Public-Private Interface

• Information at the NSF website: http://www.nsf.gov/statistics/seind10

• Who Funds R&D? Is it the private sector that matters?

• Which countries spend more on R&D?

• How much money goes for defense-related R&D?

• To whom does the university owe allegiance?

Example 1: Xalatan
Example 2: GM maize

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Nondefense Government Spending on R&D

In decreasing order of terminal (1998) values: Japan, Germany, U.S. (in bold), France, U.K., Canada, Italy

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Who pays for R&D? Dark blue = public, Light blue = private
Who performs R&D?

Federal Government 7%
Universities and Colleges 14%
Nonprofits and other government 4%
Industry 75%

Note: R&D performed by FFRDC's is included where the FFRDC is located, either industry or universities.

Source: National Science Foundation, Science and Engineering Indicators 2002, Appendix Table 4-3.
Who funds R&D? (Compare with the previous chart.)

Federal Government  FFRDC 3%
Federal Government  23%
Universities and Colleges  2%
Non profits and other government  3%
Industry  68%

Source: National Science Foundation, *Science and Engineering Indicators 2002*, Appendix Table 4-5
Top: US Funding to industry. Bottom: US Funding to universities
<table>
<thead>
<tr>
<th></th>
<th>Federal Intramural</th>
<th>Industrial Firms</th>
<th>Total</th>
<th>Universities</th>
<th>other nonprofit</th>
<th>State/Local Government</th>
<th>Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>$83,609 R&amp;D Budget</td>
<td>23.67%</td>
<td>40.17%</td>
<td>8.88%</td>
<td>21.43%</td>
<td>5.01%</td>
<td>0.49%</td>
<td>0.34%</td>
</tr>
<tr>
<td>$36,462 Defense</td>
<td>23.66%</td>
<td>69.43%</td>
<td>2.06%</td>
<td>4.21%</td>
<td>0.42%</td>
<td>0.03%</td>
<td>0.18%</td>
</tr>
<tr>
<td>$19,463 HHS</td>
<td>19.90%</td>
<td>5.92%</td>
<td>1.32%</td>
<td>56.47%</td>
<td>15.40%</td>
<td>0.68%</td>
<td>0.31%</td>
</tr>
<tr>
<td>$9,966 NASA</td>
<td>25.16%</td>
<td>48.67%</td>
<td>13.19%</td>
<td>7.90%</td>
<td>3.86%</td>
<td>0.11%</td>
<td>1.11%</td>
</tr>
<tr>
<td>$7,656 Energy</td>
<td>11.38%</td>
<td>15.32%</td>
<td>63.05%</td>
<td>9.43%</td>
<td>0.78%</td>
<td>0.04%</td>
<td>0.01%</td>
</tr>
<tr>
<td>$3,431 NSF</td>
<td>1.78%</td>
<td>3.91%</td>
<td>6.73%</td>
<td>81.26%</td>
<td>5.63%</td>
<td>0.20%</td>
<td>0.50%</td>
</tr>
<tr>
<td>$1,892 Agriculture</td>
<td>72.09%</td>
<td>0.58%</td>
<td>0.00%</td>
<td>26.48%</td>
<td>0.48%</td>
<td>0.16%</td>
<td>0.21%</td>
</tr>
<tr>
<td>$1,163 Commerce</td>
<td>69.82%</td>
<td>16.08%</td>
<td>0.00%</td>
<td>10.92%</td>
<td>2.06%</td>
<td>1.03%</td>
<td>0.00%</td>
</tr>
<tr>
<td>$882 Interior</td>
<td>88.06%</td>
<td>3.06%</td>
<td>0.00%</td>
<td>7.74%</td>
<td>0.16%</td>
<td>0.81%</td>
<td>0.32%</td>
</tr>
<tr>
<td>$672 DOT</td>
<td>32.77%</td>
<td>36.96%</td>
<td>0.68%</td>
<td>6.92%</td>
<td>2.04%</td>
<td>20.52%</td>
<td>0.11%</td>
</tr>
<tr>
<td>$620 EPA</td>
<td>18.60%</td>
<td>47.62%</td>
<td>0.00%</td>
<td>22.62%</td>
<td>9.38%</td>
<td>1.64%</td>
<td>0.30%</td>
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<tr>
<td>$1,401 Others</td>
<td>51.25%</td>
<td>7.07%</td>
<td>2.50%</td>
<td>14.78%</td>
<td>20.41%</td>
<td>2.50%</td>
<td>1.57%</td>
</tr>
</tbody>
</table>

Source: NSF, Science and Engineering Indicators 2002, Table 4-25

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Xalatan (glaucoma) example

- Glaucoma: more than 0.5% of population.
- Who funded this drug? Who profited?
- Who gets the benefits?

Genetically modified corn example

- What was the public/private conflict?
- What was the funding arrangement that (allegedly) created this conflict?
- What is the lesson here?
Public versus private funding

• Review: What is the main problem with private IP incentives? How does public funding avoid it?
• Criticism: Does public funding really avoid this? What do we learn from Xalatan? The Novartis deal?
• Virtue of IP: Reward is only given to valuable innovations (weak efficiency test).
• Criticism of public funding: Grants are given before any success may be forthcoming. How can this work?
New Hybrids: IP on government-sponsored research. Despite public policy conflicts (Chapela), is there a rationale for granting IP on government-subsidized research? What is the argument against this?

$s=\text{subsidy}, \ m=\text{firm matching requirement}, \ \nu=\text{value}, \ \nu \pi T=\text{profit}$
The government grant process: Funding Inventors instead of Inventions?

Can the grant process be exploited?

Let $\rho$ be the grant per project, and $c$ be the cost per project.

Let $\lambda$ be the “fertility” of the researcher (ideas per period)

Value of ideas in period $t$: $\frac{\lambda}{(1+r)^t} (\rho - c)$

Discounted value of future grants:

$$\sum_{t=1}^{\infty} \frac{\lambda}{(1+r)^t} (\rho - c) = \lambda (\rho - c) \sum_{t=1}^{\infty} \frac{1}{(1+r)^t} = \frac{\lambda}{r} (\rho - c)$$

Invest if the value of cheating, $c$, is less than value of future grants

$$c \leq \sum_{t=1}^{\infty} \frac{\lambda}{(1+r)^t} (\rho - c) \quad \Rightarrow \quad c \leq \frac{\lambda}{\lambda + r} \rho$$

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Questions about grants:

- How does the inclination to cheat depend on the fertility $\lambda$?
- What if you are a high-cost researcher?
- What if you are a low-fertility (low-$\lambda$)?
- Will the government have to “over pay?”