

# Assessing individual policies in the presence of complementarities

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# Policy mix for innovation

- Panoply of policies:
  - Tax incentives
  - Subsidies
  - Reimbursable and/or low-interest loans
  - Venture capital
  - Intellectual property rights
  - Procurement
  - R&D cooperation permits ...

# Two policy instruments:

## R&D tax credits and R&D subsidies

- Criterion for evaluating the effectiveness: R&D spending (i.e. additionality or crowding out)
- Further criteria could be innovation and productivity
- How to evaluate treatment effect?
- Do we expect complementarity or substitutability?
- Some of the evidence

# Methods of evaluation of individual policies

- Problem: endogeneity of recipient

$$(1) \quad R_i = \alpha T_i + \beta' X_i + \varepsilon_i$$

- Solutions

- Instrument T

- Structural model to explain selection

$$(2) \quad T_i^* = \gamma' Z_i + v_i \quad \text{with} \quad T_i = 1[T_i^* > 0]$$

- Roy model

$$(3) \quad R_i = \beta_1' X_i + \varepsilon_{1i}$$

$$R_i = \beta_2' X_i + \varepsilon_{2i}$$

# Methods of evaluation of individual policies (2)

- Propensity score matching
  - Compare treated firms with untreated counterfactual firms that have (almost) the same probability of being treated
  - Binary comparisons can be generalized to category comparisons or continuous treatments (generalized propensity score)
- Randomized control trials (RCT)
  - Assign at random individuals to the treatment and the control group

# RTC with two policy instruments

- If only one treatment effect is controlled for, the treatment effect can be overestimated if the two instruments are complements and underestimated if they are substitutes.
- If the two treatment effects are controlled for, one can evaluate the partial effects of each, the joint effect, the additional effects, the sequential effects

# Structural models with two policy instruments

- Control function approach
  - Instead of one selection equation, there are two selection equations and instead of one inverse Mills ratio there are two of them
- Roy model
  - Again there are two selection equations instead of one and then four regimes instead of two (0,0), (0,1), (1,0) and (1,1)
- RCT
  - Assign individuals at random to the four groups
- Propensity score matching
  - Match treated firms of a certain kind with counterfactual untreated firms that are “as” likely to be treated likewise

# Examples of evaluations with two policy instruments

- Haegeland and Moen (2007), Norway
  - Higher additionality for R&D tax credits, complementarity at firm level, substitutability at macro level
- Berube/Mohnen (CJE, 2009), Canada
  - effectiveness of R&D subsidies are only examined for firms that receive R&D tax credits
- Busom/Corchuelo/Martinez-Ros (2012), Spain
- Lhuillery, Marino, Parrotta (2013), France
  - Higher additionality for R&D subsidies, little sign of complementarity, additionality shows up for very small or very large support



# Complementarity R&D subsidies and R&D tax incentives (Busom et al.)

- Regarding financial constraints, SMEs and startups prefer direct subsidies because they do not need to have profit to be able to claim tax credits
- Regarding appropriability (externalities), large firms that have IPR rights feel protected from imitation and prefer direct subsidies whereas small firms with low appropriability prefer tax incentives (absence of IP protection and high cost of applying for subsidies)
- Hence demand for both instruments for different kinds of firms; in this sense, complementarity R&D subsidies and R&D tax incentives

# Market failures

- Presence of externalities
- Financing constraints in the face of asymmetric information
- Coordination problems

# Arguments for complementarity

- Externalities
  - Large firms produce more externalities than small firms (Bloom, Schankerman, van Reenen, 2013)
  - large firms that have IPR rights feel protected from imitation and prefer direct subsidies whereas small firms with low appropriability prefer tax incentives (Busom/Corchuelo/Martinez-Ros)
  - R&D subsidies can be more focused on projects with high spillovers and not necessarily high private returns

# Arguments for complementarity

- Financing
  - R&D tax incentives cannot be used in the absence of profits, unless they can be reimbursed. Hence SMEs and startups prefer subsidies.
- Coordination
  - As R&D tax incentives let firms decide on what to invest in, coordination problems are probably better solved by subsidies

# Cost-benefit arguments

- R&D tax credits are
  - neutral (no picking the winner)
  - predictable for the firms
  - Lower administrative costs than subsidies
- But
  - R&D tax incentives (especially if level based) contain a deadweight loss (R&D that would have been done anyway)
  - Budget less predictable
  - Although rates are more favourable to small firms, funding goes more to large firms