The effects of R&D tax incentives and their role in the innovation support policy mix

Findings from the OECD microBeRD project

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R&D tax incentives matter!

Direct funding and federal tax support for business R&D, 2013 (% GDP)

Design and heterogeneity matters!

Example 1: R&D tax incentives in Portugal

1-B-Index by firm size and profit scenario

Design and heterogeneity matters!

Example 2: R&D tax incentives in Norway

1-B-Index by firm size and profit scenario

Approaches to studying R&D tax incentives

- Firm-level single-country
- Aggregate cross-country
- Firm-level cross-country
  - microBeRD
microBeRD: Distributed microdata approach

As seen on... Dynemp and Multiprod

Figure: Confidential national microdata

- Confidential national microdata
- Statistical code
- Incentive design information
- Non-confidential harmonized output

1. Moments of firm distribution → micro-aggregated regressions
2. Firm-level distributed regressions

Diagram:
- Confidential national microdata
- Statistical code
- Incentive design information
- Non-confidential harmonized output

R&D survey data
Corporate tax data
**Micro-aggregated regressions**

**Methodology**

\[ \log Y_{\text{cist}} = \sum_{g \in G} \beta_g^{\text{TAX}} \log B\text{Index}_{\text{cist}} + \beta^{\text{VA}} \log V\text{A}_{\text{cist}} + \gamma_{\text{cis}} + \gamma_{\text{it}} + \gamma_{\text{st}} + \varepsilon_{\text{cist}} \]

- Country-size-industry-year
- Link R&D performance to user cost of R&D
- Input additionality
  - effect on intramural R&D but also its components by costs (labour, material, capital R&D exp.) or type of R&D (basic vs applied vs experimental) and extramural R&D
- Control for value added and rich fixed effects
- 18 countries, 36 A38 industries, 3 size classes, 2000-2017
Micro-aggregated regressions

Estimated R&D user cost elasticities

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implied gross</td>
<td>1.0</td>
<td>1.5</td>
<td>1.0</td>
<td>0.4</td>
</tr>
<tr>
<td>incrementality</td>
<td></td>
<td></td>
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<tr>
<td>ratios</td>
<td></td>
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</table>
**Micro-aggregated regressions**

**Size or R&D performance?**

<table>
<thead>
<tr>
<th></th>
<th>By size</th>
<th>By average R&amp;D expenditure</th>
<th>By industry R&amp;D intensity</th>
<th>Horse race</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>log B-Index</td>
<td>-0.255*</td>
<td>-0.642***</td>
<td>-0.646***</td>
<td>-0.693***</td>
</tr>
<tr>
<td></td>
<td>(0.141)</td>
<td>(0.070)</td>
<td>(0.076)</td>
<td>(0.180)</td>
</tr>
<tr>
<td>x medium (50-249 emp.)</td>
<td>-0.443**</td>
<td></td>
<td></td>
<td>0.100</td>
</tr>
<tr>
<td></td>
<td>(0.180)</td>
<td></td>
<td></td>
<td>(0.221)</td>
</tr>
<tr>
<td>x small (10-49 emp.)</td>
<td>-0.762***</td>
<td></td>
<td></td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>(0.190)</td>
<td></td>
<td></td>
<td>(0.263)</td>
</tr>
<tr>
<td>x initial mean(R&amp;D)</td>
<td></td>
<td>0.489***</td>
<td></td>
<td>0.510***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.066)</td>
<td></td>
<td>(0.107)</td>
</tr>
<tr>
<td>x initial R&amp;D/VA</td>
<td></td>
<td></td>
<td>0.174</td>
<td>-0.025</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.128)</td>
<td>(0.090)</td>
</tr>
</tbody>
</table>

| N                   | 5616    | 5616                       | 5616                     | 5616       |

**Note:** All regressions control for log(value added), country-industry-size FE, industry-year FE and size-year FE. Standard errors clustered at country-industry-size level. Countries: AUS, AUT, BEL, CAN, CHL, CZE, DEU, FRA, ISR, ITA, JPN, NLD, NOR, NZL, PRT, SWE.
Micro-aggregated regressions

Additional results

- among existing & new R&D performers
- R&D capital and extramural R&D
- No wage effects (part-time R&D employment)
- Exp. development vs. Research
- Direct support
3 types of DiD analysis

1. Tax relief beneficiaries vs. non-beneficiaries
   AUS, BEL, CZE, FRA, NOR, PRT, SWE

2. Tax incentive change: affected vs. non-affected firms
   AUS, AUT, BEL, CHL, FRA, JPN, NOR, SWE

3. Direct support beneficiaries vs. non-beneficiaries
   AUT, CAN, CZE, DEU, FRA, ITA, JPN, NOR, NZL, PRT
Firm-level regressions
Input additionality by country and method
• Heterogeneity and design matter!

• R&D ceilings/thresholds likely to increase overall input additionality
  – But spillovers stronger for larger firms? (Bloom et al., 2013)

• How to incentivize large R&D performers?
  – Mission-oriented policies? Procurement?
Thank you

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B-Index

• B-Index: pre-tax return required for a firm to financially break-even, following a decision to spend one additional monetary unit on R&D, taking into account how much tax is ultimately due.

  – The more generous the tax provisions for R&D, the lower the before-tax breakeven economic return required by firms (i.e. the B-Index) Implied Subsidy Rate = 1 - B-Index.

  – \( B \text{ Index} := \frac{\text{ATC}}{1-\tau} = \frac{1-A}{1-\tau} \)

    • Where ATC= after-tax cost of one additional unit of R&D expenditure
    • A = combined net present value of tax allowances and credits applying to the marginal R&D outlay and \( \tau = \) corporate tax rate
From B-Index to Incrementality ratio (bang for the buck)

• Analytical derivation of the incrementality ratio from the elasticity of business R&D expenditure (BERD) to the B-index (Thomson, 2017)
• The estimated elasticity parameter $\beta_{gTAX}$ represents the expected percentage change in business R&D resulting from a marginal percentage change in the B-Index, i.e.
  $$\beta_{gTAX} = \frac{d \log BERD}{d \log BIndex}$$
• Based on this elasticity, the gross incrementality ratio (IR), i.e. marginal change in BERD resulting from a marginal change in government tax relief for R&D (GTARD) can be derived as follows:

$$IR^{Tax} := \frac{dBERD}{dGTARD} = \left( \frac{1}{1 - \tau} \right) \beta_{gTAX} (1 - BIndex) - BIndex$$