

Are Lawyers Good for Growth?

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Abstract:

This paper considers the role of private legal activity in determining the rate of economic growth. We develop a Schumpeterian growth model in which private expenditures on IPR enforcement by profit-seeking patent holders, which we term “rent protection”, influences the level of patent protection. The model incorporates two, potentially offsetting effects of rent protection on the rate of innovation. First, it increases the cost of research to innovators seeking to replace the current patent holders. The *research cost effect* reduces the rate of innovation. Second, rent protection deters imitation, which increases the expected return to successful innovation. This *market share effect* increases the rate of innovation. We find that the net effect of rent protection on growth depends on the strength of public IPR protection: at the margin, lawyers increase growth in countries with moderate levels of public IPR protection, and decrease growth in countries with weak and strong IPR protection. We also find that accounting for private IPR protection increases the argument for research subsidies. Finally, we find that stronger levels of public IPR protection unambiguously increase social welfare, a result that is at odds with well-established results in the literature on optimal IPRs.

Key words: Technological Change, Institutions, Growth, Intellectual Property Rights, Rent Seeking

JEL Codes: O1, O34, O43

Section 1: Introduction

Models of endogenous technical progress are an important tool for understanding the role of intellectual property rights (IPRs) in determining the rate of economic growth. Following the seminal contributions of Romer (1990), Aghion and Howitt (1992) and Grossman and Helpman (1991), this literature has been built around the notion that IPRs provide innovators with a stream of monopoly profits that serve to motivate private actors to undertake costly research activities. While much of this literature assumes perfect protection of IPRs in the form of “infinitely-lived” patents, an important strand of this research allows for incomplete or insecure IPRs.

One strand of the literature on IPRs and growth considers how the public enforcement of intellectual property rights affect innovation and welfare. In an open economy North-South model, Helpman (1993) shows that stronger IPR protection both increases the rate of innovation and distorts consumption decisions due to the influence of monopolist market power. As a result, incomplete IPR protection is welfare maximizing. In a similar model, Kwan and Lai (2003) derive an explicit expression optimal strength of IPRs in a closed economy. O’Donoghue and Zweimueller (2004) use a quality-ladder model of endogenous growth to consider optimal patent design, including patentability and leading breadth. Grossman and Lai (2004) consider why the optimal IPR regime, as characterized by the length and strength of patent protection, might differ across countries in the global economy.

While the papers cited above treat IPR protection as a function of the public sector, recent contributions by Dinopoulos and Syropoulos (2007) and Eicher and Garcia-Peñalosa (2007) endogenize the strength of IPRs by assuming that *de facto* IPRs depend on the level of private resources devoted to IPR enforcement. While both papers recognize the critical role that private

actors play in initiating and pursuing actions to defend their intellectual property, they reach very different conclusions regarding the benefits of private IPR enforcement.

Dinopoulos and Syropoulos (2007) model the private IPR enforcement as activity that deters innovation and prolongs the duration of monopoly power. They develop a Schumpeterian, quality-ladder model in which current patent holders are threatened with replacement by researchers who are attempting to develop a higher quality variety of their good. To protect their rents, patent holders devote resources to litigation and lobbying, which reduces the instantaneous probability of successful innovation. Because it serves to block the next round of innovation, private IPR enforcement reduces the rate of innovation and growth.

In contrast, Eicher and Garcia-Peñalosa (2007) assume private IPR enforcement deters imitation rather than innovation, and thereby increases the profit flow of the monopolist. They investigate endogenous IPRs in an expanding varieties innovation model, in which new innovations complement rather than replace previous patent holders. In their model, then, the profit flows of current patent holders are reduced by the prospect of imitation. The devotion of resources to private IPR enforcement reduces the probability of imitation, which raises the expected return to innovation and with it the rate of economic growth. As a result, private IPR enforcement efforts is a growth-promoting activity.

We contribute to this literature by developing a Schumpeterian model that incorporates two threats to the rents of current patent holders, replacement by a successful innovator and loss of current market share to imitators. The patent holders can engage rent protection by expending private resources on IPR enforcement, for example by hiring lawyers to engage in litigation or lobbyists to influence policy outcomes. An incremental increase in the intensity of rent protection has two effects on the incentive to engage in research. The *research cost effect* refers

to the idea that, as in Dinopoulos and Syropoulos, rent protection increases the research difficulty in the next R&D race, increasing the cost of research. The *market size effect*, as in Eicher and Garcia-Peñalosa, private IPR enforcement increased rent protection lowers the share of the market lost to imitators, and thereby raises the reward for successful innovation.

Because rent protection increases both the cost and expected returns to innovation, it may increase or decrease the equilibrium rate of innovation and growth. The primary contribution of the paper is to show that the relative strength of these two effects depends on the strength of public IPR protection and does so in a non-linear fashion. In particular we find public and private IPR protection are substitutes. As a result, rent protection tends increase the rate of growth when public IPR enforcement is relatively weak. However, if public IPR enforcement is below a particular threshold, the return to research is too low to generate positive rates of innovation. In this case, rent protection has no impact on economic growth and unambiguously decreases social welfare.

We also consider how private IPR enforcement affects central policy issues related to innovation and growth. Like Helpman (1993) and the related literature much, our model suggests that public IPR enforcement involves a trade-off between static consumption gains and dynamic gains in the form of more rapid economic growth. However, unlike, we find that the dynamic welfare effects dominate, such that perfect public IPR protection is welfare maximizing, a result that hinges on the gap between the social and private discount rates on the returns to innovation. This finding suggests that future work on the optimal design of IPR regimes ought to account for how private legal activity responds to changes in public IPR protection.

Our paper also contributes to the larger debate regarding the role of law in economic growth. To a large extent this literature tends to stress the positive role of public sector legal

activity and the negative role of private legal actions. Thus, economists from Adam Smith (1976) to Douglas North (1990) have stressed the fundamental role of the public protection of private property rights to economic growth and development. In contrast, Krueger (1974), Olson (1982) and Murphy, Shleifer and Vishny (1991) have made a persuasive case for the detrimental impact of private rent seeking. Allocating resources to rent seeking both reduces the resources available for productive activities and distorts relative prices, thereby diminishing the efficiency with which the market system functions.

We break from this line of research by recognizing a positive social role for private legal activity. Because the rents accruing to patent holders are in part the legitimate rewards to socially beneficial research, private rent seeking regarding intellectual property may decrease the gap between private and social returns. In positing a positive role for private legal activity, we follow Hayek (1960) and Rubin (1982), who cast private litigation in an important social role in driving the efficiency of commercial law in common law countries, and Becker (1993) and Wittman (1989), who argue that private lobbying increases the efficiency of democratic political markets.

Finally, our paper addresses what we view as the central gap in the literature on economic growth. Following the seminal contributions of Romer (1990), Aghion and Howitt (1992) and Grossman and Helpman (1991), models of endogenous technical progress have been at the center of theorizing on economic growth. In contrast, the dominant theme in the empirical growth literature has been the importance of institutions and, in particular, the protection of property rights as demonstrated by Acemoglu et al. (2001) among others. Closing this gap will require a much better understanding of how different institutional structures affect the incentives to engage in technological change. Modeling the role of IPRs in technological progress is one place to

start. Indeed, by addressing how private actors respond to public IPR regimes, we are responding to the issue that North (1990) places at the center of economic growth: whether institutions serve to align private and social returns to various economic activities.

Section 2: The Model

Monopoly and Parallel Markets

There is a unit continuum of goods indexed by $\theta \in [0,1]$. In each industry, there exists an incumbent who has the exclusive legal right via a patent to produce the highest quality good. These rights, however, are incompletely enforced, so that the incumbent only captures a fraction $(1-m)$ of the available market. In this portion of the market, which we call the *monopolized* market, the incumbent can charge a mark-up over marginal cost and enjoys monopoly profits. The remainder of the market, which we call the *parallel* market, is supplied by a competitive fringe of imitators that produce the good under perfectly competitive conditions and thus price at marginal cost. In the parallel market, production of the highest available quality good can take place with or without infringing the patent, e.g., counterfeiting, imitating around the patent, adopting the central idea without infringing the patent, etc.

The parallel market captures the presence of a number of disparate activities that stem from imperfect IPR protection and result in reduced market share and profit for patent holders. For example, the degree of patent protection may vary across space, a point central to the analysis of international IPR enforcement by Helpman (1993) and others, or geographically within a country if the rule of law is unevenly enforced. A second possibility is the existence of parallel markets in the form of pirated goods produced by extra-legal firms in the informal

sector, a common phenomenon for branded goods even in industrialized countries. A third possibility occurs when new innovations incorporate and serve to introduce a number of new ideas, some of which are inevitably of a relatively public nature and are harder to protect under IPR law. For example, within a year of the introduction of Apple's I-Phone in 2007, Samsung and Blackberry had produced cellular phones that imitated Apple's touch-screen design. Similarly, numerous internet search engines have created algorithms based on Google's idea of using links to rank web pages, and the success of quick-dry apparel company Under Armor has led many companies to offer products in this particular product line.

These forms of parallel market activity are based on different microeconomic foundations - the uneven enforcement of IPRs across space, the extra-legal status of imitators, and partially public nature of some ideas – that constitute different kinds of challenge to the patent holder. Rather than formalize these differences in the model, we focus on two characteristics that all three forms of parallel market activity have in common. First, as noted above, we allow for imitated goods to compete with the patented good and thereby reduce the patent holder's market share and profit. To avoid complications involving the simultaneous coexistence of the monopoly and parallel markets, we treat the share of the market lost to imitators as the probability that the entire market is lost to imitators for a small increment of time, dt , as suggested by Grossman and Lai (2004).

Second, we assume that the degree of IPR enforcement, and thus the losses to the parallel market, are functions of private lobbying and legal actions by incumbent monopolists. Private litigation by patent holders may impose significant costs on current imitators and deter potential entrants. For example, Lerner (1995) finds the cost of patent litigation cases started in 1991 will account for 27% of total R&D expenditures of US companies in that year. Similarly, according

to Lanjouw and Cockburn (2000) private lobbying efforts appear to have influenced the US government's efforts in promoting IPR protection in both bilateral and multilateral negotiations. As noted earlier, the assumption that private actors play a critical role in IPR enforcement distinguishes our approach from most of the literature on IPRs and growth. Notable exceptions include Dinopoulos and Syropoulos (2007), Eicher and Garcia Peñalosa (2007) and Sener (2008).

Households

There is a unit continuum of infinitely lived dynastic households. Each family starts model time, $t = 0$, with a single member and grows at an exogenous rate n , such that population size at time t is given by $N(t) = e^{nt}$. Households discount future utility at a rate $\rho > 0$, so that dynastic utility is given by

$$(1) \quad U = \int_0^{\infty} e^{-(\rho-n)t} \log u(t) dt .$$

We assume the household discount rate is positive: $\rho - n > 0$. Instantaneous per capita utility, $u(t)$, is defined as follows:

$$(2) \quad \log u(t) = \int_0^1 \log [\lambda^k Z(k, \theta, t)] d\theta .$$

The variable $Z(k, \theta, t)$ is the consumption of good θ of quality k at time t . The parameter $\lambda > 1$ defines the size of quality improvements. Equation (2) has a familiar Cobb-Douglas structure,

$u(t) = \prod_{\theta=0}^1 \lambda^k Z(k, \theta, t)$, with a unit exponent on each. The resulting demand functions are

identical across industries, with

$$(3) \quad Z(k, \theta, t) = cN(t) / p ,$$

where c is nominal per capita consumption expenditure and p is the price of the good. Adjusted for quality, goods in an industry perfect substitutes, so that consumers will purchase only the good with the lowest quality adjusted price.

Maximizing (1) subject to an intertemporal budget constraint produces the familiar equation of motion for per capita consumption expenditure:

$$(4) \quad \frac{\dot{c}}{c} = r - \rho.$$

where r is the market rate of interest. In the steady state, $r = \rho$ such that nominal consumption expenditure is constant. Economic growth takes the form of increases in utility due to the introduction of higher quality goods available at a constant set of prices.

Production

For each industry, the product market consists of monopolized and parallel markets. Producers engage in price competition. In the monopolized market, the quality leader (i.e., the patent holder) competes with quality followers who can produce the one-step-down quality product. The production technology is linear with a unit labor input requirement such that firm output equals employment. Thus the marginal cost of production equals the wage, which is taken to be the *numeraire*: $w = 1$. Given the equal production costs, the patent holder can drive the quality followers out of the market by engaging in limit pricing. More specifically, the leader offers the lowest quality-adjusted price by charging $p^L = \lambda$. The quality followers cannot do better than break even and exit the market.

In the parallel market, where the quality leader's patent cannot be enforced, there exists a competitive fringe of imitators who produce the top quality product. Price competition implies

marginal cost pricing, $p^M = 1$. At each moment in time, the expected production of a representative good is given by

$$(5) \quad Z^e(t) = \left[\frac{1 + (\lambda - 1)m}{\lambda} \right] cN(t)$$

Equation (5) shows that expected consumption of each good is increasing in the share of the parallel market m , since in this market goods are offered at a lower price compared to the monopolized market. Exploiting symmetry across goods, with unit labor input requirements and a unit interval of goods, employment in the production sector is given by

$$(6) \quad N_Q(t) = \frac{1 + (\lambda - 1)m}{\lambda} cN(t)$$

Innovation

Entrepreneurs in each industry participate in R&D races to invent higher quality products. At any point in time, the current patent holder faces multiple entrepreneurs who seek to replace her as the market leader by discovering the good one step up the quality ladder. The patent holder may seek to deter these entrepreneurs by engaging in rent protection and thus prolong her market dominance.

An entrepreneur j that invests $R_j(t)$ in research at time t discovers the next higher-quality product with instantaneous probability $i_j = \frac{R_j(t)}{X(t)}$, where $R_j(t)$ is the entrepreneur's investment in R&D and $X(t)$ is the incumbent's intensity of rent protection. Let V denote the value of a successful innovation, a_R the unit labor requirement in R&D and s_R the subsidy rate for research expenditures. Free-entry into R&D implies:

$$(7) \quad \begin{cases} i_j V(t) - (1 - s_R) a_R R_j(t) \leq 0 \\ R_j(t) \geq 0 \end{cases}$$

where strict equality must hold in exactly one of the lines of (7). $i_j V$ is challenger j 's expected reward from undertaking R&D and $(1 - s_R) a_R R_j(t)$ is her expenditure on R&D. Free entry in the research sector implies that in every industry with positive research expenditure, the cost of research must equal the expected gain:

$$(8) \quad V(t) = (1 - s_R) a_R X(t).$$

In this equation, the equilibrating mechanism works through the value of the firm, $V(t)$, which is decreasing in the intensity of research effort. Similarly, the absence of R&D in an industry indicates that the costs exceed the expected gains.

The probability of successful discovery, is assumed to be independently distributed over entrepreneurs, industries and time, so that the probability of innovation is uniform across industries. For a representative industry, the rate of innovation is found by summing over the probabilities for each researcher:

$$(9) \quad i = \sum_j \frac{R_j(t)}{X(t)} = \frac{R(t)}{X(t)}$$

In each industry, the arrival of innovations follows a Poisson process with intensity i , which we call the rate of innovation. Total employment in research is given by:

$$(10) \quad N_R(t) = a_R R(t).$$

Imitation

We model the share of the parallel market m as an endogenous variable determined by

$$(11) \quad m = \frac{\mu N(t)}{X(t)}.$$

In this equation, m increases with $N(t)$: the larger the population size, the greater the number of potential imitators and the larger the absolute scope of the parallel market. This formalization captures the idea that it takes greater resources to enforce property rights in a more extensive market. This is in the spirit of Aghion and Howitt (1998, Chapter 12).

The parameter $\mu > 0$, which we refer to as the ease of imitation, captures the *public* component of patent protection. In general, μ will be lower in countries that provide more effective enforcement of IPRs through courts, police and other administrative mechanisms. The endogenous variable $X(t)$ is determined by the optimal rent protection decisions of patent holders and hence captures the *private* component of patent protection. Employment in rent protection is given by

$$(12) \quad N_x = a_x X.$$

Rent Protection

The level of rent protection is chosen by patent holders to maximize the value of their firms. A useful benchmark in analyzing this decision is the instantaneous profit of an incumbent that does not face competition from a parallel market, which is given by

$$(13) \quad \pi(t) = \left[\frac{\lambda - 1}{\lambda} \right] cN(t).$$

Actual profit differs from this for two reasons. First, imitators capture a share m of the total market, reducing the quality leader's profits by $m\pi(t)$. Second, incumbent firms can engage in costly rent protection activities that take the form of lobbying and litigation in defense of the incumbent's intellectual property rights. These activities are assumed to be non-rival in that they

simultaneously deter entry by innovators and restrict the size of the parallel market. Accounting for these two factors, the incumbent's instantaneous profit is given by

$$(14) \quad \hat{\pi}(t) = (1 - m)\pi(t) - (1 - s_x)a_x X(t),$$

where a_x is the unit labor requirement in rent protection and s_x is the subsidy on rent protection activities.

In equilibrium, the value of the firm $V(t)$ is determined by an arbitrage condition that holds that at each point in time, which equates the expected returns on the stocks issued by the incumbent firm to the market interest rate $r(t)$. This condition takes the form:

$$(15) \quad rV(t) = (1 - m)\pi(t) - (1 - s_x)a_x X(t) - iV(t) + \dot{V}$$

The left-hand side of this equation is the return available if the firm's owners invested in risk-free bonds. On the right-hand side, the first two terms are the instantaneous profits. The third term is the loss incurred if the firm is replaced by a successful innovator. The final term captures the capital gain due to the increase in the value of the firm. Substituting (9) and (11) into the arbitrage condition (15) to eliminate m and i , and maximizing (15) with respect to X , we find that the optimal level of rent protection is given by

$$(16) \quad (1 - s_x)a_x X = m\pi + iV$$

Equation (16) implies that the optimal level of rent protection occurs when the cost of rent protection equals the reduction in profits due to imitation plus the instantaneous expected loss to replacement.

Substituting (16) into the stock market arbitrage condition (15) gives an expression that relates the value of the firm to its potential profits:

$$(17) \quad V(t) = \left[\frac{1 - 2m}{\rho - n + 2t} \right] \pi(t)$$

(17) implies that the value of the firm equals potential instantaneous profit discounted by the effective discount rate,

$$(18) \quad \rho^* = \frac{\rho - n + 2i}{1 - 2m}.$$

The effective discount rate is the household discount rate adjusted for the risk of replacement, losses to imitation, and the cost of rent protection. Recall from (16) that the cost of rent protection effectively doubles the losses from imitation and replacement, which accounts for the doubling of i and m .

A second implication of (17) is that the firm has negative value if the parallel market share is greater than one-half. Since the only asset the firm owns is the patent for the good it produces, this result implies that when the parallel market is large, intellectual property is not sufficiently valuable to profitably protect. In this case, equations (16) and (17), our expression for optimal rent protection and firm value, are replaced by

$$(19) \quad X = V = 0.$$

With the value of intellectual property too low to warrant protection, research activity is also absent.

The First Steady State Condition: Relative Profitability of Rent Protection and R&D

We establish the steady-state equilibrium by reducing the model to two equations in i and m . The first steady state equation, called the relative profitability condition, is derived from the conditions for optimal rent protection and R&D, (16) to (8):

$$(20) \quad \frac{(1 - s_x)a_x}{(1 - s_R)a_R} = \frac{m\pi + iV}{V}.$$

In (20), the left-hand side is the cost of rent protection relative to the cost of research. The right-hand side is the return to rent protection relative to the return to research. Substituting our expression for the value of the firm in (17) into (20), provides our first steady state condition, SS1, the relative profitability condition:

$$(21) \quad i = \frac{(1-s_x)a_x}{(1-s_R)a_R} - \left[\rho - n + 2 \frac{(1-s_x)a_x}{(1-s_R)a_R} \right] m$$

Equation (21) defines a negative relationship between i and m , as is shown in Figure 1.

The vertical intercept of the SS1 curve indicates the maximum rate of innovation,

$$i_{\max} = \frac{(1-s_x)a_x}{(1-s_R)a_R},$$

which obtains when the monopolist captures the entire market. From that

point, innovation decreases with increases in the parallel market share. Intuitively, the greater the share of the parallel market m , the lower the less the expected return to research, and the lower the equilibrium rate of innovation. Substituting (21) into (18) gives a parsimonious expression for the effective discount rate in terms of model parameters:

$$(22) \quad \rho^* = \rho - n + 2 \frac{(1-s_x)a_x}{(1-s_R)a_R}$$

The Second Steady State Condition: The Resource Constraint

Each person inelastically supplies a single unit of labor such that labor supply is equal to population size $N(t)$. Workers may engage in any of three activities, production, R&D or rent protection. Since there is a unit measure of industries, we can write the labor market equilibrium condition as

$$(23) \quad N = N_Q + N_X + N_R.$$

In equilibrium, the labor allocated to each activity will increase at the same rate as the population, so that the share of labor in each activity remains constant.

With a unit average cost of production and a unit measure of goods, labor in goods production is equal to output. Equation (5) provides a relationship between labor in goods production, the share of the parallel market and nominal consumption expenditures. A second expression relating consumption and parallel market may be derived from (13) using equations (8), (11), (17), and (22):

$$(24) \quad c = [(\rho - n)(1 - s_R)a_R + 2(1 - s_X)a_X] \frac{\lambda\mu}{(\lambda - 1)m}$$

Substituting (5), (9), (8), (10), (11) and (24) into (23) provides an expression for the resource constraint in terms of the innovation rate and the parallel market share that is our second steady

state condition: $1 = \frac{\mu}{m} \left[[(\rho - n)(1 - s_R)a_R + 2(1 - s_X)a_X] \left[\frac{1}{\lambda - 1} + m \right] + a_X + a_R i \right]$, which may also

be expressed as

$$(25) \quad i = - \frac{(\rho - n)(1 - s_R)a_R + (\lambda + 1 - 2s_X)a_X}{(\lambda - 1)a_R} + \left[\frac{1}{\mu} - (\rho - n)(1 - s_R)a_R - 2(1 - s_X)a_X \right] \frac{m}{a_R}$$

Note that this expression contains both subsidy rates. While resource availability is independent of the subsidy rates, labor use in each activity is not.

As shown in Figure 1, SS2 is the locus of points in i - m space that satisfies the resource constraint. SS2 will have a positive slope, as shown, if the bracketed part of the second term is positive. This is a necessary condition for an equilibrium with a positive rate of innovation and

growth, and occurs provided $\mu(1-s_R)a_R\rho^* < 1$. This inequality involves the ease of imitation, the cost of research and the effective discount rate for researchers, each of which serves as a disincentive to engage in research. Thus, SS2 is upward sloping provided that the disincentives to engaging in research are not too large. We assume this condition to hold and explore its implications further below.

Interior Equilibria

The model supports both interior and boundary equilibria. In an interior equilibrium, equilibrium values for the rate of innovation and the share of the parallel market are jointly determined by the relative profitability condition (21) and the resource constraint (25). As illustrated in Figure 1 below, equation (21) has a positive intercept and negative slope, while (25) has a negative intercept and positive slope. These characteristics guarantee that any interior equilibrium will be unique. The equilibrium parallel market share and innovation rate are given by

$$(26) \quad m^* = \frac{(\rho - n)(1 - s_R)^2 a_R + [2\lambda - (1 + \lambda)(s_R + s_X) + 2s_R s_X] a_X}{(\lambda - 1) \left\{ \frac{1 - s_R}{\mu} + [(\rho - n)(s_R - s_R^2) a_R + 2s_R(1 - s_X) a_X] \right\}}$$

and

$$(27) \quad i^* = \frac{(1 - s_X) a_X}{(1 - s_R) a_R} - \left[\rho - n + 2 \frac{(1 - s_X) a_X}{(1 - s_R) a_R} \right] m^*$$

We may also write (27) as $i^* = i_{\max} - \rho^* m^*$ where the first term, $i_{\max} = \frac{a_X}{a_R}$, captures the *research cost effect* of rent protection on the innovation rate, while the second term, equal to the parallel market share multiplied by the effective discount rate, shows the *market share effect*.

Substituting (26) into (24) gives the equilibrium level of per capita nominal consumption expenditure:

$$(28) \quad c^* = \frac{\lambda\mu[(\rho - n)(1 - s_R)a_R + 2(1 - s_x)a_x]}{(\lambda - 1)m^*}$$

which is strictly positive under the parametric restrictions of the model.

The equilibrium conditions above express the parallel market share and innovation rate as functions of government policy variables, allowing us to evaluate the effects of policy changes. However, it is also useful to consider the equilibrium that obtains in the absence of government intervention, which serves as a natural reference point when we turn to considering the impact of policy changes. Setting the subsidy rates equal to zero in (26), (27) and (28), we have

$$(29) \quad m_0^* = \frac{a_R(\rho - n) + 2\lambda a_x}{\lambda - 1} \mu,$$

$$(30) \quad i_0^* = \frac{a_x}{a_R} - \left[2\frac{a_x}{a_R} + (\rho - n) \right] \left[\frac{a_R(\rho - n) + 2\lambda a_x}{\lambda - 1} \right] \mu,$$

and

$$(31) \quad c_0^* = \frac{2\lambda a_x + (\rho - n)\lambda a_R}{2\lambda a_x + (\rho - n)a_R}.$$

Here we adopt the notational convention that the subscript “0” denotes the value of a variable in the case in which $s_x = s_R = 0$.

Finally, the absence of transition dynamics allows dynastic utility to be expressed as a simple function of the equilibrium values of the model’s key endogenous variables. At any instant in time, a share m of goods is available in the parallel market at a competitive price, $p = 1$, while the remaining $(1 - m)$ goods are produced by patent holders and sold at the monopoly price

$p = \lambda$. Instantaneous utility is given by $\log u_t = \int_0^{m^*} \log(\lambda^{k_i} c^*) d\theta + \int_{m^*}^1 \log(\lambda^{k_i-1} c^*) d\theta$.

Substituting this expression into equation (1), we have

$$(32) \quad (\rho - n)U(i^*, m^*, c^*) = \left[\frac{\log \lambda}{\rho - n} \right] i^* + \log c^* + m^* \log \lambda - \log \lambda.$$

Equation (32) indicates that dynastic utility is increasing in the rate of innovation, nominal consumption expenditure and the imitation rate. The third term captures the utility gains from access to parallel market goods at competitive prices.

Boundary Equilibria

The model supports two boundary equilibria that are associated with constrained behavior in the Kuhn-Tucker conditions that describe optimal research and optimal rent protection. One boundary equilibrium obtains when inequality holds in the first line of the R&D zero-profit condition expressed in equation (7), such that it is not profitable to devote resources to R&D. Noting that the equilibrium innovation rate is strictly decreasing in the ease of imitation, we may use (30) to implicitly define a threshold value of this parameter,

$$\bar{\mu} \equiv \frac{(\lambda - 1)a_x}{[(\rho - n)a_R + 2\lambda a_x][(\rho - n)a_R + 2a_x]}, \text{ such that } i^*(\bar{\mu}) = 0. \text{ It follows that for an economy}$$

with $\mu > \bar{\mu}$, the zero-profit condition for research is replaced by $R = i = 0$. Substituting (11),

(13) and $i = 0$ into (16), our new SS1 condition is given by

$$(33) \quad c = \frac{\lambda(1 - s_x)a_x \mu}{(1 - \lambda)m^2}.$$

SS1 is consistent with optimal rent protection and, as shown in Figure 2, is downward sloping in m - c space. Intuitively, a rise in consumption expenditure increases the rate of profit and the

incentive to engage in rent protection by patent holders, thereby reducing the share of the parallel market.

Setting $N_r = 0$ in (23) and substituting labor inputs from (6) and (12) provides a new equation for the resource constraint

$$(34) \quad c = \left[1 - \frac{a_x \mu}{m} \right] \left[\frac{\lambda}{1 + (\lambda - 1)m} \right].$$

In this equation, the first term is the share of labor employed in goods production and the second term is the price level. This locus is shown in Figure 2 as SS2. Combined with a non-negativity constraint for parallel market share, equations (33) and (34) generate unique equilibrium values for parallel market share and nominal consumption expenditure:

$$(35) \quad \begin{aligned} \bar{i} &= 0 \\ \bar{m} &= \frac{(2 - s_x) a_x \mu}{2} + \frac{1}{2} \left[(2 - s_x)^2 a_x^2 \mu^2 + \frac{4(1 - s_x) a_x \mu}{\lambda - 1} \right]^{1/2} \\ \bar{c} &= \frac{(1 - s_x) a_x \mu \lambda}{\bar{m}^2 (\lambda - 1)} \end{aligned}$$

In this equilibrium, there is no innovation and patent holders enjoy a perpetual monopoly position. These monopolies, however, are imperfectly realized due to the constant presence of imitators. Note also that in the absence of innovation, there is no longer a positive social role for lawyers in the model. Private IPR enforcement increases the patent holder's share of the market but, the monopoly rents are insufficient to spur further innovation. We refer to this outcome as a *static rent seeking equilibrium*.

In the second boundary equilibrium, the rate of imitation is sufficiently high that optimal rent protection is zero. From equation (17), we see that this obtains when the share of the parallel market exceeds one half. This equilibrium obtains when equilibrium level of rent protection in equation is greater than one-half. In particular, optimal rent protection is zero

provided $\mu > \tilde{\mu} = \frac{\lambda - 1}{(2\lambda - 1)a_x}$, which is derived from $\bar{m}(\tilde{\mu}) = 1/2$ in (35). In this case, firms cannot profitably protect their intellectual property, so that $R = X = 0$ and equilibrium values for the model's primary variables are

$$(36) \quad \begin{aligned} \tilde{i} &= 0 \\ \tilde{m} &= 1 \\ \tilde{c} &= 1 \end{aligned}$$

In this equilibrium there is no rent protection and no research. Intellectual property rights are unenforceable, all goods are sold in the parallel market under competitive conditions, and all labor is used in production. We refer to this as a *competitive anarchic equilibrium*.

Section 3: Public Policies and Welfare Analysis

This section considers the economic and welfare implications of changes in the model's policy variables. In particular, we consider the impact of incremental increases in the research and rent protection subsidies and ease of imitation, which may be interpreted as a measure of the efficacy of public IPR protection.

Research Policy

As shown in Figure 3, an increase in the research subsidy increases the relative return to R&D, shifting the relative productivity condition upward. Similarly, it increases the demand for research labor, which tightening the resource constraint and shifting it up and to the left. As suggested by this analysis, an increase in the research subsidy increases the equilibrium rate of innovation has an ambiguous change on the parallel market share. More formally, differentiating (26) and (27) with respect to s_R , we have

$$(37) \quad \frac{dm_0^*}{ds_R} = \frac{\{(\lambda-1)a_X - [(\rho-n)a_R + 2\lambda a_X][(\rho-n)a_R + 2a_X]\mu - (\rho-n)a_R\} \mu}{(\lambda-1)} \gg 0$$

and

$$(38) \quad \frac{di_0^*}{ds_R} = (1-2m^*) \frac{a_X}{a_R} - \left[\rho - n + \frac{2a_X}{a_R} \right] \frac{dm_0^*}{ds_R} > 0$$

(Note to reader: Although the graphic analysis is clear, for some reason I cannot sign the second comparative static. Need to check derivations.)

Choosing the subsidy rates to maximize social welfare proves to be analytically messy. In lieu of this we consider the problem facing a social planner who chooses the levels of research, consumption and rent protection to maximize social welfare subject to the resource constraint. Defining the intensity of research and rent protection as $r = R/N$ and $x = X/N$, such that $i = r/x$ and $m = \mu/x$, the LaGrangian function for the social planner's problem is

$$L(c, r, x, k) = \left[\frac{\log \lambda}{\rho - n} \right] \frac{r}{x} + \log c + \frac{\mu \log \lambda}{x} - \log \lambda + k \left\{ 1 - \left[1 + \frac{(\lambda-1)\mu}{x} \right] \frac{c}{\lambda} - a_X x - a_R r \right\}, \text{ where } k$$

is the LaGrange multiplier. The first-order conditions for this problem are:

$$(39) \quad \frac{dL}{dr} = 0 : a_R k x = \left[\frac{\log \lambda}{\rho - n} \right]$$

$$(40) \quad \frac{dL}{dc} = 0 : ck = \left[\frac{1 + (\lambda-1)m}{\lambda} \right]^{-1}$$

$$(41) \quad \frac{dL}{dx} = 0 : - \left[\frac{\log \lambda}{\rho - n} \right] \frac{r}{x^2} - \frac{\mu \log \lambda}{x^2} + k \left[-a_X + \frac{\lambda-1}{\lambda} \frac{\mu c}{x^2} \right] = 0,$$

and

$$(42) \quad \frac{dL}{dk} = 0 : \left[1 + \frac{(\lambda-1)\mu}{x} \right] \frac{c}{\lambda} + a_X x + a_R r = 1.$$

Substituting (40) into (39) to eliminate the multiplier, gives an expression for the socially optimal level of research: $a_R x = \left[\frac{\log \lambda}{\lambda} \right] \left[\frac{1 + (\lambda - 1)m}{\rho - n} \right] c$. This expression equates the social

cost of research (LHS) with the social return to research. A similar expression for the privately optimal choice of research level is derived from the free-entry condition (8), definition of firm

profits (13), and firm value given optimal rent protection (17): $a_R x = \left[\frac{\lambda - 1}{\lambda} \right] \left[\frac{1 - 2m}{\rho - n + 2i} \right] c$.

Comparing these two expressions, we see three reasons for the private and socially optimal levels of research to differ.

First, the return to private researchers is depends on the monopoly mark-up, $\lambda - 1$, whereas social welfare depends on the increase in consumer surplus, $\log \lambda$. Since $\lambda - 1 > \log \lambda$, taken alone this effect suggests the private level of R&D is too high, so the optimal subsidy would be negative. Second, because they must account for the expected loss of profits due to replacement by a successful innovator, the discount rate applied by private researchers, $\rho - n + 2i$, is greater than the social discount rate, $\rho - n$. And finally, the existence of a parallel market reduces the return to private research by a factor $(1 - 2m)$, while it increases the social return to research by increasing consumption of final goods, as captured by the term $1 + (\lambda - 1)m$. These last two distinctions increase the argument for a positive research subsidy. The key innovation in this model, the presence of private IPR enforcement, clearly strengthens the argument for research subsidies by increasing the magnitude of the second and third effects. Accounting for the cost of private IPR enforcement effectively doubles losses from replacement and imitation.

Rent Protection Policy

Here we consider the role of private IPR enforcement in the determining the rate of growth and level of welfare. As noted in the introduction, the model is constructed so that it contains two channels through which rent protection may affect growth. First, rent protection by patent holders raises the expected cost of innovation to current researchers. This *research cost effect* results in a negative relationship between rent protection and economic growth. Second, by decreasing the share of the market lost to imitators, rent protection increases the expected return to innovation. The *market share effect* results in a positive relationship between rent protection and economic growth. As shown below, the net effect of rent protection on economic growth depends on the relative size of these two effects.

We evaluate the role of private IPR enforcement by considering the impact of an incremental increase in the subsidy rate on rent protection, s_X . Informally speaking, if a small rise in the rent protection subsidy increases the rate of innovation, then lawyers are good for growth. To facilitate comparison with our earlier results, we evaluate our comparative static results at $s_X = s_R = 0$.

Figure 4 shows the impact of an increase in the rent protection subsidy, s_X . Equation (21) indicates that a rise in s_X increases the profitability of rent protection relative to research, reducing innovation efforts i and shifting the SS1 curve down. At the same time, by reducing imitation, a rise in s_X reduces labor in the goods sector, relaxing the resource constraint and shifting SS2 upward. As shown in Figure 4, the graphical analysis implies that the equilibrium share of the parallel market m^* increases and the change in rate of innovation i^* is ambiguous.

We address this ambiguity by differentiating (29) and (30) with respect to s_X , we have

$$(43) \quad \frac{dm_0^*}{ds_X} = - \left[\frac{\lambda + 1}{\lambda - 1} \right] a_X \mu < 0$$

and

$$(44) \quad \frac{di_0^*}{ds_x} = \left[\rho - n + \frac{2a_x}{a_R} \right] \left[\frac{\lambda + 1}{\lambda - 1} \right] a_x \mu - [1 - 2m_0^*] \frac{a_x}{a_R}.$$

The result reported in (43) coincides with Figure 4: a rise in the rent protection subsidy unambiguously decreases the equilibrium imitation rate.

The first term of (44) is positive and equals the effective discount rate times the change in the imitation rate: $\rho^* [dm_0^*/ds_x]$. This term captures the impact of the market share effect noted above, in which a rise in rent protection increases the share of the market captured by the patent holder and, thus, the expected return to innovation. The second term of (44) is negative and captures the impact of the research cost effect of rent protection, which occurs because rent protection reduces the probability of successful innovation. This term is unambiguously negative since $m^* < 1/2$.

Lawyers are good for growth provided the market share effect dominates the research cost effect, such that an incremental subsidy to rent protection increases the rate of innovation. In particular, the comparative static reported in (44) is positive provided the ease of imitation is above a threshold value: $\mu > \mu^C \equiv \frac{\lambda - 1}{(\lambda + 3)(\rho - n)a_R + (6\lambda + 2)a_x}$. Taken together with the

requirement for the existence of the interior equilibrium, lawyers are good for growth provided $\mu \in (\mu^C, \bar{\mu})$, an interval that has positive measure provided $2 \frac{a_x}{a_R} > \rho - n$.

If we interpret the ease of imitation broadly as an indicator of the rule of law and the protection of property rights, then this result may seem surprising. It suggests that lawyers tend to be good for growth in countries that have relatively underdeveloped or inefficient institutions, and bad for growth in the more developed countries of the world. The logic of this outcome

hinges on a key difference in the private and public enforcement of intellectual property rights. Whereas private enforcement efforts target both imitation and innovation, public enforcement only reduces imitation. As a result, in countries with strong public enforcement of IPRs, the threat to patent holders posed by imitation is low and there is little in the way of a positive social role for private IPR protection. In contrast, in countries with underdeveloped institutions and correspondingly high rate of imitation, private efforts to protect intellectual property rights may be growth promoting by effectively substituting for the absence of adequate public efforts along these lines.

We turn next to the welfare effects of rent protection. Consider first the first-order condition for optimal rent protection derived above. Taken in order, the first three terms of (41) capture losses due to lower innovation, lower parallel market and the opportunity cost of labor employed in rent protection. The sole social gain to rent protection is captured by the final term, which equals the value of the resources saved because rent protection deters consumption. The key insight here is that the defense of protecting the monopoly rents from intellectual property relies on the assumption that monopoly profits are necessary to induce costly research expenditures. As a result, if a social planner may freely choose the level of research, there is little in the way of a social role for rent protection to play.

$$\frac{1}{c_0^*} \frac{dc_0^*}{ds_X} + \left[\frac{\log \lambda}{\rho - n} \right] \frac{di_0^*}{ds_X} + \log \lambda \frac{dm_0^*}{ds_X}$$

We therefore consider the related question of whether at the margin, a rent protection subsidy raises welfare. As is shown below, the welfare effects of an incremental increase in the rent protection subsidy depend on the ease of imitation. Differentiating (32), we have

$$(45) \quad (\rho - n) \frac{dU}{ds_x} = \frac{[(\lambda - 1)(\rho - n)a_R + 2a_X]a_X}{[(\rho - n)a_R + 2a_X][(\rho - n)a_R + 2\lambda a_X]} + \left[\frac{(\log \lambda)a_X}{(\lambda - 1)(\rho - n)a_R} \right] \{ [2(\rho - n)a_R + (6\lambda + 2)a_X] \mu - (\lambda - 1) \}$$

Here, the first term is the utility gain from the increase in nominal consumption expenditure,

$\frac{1}{c_0^*} \frac{dc_0^*}{ds_x}$, which is positive. The second term combines the impact of the rent protection

subsidy on innovation and parallel market share, $\left[\frac{\log \lambda}{\rho - n} \right] \frac{di_0^*}{ds_x} + \log \lambda \frac{dm_0^*}{ds_x}$. This term is

positive provided the ease of imitation is sufficiently large, $\mu > \frac{\lambda - 1}{2(\rho - n)a_R + (6\lambda + 2)a_X}$, which

is a sufficient condition for a small increase rent protection subsidy to raise social welfare. By implication, lawyers tend to increase welfare in countries in which the public protection of IPRs is relatively weak.

As seen in Figure 5, an increase in the rent protection subsidy shifts the SS1 down and to the left, decreasing the equilibrium level of consumption expenditure and the parallel market share. As seen from (32), both of these changes reduce dynamic utility. Intuitively, by making rent protection more attractive, an increase in the rent protection subsidy decreases the resources allocated to the production of goods. In addition, it decreases the range of goods available at competitive prices. More fundamentally, in the absence of innovation, there is no positive social role for intellectual property rights or for their protection.

To sum up, at the margin, the impact of lawyers are growth and welfare depends in a non-linear fashion on the strength of public IPR protection. When public IPR protection is sufficiently strong, parallel market share is low, the research cost effect dominates the market share effect, and the rent protection decreases both growth and social welfare at the margin.

Within some intermediate range of values for public IPR protection, the parallel market share is large, the market share effect dominates the research cost effect, and rent protection increases growth and (for slightly differently threshold level) social welfare. Finally, if public IPR protection is sufficiently weak, there is no research sector, economic growth is zero, and rent protection decreases social welfare.

Public IPR Enforcement

Like much of the earlier literature that has addressed the question of optimal IPR protection, beginning with Helpman (1993), we interpret the strength of public IPR protection with the ease of imitation. The ease of imitation likely reflects a host of factors, such as social norms, respect for the rule of law, and the technology of imitation and detection, many of which are probably best considered outside the scope of public policy. As a result, this parameter should not be thought of as a policy variable in the same manner as, say, a tax rate, in that it is not clear a government may simply choose its value. However, as the ease of imitation is also undoubtedly influenced by public policy decisions, such as the nature and intensity of enforcement of intellectual property law, it makes sense to consider marginal changes in the ease of imitation.

As shown in Figure 6, an increase in the ease of imitation tightens the resource constraint, rotating SS2 to the right. Intuitively, an increase in the ease of imitation increases the demand for labor in production labor, leaving fewer resources for research and rent protection. In contrast, the trade-off between the innovation and imitation is not affected, leaving the position of SS1 unchanged. Differentiating (29) and (30), with respect to μ : we find that an increase in the ease of imitation increases the parallel market share and decreases the innovation rate:

$$(46) \quad \frac{\partial m_0^*}{\partial \mu} = \frac{a_R(\rho - n) + 2\lambda a_X}{\lambda - 1} > 0$$

$$(47) \quad \frac{\partial i_0^*}{\partial \mu} = - \left[\rho - n + 2 \frac{a_X}{a_R} \right] \left[\frac{a_R(\rho - n) + 2\lambda a_X}{\lambda - 1} \right] < 0$$

Nominal consumption expenditure, c_0^* , does not change.

The intuition behind these results is straightforward. A rise in the ease of imitation increases the parallel market share, raising the return to rent protection. Patent holders respond by increasing resources devoted to rent protection, which simultaneously reduces the return to labor employed in research and puts additional pressure on resource availability. Restoring equilibrium in the labor market requires a decline in the innovation rate i .

Equations (46) and (47) appear to confirm the growth-consumption trade-off highlighted by earlier papers in this line of research. Relaxing public IPR protection decreases the rate of growth, but leads to real consumption gains as consumers have access to an expanded range of good produced at competitive prices. However, in this model the appearance of a trade-off is superficial. Relaxing the protection of intellectual property rights unambiguously decreases household welfare.

Differentiating equation (32) with respect to the ease of imitation, the change in household welfare is given by

$$(48) \quad (\rho - n) \frac{dU}{d\mu} = \frac{\partial U}{\partial m^*} \frac{dm_0^*}{d\mu} + \frac{\partial U}{\partial i^*} \frac{di_0^*}{d\mu} = - \frac{2a_X}{a_R} \ln \lambda \frac{dm_0^*}{d\mu} < 0.$$

This welfare decrease is proportional to the difference between the dynamic discount rate,

$\rho - n$, and the effective discount rate for patent holders, $\rho^* = \rho - n + 2 \frac{a_X}{a_R}$, and results from

differences in how households and patent holders value innovation. As noted earlier, the

effective discount rate employed by patent holders adjusts the value of an innovation downward to account for two factors, the probability of replacement and losses due to imitation. However, neither of these factors matter for the impact of an innovation on household welfare due to two spillover effects that limit the ability of patent holders to appropriate the full gains to innovation.

The first spillover is the well-known “standing on shoulders” effect, in which an innovation increases the quality of the next generation of good. The second effect involves a spillover from the innovation to imitators: a new innovation increases the quality of the good produced in both the parallel and monopoly markets. Because they are unable to appropriate the full value of an innovation, researchers discount the future more heavily than households and thus, from a welfare perspective, over-respond to the loss of profits that results from an increase in the rate of imitation. If we treat the ease of imitation as a policy variable, then our analysis implies that the welfare maximizing ease of imitation is zero.

With perfect public IPR protection, $\mu = 0$, the model produces a degenerate equilibrium in which a whole category of economic behavior, imitation, is absent. In this case, the resource constraint becomes a vertical line that coincides with the i -axis. Imitation is absent, patent holders capture their entire market, and the innovation occurs at its maximum rate, $i^* = i_{\max}$. In the degenerate equilibrium the innovation rate coincides with that found by Dinopoulos and Syropoulos (2007), who do not allow for imitation.¹

As shown in Figure 7, in the rent seeking equilibrium, an increase in the ease of imitation shifts both curves to the right. Setting $s_x = 0$ and differentiating (35) with respect to μ , and substituting the results into our expression for dynamistic utility, we have

¹ This is the level of i^* that would be obtained in Dinopoulos and Syropoulos (2007) when labor is of one type and perfectly mobile between three activities R&D, manufacturing, and rent protection. As their main model though, Dinopoulos and Syropoulos consider two types of labor: general purpose and specialized labor. The former can be employed in either manufacturing or R&D, whereas the latter can be employed exclusively in rent protection.

$$(49) \quad \frac{dU}{d\mu} = \left(\log \lambda - \frac{2}{\bar{m}} \right) \frac{d\bar{m}}{d\mu} \gg 0.$$

In equation (49), the second term $\frac{d\bar{m}}{d\mu} > 0$ is positive. Consistent with the graphic analysis, an increase in the ease of imitation and increases the equilibrium parallel market share. In spite of this, the impact on welfare is ambiguous, reflecting two potentially offsetting effects. The first term in the parentheses captures the reduction in the *price distortion effect*: the utility gain to consumers from an increase in the range of goods available at competitive prices in the parallel markets. The second term in the parentheses captures the *resource diversion effect* of rent protection. An increase in the share of the parallel market induces greater rent protection activity by patent holders, which reduces the resources available for the production of goods.

Finally, note that if the parallel market share increases beyond $\bar{m} = 1/2$, then the model transitions to a competitive anarchic equilibrium. In this case, either public IPR protection is so weak or the cost of private IPR protection is so high that firms do not bother to engage in rent protection. As a result, equilibrium values are independent of the policy variables that capture IPR policy.

Section 4: Conclusion

The economics literature is of two minds regarding the benefits of private legal activity. The literature on the economics of the law suggests that private legal activities play a central role in the efficient functioning of the market system based on enforceable contractual and property rights. It also suggests the potential for significant abuse through rent seeking activities that distort the pattern of relative prices. This paper is the first to use a formal model to address balance between the incentive of patent holders to engage in property rights protection and the

incentive to engage in socially destructive rent seeking. Indeed, most formal growth models that address the role of intellectual property rights consider only the role of public protections. Because private actors play a key role in the protection of intellectual property rights, it is important to consider how changes to the public system of intellectual property rights protection affect the incentives for different forms of private legal activity.

In the framework we develop, the private enforcement of intellectual property rights increases the cost of innovators seeking to discover higher quality goods, which slows the rate of innovation. However, private rent protection also deters imitation, which raises the expected return to innovation. Taken together, these effects suggest that the relationship between private rent protection and social welfare varies in a non-linear fashion with the level of public IPR protection, which we interpret in part as a proxy for the quality of institutions. In economies with strong public protection of IPRs, the rate of imitation tends to low, and the positive role for rent protection is limited. As a result, increases in rent protection subsidy tend to reduce growth and social welfare. This outcome is consistent with fears that the patent system may divert too many resources into distortionary, rent protecting activities and do too little to foster research.

In contrast, in economies in which the public protection of IPRs is relatively weak, rent protection subsidies increase innovation and social welfare. In these economies, private rent protection is directed to a greater degree toward limiting imitation, and marginal increasing in the rent protection subsidy increase the rate of innovation and social welfare. Finally, in economies with extremely low levels of public IPR protection, imitation is sufficiently widespread as to make investing in new ideas unprofitable. In these economies, there is no positive social role for private rent protection, and rent protection subsidies unambiguously decrease social welfare.

Our second major finding is that the welfare maximizing rate of imitation is zero, corresponding to strict public enforcement of intellectual property rights. This finding challenges the conclusions of a long line of research on optimal protection of intellectual property rights, most prominently Helpman (1993) and Grossman and Lai (2004). Like these researchers we find that stricter protection of intellectual property rights involves a trade-off between increasing the rate of economic growth and decreasing the level of consumption. This trade-off, however, does not extend to our welfare analysis, where the utility gains from faster innovation are shown to exceed the losses from decreased consumption. While it is possible that our finding is a special case, dependent on particular functional forms or assumptions employed in our model, we think this is unlikely as our result is rooted in the well-accepted divergence between private and social returns to innovation. Since we use a closed economy model, however, we cannot address the central policy question of earlier papers in this literature, the welfare effects of increased IPR protection by less developed countries.

Our third finding is that consideration of the incentives to engage in private rent protection increases the gap between the privately and socially optimal levels of research, and thus strengthens the argument for research subsidies. This occurs because the private cost of rent protection is increasing in the parallel market share and the expected rate of innovation, both of which decrease the private return to research without affecting the social return.

As noted in the introduction, there is an immense divide between the theoretical and empirical literatures on economic growth, with the former focusing on the role of technological progress and the latter on the role of institutions. We believe that beginning to address this gap should be high on the agenda of growth economists. By modeling the interaction between innovation and the law, this paper takes a step in this direction.

References:

- Acemoglu, D., Johnson S. and J. Robinson, 2001, The Colonial Origins of Comparative Development: An Empirical Investigation, *American Economic Review*, Vol. 91 (5), 1369-1401.
- Aghion, P. and Howitt, P. 1992. A Model of Growth through Creative Destruction, *Econometrica*, vol. 60, no. 2, 323-51
- Aghion, P. and Howitt, P. 1998. *Endogenous Growth Theory*. MIT Press: Cambridge MA.
- Becker, Gary (1983) "A Theory of Competition Among Pressure Groups for Political Influence," *Quarterly Journal of Economics* 98, 371-400.
- Dinopoulos, E., Syropoulos, C. 2007. Rent Protection as a Barrier to Innovation and Growth. *Economic Theory* 32(2), 309-32.
- Eicher, T., Garcia-Peñalosa, C. 2007. Endogenous strength of intellectual property rights: Implications for economic development and growth. *European Economic Review* 52(2), 237-58.
- Grossman, G. M. and Helpman, E. 1991. *Innovation and Growth in the Global Economy*. Cambridge, Mass, MIT Press
- Grossman, G.M., Lai, E.L.-C., 2004. International protection of intellectual property. *American Economic Review* 94 (5), 1635–1653.
- Hayek, F.A. 1960. *The Constitution of Liberty*. Chicago: University of Chicago Press.
- Helpman, E., 1993. Innovation, imitation, and intellectual property rights. *Econometrica* 61, 1246–1280.
- Kwan, F., Lai, E., 2003. Intellectual property rights protection and endogenous economic growth. *Journal of Economic Dynamics and Control* 27, 853–873.

- Krueger, A. 1974. The Political Economy of the Rent-Seeking Society. *American Economic Review* 64, 291-303.
- Lerner, J., 1995. Patenting in the shadow of competitors. *Journal of Law and Economics* 38, 463–496.
- Murphy, K.M., Shleifer A., and Vishny R.W. 1991. The Allocation of Talent: Implications for Growth. *Quarterly Journal of Economics*, 503-530.
- North, D. 1990. *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, New York
- O’Donoghue, T. and Zweimueller J. 2004. Patents in a Model of Endogenous Growth. *Journal of Economic Growth* 9, 81-123.
- Olson, Mancur. 1982. *The Rise and Decline of Nations*. Yale Univ. Press, New Haven, CT.
- Romer, P. M. 1990. Endogenous Technological Change, *Journal of Political Economy* 98(5), 965-82.
- Rubin, P.H. 1982. Common Law and Statute Law. *Journal of Legal Studies* XI, 205-223.
- Segerstrom, P., Anant, TCA, and Dinopoulos, E. 1990. A Schumpeterian Model of the Product Life Cycle, *American Economic Review* 80, 1077-1092.
- Sener, F. (2008) “Rand D policies, Endogenous Growth and Scale Effects” *Journal of Economic Dynamics and Control* .
- Smith, A. 1976. *An Inquiry into the Nature and Causes of the Wealth of Nations*, New York, The Modern Library (originally published in 1776).
- Wittman, Donald (1989) “Why Democracies Produce Efficient Results,” *Journal of Political Economy* 97, 1395-1424.

Figures

Figure 1: Steady-State Equilibrium with Positive Innovation

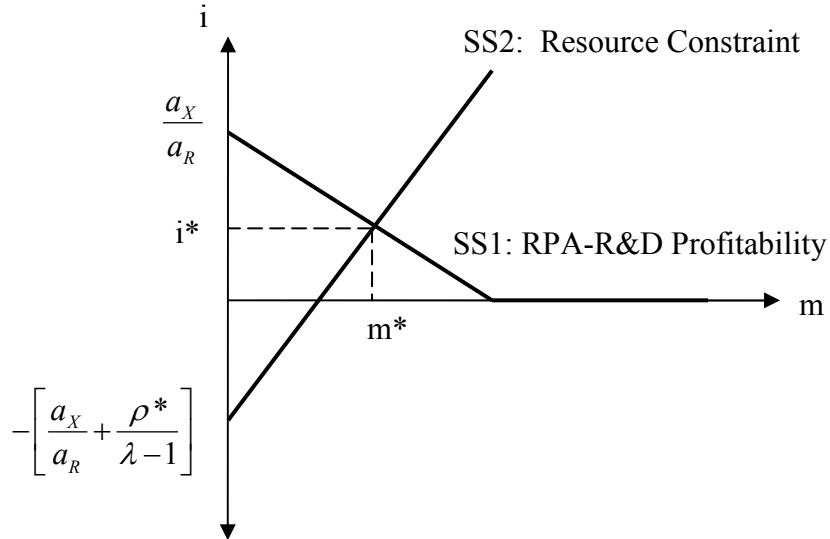


Figure 2: The Rent Seeking Equilibrium

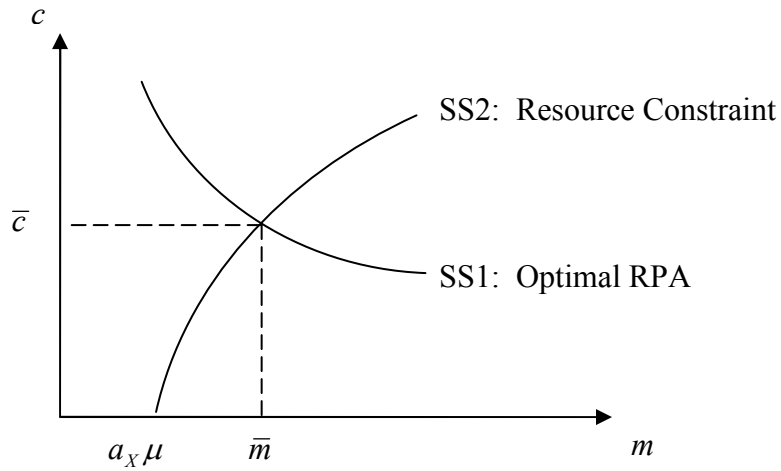


Figure 3: An Increase in the Research Subsidy, s_R

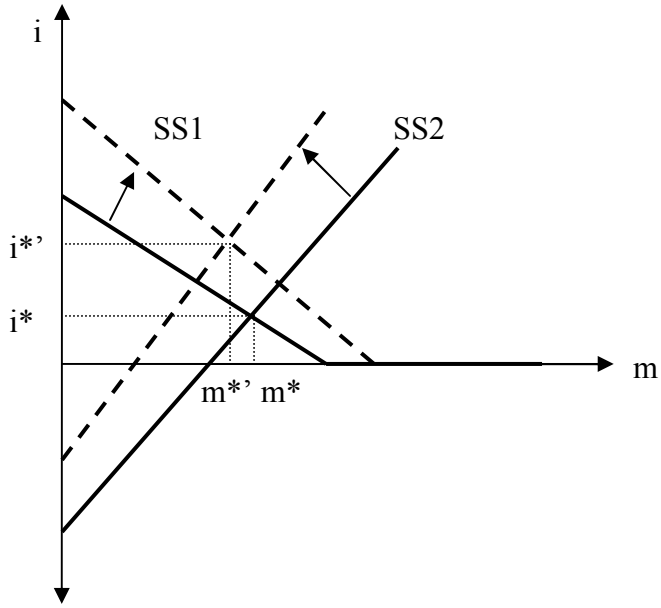


Figure 4: An Increase in the Rent Protection Subsidy, s_X

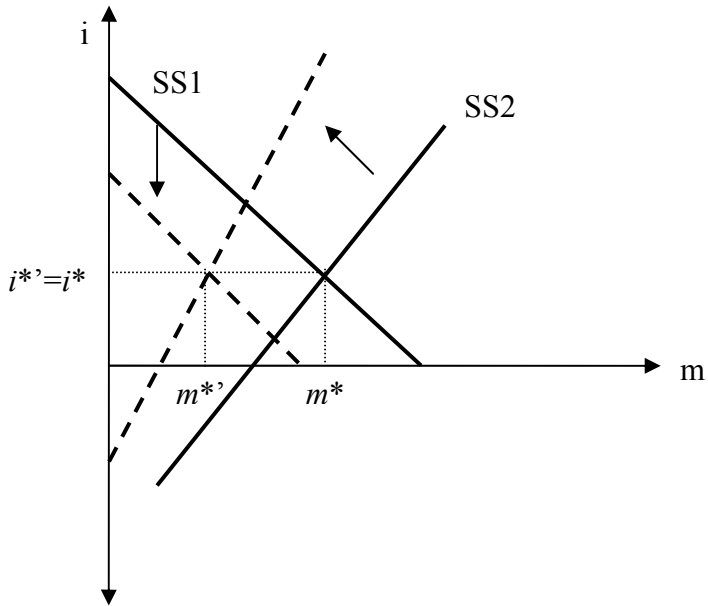


Figure 5: An increase in s_X in the Rent Seeking Equilibrium

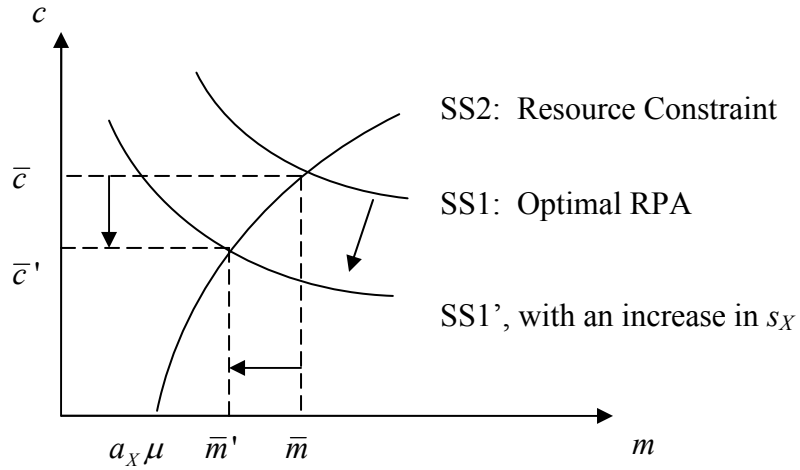


Figure 6: An Increase in Ease of Imitation, μ

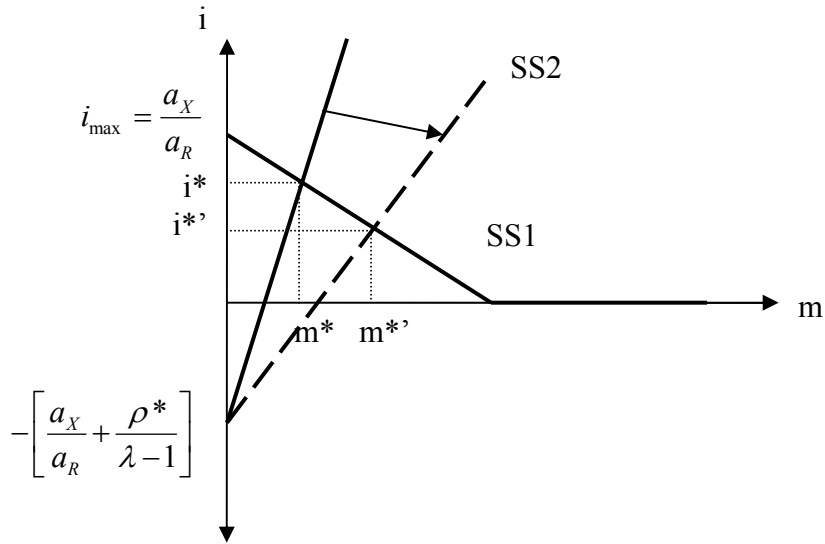


Figure 7: An increase in μ in the Rent Seeking Equilibrium

