

Symposium on the possibility of science funding as an 'idea futures' market

Abetting science

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Koestler (1967) and many others have speculated that the interface of disciplines is a wild frontier that encourages creativity. If so, then Robin Hanson is either lucky or else he has made some shrewd choices. He was 'trained' at the interdisciplinary Committee on Conceptual Foundations of Science at the University of Chicago and he currently converses with a notoriously creative group of computer visionaries in Silicon Valley.

Reading Hanson's paper gave me the sort of pleasure that I get from reading science fiction. Both provide bold, optimistic visions of a different world. The comparison will not dismay Hanson since he flaunts academic respectability by favorably quoting a science fiction novel as a source! Not content with that minor breach, he also puts his paper at risk in many more fundamental ways: he makes controversial claims about epistemology, about science, and about markets.

Hanson has thought through his proposal well and has identified (if not fully answered) many of the credible criticisms that he will receive. Still, his paper pulls me in two different directions. One is to criticize the flaws and highlight the gaps. The other is to nurture and defend a fragile but promising idea.

My intent in what follows is to balance constructive criticism with helpful suggestions in a way that will support the further elaboration and improvement of Hanson's betting scheme. First I briefly mention some philosophical issues, then some issues of the practical running of the market, next whether the market would achieve its objectives, and finally, what to do next.

Hanson will be viewed as a naïve pre-Kuhnian by the jaded constructivists of much modern sociology of science. His proposal assumes that science progresses in a straightforward way. For Hanson, scientific advance either confirms or refutes old hypotheses; it does not, as with Kuhnian incommensurability (1970), render old hypotheses meaningless.

Quine has taught us that although all language is theory-laden, some is more theory laden than the rest.¹ The odds of Hanson's scheme working will be increased if the propositions in the science market are as little theory-laden as possible. This does not mean that one cannot bet on a theory. The way to do so would be to bet on the apparent empirical implications of the theory (where these implications are stated so as to be as theory-neutral as possible).²

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The unpredictable (and sometimes long) time that it takes to definitively settle a scientific dispute is one of the primary difficulties in Hanson's scheme. Almost always, we bet on the outcome of events, such as sporting matches, political elections and the like where the outcome is uncertain, but the duration of the uncertainty is not.

Another question is how such a market would be sustained. Maybe initially it could be funded by a seed grant from the National Science Foundation or some other funding agency. A large initial grant might not be needed since the computer technology for running such a market is fast-improving, and hence the costs for running such a market are fast-declining. If bettors are required to put down initial stakes, as in the Iowa Political Stock Market,³ then this money could be invested in reasonably secure dividend-yielding securities (like a portfolio of bank accounts and low-risk mutual funds). The dividends could be used to finance the operating costs of the market (computer technicians, judging honoraria, etc.)

Hanson claims that the market odds will reflect the best consensus judgement, at the time, about the probable truth of a given hypothesis. However, his claim rests on the assumption that scientists will bet on what they believe is true. They may instead bet the *opposite* of what they believe. If they have invested their time heavily in research on one side of an hypothesis, they may seek to insure themselves, by diversifying their portfolio (time invested for the hypothesis, money invested against it). This apparently (but not too seriously) has been the strategy of celebrity-cosmologist Stephen Hawking:

A black hole seems to be the only really natural explanation of the observations. Despite this, I have a bet with Kip Thorne of the California Institute of Technology that in fact Cygnus X-1 does not contain a black hole! This is a form of insurance policy for me. I have done a lot of work on black holes, and it would all be wasted if it turned out that black holes do not exist. But in that case, I would have the consolation of winning my bet, which would bring me four years of the magazine *Private Eye*.⁴ (Hawking, 1988: 94)

Of course, even if providing insurance proved a common use of the market, that might be an advantage for Hanson's scheme, albeit one not foreseen.

Besides unforeseen advantages, it may be worth asking whether the foreseen ones are likely to occur. A betting market would seem mainly to be a proposal to improve the distribution of money among scientists. There are two ways for a donor to increase the rate of advance of science: donate more money or increase the effectiveness of the money donated. Hanson claims that his scheme 'allows patrons to choose questions to be researched without choosing people or methods'. Two questions arise. One: Does a donor seeking the progress of science generally spend the money more efficiently if problems are chosen rather than people? Two: Does Hanson's scheme provide an effective way for donors to donate?

On question one: Peter Medawar (1967) argued that the hallmark of the good scientist was good judgement about which of the important problems is currently solvable. If donors are to successfully pick problems, then they themselves must have such judgement. Otherwise the donors may spend their money more effectively if they pick the good scientists and allow the scientists themselves to pick the good problems. If donors are themselves successful entrepreneurs and if entrepreneurship in science requires similar characteristics to entrepreneurship in business, then it seems likely that donors would better spend their money picking people than picking problems.

On question two: it is not clear how a donor distributes money through Hanson's market. Perhaps the donor would offer a sum of money to be distributed to those who had a share in the winning side. However, as currently envisioned, the market would be open to all comers. In fact, for Fuller (1994) this is one of the most promising features of the market: public interest, media coverage, and the like will increase when the public has a concrete money stake in the results of science. If the market is open to the general public, then how does the donor subsidize the scientific winners without wasting money in subsidizing the winners in the general public?

Another foreseen advantage of Hanson's scheme is that it would permit unrecognized scientific innovators to benefit from their foresight. To focus his discussion, Hanson mentions Alfred Wegener, the defender of the theory of continental drift, who during his lifetime was not recognized for his achievements. Hanson speculates that Wegener's situation would have been improved if a betting market for ideas had existed. In that case he would have been able to increase his stake in the continental drift theory by 'buying more bets to move the price back up'. However, are not the scientists with the highest salaries (and greatest wealth) usually just the same privileged elite whom Hanson is criticizing as having too much power in the present system? Wouldn't they still have the most resources to influence the odds? In addition, wouldn't prestigious institutions provide their scientists with greater betting resources just as they now provide their scientists with better laboratories, more research assistants, lower teaching loads and the like?

Perhaps the most crucial problem with Hanson's scheme is that it might change a scientist's incentives in a particularly perverse way. According to Merton (1973) and others, a scientist seeks fame. Fame comes by being first with new information. Hence scientists compete to spread their findings as widely as possible. However, if a scientist plans to bet on an issue, then the scientist will profit by keeping any information on new findings private for as long as possible. A scientist might even have an incentive to spread false information so as to move the price in a direction where greater profits are possible.

Hanson responds that a scientist will reveal new information quickly so as to drive up the price, but this is not at all clear. As in the stock market, there will probably be two kinds of analysts: those who look at fundamentals (the likely 'truth' of the proposition) and technical analysts who look at trends in betting (for example). A shrewd scientist would not want to reveal his hand to the latter group too rapidly. He would want to place his bets slowly and quietly. Also, the more time the scientist has before the price goes up, the more time he has to acquire more money to place additional bets at favorable odds.

Leo Szilard once said that he only submitted funding proposals for work that he had already completed; otherwise the reviewers would explain to him why the work was impossible. The sheer audacity of Hanson's proposal is likely to reduce the seriousness with which it is taken. He will be told that it is impossible.

I believe that the best way to convince the skeptics is to create a demonstration market to show concretely that such a market could function successfully. Hanson should write a funding proposal to set up and maintain a demonstration market. He should seek propositions from scientists that they think will be resolvable within 10 years. He should then seek an authoritative panel of judges who will decide which side of the proposition is right and who, to avoid conflict of interest, will pledge not to bet on the market.

Short of a full-scale demonstration, other efforts can increase the plausibility of his scheme. One would be to discuss the low costs and the procedural success of a somewhat similar, and precedent setting, scheme: the Iowa Political Stock Market. Another way would be to compile a long list of important published hypotheses from the distant and not-so-distant past that turned out to have been readily resolvable by empirical evidence.

When all is said and done, Hanson has a neat idea that he should develop further. No great harm, and possibly some great good, would come from trying to implement it as a modest adjunct to current institutions, while still trying to find other ways to make those institutions more efficient.

Notes

1. 'The firmness of association to non-verbal stimuli, the power of such association to withstand the contrary pull of a body of theory, grades off from one sentence to another. Roughly imaginable sequences of nerve hits can confirm us in the statement that there is a brick house on Elm Street, beyond the power of secondary associations to add or detract' (Quine, 1960: 13).
2. Some philosophers of science (Laudan *et al.*, 1986) have recently attempted such an exercise for the philosophy of science by stating (in as theory-neutral a way as possible) empirically testable propositions arising from work in the philosophy of science.
3. The Commodities Futures Trading Commission has given permission to a group of professors at the University of Iowa to establish the Iowa Political Stock Market (IPSM). IPSM traders, of which I am one, deposit money with the market, which they can then invest through the Internet, in a variety of political 'stocks'. Each 'share' has a value ranging from \$0 to \$1. In one of the IPSM markets, for instance, a share of 'Bush' once sold for about \$0.50. If Bush wins the election, that share will be worth \$1. If he loses it will be worth nothing. (For more on the IPSM, see Angrist, 1992; Wilson, 1992.)
4. Stephen Hawking continues: 'If black holes do exist, Kip will get one year of *Penthouse*. When we made the bet, in 1975, we were 80 percent certain that Cygnus was a black hole. By now, I would say that we are about 95 percent certain, but the bet has yet to be settled' (p. 94). Shortly after the publication of his book, Hawking apparently paid off his bet with Kip Thorne: 'I will give Kip Thorne a subscription to *Penthouse*' (Byrne, 1988: 1165).

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