Referee report on: "Patent Buyout in a Model of Endogenous Growth", by Ravi Radhakrishnan

The paper develops a quality ladder growth model to compare two alternative intellectual property regimes:

1) A *traditional patent system*, granting infinitely lasting but imperfect patent protection. Under this system, a leading-edge patent holder's incumbency in the product market can be terminated by imitation with an instantaneous probability which decreases with the leader's flow investment in Rent Protection Activities, RPA. On the contrary (and contrary to what typically happens in standard quality ladder models), the leader's incumbency can not be terminated by the occurence of a more efficient competing innovation, as any innovative activity is assumed to stop in the industries where the leading technology is still effectively protected by the patent system (i.e., imitation has not occured yet);

2) A *reformed patent system* along the radical reform lines suggested by Kremer (QJE, 1998). In this system, patents granted to innovators are immediately auctioned and (except for a fraction of them actually sold to the winning bidders) purchased by the government at the winning auction prices (possibly adjusted to account for any divergence between social and private value the innovations) and released into the public domain. Patent buyout expenditure is fundend with a distortive sale tax on innovative products.

The main result of the paper is that the reformed system can offer society a net welfare gain (due to the elimination of monopolistic distortions and of socially wasteful RPA) without affecting the long run growth rate of the economy.

Major comments

The paper addresses an interesting idea: whether the Kremerian mechanism can do better than the traditional patent system should actually be investigated in a dynamic general equilbrium model, to account for all relevant (static and dynamic) general equilibrium effects of the two systems, and hence for all (static and dynamic) potential sources of social costs and benefits relevant for the comparison. I have however several concerns on the way the paper is presented, some doubts on the modelling strategy, a serious concern about the main results.

1) Most of the paper is dedicated to the presentation and solution of the model under the traditional patent system. Besides the fact that most of the analysis presented in this part is standard, the modelling strategy should be properly motivated and discussed in view of the comparison of the traditional patent system with the Kremerian system, which is the focus of the paper. For instance, even if the assumption that the innovation process is interrupted by effective patent protection of the leader has been made by previous studies to simplify matters, here it crucially hinges on one of the most diffused criticism of the patent system: to conceal innovative knowledge necessary to achieve follow-up innovations. In addition to decreasing monopoly distortions and reducing RPA socially wasteful invesments, the Kremerian system would then allow for

more intense innovative activity by releasing into the public domain all information relevant to engage in follow-up R&D. For the purpose of the paper, this assumption cannot be seen just as (a more or less reasonable but) unessential simplification, as it actually set a potential social cost of the traditional patent system at the maximum possible value. Similarly, the Kremerian system is potentially costly in terms of auction organization costs, which should be modelled and accounted for.

2) Again on the model assumptions, it seems to me that combining increasing difficulty of research with the "scarse resource" model of R&D, will produce (as in Segerstrom, 2007) a semi-endogenous growth model where the steady state rate of growth of the economy is just pinned down by the rate of growth of the population, irrespective of the intellectual property regime. Then, the fact that the long run rate of growth of the economy is not affected by a switch to the reformed patent system is not an original result arising from the comparison of the two regimes (as claimed in the introduction, abstract and formally stated in Proposition 5) but an assumption of the model. This aspect of the model should at the very least be clarified and deeply discussed before comparing the two regimes (which is done in the very last few pages!), even if I do not find particularly appropriate to cast the comparison within a semi-endogenous growth model, and then just consider the steady state dynamics. Relative to Segerstrom (2007), one interesting aspect is that, due to RPA investments and endogenous imitation probability, the innovation rate depends on the equilibrium rate of imitation, which should be affected by the intellectual property regime. Unfortunately, the paper is silent on it, as well as on the comparison of the equilibrium rates of innovation, and their role in the welfare comparison of the traditional and the Kremerian patent systems.

3) Towards the end of the paper (p. 18), the reader is finally presented with the version of the model with the Kremerian system and the welfare comparison. Here the analysis becomes really quick, and the interpretation of results (at the very most really) partial. In this part, I have several concerns on the way the various results are derived. It is absolutely possible that it is just a matter of lack of explanations, but I am not sure at all of the way the model is solved and the welfare analysis is conducted. The analysis seems to assume that the equilibrium variable $\frac{z^*}{x^*}$ does not change when the Kremerian system replaces the traditional system. But, if so, I am not given any reason to for it and I do not have any reason to believe it. Furthermore, the logic of the welfare comparison is not clear to me. First of all, the innivation rate could (should) be different in the two systems. But there is no discussion of the welfare effects of it. Second, even assuming that any "dynamic effeciency" aspect of the (steady state) welfare comparison is washed out by the semi-endogeneity of the model (so that the welfare comparison just requires to contrast the representative consumer's flow utilities in the two regimes), why should I assume that the per-capita total expenditure in innovative good, E, is the same in the two equilibria (as written in equation (33) and, as far as I understand, assumed in the following analysis)? Finally, comparing the welfare analysis of the paper with the one in Segerstrom

(2007), it is quite striking how much simpler the first is. A more precise and complete discussion of it would really be required to reassure the reader that the analysis is correct.

4) Related to point (3), a discussion of the main effects (especially the allocative effects) underlying the welfare comparison of the two intellectual property regimes (which is almost completely missing) should be provided. In addition, working out the first best solution of the model would help to understand the welfare comparison of the two intellectual property regimes.

Minor comments

1) What is "α" in the indirect utility function of p. 8? Are we sure of this formula?

2) Q_L should replace "Q_I" in equations (16) and (17).

3) The discussion of equation (21) at p. 16 should also notice that I decreases with P, and link this characteristic of the model to the results of the previous (growth) literature on RPA.

4) Equation (in the text) and proof (in the appendix) numeration seem wrong.

5) References to the literature should be more precise: Kremer (QJE, 1998) is correctly listed in the References section, but it is referred to as Kremer (2010) or Kremer (1993) in the introduction; Davis and Sener (EER, 2012), is missing from the References section, and imprecisely referred to as Davis and Sener (2013) throughout the paper; Segerstrom is everywhere spelled Segerstorm.