The effectiveness of R&D tax incentives

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Workshop on the revision of state aid rules for research and development and innovation (R&D&I)

Brussels, January 9, 2013
Direct government funding and R&D tax incentives in % of GDP

Source: OECD, Main Science and technology Indicators, 2011
Market failures in R&D&I

- **Spillovers**
  - Disincentive from imperfect appropriation
  - Social return higher than the private return
- **Asymmetric information**
- **Uncertainty and incomplete capital markets for risky events**
- **Large size and indivisibility of certain projects**
- **Coordination problems (e.g. skills availability)**

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Kinds of R&D tax incentives

• In proportion to the level of the expenses
  – immediate write-off or expensing
  – tax credits proportional to the level of R&D

• In proportion to the increment of R&D
  – Definition of the base (fixed or variable, e.g. last two years)

• Measures intended to remove ceilings in the effective use of tax incentives
  – refundability of unused tax credits
  – Carry-back and carry forward of unused tax credits
  – Flow through mechanisms, i.e. transfer of unused tax credits to an eligible third party

• Focus on specific types of R&D
  – environment, health, defense, agriculture, information
  – university, small and medium enterprises (SME), regional support, R&D cooperation

• Indirect tax incentives
  – reduced corporate income taxes, exemption of capital gains taxes
  – Reduced taxes on dividends from venture capital funding
  – Reduced taxes for high-skilled immigrants
Table 1. Details of differences in R&D tax incentives schemes across selected OECD countries 2009

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<tr>
<th>Design of the R&amp;D tax incentive scheme</th>
<th>Volume base R&amp;D tax credit</th>
<th>Australia, Canada, France, Norway, Brazil, China, India</th>
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<td>Incremental R&amp;D tax credit</td>
<td>United States</td>
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<td>Hybrid system of a volume and an incremental credit</td>
<td>Japan, Korea, Portugal, Spain</td>
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<td>R&amp;D tax allowance</td>
<td>Denmark, Czech Republic, Austria, Hungary, UK</td>
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<tr>
<th>Payroll withholding tax credit for R&amp;D wages</th>
<th>Belgium, Hungary, Netherlands, Spain</th>
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<th>More generous R&amp;D tax incentives for SMEs</th>
<th>Canada, Australia, Japan, United Kingdom, Hungary, Korea, Norway</th>
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<th>Targeting</th>
<th>Special for energy</th>
<th>United States</th>
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<td>Special for collaboration</td>
<td>Italy, Hungary, Japan, Norway</td>
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<td>Special for new claimants</td>
<td>France</td>
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<td>Special for young firms and start-ups</td>
<td>France, Netherlands, Korea</td>
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<th>Ceilings on amounts that can be claimed</th>
<th>Italy, Japan, United States, Austria, Netherlands</th>
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<th>Income based R&amp;D tax incentives</th>
<th>Belgium, Netherlands, Spain</th>
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| No R&D tax incentives | Estonia, Finland, Germany, Luxembourg, Mexico, New Zealand, Sweden, Switzerland |

Note: R&D tax allowances are tax concessions up to a certain percentage of the R&D expenditure and can be used to offset taxable income; R&D tax credits reduce the actual amount of tax that must be paid.
Price elasticity of R&D

• Netherlands: short-run -0.3, long-run -0.7

• Quebec:
  – Small firms: -0.14 in SR, -0.19 in LR
  – Large firms: -0.06 in SR, -0.10 in LR

• Comparison with other studies:
  – Bloom, Griffith, van Reenen (2002), -0.1 in SR, -1.0 in LR
  – Harris, Li, Trainor (2009), -0.53 in SR, -1.36 in LR
  – Wilson (2005), in LR -1.0 within states, but given market stealing from out-of-state, total effect -0.1
  – Mairesse-Mulkay, 0.6 after 2008, above 2 before 2008 (incremental R&D tax credit)

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Not all firms apply for R&D tax credits

• Higher probability to apply if
  – Capacity for innovation (human and financial capital)
  – Stable financial position
  – Received R&D subsidies before

• SMEs incur obstacles in applying for R&D tax credits

• Corchuelo and Martinez-Ros report that in Spain around 50% of the firms in 2002 did not know about the tax incentives and only 29% of those you knew used them.

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Ways to assess effectiveness of R&D

Additionality
Cost-effectiveness ratio
Incrementality ratio
Tax sensitivity ratio

Full Cost benefit analysis
Spillovers
Administration costs
Compliance costs
Opportunity costs

General equilibrium analysis
Wage effects
Balanced budget
Open trade

Second-order effects
Third-order effects
Bang for the buck (BFTB)

• Definition:
  – changes in R&D/changes in tax expenditures

• Deadweight loss:
  – Paying for R&D levels and R&D increases that would have happened anyway
Figure 1: Mean BFTB after $t$ years

Large and small firms
BFTB in Quebec

• If level-based R&D tax credit increases by 10%, for small firms, the BFTB stays above 1 after 20 years, for large firms it falls below 1

• Deadweight loss: 68% for small firms, 82% for large firms

• If increment-based R&D tax credit increases by 10%, the BFTB= 2.98 for small firms, 2.79 for large firms

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Sensitivity analysis (from Parsons and Phillips, 2007)

The MEB lines trace combinations of spillover effects and incrementality ratios that result in a welfare gain of zero. Combinations that lie above the line result in a welfare gain while combinations below the line result in a welfare loss.

Net Welfare Gain

Net Welfare Loss

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Wage effects

• Why?
  – To stimulate researchers to apply for R&D tax credits
  – Supply constraint of R&D personnel
  – Search costs for R&D personnel
  – Negotiating power of R&D personnel

• Elasticity of the R&D wage with respect to the fraction of the wage supported by the fiscal incentives scheme is estimated at 0.1 in the short run and 0.13 in the long run.

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Extensive margin

• Attract new R&D performers
• Because of sunk entry costs, give extra incentive to newcomers to cover these costs
• Because of R&D persistence, effects are long-lasting
• low deadweight loss
• 25% of manufacturing firms in Spain need subsidies to enter but not to continue R&D
• This would raise the percentage of R&D performing manufacturing firms in Spain from 20% to 30%, cost 110 million Euro but yield over 15 years 2,500 million Euro of additional R&D stock

Study by Pere Arqué-Castells and Pierre Mohnen, “Sunk costs, extensive R&D subsidies and permanent inducement effects”, UNU-MERIT working paper 2012-029

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Increment-based R&D tax incentives

• Pros
  – Less deadweight loss
  – Larger bang for the buck

• Cons
  – Little effect of the user cost of R&D
  – More effective with fixed base than with rolling base, although fixed base not very realistic.
  – Limit to R&D acceleration

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Pros and Cons of R&D tax incentives

Pros

- Let the private sector decide on the allocation of funds and let it foot part of the bill
- Neutral, not biased towards particular projects
- Predictable, reliable
- Lower administration costs than direct subsidies

Cons

- R&D tax incentives are not terribly effective in stimulating more R&D than the amount of tax revenues foregone in the long run, except perhaps for small firms
- Deadweight loss for level-based R&D tax credits
- Tax incentives support more the big firms than the small firms even if rates are more favorable for small firms
- Tax incentives might lead to research projects with a low rate of return, unprofitable without the tax support
- Benefits partly washed out by a wage effect

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Policy discussion

• Deadweight loss and effectiveness should be compared for tax credits versus direct government aid for R&D support.

• Combine R&D tax incentives with other incentives and complementary measures (e.g. creating human capital)

• Coordination of tax incentives to avoid tax competition

• Devise tax incentives or other means of support for innovation appropriate to the particular market failures (e.g. spillover, financing problems, or human capital insufficiencies)

• Keep tax laws stable