The Economic Case for Public Support of Science and Innovation

Supplementary Submission to the Productivity Commission's study on "Public Support for Science and Innovation"

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1. Introduction

This is a supplementary submission to my submission of 18th July, 2006. It follows the release of the Productivity Commission's Draft Research Report on *Public Support for Science and Innovation*. That report referred in places to my earlier submission. My purpose here is to clarify some issues associated with those references.

2. Definitions of Science

My earlier submission examined the economic arguments for science. In particular, I argued (pp.5-6) that science could be defined as an institution:

> … particular way of allocating resources, that is, an institution. … science is a way of deciding which projects should be undertaken. First, it is scientist driven in that scientists propose the projects and scientists review them. Second, it has a priority based reward system whereby there is a commitment to give a reward to those scientists who are first to establish a new fact or way of understanding the world ... those rewards are paid upon success through citation and academic promotion and notoriety.

The draft report notes this definition but argues that it is inadequate:

> Gans' definition valuably describes some of the common features of basic science as an institution for allocating resources within universities and it is a useful framework for discussing some of the processes used by government in the design of the system. However, *it is incomplete as a description of science as an institution outside universities and basic research*. And, for the definitional purposes of this chapter, it does not indicate the features which distinguish the discipline of science from other research activities. (PC, 2006, 1.6, emphasis added)

I would strongly question that this definition is incomplete outside universities and basic research. Indeed, it is outside that it is most useful to think about scientific motivations and drivers rather than purely commercial drivers. My point is that, in fact, one should avoid thinking of science as a type of knowledge. Instead, it is a way of deciding which knowledge to pursue. The other driver of this is commercial returns. However, what is critical is that these drivers interact and for outside universities even more so. That was the point of Stokes (1997) investigation. It has been backed up by examinations of scientist behaviour in commercial laboratories (Stern, 2004).

Otherwise, I am in support of the idea of looking at science within the context of our national innovation system.

3. Rates of Return for Domestic R&D

The draft report looks at the rate of return to Australian domestic R&D expenditures. It reports that the analysis in my previous submission implies a spillover rate of around 300 percent (PC, 2006, 4.26).

While it is acknowledged that our elasticity calculation of 0.11 appeared higher than other studies, it is possible that given Australia's low R&D to GDP ratio, that the rate of return to domestic expenditures could be that high. However, ultimately, I believe that the methodology employed by the PC is inadequate to support that implication.

Put simply, the underlying data we used was in constant 1990 GDP prices and US purchasing power parity. This does not appear to be the case for the PC calculations that derived the implied rate of return. This inconsistency in the units of measurement could provide erroneous conclusions. For example, using year 2000 prices for GDP and 1990 prices for R&D stocks would have the effect of incorrectly inflating the ROR. Even if consistent units are used, we are unsure that a rate of return based on increasing the business R&D stock in constant 1990 GDP prices and US PPP is as intuitively informative as a simple elasticity.

We would request that the PC does not report that implication given these difficulties.

4. Drivers of Australian Innovative Capacity

The draft report takes some time to consider the results of my study with Richard Hayes of the drivers of Australian innovative capacity. It does this in the context of looking at measures of innovative output.

One issue it raises (Box J.1) is that rather than constructing a predicted measure of patents per capita (as our Innovation Index) does it may be simpler to focus upon actual patents per capita as a relative measure of Australia's innovative performance. The following table compares these two measures for 2005:

Table: Actual and Estimated Patents per Million, 2005

Country	Actual	Innovation Index
Japan	237.1	136.2
U.S.A.	222.3	194.7
Finland	137.3	171.7
Switzerland	133.7	132.2
Sweden	124.5	142.1
Germany	109.2	96.1
S. Korea	90.1	20.9
Luxembourg	89.8	-
Canada	89.7	90.5
Iceland	67.8	61.4
Denmark	66.1	121.3
Netherlands	60.8	56.6
Austria	56.3	50.4
U.K.	52.3	43.4
Belgium	49.6	57.9
Norway	47.6	92.0
France	47.2	68.8
Australia	44.8	49.9
Ireland	37.6	33.4
New Zealand	29.7	24.1
Italy	22.6	17.4
Spain	6.3	18.3
Hungary	4.6	4.1
Czech Republic	2.5	5.8
Greece	1.4	7.9
Portugal	1.0	5.9
Mexico	0.8	0.9
Poland	0.6	2.3
Turkey	0.1	-
Slovak Rep	0.0	2.7

As can be seen from this table, there is a substantial difference between the actual and estimate patent per capita measures. This is not surprising as the estimated measures pool data across countries and years and so would be expected to be less volatile but also to deviate from year to year actuals.

However, there is important policy information in the estimated numbers that the actuals cannot give. In particular, the Innovation Index can provide an appreciation of whether the policy parameters that are currently in place are ones that are likely to improve the capacity to innovate or not. For instance, the actual performance of Denmark appears relatively low compared to its potential as described by the Innovation Index while the reverse conclusion would be drawn

for South Korea. For these reasons, the Index will be a more stable measure of innovative performance.

My earlier submission was based on the previous year's update of the Innovation Index. We have since updated the index and it is those numbers that are reported above. It is available at http://www.mbs.edu/home/jgans/papers/Aus-Innovation%20Index-2006-Update.pdf

The Commission might like to incorporate the updated analysis in their final report.