R&D Satellite Accounts and the Returns to Private R&D: Discussion

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Overview

- Important effort – overdue
  - Satellite approach a good one (amount of imputation)
- Describe measurement
  - Issues and questions
- Econometric evidence on the contribution of R&D to economic growth

R&D satellite accounts

$$GDP = GDI$$

$$p^C C + p^I I = wL + \Pi$$

Add in business R&D investment:

$$p^C C + p^I I + p^R R = wL + \Pi + p^R R$$

Reinterpret property income:

$$p^C C + p^I I + p^R R = wL + r_I K + r_R K_R$$

where $K_R = (1-\delta_R)K_R(-1) + R$

And r_R is the social return to R&D capital.

Adding in govt/non-profit R&D

K_G = government/non-profit R&D capital

r_G = social return to K_G

r_{GP} = private return to K_G

$$p^C C + p^I I + p^R R + r_{GP} K_G = wL + r_I K + r_R K_R + r_G K_G$$

Implies another revaluation of r_I, the return on ordinary investment

aggregate effect – 1% lower return

NB: This is not exactly correct. Fraumeni says that social return was added to both sides.

R&D satellite accounts ($1996B)

	1961	1966	1973	1995	2000
Additions to GDP*					
R&D investment					
Business	34	47	49	133	213
Non-profit	4	5	6	17	22
Govt.	8	14	17	37	50
Private returns to R&D					
Non-profit	2	4	7	17	22
Govt.	7	10	17	39	49
Total increase in GDP	**55**	**80**	**96**	**243**	**356**
Additions to GDI*					
Social returns to R&D					
Business	73	120	178	438	567
Non-profit	3	7	14	34	44
Govt.	14	21	35	78	98
Total	**90**	**148**	**227**	**550**	**709**
Reduction to capital income	-35	-68	-131	-307	-353
Total increase in GDI	**55**	**80**	**96**	**243**	**356**

*This table is not quite right, but I do not have the exact numbers - it is a guide to what to do.

Some measurement issues

- Depreciation - social versus private:
  - Private rate can be very high, due to displacement innovation
  - Social rate may be low – cumulative nature of innovation; non-pecuniary spillovers
  - Another way to model this: the gap between social and private grows with the age of the investment.
- Gestation lags vary substantially across industry:
  - Typically fairly short for IT technologies
  - Long (~10 years) for biotech

Some measurement issues

- Double-counting of R&D equipment investment?
  - Usual NSF numbers contain some expense for equipment specific to R&D; this investment may also be in ordinary capital.
- How should we capture the costs and benefits of government/non-profit R&D? (*not sure how this was done*)
  - Expenditure is in consumption.
  - Social returns are added back in on both sides?
- Scenarios - add variation in return assumptions

R&D and growth

1. Product side: share of R&D in GDP times growth of R&D
2. Income side: share of R&D income in GDI times growth in R&D capital

(2) is roughly 3 times (1), why?

1. R&D income share>R&D expenditure share (due to 50% social returns)
2. R&D capital growth>R&D expenditure growth (not true in constant growth steady state).

Primary reason is (1), not (2).

Results seem consistent with the econometric evidence.