Production function

- with N effective units of input can produce value V
- with less than N, the value is zero
- with more than N, the value is V.

Two types of workers

1. cheap workers devote one unit of time and produce one unit of effective input with probability aP and cost W(u).

2. expensive workers devote one unit of time and produce one unit of effective input with probability P and cost W(ps).

Key assumptions

1. a positive but lower than one
2. W(u) < W(ps)

Consider existing projects that have N-t effective units of inputs.

Compute the expected cost and the expected product of hiring t workers of either type.

NOTE: this is not correct, since if any worker fails to deliver an effective unit, the project has a positive option value. But intuition is the same.

Result 1: If a is not “too” small, or W(u) not “too” high, efficiency calls for early use of cheap workers and, if

$$PV - W(ps) > aPV - W(u) \text{ or}$$

$$PV(1-a) > W(ps)-W(u),$$

efficiency calls for later use of expensive workers.

NOTE: in the model, workers are equally productive, but the “cheap” technology allows them to distract in other issues with positive probability, and they get utility from that. This is why they are willing to receive lower wages.

Equilibrium

There is no IPR protection for output of “cheap” workers. Thus, projects with effective inputs produced with the cheap technology are free goods.

Result 2: The “green” strawberry effect.

I will discuss 2 issues

1. Role of preferences ($W(u)<W(ps)$)
2. Role of IPR protection.

An underlying theme: which are the restrictions on contracts?

1. Role of preferences

   a. There are some projects that all scientists dislike, but cannot tell which ones ex-ante.
   b. Can’t you auction projects and let the mechanism choose the scientist that likes it the most? The WB does it!
   c. Eventually, in the model, some scientist will “like” to do the project at the University, but the private sector is forced to have a mismatch of scientist-project.
   d. It appears as if scientists get utility from “freedom”, since eventually someone will be willing to do the project for 100 at the university, but will not do it for less than 200 at the private sector.
   e. Restrictions on contracts?

f. How large (from a quantitative point of view) are these effects once we take into account heterogeneous preferences and differences in productivity? (Comment would apply also to the case analyzed in the paper)

g. Can the evidence on W(u)<W(ps) reflect differences in productivity? In this case, there appears to be no mismatch in the private sector. Would the conclusions of the model go through?

2. Role of IPR protection

a. There is no IPR protection at early stages. If you have an idea at the University that has non-positive NPV *evaluated at W(ps) wages*, the private value is indeed zero. But the ultimate value of projects is positive, so if getting the idea protected is very cheap, they would do so at Universities.
b. Allowing “cheap” workers to IPR protect their ideas, may change the “green” strawberry effect.
c. Which are the restrictions imposed on contracts?
d. Which contract (if any) would decentralize the efficient allocation?

e. If the only problem is externalities, it appears that an "optimal" contract exists.
f. Is there a value for T (the price charged by the University) such that the equilibrium is optimal?
g. Can the model (particularly the model of Section 4) shed light on the optimal way to grant IPR protection to early stage ideas?

Conclusions

This paper is an important step towards understanding the production function of knowledge

The paper asks insightful questions in a very important topic.

It explores the role that preferences of scientists play in the development of technology.

Main two comments

1. Make more explicit the assumptions regarding the constraints imposed on contracts.

2. Are quantitative effects large?