MODEL OF HYPOTHECATED TAX ON INFORMATION GOODS

Oksana Melikhova, PhD.
IES, Faculty of Social Sciences, Charles University in Prague
Faculty of Mathematics and Physics, Charles University in Prague
E-mail: Oksana.Melikhova@mff.cuni.cz

─**Abstract** ─

Information or knowledge, which can be incorporated in tangible objects at the same time in an unlimited number of copies at different locations anywhere in the world, constitutes intellectual property of an information producer. Intellectual property rights (IPR) legislation was created to optimize social welfare and to promote production of information by granting producers a temporary monopoly in return for a disclosure of their works. However, current IPR regimes are over-protective in terms of monopoly that is granted to a producer but they are under-protective against piracy and unauthorized use. Nowadays, the main effort is made to secure information in order to forbid unauthorized use, and thus this approach creates high barriers for information diffusion. The aim of the current work is to look for alternative solution of the IPR problem which can be defined as: how to profit from production of information without reduction its natural non-excludability and transferability. One of the possible solutions of IPR problem could be introduction of hypothecated tax on information goods. A theoretical model which describes exchange and production of the information goods was developed in support of the suggested solution. The case when production of the information goods is subsidized from the tax proceeds is also compared with the case when the information goods are sold on the market for unlimited flat rate. It was found that under assumption of homogeneous wealth and cost distributions the both cases result in the same consumption levels and the same condition on production costs.

Key Words: *Information good, Intellectual property rights, Hypothecated tax*
JEL Classification: O34, O38

1. INTRODUCTION

Information goods (IGs) are such goods for which knowledge is more critical for production than other economic resources such as land, natural resources, or manpower. Producers of IGs usually face high fixed costs of production with low (or even zero) marginal costs. IGs can be considered as quasi-public goods. To a large extent they are intangible and non-rivalrous. Moreover, many of IGs can be characterized by a strong network effect, when benefits to a single user increase with the number of others agents using the same good. It means that public welfare increases when information is disseminated and widely used, both in the production of goods and in the production of further information. However, a problem arises when we are looking for optimal pricing of IGs. Zero marginal cost of production implies that optimal price of the good is also zero, thus there is no private incentive for production. Intellectual property rights (IPR) legislation was created to optimize social welfare and to promote production of information by granting producers a temporary monopoly in return for a disclosure of their works. Main goals of current IPR system are to enable creators to reap some benefit from their work, to stimulate production and diffusion of innovation and to contribute to market order (WIPO).

Nowadays, the main effort is made to secure IGs in order to forbid unauthorized use and distribution using IPR legislation. Although IPR can somehow solve the "free rider" problem, the main problem still remains: current IPR imply private monopoly power and thus are not Pareto-optimal. Due to the limits of price discrimination, those who are unwilling or unable to pay a profit-maximizing price do not get access to the good. Current IPR legislation creates barriers for information diffusion, which otherwise can occur at no cost, and wastes a lot of resources on keeping information excludable. Moreover, canonical theories of IPR are not justified by reality. The idea "that a lone genius can solve problems that stump the experts, and that the lone genius will do so only if properly incented" is opposed by historical facts that the most of new technologies are invented nearly simultaneously by independent inventors (Lemley,2011). Empirical evidence suggests that between 90 and 98% of modern patent lawsuits are against independent inventors, not copiers (Cotropia,2009, Lemley,2011). The theory that patents are important for the information they disclose is opposed by the fact "that companies primarily rely on patent protection to protect self-

disclosing inventions: those that the inventor could not maintain as a trade secret after putting it into commercial practice. If an invention can be kept secret, inventors are more likely to forego patent protection and keep it secret" (Lemley,2011, Arora,2008, Cohen,2002). It was also found that patents and copyright publications are almost the least important source for firm's learning in order to acquire technical knowledge. The study of (Arundel,2000) showed that IPR regimes are mainly used as strategic means to block competitors from developing of rival technologies and to prevent infringement suits by competing firms. These uses are beyond the original intention of IPR legislation and outside of traditional rationalization of it. *"Theory of patent law doesn't seem to explain the way we actually implement that law...If patent law in its current form can be saved, we need an alternative justification."* (Lemley,2011).

An extensive research on IGs, computer mediated transactions, IPR and their impact on public welfare was done by Hal R. Varian, who states a necessary condition for Pareto efficient pricing of IGs: "the marginal willingness to pay must equal marginal cost" (Varian,1996) and formulates "the third and fourth welfare theorems of welfare economics: 3rd, a perfectly discriminating monopolist can capture all surplus for itself and therefore produce Pareto efficient output; 4th, competition among perfectly discriminating monopolists will transfer this surplus to consumers, yielding the same outcome as pure competition." (Varian,2001). He also discusses inefficiencies which society faces due to monopolistic production (Varian,2001), when resources are wasted on creation of low-quality versions, on control of artificial excludability of the goods and on the duplication of the efforts in the innovation. "From the viewpoint of competing for a monopoly, promotional pricing or adopting inferior technology are both costs to the firms, but they may have very important differences for consumer welfare calculations. Designing an environment in which competition results in transfers to consumers, rather than wasteful rent dissipation, is clearly an attractive policy goal." (Varian,2001). He also wrote that "universal access to all the world's information is technologically possible now; the missing piece is the legal infrastructure that will provide the incentives to make such access economically viable "(Varian,2005).

Thus creation of a new system, which promotes the knowledge diffusion and does not suffer from distortions caused by monopoly rights, is a task of a high importance. Taking at account "public" attributes of information as non-rivalry

and natural non-excludability it is natural to think about financing of information production from the tax proceeds. Assuming that willingness to pay for information is increasing function of income, proportional taxation of income can be natural choice for hypothecated tax on IGs. Redistribution of the tax proceeds between IPR holders creates a reimbursement for information. A received share should be dependent on the usage of information. In exchange, information should be available for free public usage on equal basis.

This can create a self-regulating system. Availability of advanced technologies increases productivity of economy. This is automatically reflected in increase of the tax proceeds sheared between producers and thus higher incentives for research and development. Additionally, a disclosure of knowledge promotes innovation, which results in more advanced technologies. This system will be incompatible with monopoly pricing and it will remove restriction in the choice of technology together with an incentive to adopt a low-efficient technology. As result, a probability for society to be locked in a low-efficient technology will be reduced. It also makes information available for poor people for smaller "price" than for rich people. Under assumption that willingness to pay is increasing function of an income, IPR holders in this system can be considered as discriminating monopolists competing among themselves. Thus conditions of the 3rd and the 4th welfare theorems (Varian,2001) would be satisfied, the same outcome as pure competition can be expected. A theoretical model in support of the suggested solution is presented in the next section.

2. MODEL DESCRIPTION AND DISCUSSION

The model describes situation with 2 decision makers A & B, which produce and consume 2 IGs i_1, i_2. The IGs i_1, i_2 are produced with positive fixed costs $FC_1 > 0, FC_2 > 0$ and zero marginal costs $MC_1 = 0$, $MC_2 = 0$, respectively. The IGs i_1, i_2 are public goods. Their production is subsidized from the tax proceeds

$$TP = t(w_A + w_B),$$

where w_A, w_B are A's and B's initial wealth, respectively, and t is a tax rate on the wealth.

<u>The tax proceeds TP are shared between producers according to relative usage of their products</u>.

- A produces i_1 which is consumed by B.
- B produces i_2 which is consumed by A.

A's profit from production i_1 is $\pi_A = \dfrac{i_1}{i_1+i_2}t(w_A+w_B)-FC_1$.

B's profit from production i_2 is $\pi_B = \dfrac{i_2}{i_1+i_2}t(w_A+w_B)-FC_2$.

The IGs are produced only if profit is nonnegative $\pi_A \geq 0, \pi_B \geq 0$ and if the after tax wealth is sufficient to cover the production costs:

$$(1-t)w_A - FC_1 \geq 0 \,,\; (1-t)w_B - FC_2 \geq 0 \,.$$

There is also a unique physical good (PhG) which is used for production of the IGs as well as for direct consumption. Price of PhG is normalized to 1. The decision makers A & B have positive initial endowments of the PhG and zero initial endowments of the IGs. Thus, A's and B's initial wealth w_A, w_B are A's and B's initial endowments of the PhG, respectively. Amount of the PhG consumed by A and B is denoted by x_A and x_B, respectively.

The decision maker utilities depend on consumption of the PhG as well as on consumption of the IGs:

A's utility function: $u_A(x_A, i_2) = \ln x_A + \ln i_2$

B's utility function: $u_B(x_B, i_1) = \ln x_B + \ln i_1$

Solving the utility maximization problem for the decision maker A (UMP$_A$):

$$\max\; \ln x_A + \ln i_2 \tag{1}$$

$$\text{s.t. } x_A \geq 0\,;\; i_2 \geq 0\,;\; x_A \leq (1-t)w_A + \frac{i_1}{i_1+i_2}t(w_A+w_B)-FC_1\,;$$

$$\pi_A = \frac{i_1}{i_1+i_2}t(w_A+w_B)-FC_1 \geq 0\,;\; (1-t)w_A - FC_1 \geq 0\,;$$

$$\pi_B = \frac{i_2}{i_1+i_2}t(w_A+w_B)-FC_2 \geq 0\,;\; (1-t)w_B - FC_2 \geq 0$$

we can find the optimal consumption levels of the PhG and IGs for A

$$x_A^* = (1-t)w_A\,; \tag{2}$$

$$i_2^* = i_1 \frac{\left[t(w_A + w_B) - FC_1\right]}{FC_1}. \tag{3}$$

Further, the tax rate t and the ratio $\dfrac{i_2}{i_1}$ should also satisfy the following conditions:

$$t \geq \frac{(FC_1 + FC_2)}{w_A + w_B}; \tag{4}$$

$$t \leq \min\left\{\frac{w_A - FC_1}{w_A}, \frac{w_B - FC_2}{w_b}\right\}; \tag{5}$$

$$\frac{FC_2}{FC_1} \leq \frac{i_2}{i_1}; \tag{6}$$

$$\frac{t(w_A + w_B)}{t(w_A + w_B) - FC_1} > \frac{FC_1}{(1-t)w_A}. \tag{7}$$

Solving the utility maximization problem for the decision maker B (UMP$_B$) :

$$\max \ \ln x_B + \ln i_1 \tag{8}$$

s.t. $x_B \geq 0$; $i_1 \geq 0$; $x_B \leq (1-t)w_B + \dfrac{i_2}{i_1 + i_2} t(w_A + w_B) - FC_2$;

$$\pi_B = \frac{i_2}{i_1 + i_2} t(w_A + w_B) - FC_2 \geq 0; \ \ (1-t)w_B - FC_2 \geq 0;$$

$$\pi_A = \frac{i_1}{i_1 + i_2} t(w_A + w_B) - FC_1 \geq 0; \ \ (1-t)w_A - FC_1 \geq 0$$

we can find the optimal consumption levels of the PhG and IGs for B and the conditions for the tax rate t and the ratio $\dfrac{i_1}{i_2}$:

$$x_B^* = (1-t)w_B; \tag{9}$$

$$i_1^* = i_2 \frac{\left[t(w_A + w_B) - FC_2\right]}{FC_2}; \tag{10}$$

$$t \geq \frac{(FC_1 + FC_2)}{w_A + w_B}; \tag{11}$$

$$t \leq \min\left\{\frac{w_A - FC_1}{w_A}, \frac{w_B - FC_2}{w_b}\right\}; \tag{12}$$

$$\frac{FC_1}{FC_2} \leq \frac{i_1}{i_2}; \tag{13}$$

$$\frac{t(w_A + w_B)}{t(w_A + w_B) - FC_2} > \frac{FC_2}{(1-t)w_B}. \tag{14}$$

Combining the solutions (2)-(7) of UMP$_A$ (1) and the solutions (9)-(14) of UMP$_B$ (8) we obtain the following conditions for the consumption levels and the tax rate t:

$$\frac{i_1^*}{i_2^*} = \frac{FC_1}{FC_2}; \tag{15}$$

$$t = \frac{(FC_1 + FC_2)}{w_A + w_B}; \tag{16}$$

$$t \leq \min\left\{\frac{w_A - FC_1}{w_A}, \frac{w_B - FC_2}{w_b}\right\}; \tag{17}$$

$$x_A^* = (1-t)w_A; \tag{18}$$
$$x_B^* = (1-t)w_B. \tag{19}$$

In a symmetric case, when $w_A = w_B = w$ and $FC_1 = FC_2 = FC$, the Eqs. (15)-(19) imply

$$i_1^* = i_2^*; \tag{20}$$

$$t \leq \frac{1}{2}; \tag{21}$$

$$FC \leq \frac{w}{2}; \tag{22}$$

$$x_A^* = x_B^* = w - FC. \tag{23}$$

It is useful to compare received results (20)-(23) with the situation when the IGs i_1, i_2 are sold on the market for prices p_1 and p_2, respectively.

Solving the utility maximization problem for the decision maker A (UMP$_A$) in this case

$$\max \ \ln x_A + \ln i_2 \tag{24}$$
$$\text{s.t. } x_A \geq 0 \ ; \ i_2 \geq 0 \ ; x_A + p_2 i_2 \leq w_A + p_1 i_1 - FC_1 \ ;$$
$$\pi_A = p_1 i_1 - FC_1 \geq 0 \ ; \ \ \pi_B = p_2 i_2 - FC_2 \geq 0$$

we can find the optimal consumption levels

$$x_A^* = p_2 i_2^* = \frac{1}{2}\left(w_A + p_1 i_1 - FC_1\right). \tag{25}$$

Solving the utility maximization problem for the decision maker B (UMP$_B$)

$$\max \ \ln x_B + \ln i_1 \tag{26}$$
$$\text{s.t. } x_B \geq 0 \ ; \ i_1 \geq 0 \ ; \ x_B + p_1 i_1 \leq w_B + p_2 i_2 - FC_2 \ ;$$
$$\pi_B = p_2 i_2 - FC_2 \geq 0 \ ; \ \pi_A = p_1 i_1 - FC_1 \geq 0$$

we can find the optimal consumption levels

$$x_B^* = p_1 i_1^* = \frac{1}{2}\left(w_B + p_2 i_2 - FC_2\right). \tag{27}$$

Combining the solution (25) of UMP$_A$ (24) and the solution (27) of UMP$_B$ (26) we obtain the following conditions for consumption levels

$$x_A^* = p_2 i_2^* = \frac{2}{3}\left(w_A - FC_1 + \frac{1}{2}\left(w_B - FC_2\right)\right); \tag{28}$$

$$x_B^* = p_1 i_1^* = \frac{2}{3}\left(w_B - FC_2 + \frac{1}{2}\left(w_A - FC_1\right)\right). \tag{29}$$

Note, that i_1, i_2 are sold on the market for unlimited flat rate.

From the assumption, that profit is nonnegative we obtain the following conditions on the production costs:

$$FC_1 \leq \frac{1}{2}\left(w_B - FC_2 + \frac{1}{2}w_A \right); \tag{30}$$

$$FC_2 \leq \frac{1}{2}\left(w_A - FC_1 + \frac{1}{2}w_B \right). \tag{31}$$

In the symmetric case, when $w_A = w_B = w$ and $FC_1 = FC_2 = FC$, Eqs. (28)-(31) imply

$$FC \leq \frac{w}{2} ; \tag{32}$$

$$x_A^* = x_B^* = p_1 i_1^* = p_2 i_2^* = w - FC . \tag{33}$$

Comparing (32)-(33) with (22)-(23) we can conclude, that the case when production of the IGs i_1, i_2 is subsidized from the tax proceeds and the case when the IGs i_1, i_2 are sold on the market for unlimited flat rate are equivalent. Both cases result in the same consumption levels and the same condition on production costs. It is necessary to mention, that the model, where no monopoly power can be applied at pricing of information, was used as a benchmark. The both cases capture only one aspect of information production, which is zero marginal cost, and ignore the network effect and effect of "free riding". These effects will be incorporated in the model in future.

3. CONCLUSION

The hypothecated tax on IGs, when production of the IGs is subsidized from the tax proceeds according to relative usage of the products can create a private incentive for information production as well as remove barriers for information diffusion and inefficiencies caused by current monopoly rights on intellectual property. The paper presents an original model, which describes exchange and production of the IGs subsidized from hypothecated tax. This model is compared with the case when the IGs are sold on the market for unlimited flat rate. It was found that under assumption of homogeneous wealth and cost distributions the both cases result in the same consumption levels and the same condition on production costs.

ACKNOWLEDGEMENT

REFERENCES

Arora, Ashish, Marco Ceccagnoli and Wesley Cohen (2008), "R&D and the Patent Premium", *International Journal of Industrial Organization*, Vol. 26, No. 5, pp. 1153-1179.

Arundel, Anthony (2000), "Patent – the Viagra of Innovation Policy?", *Internal Report to the Expert Group in the Project "Innovation Policy in a Knowledge-Based Economy"*, Maastricht, MERIT.

Cohen, Wesley M., Akira Goto, Akiya Nagata, Richard R. Nelson and John P. Walsh, (2002) "R&D Spillovers, Patents and the Incentives to Innovate in Japan and the United States", *Research Policy*, Vol. 31, pp.1349–1367.

Cotropia, Christopher A. and Mark A. Lemley (2009), "Copying in Patent Law", North Carolina Law Review, Vol. 87, p 1421.

Lemley, Mark A. (2011), "The Myth of the Sole Inventor", *Stanford Public Law Working Paper.* Available at SSRN: http://ssrn.com/abstract=1856610.

Varian, Hal. R. (1996), "Differential Pricing and Efficiency", *First Monday,* Vol. 1, No. 2
http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/473/394

Varian, Hal R. (2001), "Economics of Information Technology", a revised version of the Raffaele Mattioli Lecture, delivered at Bocconi University, Milano, Italy, on November 15-16, 2001 and the Sorbonne on March 6, 2003.
http://people.ischool.berkeley.edu/~hal/people/hal/papers.html

Varian, Hal R. (2005), "Universal Access to Information", *Communications of the ACM,* Vol. 48, No. 10
http://people.ischool.berkeley.edu/~hal/Papers/2006/univ-access-info.pdf

World Intellectual Property Organization (WIPO) http://www.wipo.int/ipstats/en/