Journal of Economic Dynamics & Control 36 (2012) 851–861

Contents lists available at SciVerse ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Intellectual property rights protection and endogenous economic growth revisited

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ARTICLE INFO

Article history:
Received 3 November 2010
Received in revised form
9 September 2011
Accepted 30 December 2011
Available online 14 January 2012

JEL classification:
O31
O34
O4

Keywords:
Intellectual property rights
Innovation
Lab equipment model
Patent protection
Growth

ABSTRACT

We present an analytical solution to the lab-equipment R&D growth model with an exogenous rate of imitation and apply it to study the optimal level of intellectual property rights (IPR) protection. This has already been studied in Kwan and Lai (2003); however, a mistake in writing out the dynamics of the problem has contaminated that analysis. For the whole parameter space considered there, the conclusion is no longer to strengthen IPR protection partially, but fully (a result which we prove analytically for the logarithmic utility function). The usual tradeoff persists, though, for different choices of parameters.

1. Introduction

It is well known that the issue of protection of intellectual property rights (IPR) presents governments with a tradeoff. On the one hand, by lessening the public good character of ideas and being beneficial to entrepreneurship, IPR protection alleviates possible underinvestment problems that arise in the knowledge market and may, thereby, foster economic growth and welfare.[1] On the other hand, by favoring a less competitive economic environment, it might also bring about a short-term welfare reduction.

Since Tandon (1982), Judd (1985) and Gilbert and Shapiro (1990) prescriptions of an infinite-length patent policy, several studies using diverse models and methods have shown that, on the contrary, optimal patent length could be expected to be finite. Some examples are Horowitz and Lai (1996), Iwaisako and Futagami (2003), Koléda (2004), and, more recently, Horii and Iwaisako (2007), Futagami and Iwaisako (2007), Furukawa (2007), Bessen and Maskin (2009), Acs and Sanders (forthcoming) and Chen and Iyigun (2011).

Here we shall pursue a simple solution to the IPR tradeoff by working within the "lab-equipment" general equilibrium model of endogenous growth of Rivera-Batiz and Romer (1991), in which the R&D sector uses final good as input for the production of blueprints. Here, R&D is responsible for "horizontal" innovation (in product variety), in contrast to Schumpeterian

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[1] This effect has been empirically evaluated in Gould and Gruben (1996), Park and Ginarte (1997), Schneider (2005) and Falvey et al. (2006).

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doi:10.1016/j.jedc.2011.12.005

“vertical” innovation (in product quality). Added to the model is an exogenous imitation rate a la Krugman (1979) (also used by Barro and Sala-i-Martin, 2004, Chapter 6.2; and by Gancia and Zilibotti, 2005, Section 2.3), associated with the prevailing level of IPR protection.

The first effect of the tradeoff above, related to long-term growth, will derive essentially from the usual Euler equation. By giving the model a global analytical solution (unlike any other analyses of this model of which we are aware in the literature), it becomes possible to precisely gauge the second effect, the one which emerges from the instantaneous change in the consumption level. In this way all the dynamic welfare gains/losses related to a change in IPR protection policy can be taken into account.

Kwan and Lai (2003) uses this same model in order to analyze optimal patent protection. However, that analysis contains a mistake in the writing out of the dynamics of the problem which ends up contaminating the results.[2] Iwaisako and Futagami (2003) also addresses this issue in a model equivalent to the one presented here, although using a fixed-length patent system, rather than an imitation rate of invented varieties. However, they limit their welfare analysis to steady states. The present paper considers the whole dynamic path.

This paper shows, in contrast with Kwan and Lai (2003), that for the whole set of parameter vectors considered there, the optimal policy is always that of providing *full* (infinite-length) protection of IPR—and not an incomplete one. This is to say that, when restricted to the parameter values used by Kwan and Lai, the IPR protection tradeoff has in fact a corner solution, and the model’s policy implication is that governments should pursue an infinite-length patent policy. In particular, if utility is logarithmic, we prove that this conclusion is valid irrespective of any other parameter values.

We also provide examples based on a parameter set other than the one worked out by Kwan and Lai (2003). In such cases, their insight that the present model is able to generate incomplete optimal patent protection happens to be correct. The IPR protection tradeoff may then have an interior solution, meaning that the optimal policy may be that of inaction (in very specific situations), loosening, or partial tightening of patent protection.

The structure of the paper is as follows. Section 2 presents the model and covers the growth effect of the IPR protection tradeoff. Section 3 gives the closed-form solution for its dynamic path and evaluates the current-consumption effect. Section 4 builds on the foundations established in the two previous sections to consider the optimal IPR protection problem, first analytically (through Proposition 3) and then numerically. Section 5 concludes.

2. The model

Following Kwan and Lai (2003) or Gancia and Zilibotti (2005, Section 2.3), the representative household seeks to maximize

$$U=\int_0^{+\infty} e^{-\rho t}u(c_t)\,dt, \tag{1}$$

where u is the CRRA function

$$u(c)=\begin{cases}\frac{c^{1-\theta}-1}{1-\theta} & \text{if } \theta\neq 1,\\ \log c & \text{if } \theta=1\end{cases}$$

subject to the budget constraint $\dot{b}=w+rb-c$, where consumption c is in terms of the final good, r is the rate of return on assets held b (which equals b_0 at time 0 and must be nonnegative for sufficiently advanced time), and w is the wage rate paid by final-good firms. This problem implies the standard Euler equation

$$\gamma := \hat{c}=\frac{r-\rho}{\theta}, \tag{2}$$

as well as the transversality condition $r>\gamma$ (throughout the paper, “^” will stand for growth rate).

Firm $i\in I$ produces final goods according to the homogeneous production function $Y_i=L_i^{1-\alpha}\int_0^A x_{i,j}^{\alpha}\,dj$, where L_i is the labor input, $x_{i,j}$ is the quantity of index-j intermediate good being used as input, to which an elasticity of $\alpha\in(0,1)$ corresponds, and A is the measure of existing intermediate goods. In order to maximize profit $Y_i-wL_i-\int_0^A p_j x_{i,j}\,dj$, the demand of firm i (who is a taker of prices p_j in the intermediate goods market) satisfies $x_{i,j}=L_i(\alpha/p_j)^{1/(1-\alpha)}$.

Let $x_j := \sum_{i\in I}x_{i,j}=L(\alpha/p_j)^{1/(1-\alpha)}$, where $L:=\sum_{i\in I}L_i$. It is convenient to write the production function in an aggregate form, noting that $x_{i,j}/L_i=x_j/L$:

$$Y:=\sum_{i\in I}Y_i=\sum_{i\in I}L_i^{1-\alpha}\int_0^A\left(L_i\frac{x_j}{L}\right)^{\alpha}dj=\sum_{i\in I}L_i\int_0^A\left(\frac{x_j}{L}\right)^{\alpha}dj=L^{1-\alpha}\int_0^A x_j^{\alpha}\,dj. \tag{3}$$

The version of the lab-equipment model we use here prescribes that the representative of the R&D sector who invented intermediate good j will produce it using a unit of the final good.[3] Thus, it chooses p_j seeking to maximize $(p_j-1)x_j$ within

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[2] Edwin L.-C. Lai and Yum K. Kwan have been invited by the editor to submit their views, but have declined to do so.

[3] The original lab-equipment model (see Rivera-Batiz and Romer, 1991) assumes that firms produce intermediate goods using capital. In this paper, we borrow this terminology (lab equipment) from Rivera-Batiz and Romer (1991) but assume, as in Barro and Sala-i-Martin (2004), that the production of intermediate goods demands final good, rather than capital.