Incentives and Support Systems to Foster Private Sector Innovation

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Science, Technology & Innovation Network
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Supporting Business R&D and Innovation

- Innovation a primary driver of economic growth and other social objectives
- Business the main actor in innovation
  - Business outspends government by 2:1 in OECD
  - Business produces new products and services
- Developing effective policies is challenging
  - Instruments must be tailored to specific national needs
  - Target specific types of firms and industry sectors
  - Need to take a holistic approach—policy mix
- Financing business R&D an important element of innovation support
  - Firms invest less than socially optimal
  - Traditional sources of funding difficult to tap for R&D
- Other policy instruments also important
Direct Funding of Business R&D

Policy instrument that subsidizes business R&D through the provision of a grant or contract that pays for R&D projects conducted by a firm.

- Used in all 30 OECD countries and many non-OECD countries.
- Typically supports the costs of individual, pre-specified projects.
- Administered by wide range of government ministries, e.g., science and education, industry and economy, health, defense.
- Can have multiple objectives, e.g., to support commercially oriented R&D and/or to support R&D linked to another public mission (health, defense, environment, etc.) from which commercial spill-overs may result.
Design elements of direct funding programs

- **Objective of program**
  - Economic growth as primary objective
  - Other public mission (health, defense, environment)
  - Specific target industry, technology

- **Supplementary objectives**
  - Foster collaboration among firms or with public research organizations
  - Mandate inclusion of SMEs?
  - International linkages, as in European Framework Programme

- **Evaluation & selection criteria**
  - Competitive selection or first-come-first-served
  - Balance among scientific & technical quality, business plan for commercialization, other criteria
  - Peer review, international peer review, selection by government officials

- **In-process review and management**
  - Mid-term reports due
  - Final output
  - Role of government in mid-course correction

- **Budget and size of individual award**
  - Budget determined in advance; link to success rate
  - Many small awards or fewer larger awards
  - Duration of grant (1 year or multiple years)
  - Co-financing by industry?
Direct government funding of business R&D

Government-funded business R&D as % of GDP

Source: OECD MSTI Database 2006-2
R&D tax incentives

Policy instruments that aims to increase business expenditure on R&D by providing financial benefits through the tax system

- Typically in the form of a tax credit to be taken against taxes owed or an allowance that reduces taxable corporate earnings.
- Typically administered through corporate tax system, but the some countries administer them through wage/payroll tax reductions.
- Increasingly popular: Used in 19 OECD countries in 2006, up from 12 in 1996.
- Still not universally used due to concerns about effectiveness and deadweight loss.
Design elements in tax incentives

- **Structure of incentive**
  - Credit vs. allowance
  - Volume vs. incremental (i.e., apply to all R&D or just increase in R&D)

- **Definition of qualifying R&D**
  - R&D or all innovation expenses (e.g., in Spain)
  - In-house vs. external R&D
  - Some preferences for funding public & basic research (Denmark, Japan, Norway, UK)
  - Foreign R&D (within EEA) allowed in Ireland; not in US, Australia or Canada

- **Other allowable expenditures**
  - Cost of licensing patents in Canada, France, Hungary, Portugal, Spain
  - Patent defense and technology monitoring in France

- **Administration/enforcement**
  - R&D projects certified in advance in Netherlands, Norway, Spain
  - Claimed company-level expenditures subject to review by tax authorities in Australia, Ireland, UK, US

- **Budgeting**
  - Most countries have no budget for R&D tax incentives. Claims vary depending on corporate R&D expenditures
  - A priori budget established in Netherlands
# R&D Tax Incentives in OECD Countries

<table>
<thead>
<tr>
<th>Type of Incentive</th>
<th>Large firm</th>
<th>SME</th>
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<tbody>
<tr>
<td><strong>Volume</strong></td>
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<tr>
<td><strong>Denmark</strong> (150%)</td>
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<td><strong>Belgium</strong> (113.5%)</td>
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<tr>
<td><strong>Hungary</strong> (100-300%)</td>
<td><strong>Canada</strong> (20%)</td>
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<td>Mexico (30%)</td>
<td><strong>Japan</strong> (10-12%)</td>
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<tr>
<td><strong>Czech Republic</strong> (200%)</td>
<td><strong>Netherlands</strong> (14%)</td>
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<tr>
<td><strong>Norway</strong> (18%)</td>
<td><strong>Poland</strong> (30%)</td>
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<tr>
<td><strong>UK</strong> (125%)</td>
<td><strong>UK</strong> (125%)</td>
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<tr>
<td><strong>Belgium</strong> (118%)</td>
<td><strong>Canada</strong> (25%)</td>
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<tr>
<td><strong>Japan</strong> (15%)</td>
<td><strong>Italy</strong> (30%)</td>
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<tr>
<td><strong>Netherlands</strong> (42%)</td>
<td><strong>Poland</strong> (50%)</td>
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<tr>
<td><strong>Norway</strong> (20%)</td>
<td><strong>UK</strong> (150%)</td>
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<tr>
<td><strong>Australia</strong> (125%/175%)</td>
<td><strong>Austria</strong> (125%/135%)</td>
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<tr>
<td><strong>France</strong> (5%/45%)</td>
<td><strong>Korea</strong> (7%/40%)</td>
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<tr>
<td><strong>Portugal</strong> (20%/50%)</td>
<td><strong>Spain</strong> (30%/50%)</td>
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<tr>
<td><strong>Ireland</strong> (20%)</td>
<td><strong>United States</strong> (20%)</td>
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<tr>
<td><strong>Finland</strong></td>
<td><strong>Germany</strong></td>
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<tr>
<td><strong>Iceland</strong></td>
<td><strong>Luxembourg</strong></td>
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<td><strong>Slovak Republic</strong></td>
<td><strong>Sweden</strong></td>
<td></td>
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<tr>
<td><strong>Turkey</strong></td>
<td><strong>New Zealand</strong></td>
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</table>
| **Notes:** *Bold* indicates incentive introduced after 2000. *Italics* indicates tax allowance instead of tax credit. France has additional tax incentives for young, innovative firms.
Relative generosity of tax incentives: B-index

Rate of tax reduction for 1 unit of R&D spending (1 minus B-index)

### Mix of instruments for financing business R&D

<table>
<thead>
<tr>
<th>Country</th>
<th>Tax incentives</th>
<th></th>
<th>Direct funding</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td><em>PPP millions</em></td>
<td>% BERD</td>
<td><em>PPP millions</em></td>
<td>% BERD</td>
</tr>
<tr>
<td>Australia</td>
<td>328</td>
<td>6.8</td>
<td>219</td>
<td>4.1</td>
</tr>
<tr>
<td>Austria</td>
<td>154</td>
<td>4.5</td>
<td>193</td>
<td>5.6</td>
</tr>
<tr>
<td>Canada</td>
<td>1381</td>
<td>14</td>
<td>258</td>
<td>2.6</td>
</tr>
<tr>
<td>France</td>
<td>543</td>
<td>2.2</td>
<td>2655</td>
<td>11.1</td>
</tr>
<tr>
<td>Japan</td>
<td>431</td>
<td>0.5</td>
<td>681</td>
<td>0.8</td>
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<tr>
<td>Netherlands</td>
<td>470</td>
<td>8.1</td>
<td>175</td>
<td>3.4</td>
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<tr>
<td>Norway</td>
<td>24</td>
<td>1.3</td>
<td>178</td>
<td>10.4</td>
</tr>
<tr>
<td>Spain</td>
<td>285</td>
<td>3.9</td>
<td>802</td>
<td>12.5</td>
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<tr>
<td>UK</td>
<td>860</td>
<td>2.8</td>
<td>2408</td>
<td>10.9</td>
</tr>
<tr>
<td>US</td>
<td>6356</td>
<td>3.1</td>
<td>23,535</td>
<td>10.7</td>
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</tbody>
</table>

*Source: OECD estimated based on preliminary national statistics*

*Note: Most recent years available.*
Policy Mix for Financing Business R&D

Relative shares of direct funding as tax incentives (% of total financial support to business R&D)

Source: OECD estimated based on preliminary national statistics
Note: Most recent years available.
Evaluating Tax Incentives

- Hard to do
  - Not typically linked to an individual project, so hard to identify tangible, quantifiable output
  - Costs to government and industry are diffuse

- Econometric analysis of input additionality (how much more R&D input?)
  - Variation in results: roughly 1:1 return
  - Larger gains seen in long term
  - Do not entice non-performers to start R&D
  - Unlikely to direct R&D into novel directions
  - Limited estimates/data by sector, firm size, etc.

“R&E tax credit affects firms at the level of general budget considerations, not at the level of strategic R&D choices. . . . R&D strategies derive from fundamental business and technological objectives, with little or no consideration given to the R&E tax credit per se.” (US Congress, Office of Technology Assessment, 1995).
Evaluating Direct Funding Programs

Evaluate input and *output* additionality (how much output from the R&D effort?)
Measuring Behavioral Additionality

How does government R&D support affect the behavior of firms and the way they conduct R&D?

- **More challenging R&D**
  - Japan: More than 40% of respondents claim challenging, high-risk R&D is main benefit of participation
  - Finland found that selection process heightened this effect;

- **More collaboration**
  - Germany: Almost half of collaborations endured beyond project completion (¼ of industry-science collaborations).
  - US: Almost half of ATP joint-venture participants continued working with partners 2 years later.

- **Improved R&D management**
  - Australia: 65% of R&D Start participants reported changes in firm management to comply with programme requirements
  - Belgium/Flanders: Traditional SMEs reported benefits from learning how to manage R&D processes
## Comparing R&D financing instruments

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Policy instrument</th>
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<tr>
<td></td>
<td>Direct funding</td>
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<tr>
<td>Effectiveness in boosting levels of business R&amp;D</td>
<td>Varies depending on selection criteria, design, and capability of gov’t administrators.</td>
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<tr>
<td>Ability to target industries/sectors</td>
<td>Good. Gov’t can establish criteria</td>
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<tr>
<td>Ability to influence business R&amp;D behavior</td>
<td>Can affect collaboration, management of R&amp;D</td>
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<tr>
<td>Selection of projects</td>
<td>Government selects among industry proposals.</td>
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<td>Administrative costs</td>
<td>High, to establish bureaucracy</td>
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<td>Government skills needed</td>
<td>Strong skills in selecting projects, managing program</td>
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<tr>
<td>Scope of participating firms</td>
<td>Limited to selected firms</td>
</tr>
<tr>
<td>Summary</td>
<td>Good for building R&amp;D capacity in specific sectors, concentrating resources. Incremental and radical innovation</td>
</tr>
</tbody>
</table>
Targeting industry sectors

Contribution of selected industries to aggregate R&D intensity in the business sector (deviation from OECD average, 1999-2002)

Source: OECD STAN and ANBERD databases

- Sectoral targeting frequently used in direct funding programs; **not** (yet) used in R&D tax incentives.
- Process for identifying targeted sectors is key consideration.
Targeting Services: Service sector industries are innovative...

Share of innovative firms, CIS3 Survey, 1998-2000

Services innovation driven by:
- Acquisition of equipment and knowledge (especially IT)
- Training & education (share of highly educated is twice that in manufacturing in many countries)
- Intramural and external R&D (primarily in business services: computing, software, telecommunications)
- Patterns differ by industry sector (e.g., finance versus business services)

... but policy needs differ

- Limited service sector participation in innovation programs.
- Most services programs to date focus on development and deployment of IT.
- Policy should also promote education & training; collaboration; acquisition of knowledge & technology.
- R&D programmes could be better-suited to service needs.
- Development of standards
- Entrepreneurship

**Share of manufacturing and service firms receiving public funding, 1998-2000**

Source: Enhancing the Performance of the Service Sector, OECD, 2005.
Targeting financial support to SMEs

Policy instruments

- R&D “set-asides” for SMEs (UK, US, Neth)
- Funding programs for traditional SMEs
- Funding programs for startups
- Preferential R&D tax incentives
- Tailored tax incentives

Share of SMEs in direct R&D funding programs (most recent year available)
Public Support to VC

- Finances entrepreneurial firms, not R&D
- VC and business angels
- Direct measures
  - public venture capital funds
  - public contribution to private VC fund
  - Tap into international VC markets instead?
- Indirect measures
  - Tax incentives
  - Treatment of stock
  - Secondary markets
  - Cross-border M&A
  - Bankruptcy procedures

Venture capital as a % of GDP

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<tr>
<th>Country</th>
<th>Early stage</th>
<th>Expansion</th>
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<td>Japan</td>
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<td>US</td>
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Public-Private Collaboration: Industry-science linkages

Forms of Collaboration

**Formal**
- Joint labs
- Spin-offs
- Licensing
- Research contracts

**Informal**
- Mobility of researchers
- Co-publications
- Conferences, etc.
- Informal contacts
- Flow of graduates to industry

Routes to Commercialisation

Entrepreneurial route: spin-offs/spin-outs
Patenting route: licensing of technology
Cooperative route: joint and collaborative research
Beyond financing: Impediments to business innovation

● Lack of resources for innovation
  – Financing
  – Knowledge (science, technology, marketing, etc.)
  – Human resources

● Lack of incentive to innovation
  – Limited domestic or international competition
  – Marketplace does not reward innovation
  – Difficult to appropriate returns from innovation
  – Industry structure tilted toward low-technology
  – Limited tolerance for risk-taking

● Policy instruments need to match impediments
Framework policies that influence business innovation

- **Human resources: education & labor markets**
  - Basic educational skills & accessible, high-performing tertiary education system
  - Training of scientists and engineers
  - Employment protection laws (influence ability to hire/fire)

- **Openness and restrictions on FDI**
  - Foreign R&D makes large contribution to productivity growth
  - Multiple channels: FDI, international mobility of human resources, participation of foreign firms/researchers in R&D programmes, etc.
  - Openness influenced by FDI regulations and active support for mobility and engagement in international networks of innovation where appropriate.

- **Product market competition**
  - Strong PMR encourages investments in innovation to stay ahead of competitors, but can weaken firm’s ability to appropriate returns

- **Intellectual property protection**
  - Strong IPR can enable firms to appropriate returns from investment in innovation, but can foster monopoly positions and limit knowledge diffusion.
  - Strike balance between IPR and product market regulation
  - Ensure quality of patents and promote diffusion (e.g., through licensing, research access).
Many factors influence innovation performance

Contribution to change in business R&D intensity, 1991-2000, as % GDP

1. Includes public financial support for private R&D (both grants and tax incentives), R&D performed in public institutions and the share of the latter that is funded by the private sector.

2. Includes product market regulation, employment protection legislation and the strength of intellectual property rights.

3. Includes indicators of a country's exposure and capacity to absorb foreign knowledge as well as of broad financial and economic conditions. Residual factors that can not be accounted for by the statistical relation are also included in this category.

Source: OECD, Going for Growth 2006

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IADB STI Network Meeting

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For more information

STI Outlook 2006

Innovation Policy & Performance

Going for Growth 2006

STI Scoreboard 2005

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