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

\[ \text{GDP} = \text{GDI} \]
\[ p^C + p^I\text{I} = wL + \Pi \]

Add in business R&D investment:
\[ p^C + p^I\text{I} + p^R\text{R} = wL + \Pi + p^R\text{R} \]

Reinterpret property income:
\[ p^C + p^I\text{I} + p^R\text{R} = wL + r^I\text{K} + r^R K_R \]

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

\[ K_G = \text{government/non-profit R&D capital} \]
\[ r_G = \text{social return to } K_G \]
\[ r_{GP} = \text{private return to } K_G \]

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

Implies another revaluation of \( r_I \), the return on ordinary investment

aggregate effect – 1% lower return

\[ \text{NB: This is not exactly correct. Fraumeni says that social return was added to both sides.} \]
# R&D satellite accounts ($1996B)

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<tbody>
<tr>
<td>*<em>Additions to GDP</em></td>
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<tr>
<td><strong>R&amp;D investment</strong></td>
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<td>Business</td>
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<tr>
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<td><strong>Total increase in GDP</strong></td>
<td>55</td>
<td>80</td>
<td>96</td>
<td>243</td>
<td>356</td>
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<td>*<em>Additions to GDI</em></td>
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<td><strong>Social returns to R&amp;D</strong></td>
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<td>Business</td>
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<td>Non-profit</td>
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<tr>
<td>Govt.</td>
<td>14</td>
<td>21</td>
<td>35</td>
<td>78</td>
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<tr>
<td>Total</td>
<td>90</td>
<td>148</td>
<td>227</td>
<td>550</td>
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<td><strong>Reduction to capital income</strong></td>
<td>-35</td>
<td>-68</td>
<td>-131</td>
<td>-307</td>
<td>-353</td>
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</tbody>
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*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.