Patent Policy

Legal–economic effects in a national and international framework

Pia Weiss

The Economics of Legal Relationships

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To my father

Abbreviations

$[a, b]$	closed interval
(a, b)	open interval
$\{a, b\}$	set
$\mathbb{R}_+$	set of positive real numbers
$\mathbb{R}_0$	set of non-negative real numbers
a_i^I	aggregated research effort of $n_i - 1$ firms
α	appropriability measure
b	patent breadth
β	efficiency parameter
$c(\cdot)$	production cost function
$C(\cdot)$	research cost function
d	index for the Markov-state
$d(\cdot)$	instantaneous deadweight loss
δ	deadweight loss relative to monopoly profits
E	expectation operator
$F[u_k]$	cumulative distribution function for the improvement size of an invention
$f[u_k]$	corresponding density function to $F[u_k]$
g_i	particular path of history until i
G_i	set of histories that lead to g_i at i
h	research effort
H_i	industry research effort
$\mathfrak{h}$	hazard rate for firms
i, l	country index
j	firm index
k	patent race index
$k(t)$	renewal fees
K	patent fees
λ_i	innovation efficiency of country i firms
$\bar{\lambda}_i$	some cut-off level of the innovation efficiency of country i firms
n_i	number of firms in country i
p	price
$\pi_{ji}(z)$	general, state-dependent instantaneous (flow) profit
π^c	instantaneous (flow) profit under competition

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π^m	instantaneous (flow) profit for a monopoly
ψ	maximum of the non-obviouness standards
$Q(\cdot)$	demand function
q_i	market demand; market share
r	exogenous interest rate
$r(\cdot)$	best response function
$R(\cdot)$	aggregated best response function
ρ	minimum of the non-obviousness standards
s	non-obviousness standard
σ	consumers' surplus relative to monopoly profits
T	patent term
θ	probability that a given inventions satisfies the non-obviousness standard
u_k	improvement size of the kth invention upon the preceding one
U_k	cumulated quality
$V_{ji}(z)$	general, state-dependent value function
$w(z)$	instantaneous welfare
ϖ	hazard rate for the society
$W_i(z)$	general, state-dependent welfare function
x	disutility parameter
y	patent scope
$Z[\cdot]$	distribution of the history
z	*state* of a Markov chain
z^C	state challenger of the Markov chain
z^I	state incumbent of the Markov chain

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1 General introduction

Patent rights seem to be a policy instrument that provokes great controversy. Proponents claim that, although not perfect in design, patent systems facilitate innovation, stimulate economic growth and therefore raise social welfare. Opponents point out that patent systems create an entry barrier for small innovative firms, are used as an anti-competitive device and bar access to modern technologies for poor countries; thus, patent systems reduce social welfare. Discussions about the advantages and disadvantages have accompanied the entire history of patent systems and will certainly continue.

Over the decades, a vast body of theoretical and empirical literature on patent systems, patent instruments and related issues, such as innovation and licensing, has been accumulated. The focus of the literature has shifted. Formerly, an answer to the *grand question* of whether or not patent systems as a whole should be relied on to foster innovations has been sought. Nowadays, only few scholars study alternative mechanisms to encourage new and (socially) useful inventions. Instead, ways are explored that are likely to improve the effectiveness and the efficiency of *existing* patent systems.

The shift in the principal object of inquiry is not so much a proof of failure to answer the *grand question*; rather, it bears witness to the fact that patent systems have become extremely complex instruments, and that we know surprisingly little about how they work.

A number of policy instruments have been studied, but mostly without reference to an international framework. This is remarkable especially because the import of technology or the role of national patent laws as a trade barrier were important factors in establishing and shaping patent systems. The most recent example is the Agreement of Trade Related Aspects of Intellectual Property (TRIPs Agreement) which creates a minimum standard for the protection of intellectual property with which every member of the World Trade Organization (WTO) has to comply. Some of the developing countries might only have ratified the TRIPs Agreement because they expected it to have a positive effect on their economic development. Although there is empirical evidence for this supposition, there are also studies that cast serious doubt on this hypothesis.

To shed some light on the circumstances under which developing countries may benefit from a certain patent regime is reason enough to examine the effects of patent instruments again. Yet, even for industrialized countries, the exercise may yield new insights as to how the performance of existing patent systems can be improved in an increasingly globalized world economy.

The present work does not attempt to provide an exhaustive treatise of patent instruments and their effects. Innovation activities are one of the most important aspects of economic life. Patent systems aim at increasing welfare by increasing or decreasing the incentives to create innovations. It has been demonstrated that the market structure does affect innovation activities and that a successful invention potentially changes the market structure in a given industry. Consequently, in answering the question of how to design a patent system, related issues such as competition policy and especially prevailing anti-trust regulations should be taken into account. Although certainly interesting and instructive, these aspects are beyond the scope of the present work.

Even if attention is restricted to the instruments of patent systems, the endeavour proves to be too ambitious. The patent system not only consists of the patent law. Some provisions are deliberately formulated in rather general terms so that the patent law becomes a flexible tool that is able to cope with present and future developments. Therefore, the patent office and the courts have considerable discretion. The guidelines of the patent offices or the case law developed by the courts are the result of the attempt to use this discretion in a systematic manner. Social tendencies, such as the anti-trust movement in the 1920s and 1930s in the United States, have certainly influenced patent guidelines and the case law. Again, a thorough investigation into the performance of any patent system has to take these factors into account. Since these *informal* sets of rules and customs are country specific, they have to be neglected when the general mechanisms of certain patent instruments are to be studied.

The present work, then, exclusively focusses on a few provisions and patent instruments that may well be regarded as the core of patent law: the patent requirements, patent length and the scope of a patent. It is demonstrated how changes in these policy instruments affect social welfare. In this way, conclusions on the circumstances under which a certain level or combination of the patent instruments proves to be optimal can be drawn.

The national framework

Patent law is restricted to a nation's territory, so it is natural to commence the examination of the effects of patent policy instruments in a framework of a closed economy. Indeed, most of the existing literature on patent policy relies on a model economy without international relations. The attention to a closed economy is well chosen, especially because the intricacies and the interplay of policy instruments require further study.

Consequently, patent instruments in a national framework constitute a principal part of the present work. Here, the effects of single and combinations of policy

instruments can be studied in a richer setting. In addition, the results provide a useful benchmark against which results obtained from an international framework can be evaluated.

The international framework

Although patent law is bounded by a country's border, it may have international consequences. Foreigners may apply for and be granted domestic patents. In case the underlying invention is turned into a marketable product which is produced in or imported into the domestic country, profits flow into the foreign country. Consequently, the design of the national patent system does not only affect domestic but also foreign welfare.

These cross–border profit flows may reach remarkable levels. Within the group of industrialized countries, flows into and out of a given country may have a similar magnitude. In this case, one might argue, using an international framework as the object of inquiry is not really necessary. Even if this argument were to hold true, the situation is completely different for developing countries. Almost by definition, firms in developing countries have only a limited capability of undertaking research and, therefore, of creating patentable inventions. As a consequence, the resulting net profit flows out of a developing country may well reach a level where they have to be considered when the efficiency of the patent system is to be improved.

The structure of the book

The work is divided into three parts. The first provides general information on patent systems. The second is dedicated to effects of patent policy instruments in a closed economy, whereas the third introduces two policy instruments in an open economy.

The first part commences with an overview of the history of patent systems and different attempts to justify intellectual property rights in the form of patents. It is demonstrated that patent systems are an extremely flexible policy tool. Indeed, this characteristic might be crucial in explaining why patents nowadays dominate alternative incentive mechanisms such as prizes or awards. Subsequently, a short introduction into patent law is given.

The second part presents models that focus on one patent instrument each. In particular, patent length, patent scope and breadth as well as the non–obviousness standard are considered. The questions to be answered, however, remain the same: (1) Given that the number of policy instruments is limited, how should the patent system be designed and, (2) which factors affect the optimal design.

Traditionally, policy recommendations for developing countries or specific technology fields or industries are made on the basis of the results obtained in Part II. Usually, the results are adapted so as to take deviating country characteristics into account. However, it seems undisputed that identical economies should

use the same design for their patent system. In Part III, the policy instrument of *patentable subject matters* and the non-obvious standard are used to demonstrate that the external effects generated by inventions are strong enough so that national patent laws can correct the associated incentive structure only to a limited degree. As a consequence, even identical countries may benefit from internationally heterogeneous patent systems.

Part I

Patent systems and patent law

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