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

Findings from the OECD microBeRD project

CONCORDi 2019
Seville, 25-27 September 2019

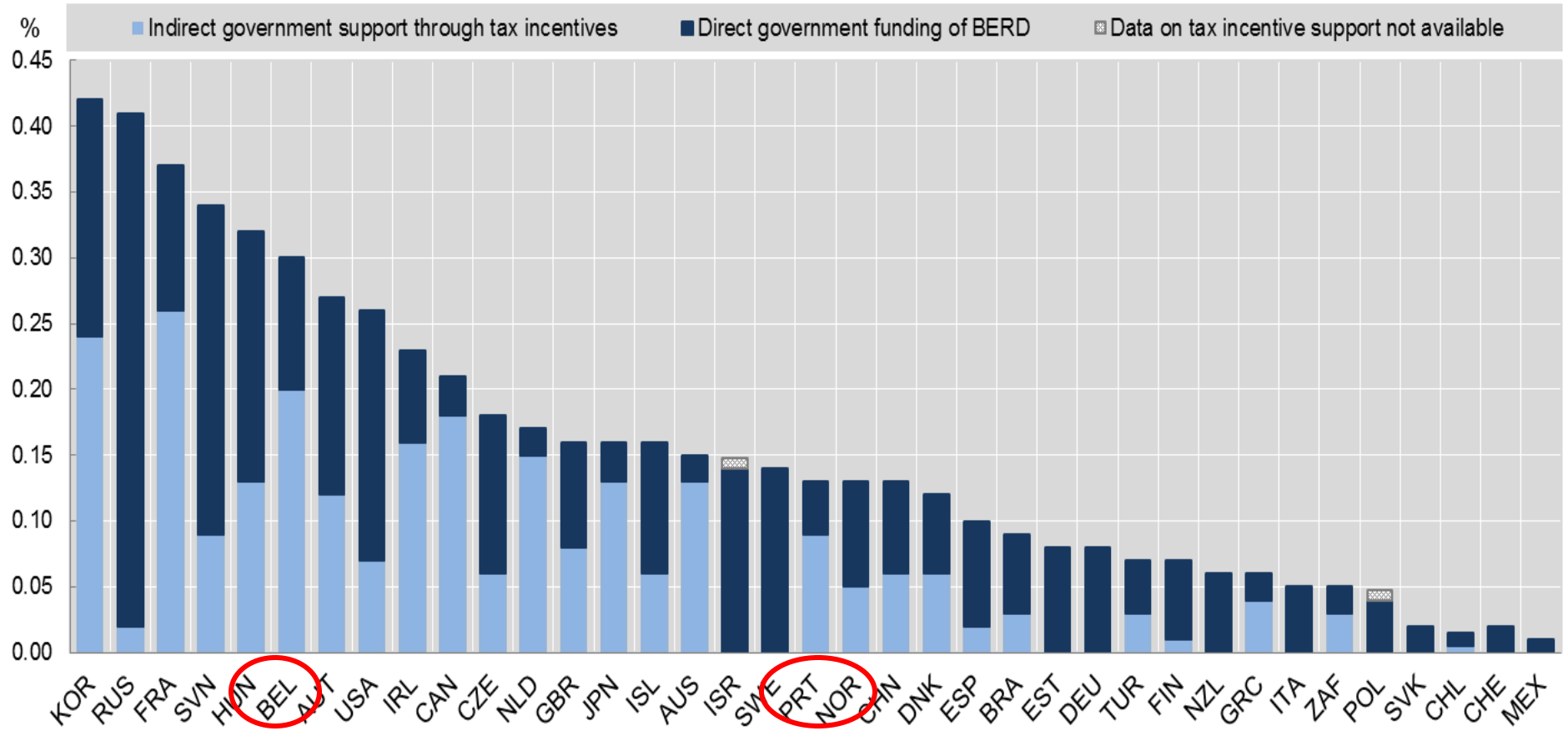
Chiara Criscuolo
with Silvia Appelt, Matej Bajgar, Fernando Galindo-Rueda
OECD Directorate for Science, Technology and Innovation

Co-funded by the Horizon 2020
Framework Programme of the European Union

OECD
BETTER POLICIES FOR BETTER LIVES

R&D tax incentives matter!

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

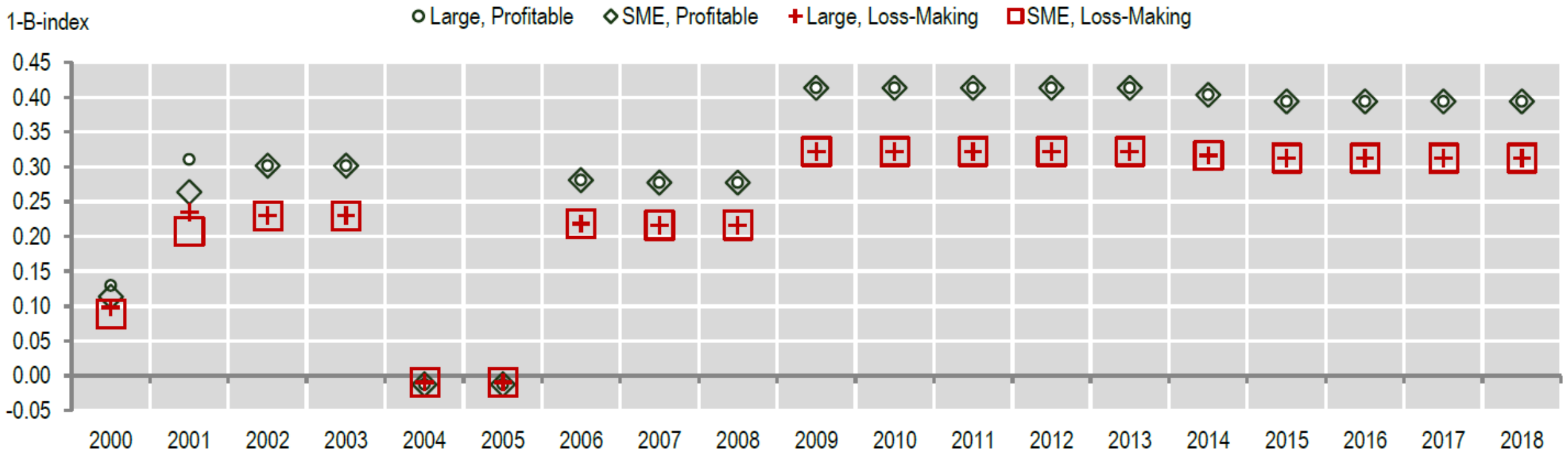


Source: OECD STI Scoreboard 2015, based on OECD, R&D Tax Incentive Indicators, www.oecd.org/sti/rd-tax-stats.htm and Main Science and Technology Indicators, www.oecd.org/sti/msti.htm, June 2015.Statlink: http://dx.doi.org/10.1787/888933274317.

Design and heterogeneity matters!

Example 1: R&D tax incentives in Portugal

1-B-Index by firm size and profit scenario

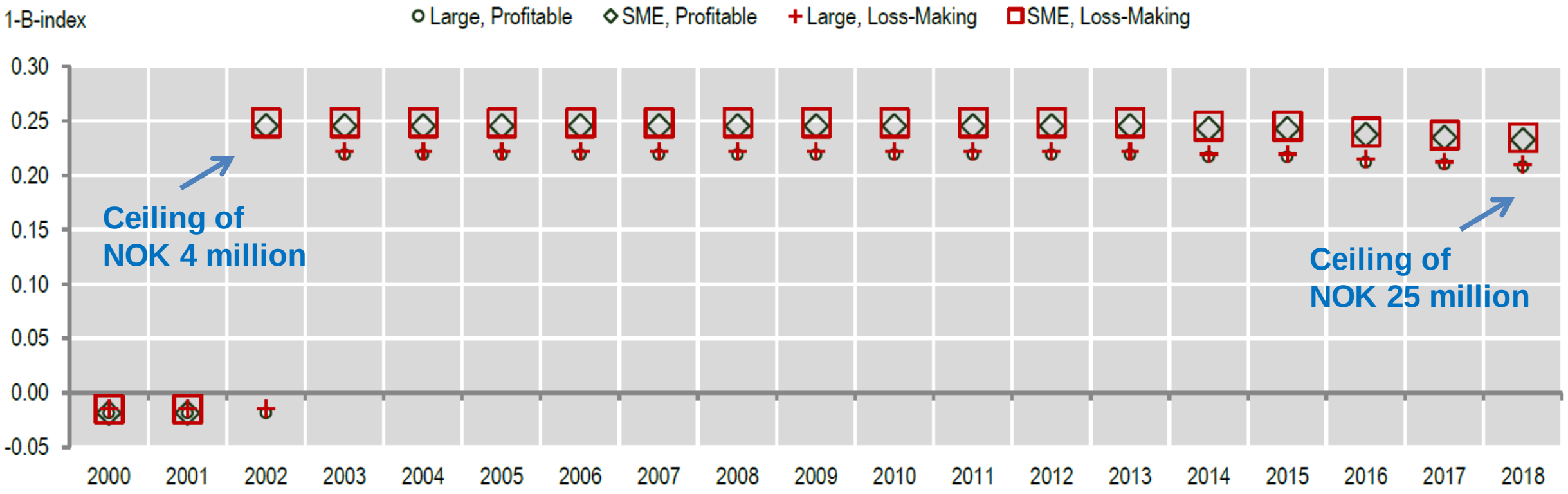


Source: OECD, R&D Tax Incentive Database, http://oe.cd/rdtax, March 2019.

Design and heterogeneity matters!

Example 2: R&D tax incentives in Norway

1-B-Index by firm size and profit scenario

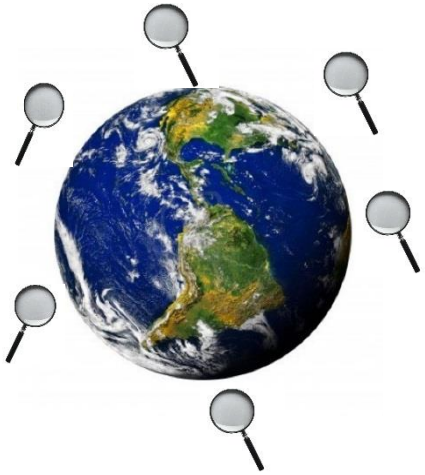


Source: OECD, R&D Tax Incentive Database, http://oe.cd/rdtax, March 2019.

Approaches to studying R&D tax incentives

Firm-level single-country

Aggregate cross-country

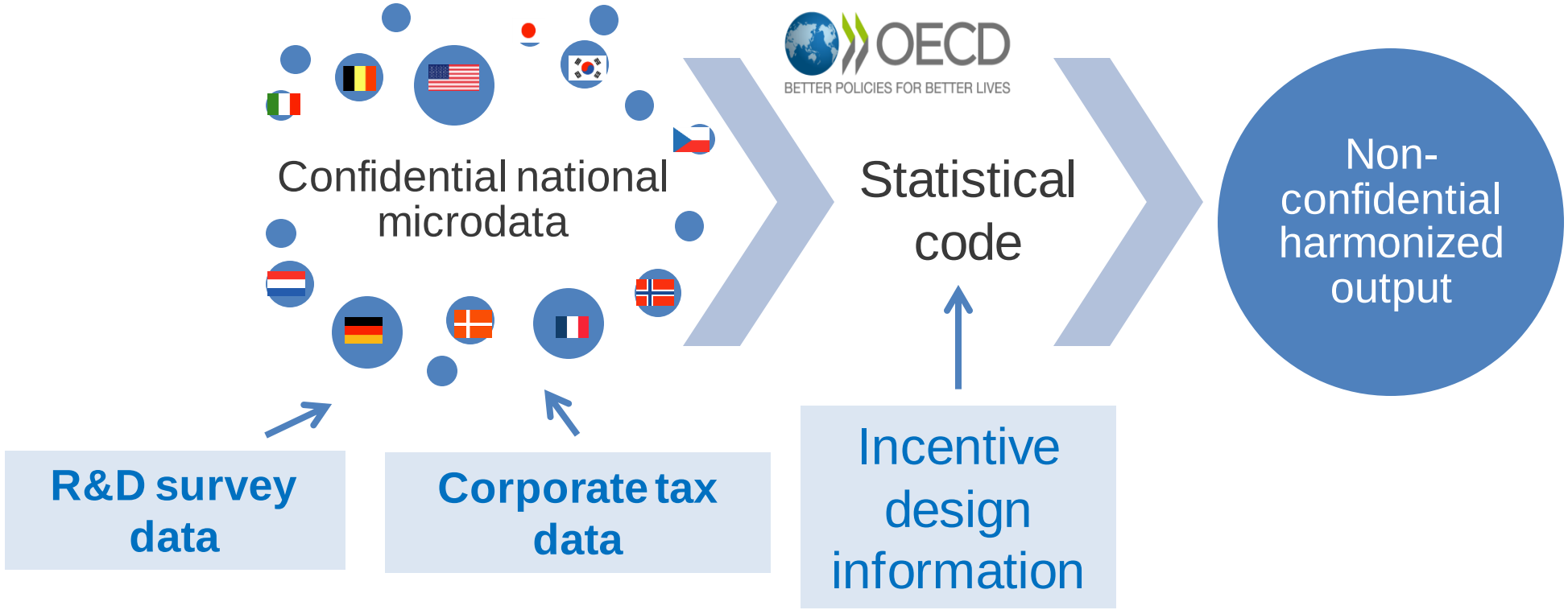


Firm-level cross-country

→ **microBeRD**

microBeRD:
Distributed microdata approach

As seen on... Dynemp and Multiprod



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

Micro-aggregated regressions

Methodology

$$logY_{cist} = \sum_{g \in G} \beta_g^{TAX} \, logBIndex_{cist} + \beta^{VA} logVA_{cit} + \gamma_{cis} + \gamma_{it} + \gamma_{st} + \varepsilon_{cist}$$

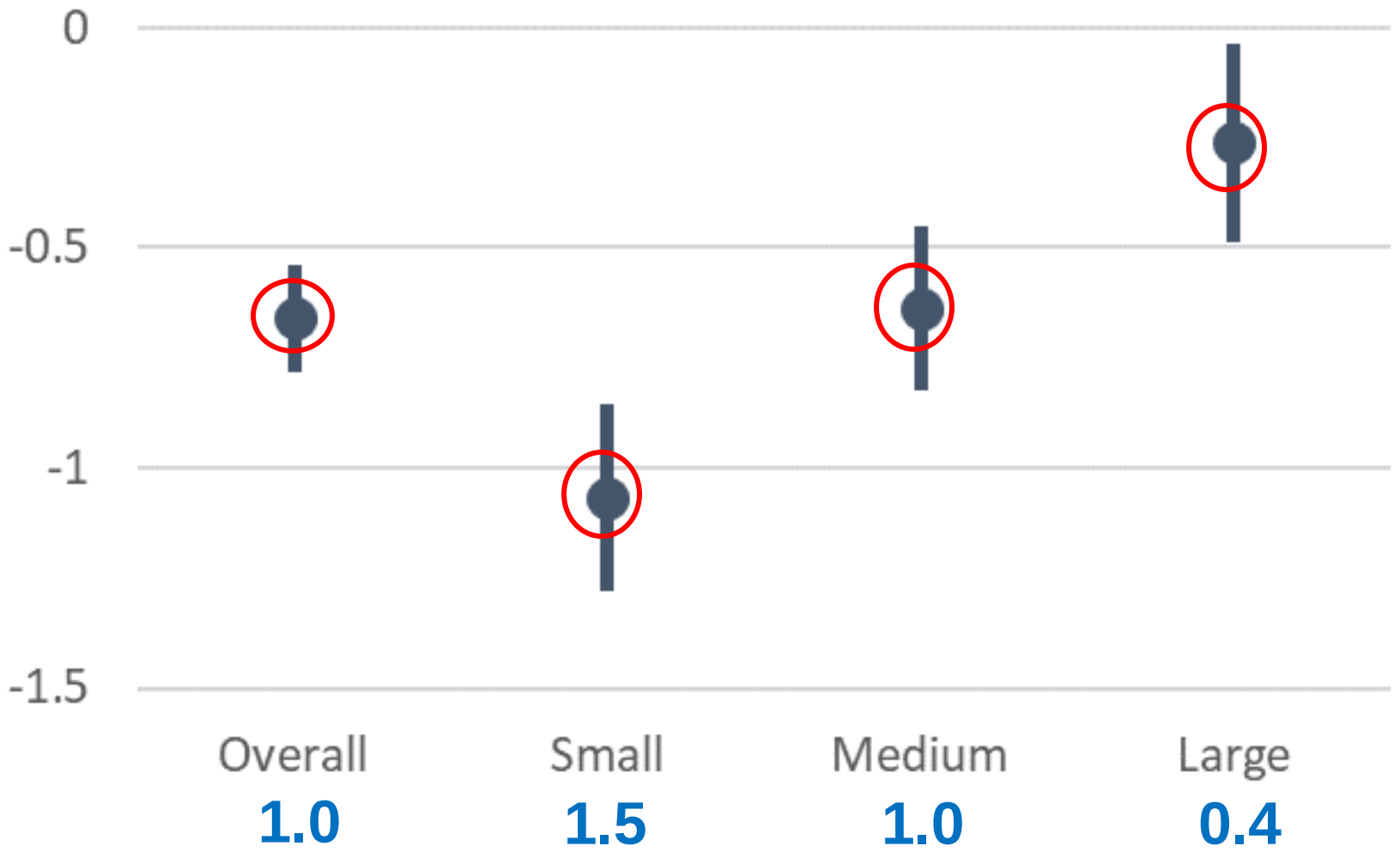
- Country-size-industry-year
- Link R&D performance to user cost of R&D
- Input additionality

→ 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



Implied gross incrementality ratios

Micro-aggregated regressions

Size or R&D performance?

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

Firm-level regressions

Methodology

Leveraging tax relief microdata

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

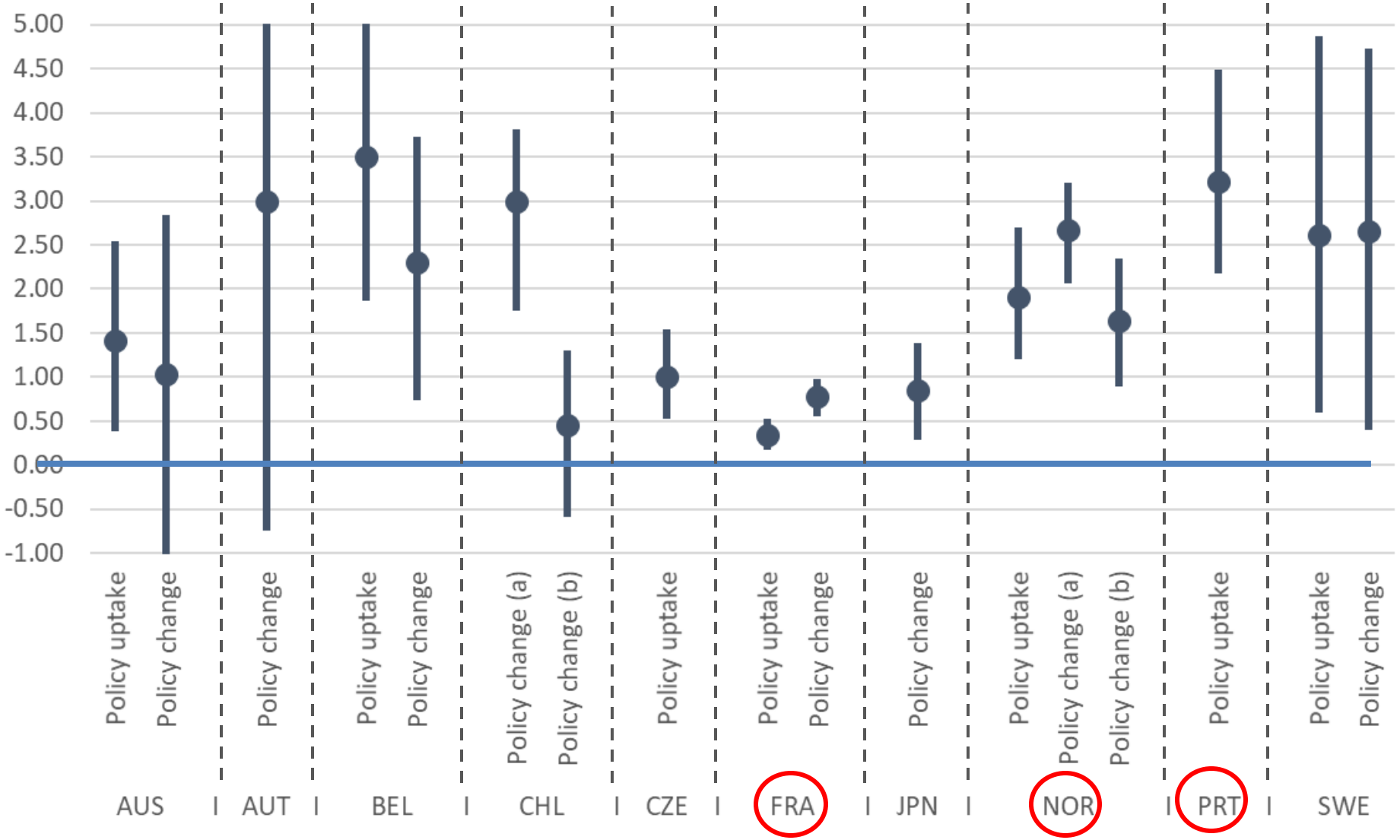
   AUS, AUT, BEL, CHL, FRA, JPN, NOR, SWE

3. Direct support beneficiaries vs. non-beneficiaries

   AUT, CAN, CZE, DEU, FRA, ITA, JPN, NOR, NZL, PRT

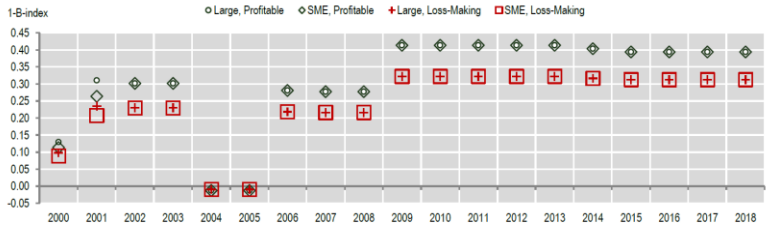
Firm-level regressions

Input additionality by country and method

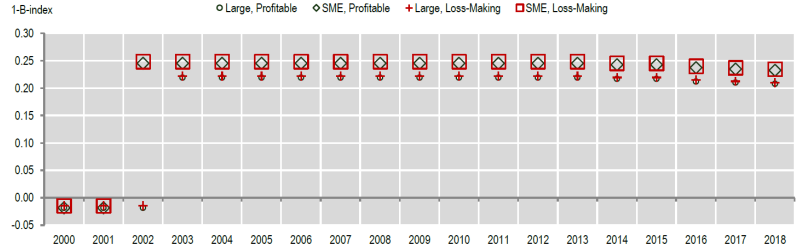


What does this mean?

Input additionality
0.4 (large) vs. 1.4 (small)
(driven by level of R&D)



Source: OECD, R&D Tax Incentive Database, http://oe.cd/rdtax, March 2019.



Source: OECD, R&D Tax Incentive Database, http://oe.cd/rdtax, March 2019.

- 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

chiara.criscuolo@oecd.org

OECD

European Commission
HORIZON 2020
The EU Framework Programme for Research and Innovation

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.
  - $B\ Index := \frac{\mathrm{ATC}}{1-\tau} = \frac{1-\mathrm{A}}{1-\tau}$
    - 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 τ = 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.
- $\beta_g^{TAX} = \frac{dlogBERD}{dlogBIndex}$
- 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:

$$IR^{Tax} := \frac{dBERD}{d\widetilde{GTARD}} = \left(\frac{1}{1-\tau}\right) * \frac{\beta_g^{TAX}}{\beta_g^{TAX}(1-BIndex) - BIndex}$$