

Regulation and innovation: technology inducement prizes in climate change policy

George Yarrow, based on work with

Adi Kremnizer and Chris Decker

Regulatory Policy Institute

www.rpieurope.org

The classical view of patents/IPRs

- *“If the legislature should appoint a pecuniary award for the inventors of new machines, etc, ... they would hardly ever be so precisely proportional to the merit of the invention as this is. For here, if the invention be good and such as is profitable to mankind, he will probably make a fortune by it; but if it be of no value he also will reap no benefit.”* Adam Smith, Lectures on Jurisprudence, 1762.
- Notes:
 - Considering patents relative to the alternative of pecuniary awards made by government (‘prizes’)
 - Fundamentally an information argument: government either has poorer information, or uses information less well (poor incentives), or both. Hence, poorer ‘proportioning’ of reward to contribution.

The emergence of marginalism

- Smith's view of IPRs was mostly sustained through the classical period, i.e. up to and including the work of J.S. Mill, who argued that this approach *"leaves nothing to anyone's discretion; because the reward conferred by it depends upon the invention's being found useful, and the greater the usefulness, the greater the reward."*
- Note the underlying scepticism, shared with Smith, about the effectiveness of discretionary decision making by government (the alternative is again considered to be a government-financed, pecuniary award approach).
- The arguments were subject to greater challenge in the later 19th century, including by economists, particularly after the development of 'marginalist' approaches.

The marginalist arguments

- Bygones are bygones. Once innovations have been made, it is efficient to use them as widely as possible and not to restrict supply by monopoly rights that raise prices and discourage consumption.
- Innovation is therefore more efficiently promoted by a pecuniary award system that provides incentives for innovation, whilst promoting efficient use of new products, techniques and technologies once advances have been made.
- Note:
 - The argument typically assumes away the information and incentive problems of pecuniary awards system, or is relatively optimistic about the prospects for smart government.

The patent controversy: a broad opposition

- German economics profession almost unanimous in opposition to patents (Shavell and Ypersele, J Law & Ec, 2001)
- Bismarck proposed abolition in 1868, though didn't.
- Netherlands repealed patent laws in 1869
- Switzerland had no patent laws, and rejected legislative proposals to adopt such a system in 1863
- Robert Macfie MP (Liberal) campaigned against patents in favour of an alternative, government-financed reward system.
- The Economist magazine supported the rewards alternative.
- The Free Trade Movement was generally opposed to what where seen as monopoly rights.

The strength of the arguments

- The patent system prevailed as adopted policy, although there is a view among historians that ‘events’, rather than the merits of the arguments, was the chief cause (specifically, the recession of the 1870s led to an ebbing of enthusiasm for anti-monopoly arguments).
- The arguments against patents do continue to have force.
- Examples:
 - High drug prices, particularly for small volume drugs where R&D costs can not be widely spread, discourage use, particularly in parts of a global market where ability to pay may be low. Why not reward the innovation directly, and price closer to marginal supply costs.
 - Patent thickets, patent ambushes, etc. Is innovation chilled?

Technology inducement prizes: history

- Longitude prize. Dating from 1714 joint petition from Royal Navy, London merchants and commercial ships' captains. £10k for one degree accuracy, £15k for 2/3 degree, £20k for half degree.
- Alkali. France, 1775, 100,000 francs for development of artificial form of alkali (demand from soap and glass sectors)
- Food preservation. France, 1795, 12,000 francs for method of preserving food (demand from Napoleon's armies)
- Auto and aviation prizes. USA, from late nineteenth, early twentieth centuries.
- Note: transition from public to private sponsorship.

Inducement prizes today

- US EPA “Golden carrots”: super-efficient refrigerator program (SERP), funded by \$30.7m from utility rate-payers (under demand-side management programmes). Relative failure.
- Ansari X-prize. Modelled on early aviation prizes, to demonstrate the potential for commercial space travel. \$10m prize, estimated to have stimulated \$100m of non-governmental R&D.
- USA: Auto X-prize (fuel efficiency), H-prize (hydrogen energy), Freedom prizes (reducing oil dependency), OMB guidance (March 2010) promoting inducement prizes.
- UK: Saltire prize (wave/tidal energy), Low carbon networks fund (energy networks)

Unpicking the trade-offs: first observations

- The major alternatives to IPRs as sources of incentives to innovate are (a) ‘first-to-market’ and (b) subsidies of various forms (from finance for basic research to much more specific programmes).
- Important to understand the advantages and disadvantages of each, as well as the pros and cons of ‘prizes’ and IPRs.
- As virtually always in economics, this is largely a matter of understanding the different contexts in which different approaches work or don’t work, and why.
- Experience suggests that for ‘broad policy problems’ (i.e. encompassing diverse contexts) a portfolio of approaches is likely to be warranted.

Unpicking the trade-offs: the role of government

- In large part because of their monopolistic nature, governments have difficulties in dealing with information and incentives issues, and hence with complexity.
- No track record of success in picking winners.
- Possible roles (?) nevertheless:
 - Basic research: externalities, and no-one is good at picking winners
 - Second/third/fourth/... best; to mitigate other failures
- In climate change policy, in addition :
 - Missing markets and lags in developing new institutions. Inevitable in the transition to scarcity-pricing of environmental 'goods and services'. Things that were in excess supply are no longer in excess supply.
 - Distorted markets, particularly in the transition (e.g. Carbon)
 - These things may adversely affect incentives to innovate.

Subsidies vs prizes: some policy dimensions

- Start with subsidies. What dimensions of choice are available?
- First, there is the degree of prescription about what the finance is for. Is the use narrowly prescribed, or are broader discretions given to the recipient?
- Is the finance given in return for an activity (or set of activities (the input to innovation) or is it given to achieve desired outcomes?
- Is the funding open to competition? That is, is the funding provided as a 'prize'?
- Note, the subsidy approach is an *ex ante* approach. Raises all the usual questions about 'picking winners' (i.e. the information and incentive problems first raised by A. Smith and J.S. Mill).

Dimensions of choice concerning awards/prizes

- For prizes, the scope of the activity can similarly be defined in a narrower or broader way *ex ante*, but the award is only made *ex post*, for some sort of success (however success is defined).
- Competition is also inherent feature of prize/award systems.
- Recall Mill on IPRs: “*the reward conferred by it depends upon the invention’s being found useful*” – the prize is not necessarily ‘market tested’ for usefulness, but it is at least contingent upon some valuation process for the ‘output’.
- The crucial things here are to do with information conditions. Typically we know considerably more *ex post* than we do *ex ante*. The assessment problem is simpler/less complex. Since dealing with informational complexity is not a comparative advantage of government, if we are to have technology policies, inducement prizes will likely dominate subsidies in many contexts.

More dimensions of choice: design features

- “... Prizes’ successes are contingent on their proper design.”
(Newell and Wilson, 2005)
- Rules of participation, duration, etc.
- Nature of the prize. Winner takes all; multiple prizes; provisional awards. (Choices here will be related to the issue of the narrowness or breadth of the outcomes for which awards are made, and the degree of *ex ante* prescription.
- The magnitude of prize(s) – an aspect of ‘proportioning’.
- Means of establishing credibility in circumstances in which awards will be made in the future.
- Who makes the assessments, and on what criteria?
- *Quis custodiet ipsos custodes?*

Is there much to be gained?

- There is a fairly wide consensus, among energy economists at least, that UK climate change policy is highly inefficient.
- Illustration: holding all else constant, why offshore wind? The onshore/offshore wind is about the allocation of land, not about climate change?
- Because we don't want lots of those big turbines everywhere? Small island, and *current technology is land intensive*.
- Holding all else constant, why not put resources into reducing the land intensity of wind power -- enabling substitution of onshore for offshore (relative to current policy) and saving £ billions relative to current policy?
- Is it feasible?

- 14 July 2011, **Experimental wind-farm produces tenfold power increase**
by Kate Melville
- Caltech researchers say the power output of wind-farms can be increased by an order of magnitude - at least tenfold - simply by optimizing the placement of vertical wind turbines on a given plot of land. Details of the experimental wind-farm, located in northern Los Angeles County, appear in the *Journal of Renewable and Sustainable Energy*. ...
- VAWTs provide an important advantage in that they can be positioned very close to one another. This lets them capture nearly all of the energy of the blowing wind and even wind energy above the farm. Having every turbine turn in the opposite direction of its neighbors, the researchers found, also increases their efficiency, perhaps because the opposing spins decrease the drag on each turbine, allowing it to spin faster. Dabiri got the idea for using this type of constructive interference from his studies of schooling fish. ...
- ... the six VAWTs generated from 21 to 47 watts of power per square meter of land area; a comparably sized conventional wind-farm generates just 2 to 3 watts per square meter. The next steps, says Dabiri, "are to scale up the field demonstration and to improve upon the off-the-shelf wind-turbine designs used for the pilot study. I think these results are a compelling call for further research on alternatives to the wind-energy status quo."