1

. xtsum

Variable		Mean	Std. Dev.	Min	Max	Observations	
lppc	overall	0.054422	0.032438	0.006783	0.196391	N =	216
	between		0.025267	0.011097	0.12681	n =	54
	within		0.020561	-0.03018	0.142136	T =	4
f	overall	0.049438	0.050819	0.00112	0.310183	N =	216
	between		0.04834	0.002911	0.257715	n =	54
	within		0.016688	-0.02479	0.161622	T =	4
compp	overall	0.134167	0.139198	0.0016	0.5105	N =	216
	between		0.137018	0.002438	0.434408	n =	54
	within		0.029396	0.04583	0.25729	T =	4
gdpc	overall	11953.8	11489.84	405.7059	41840.4	N =	216
	between		11537.51	426.4281	37756.68	n =	54
	within		871.6148	8466.867	16037.52	T =	4
enf	overall	1.324074	1.14793	0	5	N =	216
	between		1.037765	0	3.75	n =	54
	within		0.505781	-0.67593	2.574074	T =	4

APPENDIX B: POOLED OLS RESULTS AND HETEROSCEDASTICITY TESTS

Stata commands are shown. The coefficients of country dummies are not listed here.

. regress lppc f fsq compp gdpc gdpcsq enf yeard* cntryd*

Source	SS	df	MS		Number of obs	216
					F(62, 153)	8.95
Model	0.177332	62	.002860195		Prob > F	0
Residual	0.0489	153	.000319611		R-squared	0.7838
					Adj R-squared	0.6963
Total	0.226233	215	.001052245		Root MSE	0.01788

lppc	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
f	0.605727	.2010561	3.01	0.003	0.208523	1.002931
fsq	-1.26628	.561507	-2.26	0.026	-2.37558	-0.15697
compp	0.203643	.0656328	3.10	0.002	0.073979	0.333307
gdpc	1.01E-05	4.35e-06	2.33	0.021	1.54E-06	1.87E-05
gdpcsq	-1.58E-10	7.96e-11	-1.99	0.049	-3.16E-10	-8.95E-13
enf	0.002909	.0026318	1.11	0.271	-0.00229	0.008109
yeard2	-0.02427	.0036906	-6.58	0	-0.03156	-0.01698
yeard3	-0.04021	.0043441	-9.26	0	-0.04879	-0.03162
yeard4	-0.05053	.0053759	-9.40	0	-0.06115	-0.03991

. hettest
Cook-Weisberg test for heteroskedasticity using fitted values of lppc
    Ho: Constant variance
        chi2(1)   =   80.39
        Prob > chi2 =   0.0000

. hettest country

Cook-Weisberg test for heteroskedasticity using variables specified
Ho: Constant variance
chi2(1) = 4.67
Prob > chi2 = 0.0306

APPENDIX C: GLS ESIMATIONS WITH CROSS-SECTION WEIGHTS

GLS (Cross Section Weights) // Dependent Variable is LPPC?				
Date: 05/27/02 Time: 02:47				
Sample: 1996 1999				
Included observations: 4				
Total panel observations 216				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
F?	0.507514	0.106845	4.750017	0
F?^2	-1.16792	0.320052	-3.64917	0.0003
COMPP?	0.165289	0.025269	6.54123	0
GDPC?	1.02E-05	1.87E-06	5.469253	0
GDPC?^2	-1.45E-10	3.10E-11	-4.66874	0
ENF?	0.0025	0.001266	1.975127	4.93E-02
D1997	-2.13E-02	0.001555	-13.6812	0.00E+00
D1998	-0.03539	0.002386	-14.8338	0
D1999	-0.04167	0.0033	-12.6272	0
Fixed Effects				
ARG--C	0.020162			
AUS--C	-0.18141			
AVS--C	-0.21461			
BOL--C	0.100518			
BRA--C	0.04223			
BUL--C	0.056669			
CAN--C	-0.17232			
CHIL--C	0.009938			
CHIN--C	0.13155			
COL--C	0.045457			
CRO--C	-0.00593			
CZE--C	-0.01117			
DEN--C	-0.22915			
ECU--C	0.075399			
EGY--C	0.038604			
FIN--C	-0.21973			
FRA--C	-0.14427			
GER--C	-0.18548			
GRE--C	-0.01209			

HONK--C	-0.12778			
HUN--C	-0.00409			
INDI--C	0.11033			
INDO--C	0.086975			
IRE--C	-0.13637			
ISR--C	-0.11312			
ITA--C	-0.12402			
JAP--C	-0.18353			
JOR--C	0.052359			
LEB--C	-0.01057			
MAL--C	0.044843			
MEX--C	0.002447			
NET--C	-0.17925			
NEZ--C	-0.17179			
NOR--C	-0.21053			
PAK--C	0.054587			
PER--C	0.060945			
PHI--C	0.05194			
POL--C	0.042866			
POR--C	-0.05285			
ROM--C	0.022273			
RUS--C	0.042248			
SIN--C	-0.17187			
SLO--C	-0.08616			
SLOR--C	-0.00419			
SPA--C	-0.08414			
STHA--C	-0.00954			
SWE--C	-0.21263			
SWI--C	-0.21496			
THA--C	0.06467			
TUR--C	0.028322			
UK--C	-0.17495			
UKR--C	0.072079			
US--C	-0.24684			
VEN--C	0.041861			
Weighted Statistics				
R-squared	0.972395	Mean dependent var		0.093695
Adjusted R-squared	0.961209	S.D. dependent var		0.087453
S.E. of regression	0.017224	Sum squared resid		0.045391
F-statistic	673.6935	Durbin-Watson stat		2.083047

Prob(F-statistic)	0			
Unweighted Statistics				
R-squared	0.779185	Mean dependent var		0.054422
Adjusted R-squared	0.689705	S.D. dependent var		0.032438
S.E. of regression	0.018069	Sum squared resid		0.049955
Durbin-Watson stat	1.717478			

GLS (Cross Section Weights) // Dependent Variable is LPPC?				
Date: 05/27/02 Time: 03:20				
Sample: 1996 1999				
Included observations: 4				
Total panel observations 216				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
F?	0.491519	0.109201	4.501036	0
F?^2	-1.04583	0.328037	-3.18814	0.0016
COMPP?	0.148014	0.03059	4.838622	0
GDPC?	1.93E-05	4.53E-06	4.259986	0
GDPC?^2	-5.83E-10	1.73E-10	-3.36831	0.0009
GDPC?^3	5.65E-15	2.15E-15	2.631739	0.009
ENF?	0.00194	0.001414	1.372302	0.1712
D1997	-0.02154	0.001786	-12.0592	0
D1998	-0.03482	0.002586	-13.4677	0
D1999	-0.04033	0.003479	-11.5898	0
Fixed Effects				
ARG--C	-0.02532			
AUS--C	-0.21604			
AVS--C	-0.25598			
BOL--C	0.092393			
BRA--C	0.011774			
BUL--C	0.046558			
CAN--C	-0.21844			

CHIL--C	-0.02248			
CHIN--C	0.126947			
COL--C	0.027408			
CRO--C	-0.03776			
CZE--C	-0.04597			
DEN--C	-0.24905			
ECU--C	0.062973			
EGY--C	0.028787			
FIN--C	-0.2615			
FRA--C	-0.18319			
GER--C	-0.21887			
GRE--C	-0.06524			
HONK--C	-0.16548			
HUN--C	-0.03595			
INDI--C	0.107892			
INDO--C	0.081004			
IRE--C	-0.17803			
ISR--C	-0.16447			
ITA--C	-0.17119			
JAP--C	-0.20476			
JOR--C	0.039021			
LEB--C	-0.03749			
MAL--C	0.015977			
MEX--C	-0.02801			
NET--C	-0.21579			
NEZ--C	-0.22387			
NOR--C	-0.22959			
PAK--C	0.051196			
PER--C	0.043751			
PHI--C	0.043774			
POL--C	0.016087			
POR--C	-0.10606			
ROM--C	0.009923			
RUS--C	0.025964			
SIN--C	-0.21082			
SLO--C	-0.13482			
SLOR--C	-0.03125			
SPA--C	-0.1392			
STHA--C	-0.03393			
SWE--C	-0.24235			
SWI--C	-0.23273			
THA--C	0.046756			
TUR--C	0.006726			
UK--C	-0.21748			

UKR--C	0.065135			
US--C	-0.27141			
VEN--C	0.014321			
Weighted Statistics				
R-squared	0.961669	Mean dependent var		0.086529
Adjusted R-squared	0.945782	S.D. dependent var		0.073721
S.E. of regression	0.017166	Sum squared resid		0.044789
F-statistic	423.7229	Durbin-Watson stat		2.020023
Prob(F-statistic)	0			
Unweighted Statistics				
R-squared	0.783623	Mean dependent var		0.054422
Adjusted R-squared	0.69394	S.D. dependent var		0.032438
S.E. of regression	0.017946	Sum squared resid		0.048952
Durbin-Watson stat	1.728962			

APPENDIX D: THE DATA SET

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
ARG-1996	0.1112	0.01152	0.03125	7738.745	2
ARG-1997	0.080992	0.014611	0.03641	8222.101	3
ARG-1998	0.082469	0.038339	0.04155	8287.817	3
ARG-1999	0.106726	0.056608	0.04918	7755.21	3
AUS-1996	0.035909	0.063443	0.1737	28754.39	0
AUS-1997	0.024475	0.0514	0.21066	25602.44	1
AUS-1998	0.027135	0.070114	0.23342	26109.59	1
AUS-1999	0.032208	0.098061	0.2568	25725.77	0
AVS-1996	0.022101	0.088695	0.31694	22804.57	0
AVS-1997	0.019282	0.105431	0.36216	22662.51	2
AVS-1998	0.024898	0.09718	0.41176	19877.51	2
AVS-1999	0.016899	0.101988	0.4692	21431.8	2
BOL-1996	0.125966	0.015447	0.00369	971.8749	1
BOL-1997	0.128516	0.017876	0.00386	1017.389	2
BOL-1998	0.081711	0.008488	0.00754	1071.028	2
BOL-1999	0.050582	0.003824	0.01229	1022.697	1
BRA-1996	0.102536	0.022212	0.02152	4798.25	3
BRA-1997	0.091943	0.016	0.02625	4932.266	2
BRA-1998	0.073421	0.032802	0.03012	4745.996	2
BRA-1999	0.064279	0.05084	0.03631	3151.804	0
BUL-1996	0.059987	0.020742	0.01914	1176.435	1
BUL-1997	0.073156	0.030609	0.02166	1209.823	1
BUL-1998	0.089625	0.031026	0.02398	1484.508	2
BUL-1999	0.051562	0.044787	0.02657	1511.04	3
CAN-1996	0.048994	0.082725	0.24579	20274.63	0
CAN-1997	0.035942	0.084221	0.27333	20813.67	0
CAN-1998	0.032013	0.102597	0.33113	19778.85	0
CAN-1999	0.040005	0.117664	0.3608	20822.26	0
CHIL-1996	0.071391	0.028387	0.03882	4755.43	2
CHIL-1997	0.050679	0.029309	0.04473	5148.654	2
CHIL-1998	0.055176	0.032007	0.04824	4929.491	2
CHIL-1999	0.058468	0.032207	0.0666	4505.156	2
CHIN-1996	0.160577	0.004444	0.0036	670.6007	2
CHIN-1997	0.196391	0.0035	0.006	730.2348	5
CHIN-1998	0.108067	0.0018	0.00889	761.8158	4
CHIN-1999	0.042205	0.004098	0.0122	789.3021	4
COL-1996	0.08464	0.008901	0.02584	2472.856	2
COL-1997	0.050369	0.00533	0.03227	2663.888	2
COL-1998	0.062266	0.008842	0.03291	2427.466	2

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
COL-1999	0.044243	0.022318	0.03365	2085.394	2
CRO-1996	0.051384	0.030859	0.03341	4288.482	0
CRO-1997	0.037169	0.032937	0.04454	4606.87	0
CRO-1998	0.041301	0.024355	0.0558	4623.928	0
CRO-1999	0.013586	0.03874	0.06696	4550.24	0
CZE-1996	0.098732	0.05827	0.06796	5615.344	0
CZE-1997	0.061122	0.057744	0.08252	5109.311	0
CZE-1998	0.043281	0.065702	0.09709	5411.193	1
CZE-1999	0.033487	0.079841	0.1072	5158.928	2
DEN-1996	0.023404	0.066557	0.30476	34768.91	0
DEN-1997	0.024079	0.072052	0.35985	31861.85	0
DEN-1998	0.02103	0.095129	0.37736	32764.2	2
DEN-1999	0.026841	0.130285	0.414	32722.51	2
ECU-1996	0.073439	0.003342	0.01496	1627.608	0
ECU-1997	0.065962	0.005354	0.01681	1656.061	2
ECU-1998	0.06957	0.005477	0.01844	1619.933	3
ECU-1999	0.100777	0.007065	0.0201	1530.062	3
EGY-1996	0.052914	0.005709	0.00578	1141.369	2
EGY-1997	0.030017	0.00436	0.00711	1251.807	2
EGY-1998	0.019415	0.00363	0.00909	1344.34	3
EGY-1999	0.044153	0.002333	0.012	1422.837	3
FIN-1996	0.025979	0.22461	0.2729	24886.01	0
FIN-1997	0.023643	0.210387	0.31068	23817.73	0
FIN-1998	0.020097	0.285678	0.34884	25098.95	0
FIN-1999	0.027197	0.310183	0.3601	25060.86	0
FRA-1996	0.047115	0.027091	0.15068	26785.75	0
FRA-1997	0.043518	0.031164	0.16102	24155.61	0
FRA-1998	0.038468	0.038995	0.18928	24777.32	0
FRA-1999	0.042179	0.050275	0.2218	24433.84	0
GER-1996	0.029151	0.040501	0.20854	29093.2	1
GER-1997	0.025973	0.044691	0.23873	25763.85	1
GER-1998	0.020921	0.050378	0.27927	26210.82	1
GER-1999	0.026755	0.058519	0.297	25724	1
GRE-1996	0.124078	0.045346	0.03524	11872.16	3
GRE-1997	0.09481	0.041957	0.04476	11847.28	3
GRE-1998	0.101508	0.073425	0.05189	11827	3
GRE-1999	0.10673	0.098937	0.0602	11801.19	3
HONK-1996	0.107576	0.040963	0.19017	24418.38	1
HONK-1997	0.082172	0.03273	0.22866	26298.86	1
HONK-1998	0.052168	0.042517	0.25564	24459.82	2
HONK-1999	0.055089	0.049086	0.29762	23611.41	2
HUN-1996	0.095587	0.066342	0.04412	4430.746	0
HUN-1997	0.043394	0.057573	0.05784	4502.616	0

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
HUN-1998	0.058772	0.113043	0.06471	4651.885	1
HUN-1999	0.049545	0.124672	0.0747	4810.896	1
INDI-1996	0.168769	0.001875	0.0016	405.7059	3
INDI-1997	0.09181	0.002392	0.00209	423.8352	3
INDI-1998	0.073246	0.004	0.00275	427.7653	3
INDI-1999	0.064982	0.005438	0.00331	448.4059	3
INDO-1996	0.152328	0.007458	0.00657	1153.245	2
INDO-1997	0.121167	0.006784	0.00796	1076.643	3
INDO-1998	0.034967	0.006303	0.00825	468.609	3
INDO-1999	0.022375	0.008361	0.00909	682.5665	3
IRE-1996	0.060032	0.035368	0.20937	20102.26	0
IRE-1997	0.052944	0.037329	0.2411	21793.76	1
IRE-1998	0.06046	0.044454	0.27174	23239.61	2
IRE-1999	0.077602	0.038442	0.4049	24896.07	2
ISR-1996	0.086871	0.05536	0.15625	17087.38	1
ISR-1997	0.052529	0.056283	0.18613	17387.82	1
ISR-1998	0.048784	0.067611	0.21739	16892.99	2
ISR-1999	0.048325	0.076129	0.2457	16517.56	3
ITA-1996	0.064324	0.027911	0.09233	21486.25	2
ITA-1997	0.041713	0.032542	0.11324	20250.14	2
ITA-1998	0.035571	0.031965	0.17422	20680.16	2
ITA-1999	0.038116	0.0356	0.1918	20313.14	3
JAP-1996	0.058462	0.036072	0.1619	36571.92	3
JAP-1997	0.029492	0.037449	0.20238	33406.5	3
JAP-1998	0.019832	0.044927	0.2381	30124.9	2
JAP-1999	0.026861	0.057076	0.2869	34344.02	2
JOR-1996	0.085745	0.004463	0.00717	1624.834	1
JOR-1997	0.048706	0.004383	0.00867	1642.448	1
JOR-1998	0.027432	0.00621	0.01256	1732.218	2
JOR-1999	0.049759	0.008351	0.01389	1703.165	2
LEB-1996	0.017205	0.006037	0.02435	3186.862	0
LEB-1997	0.010012	0.00854	0.03185	3585.059	0
LEB-1998	0.006783	0.008499	0.03918	3839.471	0
LEB-1999	0.010389	0.015129	0.0464	3853.209	1
MAL-1996	0.138515	0.02874	0.04151	4773.094	0
MAL-1997	0.082683	0.040603	0.04608	4623.104	0
MAL-1998	0.059654	0.030679	0.05991	3268.191	0
MAL-1999	0.053939	0.03425	0.0687	3480.37	0
MEX-1996	0.037523	0.010561	0.03049	3590.093	0
MEX-1997	0.042288	0.011191	0.03351	4270.233	1
MEX-1998	0.042286	0.024117	0.03653	4368.567	1
MEX-1999	0.03138	0.052534	0.0442	4969.059	1
NET-1996	0.061757	0.075543	0.23077	26540.38	0

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
NET-1997	0.044321	0.077593	0.28205	24130.35	0
NET-1998	0.038393	0.100927	0.32484	24924.37	0
NET-1999	0.046482	0.112089	0.3599	24909.21	1
NEZ-1996	0.032224	0.093061	0.24457	17570.25	0
NEZ-1997	0.02044	0.156877	0.26385	17232.36	0
NEZ-1998	0.019873	0.162353	0.28871	13961.35	0
NEZ-1999	0.015726	0.145628	0.328	14377.39	0
NOR-1996	0.074697	0.107982	0.31735	35977.06	0
NOR-1997	0.06556	0.131348	0.36136	35187.82	0
NOR-1998	0.040415	0.174286	0.40449	33174.46	0
NOR-1999	0.043963	0.168636	0.4466	34292.2	0
PAK-1996	0.051694	0.00112	0.00357	504.9034	2
PAK-1997	0.043144	0.001902	0.00368	485.9542	2
PAK-1998	0.040249	0.003505	0.00428	472.9192	2
PAK-1999	0.032631	0.005116	0.0043	431.4413	2
PER-1996	0.161832	0.025926	0.00837	2328.422	2
PER-1997	0.054482	0.01143	0.02336	2423.208	2
PER-1998	0.049951	0.005026	0.03024	2298.52	2
PER-1999	0.030209	0.008655	0.0357	2058.388	2
PHI-1996	0.087597	0.004502	0.01155	1184.987	2
PHI-1997	0.051357	0.004478	0.0134	1152.929	2
PHI-1998	0.028317	0.006892	0.01509	898.7463	2
PHI-1999	0.02641	0.007924	0.01691	1032.268	2
POL-1996	0.140927	0.044033	0.03109	3383.119	2
POL-1997	0.071842	0.028947	0.03876	3851.529	2
POL-1998	0.075051	0.052037	0.0491	4090.399	2
POL-1999	0.068791	0.065946	0.06202	4014.231	2
POR-1996	0.054006	0.035053	0.06747	11332.82	0
POR-1997	0.055363	0.024513	0.07445	10639.29	1
POR-1998	0.044541	0.05565	0.08133	11122.82	0
POR-1999	0.053737	0.063871	0.093	11324.64	0
ROM-1996	0.023929	0.022337	0.01549	1463.169	2
ROM-1997	0.038332	0.015028	0.0177	1440.503	1
ROM-1998	0.044855	0.028551	0.02133	1858.45	1
ROM-1999	0.020165	0.033632	0.02679	1566.331	1
RUS-1996	0.109703	0.016617	0.02365	2836.026	2
RUS-1997	0.057121	0.01841	0.02993	2908.707	2
RUS-1998	0.053619	0.025598	0.03469	1923.905	3
RUS-1999	0.030262	0.034991	0.03741	1321.596	3
SIN-1996	0.058556	0.029913	0.26316	24876.19	2
SIN-1997	0.044995	0.048234	0.33155	24934.77	2
SIN-1998	0.039638	0.040459	0.37468	21099.46	2
SIN-1999	0.035793	0.060195	0.4366	21214.87	2

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
SLO-1996	0.034646	0.055202	0.12563	9481.447	0
SLO-1997	0.024455	0.045346	0.18939	9167.274	0
SLO-1998	0.02921	0.043215	0.21106	9878.73	0
SLO-1999	0.020767	0.039427	0.2514	10109.03	0
SLOR-1996	0.056607	0.031978	0.04647	3700.599	0
SLOR-1997	0.045355	0.029211	0.0697	3791.269	0
SLOR-1998	0.023868	0.030048	0.08736	3952.599	0
SLOR-1999	0.016367	0.035489	0.1093	3653.013	0
SPA-1996	0.048043	0.036549	0.07888	15503.02	0
SPA-1997	0.043998	0.032041	0.09669	14204.62	0
SPA-1998	0.054713	0.056652	0.10914	14785.93	0
SPA-1999	0.052629	0.06428	0.1194	15120.97	1
STHA-1996	0.032523	0.073762	0.03373	3603.921	2
STHA-1997	0.039591	0.06659	0.04337	3648.439	1
STHA-1998	0.044113	0.065795	0.0516	3211.607	0
STHA-1999	0.036536	0.060987	0.0547	3092.649	2
SWE-1996	0.043253	0.091442	0.29412	29617.83	0
SWE-1997	0.042353	0.094832	0.33898	26835.53	0
SWE-1998	0.034014	0.108731	0.39548	26860.64	2
SWE-1999	0.032854	0.128815	0.4514	26947.15	2
SWI-1996	0.041513	0.055434	0.33898	41840.4	0
SWI-1997	0.033234	0.052955	0.39437	36122.62	0
SWI-1998	0.025526	0.068627	0.42135	36865.02	0
SWI-1999	0.032483	0.080223	0.4619	36198.68	0
THA-1996	0.139415	0.009418	0.01667	3093.005	2
THA-1997	0.079783	0.010788	0.01993	2545.653	2
THA-1998	0.037709	0.019759	0.02156	1871.586	2
THA-1999	0.0602	0.0203	0.02266	2025.95	2
TUR-1996	0.085815	0.01656	0.01721	2954.248	3
TUR-1997	0.049848	0.017804	0.02067	3042.387	3
TUR-1998	0.034557	0.017262	0.02549	3160.766	3
TUR-1999	0.045017	0.023776	0.0339	2871.131	3
UK-1996	0.026561	0.056637	0.21599	20060.13	0
UK-1997	0.023681	0.062171	0.23939	22344.46	0
UK-1998	0.029056	0.074688	0.26995	23802.77	0
UK-1999	0.037752	0.088869	0.3025	24231.35	0
UKR-1996	0.096976	0.012926	0.00998	1227.872	2
UKR-1997	0.074263	0.017602	0.01176	1054.469	2
UKR-1998	0.067668	0.018925	0.01395	856.5259	2
UKR-1999	0.055214	0.028897	0.01578	616.2384	2
US-1996	0.024151	0.103448	0.36453	28902.89	0
US-1997	0.025169	0.107113	0.40672	30341.48	0
US-1998	0.022943	0.21029	0.45588	31645.65	0

obs	LPPC?	F?	COMPP?	GDPC?	ENF?
US-1999	0.022467	0.289863	0.5105	33086.52	0
VEN-1996	0.074516	0.003502	0.03084	3161.813	2
VEN-1997	0.069308	0.005894	0.03478	3894.436	2
VEN-1998	0.075756	0.007579	0.03879	4123.939	2
VEN-1999	0.056812	0.009434	0.04219	4357.814	2