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Stronger protection or technological revolution: what is behind the recent surge in patenting? A comment

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Kortum and Lerner have staged a horse race worth watching. The prize is an explanation for the stunning rise in patent applications in the U.S. since 1985. The horses they have entered are *friendly courts, fertile technology*, and *regulatory capture*. Lessons for policy and implications for welfare depend on who wins. I have only a few objections to how the race was run. First, I would have allowed another horse to enter, namely, *lower application cost*. Second, I would not have made the race winner take all. The hypotheses are not mutually exclusive, and there are several facts that can be explained with a combination of hypotheses but not with any single hypothesis.

Kortum and Lerner's finish line consists of the following facts. (1) U.S. patent applications by U.S. inventors doubled from 1985 to 1996. (2) The U.S. application yield (share of applications resulting in a patent being granted) held steady for U.S. inventors while falling for foreign inventors. (3) Relative to foreign inventors, U.S. inventors were a rising source of applications in the U.S. and abroad. (4) The U.S. was no more popular a destination for patent applications. (5) Most of the rise in applications reflects year effects, i.e., was common to all source and destination countries. (6) The rise in U.S. applications was roughly uniform across technology classes (e.g., it was not heavily concentrated in biotechnology and software). (7) Newer and smaller patentees account for a modestly higher share of patents since the late 1980s. (8) U.S. renewal rates have declined since 1991 for U.S. and foreign inventors alike. (9) Research intensity has not risen. (10) The rise in applications since 1985 has been continuous (an upward trend, not a step function).

In the accompanying Table I summarize the match between each hypothesis — considered in isolation — and each of the 10 facts. [The authors argue

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that Fact 7 is decisive evidence against a win for *regulatory capture*; I agree so I omit this hypothesis from the Table.] Other than the fall in the foreign application yield, the *friendly court* hypothesis does not explain any fact that *technological fertility* or *lower application cost* cannot likewise explain. Since the hypotheses are not mutually exclusive, however, this does not constitute evidence *against* the *friendly court* hypothesis. More damaging for the *friendly court* hypothesis is that the U.S. has not become a better destination (Fact 4). Unless non-U.S. patent courts became friendlier as well, which Kortum and Lerner argue has not been the case, stronger patent protection should have made the U.S. a relatively more attractive place to have patent protection. Combining the *friendly court* hypothesis with one of the other two hypotheses does not help, since the other two give no reason why the U.S. has become a less-attractive destination.

Table

Facts — Hypotheses →	Friendly Court	Tech. Fertility	Lower Cost
1. Doubling of U.S. applications	Yes	Yes	Yes
2. Flat (falling) U.S. (Foreign) yield	No (Yes)	Yes (No)	No (Yes)
3. U.S. inventors a rising source	No	Yes	No
4. U.S. no better a destination	No	Yes	Yes
5. Dominant role of year effects	No	Yes	Yes
6. Uniformity across classes	Yes	Yes	Yes
7. No shift toward bigger patentees	Yes	Yes	Yes
8. Falling renewal rates	???	Yes?	Yes
9. No rise in research intensity	No?	No	Yes?
10. Continuous rise in applications	No	Yes	Yes

The *friendly court* hypothesis also cannot explain Fact 10, that the rise in applications has been ongoing since 1985. If the new Patent Appeals Court established in 1982 raised the level of patent protection, rather than commencing a trend toward stronger and stronger protection, then one would expect applications to level off at a higher plateau. The transition might be drawn out since people must learn about the new regime, but it is hard to imagine it taking more than a decade for the news to spread. Consistent with an information lag, however, the rise in applications occurred three to four years after the new court was established, and less experienced patentees comprised a growing share of patentees after the late 1980s.

The authors declare the *technological fertility* hypothesis the winner because it fits all of the facts consistent with the *friendly court* hypothesis and then some. Take the fall in the renewal rate (Fact 8). If the number of innovations per dollar of R&D has risen and each innovation is a quality step

eclipsing the previous quality, then a faster rate of obsolescence could explain the fall in the renewal rate. In contrast, for a given patent the likelihood of renewal should rise with better patent protection. [The authors note that the change in policy could bring in patents with lower renewal rates, dominating this effect.] Or consider the continuous rise in applications. Ongoing improvements in research productivity are easier to imagine than an ongoing trend toward stronger patent protection. One could test the latter by examining the patent-friendliness of rulings over time, properly accounting for selection.

Although it has several lengths on the *friendly court* hypothesis, the *technological fertility* hypothesis does not run away with the race. It stumbles on Fact 9: why would a surge in research productivity (innovative output per dollar of R&D) fail to induce greater research intensity (privately-funded research expenditures relative to sales)? Kortum and Lerner calibrate a plausible general equilibrium model and find that the predicted rise in R&D intensity should be distinctly noticeable.

Is it possible that R&D intensity *would* be rising if not for offsetting downward pressures on R&D intensity from, say, rising relative wages of R&D personnel or falling government spending on R&D? I do not think so. The *technological fertility* hypothesis says patenting rose because research productivity rose. More innovations per dollar of R&D have produced more patents per dollar of R&D. If R&D intensity failed to increase because R&D wages rose as fast as researcher productivity, then the patent/R&D ratio should have stayed the same or fallen, not risen. Similarly, if R&D intensity did not rise because government R&D funding fell and government R&D complements private R&D, then the patent/R&D ratio should have stayed the same or fallen. Unless one wants to invoke a fall in the idea/patent ratio, it must be that the average patent has become less valuable (privately) so that it is not profitable to boost R&D intensity despite the higher patent/R&D ratio.

This leads me to a story that I believe might work. Suppose rising research productivity has led to a faster arrival rate of innovations *and* to a faster rate of private obsolescence of innovations. Then firms may not find it privately profitable to raise their research intensity because, although each R&D dollar produces more ideas, each idea is worth less privately because the stream of rents it creates declines more quickly. The observed decline in patent renewal rates (Fact 8) is consistent with this hypothesis. What this hypothesis might make it harder to do, however, is explain the rise in patent applications! A patent could be worth less if the rate of obsolescence has risen as much for patented as for unpatented innovations. Thus we might expect a fall in the propensity to patent innovations if the cost of applying for a patent has not changed. The propensity need not fall, though, if obsolescence has sped

up more for unpatented than for patented innovations. Imagine an extreme case wherein patents protect for n years, then rents dissipate at $x\%$ per year thereafter, whereas rents from unpatented innovations dissipate at $x\%$ per year with no $n-$year lag. Then if x rises but n does not fall, the propensity to patent could even rise.

To recapitulate, it is conceivable that patent applications have risen without a rise in research intensity because the arrival rate and private depreciation rate of innovations have both increased. As noted above, the decline in renewal rates is consistent with this hypothesis. Has the behavior of total factor productivity (TFP) growth been consistent with this hypothesis? If innovations feed TFP growth and innovations are arriving faster, then TFP growth should be rising. Private rents are dissipated more rapidly from the faster obsolescence, but this presumably affects prices rather than TFP. TFP growth *has* risen in manufacturing in the 1980s and 1990s relative to the 1970s. It would be interesting to know if those manufacturing industries that are more research intensive or whose patent/R&D ratios have risen faster have exhibited bigger increases in their TFP growth rates.

Now I come to the other horse I want to enter in the Kortum and Lerner race. Implicit in the above discussion was that the patent/R&D ratio rose because the idea/R&D ratio rose, not because the patent/idea ratio rose. Suppose improvements in information technology, such as the emergence of patent databases that can be searched for the prior art (for citation purposes and for determining whether an application is likely to yield a patent), have lowered the cost of applying for a patent. Then we would expect the propensity to patent innovations to have risen. This hypothesis could explain a rising number of patent applications without requiring higher research productivity. Considered in isolation, it can explain all the facts that the *technological fertility* hypothesis can explain, plus one and minus one. The "plus" is that it does not imply such a big stimulus to research intensity because, as Kortum and Lerner discuss, estimates in the literature value patents at only about 10% of R&D spending. The "minus" is that the *lower application cost* hypothesis does not explain why U.S. inventors have become a relatively bigger source of applications. One could conjecture that costs of applying have fallen faster for U.S. inventors than for foreign inventors, but this does not seem very likely, especially when I think of applications in other countries.

In summary, I think it would be too close to call if we had to declare a winner between the *technological fertility* and *lower application cost* hypotheses. They are not mutually exclusive, so each could play a role in explaining the surge in patenting. To gauge their relative importance, it would be fortuitous to have an independent "count" of innovations. Then one could decompose the surge in patents/R&D into rising research productivity (ideas/R&D), as predicted by the *technological fertility* hypothesis,

versus rising patent propensity (patents/R&D), as predicted by the *lower application cost* hypothesis.