

Response to Referee Report 2

I would like to thank the referee for reading the paper and providing invaluable comments. The comments and suggestions will improve both the exposition of the model, and explanations of the major results. In addition, I would like to thank the referee for carefully going over the derivation of the welfare results of the patent buyout model. Overall, I believe that I will be able to address the major concerns raised by the referee, and incorporate all the suggestions in the updated version on the paper. My response to the referee combines the first two major concerns and addresses them simultaneously. While major concern 3 and 4 are dealt with individually, with minor overlaps. I have also outlined my response to the minor comments at the end. At the outset, I would like to state that I agree with all of the referee concerns, and as mentioned, I believe that I will be able to address them in an updated version of the paper.

Major Concerns 1 and 2

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 investments, 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.

Response:

The referee has raised three substantive points in these two comments. First, the motivation of the paper and the modeling strategy need to be linked better. In particular, the twin assumptions of no innovation in single quality leader industries and costless auctions in the Kremerian system have to be addressed in the context of the patent buyout system. Second, the paper presently lacks a discussion on the semi-endogenous nature of the growth model, wherein long run growth is dictated by availability of resources.

Third, the paper in its current version does not discuss the new result on the rate of innovation that it establishes relative to Segerstrom (2007) and previous growth literature.

I agree entirely with the concerns posed by the referee. The paper currently spends too much time on setting up and discussing the standard model, as opposed to highlighting the main contributions it makes. In the updated version of the paper, I will shorten the exposition of the standard model, and carefully discuss the points of departure of my paper. This will include a discussion on the assumptions highlighted in the first aforementioned point. I will also include a discussion, in the introduction of the paper, on the semi-endogenous nature of the growth model, and that the growth result is derived from this assumption of the model. My paper, however, does make two novel contributions. First, as pointed by the referee, by allowing for imitation and expenditures on property right protection (the latter aspect is missing in the Segerstrom (2007) paper), the paper links the rate of innovation to the effective rate of imitation. The latter depends on the strength of the patent system, and the resources expended by the innovators in protecting their patents. While a detailed discussion of this result is missing in the current version of the paper, the updated version will make this contribution more apparent. Second, the paper compares the reformed patent system with the standard one in a framework with possibility of imitation, and rent protection activities occurring simultaneously. Most of the previous literature has ignored the expenditures on rent protection when evaluating different intellectual property right regimes or R&D policies. By developing a framework that incorporates a contest between imitators (although the rate of imitation is given exogenously) and innovators, my paper provides an additional channel of welfare improvement. That is, allocation of resources away from rent protection activities into manufacturing, or innovation.

To sum up, I will make the following changes to address concerns 1 and 2: rewrite the introduction and the main body of the paper to highlight main contributions of the paper; motivate the modelling strategy better and outline the main implications of the model assumptions; finally, as requested by the referee, I will explicitly include the cost of organizing the Kremerian auction in the patent buyout model.

Major Concern # 3

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 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 innovation 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 efficiency" 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.

The referee has raised two major concerns here. First, in the welfare analysis conducted under the patent buyout system, I have assumed that z^/x^* is the same as is the case under the traditional patent system. The reason this is the case is that the ratio z^*/x^* is determined entirely by the zero profit condition of the firms as given by equation (27). This does not change, since even under the patent buyout system the firms carry out R&D to maximize the present discounted value of monopoly profits and there is free entry*

into innovation. Since that aspect does not change, the zero profit condition is still be given by equation (27). Therefore, the ratio z^*/x^* remains the same. What changes however, are the individual values z^* , and x^* . This is because, the labor market equilibrium condition changes on account of the fact that post innovation there is no labor devoted to rent protection; that is, $R^*=0$. As the referee has pointed out, the paper does not make this explicit in the current version. In the updated version of the paper (which will have a more elaborate discussion on the patent buyout system) I will make this point clear. I will also solve for the new steady values of z and x in the patent buyout system, and compare them to those obtained under the traditional patent system.

Second, the referee has correctly identified that the steady state values of I , and E will be different under the patent buyout system as compared to the traditional patent system. The rate of innovation will be lower under the patent buyout system. This is because, under the traditional patent system there are two negative externalities associated with innovation: first, future innovations become more difficult; and second, there is a “business stealing” effect wherein consumers divert demand away from other sectors to the sector where successful innovation takes place. There is a positive externality as well. This involves a higher quality good made available to the consumers at the same quality adjusted price. The presence of imitation in the model strengthens this positive effect, while rent protection activity dampens it by extending the life of monopoly pricing. Elimination of RPA's (R goes to zero) in the patent buyout mechanism increases the probability of imitation, and therefore the positive externality dominates the two negative ones. Therefore, the rate of innovation falls. I will make this explicit in the updated version of the paper.

Further, since the value of E is also different under the two regimes (a point I overlooked in the current version of the paper), the comparison of static utilities given in equation (33) will need to be revised. Since E is constant in the steady state under both systems, equation (35) will as a result be modified to take into account the ratio of the expenditures under the two regimes. I will make this correction in the updated version of the paper, and present it (as the referee has suggested) with more intuitive explanation on the causes for the welfare differences. Most importantly, as the referee has pointed out in comment 4, I will highlight the allocative effects of the patent buyout mechanism to explain the welfare results of the model.

Major Concern #4

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.

Response:

As mentioned above, in the updated version of the paper I will include a much more detailed explanation of the main welfare effects. The welfare gain in the model arises from reallocation of resources away from RPA's and into innovation (across a greater number of sectors) and manufacturing. In addition, I will include a section on the social planner's problem which can serve as the benchmark to the welfare comparison under the two regimes.

Overall, I believe that I can address the major concerns raised by the referee. Incorporation of these suggestions in the paper will greatly improve its exposition, and make its contributions more apparent.

Minor Comments:

- 1) What is " α " in the indirect utility function of p. 8? Are we sure of this formula?
Response: " α " should be replaced with " κ "
- 2) Q_L should replace " Q_I " in equations (16) and (17).
Response: The updated version will make this correction.
- 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.
Response: Major comment #2 addresses this point as well. As I mentioned there, in the updated version of the paper I will include this discussion and link it to the previous literature
- 4) Equation (in the text) and proof (in the appendix) numeration seem wrong.
Response: The updated version will correct this discrepancy.
- 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.
Response: The updated version will correctly label all references. The paper cites two Kremer articles: Kremer (1998), and Kremer (2010). I will ensure that all references are listed precisely in the body and the references section.