R&D COLLABORATION POLICIES: ARE THEY REALLY ABLE TO PROMOTE NETWORKING?

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Setting the scene

- Networking, often in the form of R&D collaborations has been extensively used by policymakers around the world in order to promote the creation of regional innovation hubs (OECD, 2001; Tsipouri et al., 2009)

- However, *do we really need this type of policy to stimulate networking*?
  - There is no evidence of the ability of these policies to stimulate regional networking after the end of the public funds
  - No evidence on the relative effectiveness of R&D collaboration vs other types of (simpler) innovation policies, such as R&D subsidies to individual firms
  - No evidence on the comparative effectiveness of different types of networks

Our contribution

- We investigate the non-simultaneous network effects of R&D collaboration policies
- We compare the non-simultaneous network effects of R&D collaboration policies and that of R&D subsidies to individual firms

- See Caloffi et al 2014 and Rossi et al., 2015 for an analysis of the comparative effectiveness of different types of networks

Network effect / additionality?

- "Network additionality" refers to the possible increased cooperation and networking resulting from public intervention (Falk, 2004, 2007; Autio et al., 2008; Clarysse et al., 2009)

- Network additionality is a specific type of behavioural additionality of a policy (Buisseret et al., 1995; Georghiou, 2002) → BA refers to the possible *learning effects* of a policy on an organization's behaviour during and/or after the project's implementation. This approach considers a policy as successful when it increases the participants' cognitive capacities, competencies and networking in a non-transitory way (Georghiou, 2002)

- The theoretical context is that of capability and adoption failures, as well as the system failures (see Edler and Gok, 2011)

R&D collaboration policies: what do we know about their network effect?

- Mixed evidence on simultaneous network inducement effects:
  - Regional policies stimulate firms not previously engaged in R&D collaborations to establish new linkages with universities (Afcha Chavéz, 2010 – Spanish R&D collaboration policy)
  - Network additionality is positively correlated to previous funded collaborations (Wanzenböck et al., 2012 – Austria)

- Mixed evidence on the fact that, during the funded project, firms mostly collaborate with their previous research partners:
  - Policy encourages new partnerships only for 10% of participants (Davenport et al., 1998 – New Zeland)
  - Policy encourages new partnerships, also for large firms *with* network capabilities (Luukkonen, 2000 - EU Framework Programmes in Finland)
  - Policy stimulates new and more diversified types of partnerships (Fier et al., 2006 - Austria)
  - Policy encourages new partnerships, particularly thanks to the activity of intermediaries (Caloffi et al., 2013 – Small-scale regional policy in Italy)

- No evidence on network persistence!
  - Policy stimulates new and more diversified types of partnerships only for the duration of the funded project (Fier et al., 2006 - Austrian federal R&D-support scheme)

Do we need R&D collaboration policies to encourage networking?

- Some evidence on the network additionality of a policy supporting R&D in individual firms:
  - subsidies encourage both public-private and horizontal cooperation (Miotti and Sachwald, 2003)
  - Positive effect on public-private cooperation (Busom and Ribas, 2008)
  - Others find no evidence of network additionality (Belderbos et al., 2004; Mariani et al., 2012; Antonioli et al., 2014)

Our hypothesis

As R&D collaboration policies have many features that are designed specifically to promote networking – more than those of other R&D policies – we believe that they are able to produce a larger network additionality than other policies (namely R&D subsidies to individual firms)

R&D collaboration policies

✓Agents perform R&D

✓Collaboration with external organisations is required by design

✓Specific rules of the game may require agents to collaborate with some particular type of agent

R&D incentives to individual firms

✓Agents perform R&D

Two main mechanisms underlying network additionality:

*Organisational learning - by experience / interaction / absorptive capacity (Cyert and March, 1963; Cohen and Levinthal, 1989; Amin and Cohendet, 2000; Asheim et al., 2007)

*Cumulative effect of learning and of networking (Gulati, 1995; Powell et al., 1996; Van den Bosch et al. 1999)

Data from regional policies

- Two policies implemented by the same policymaker in the same region targeting the same beneficiaries (SMEs), in the same programming period:

- (1) Tuscany Region (Italy) policies supporting R&D networks from 2002 to 2008: provision of funds for the implementation of innovation projects for SMEs, carried out by R&D consortia including SMEs (similar policy implemented in other Italian and EU regions with ERDF funds).
- 4 programs (RPIA2002, SPD171 and 172, RPIA2006), in 9 waves and 6 years, 141 funded R&D networks participated by 1024 agents
- Network members: SMEs, large firms; innovation centres, technology parks and similar infrastructures; Universities and research centres; Business associations, Chamber of commerce; Local governments; other public bodies

- (2) A complementary policy implemented in the same programming period by the same policymaker targeting individual SMEs and providing R&D grants (SPD line 1.1.b)
- 336 funded firms that have completed the funded R&D project and received 30-40% of the cost of the project as grant

Empirical strategy

1. Matched sampling
2. Questionnaire to collect relevant behavioural variables
3. Inverse probability weighting strategy to account for missing responses
4. (Weighted) Propensity Score Matching
5. NN matching to assess the network additionality of each intervention
6. NN matching to compare alternative tratments → Firms receiving individual grants are now controls for firms participating in the R&D policy and vice versa

Descriptive statistics

Firms participating in R&D collaboration policies			*Firms benefiting from individual incentives to R&D*		
Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Universities_*pre*	0.392	0.491	Universities_*pre*	0.183	0.389
Other firms_*pre*	0.392	0.491	Other firms_*pre*	0.192	0.395
Absorptive_*pre*	0.620	0.488	Absorptive_*pre*	0.833	0.374
Innovator_*pre*	0.354	0.481	Innovator_*pre*	0.933	0.250

Results

R&D collaborations

Outcome variable	ATT	
Network persistence (t+3)	0.217	***
	(0.074)	
Universities	0.263	***
	(0.064)	
Other firms	0.108	
	(0.076)	

79 treated firms

R&D grants to individual firms

Outcome variable	ATT
Network persistence (t+3)	0.044
	(0.044)
Universities	0.044
	(0.041)
Other firms	0.016
	(0.032)

120 treated firms

Comparison between R&D collaboration policies and R&D grants to individual firms

Outcome variable	ATT Collaborations vs individual firms		ATT individual firms vs collaborations	
Network persistence	0.319	**	-0.170	
(t+3)	(0.153)		(0.174)	
Universities	0.297	*	-0.207	
	(0.179)		(0.181)	
Other firms	0.103		-0.311	**
	(0.090)		(0.150)	

Networking (w Universities) would be lower with individual incentives

Interfirm networking would be higher with collab programs

Conclusion

- R&D collaboration policies seem to be effective in stimulate networking, more than individual incentives to R&D
- In particular, they are able to encourage university-industry collaborations
- Although more empirical evidence is needed, the pro-networking rationale of R&D collaboration policies is confirmed

Matched sampling

- "a method for selecting units from a large reservoir of potential controls to produce a control group of modest size that is similar to a treated group with respect to the distribution of observed covariates" (Rosenbaum and Rubin, 1985, p.33)

- It is based on the estimation of a measure of similarity – in our case the propensity score – from a number of basic features available on a wide population of enterprises and then the use of this measure for the matching between treated and controls.

- Variables: firms' sector, legal form, province, number of employees

- The MS has been performed year by year, by considering one wave at a time
- We have identified 5 potential controls for each treated firm

Questionnaire

- 2,497 firms (treated / participants not receiving funds / non participants selected through the matched sampling), with a response rate of about 20% (489 firms).

- Reference year for all firms is the year of the call for tender (*t*)

- The questionnaire has the following structure:
  - Information on collaborative behaviour with external organisations (universities/intermediaries/other firms) in *t*-1 (y/n; n; freq);
  - Information on innovative behaviour in *t*-1 (inputs, outputs);
  - Same information on collaborative behaviour in *t*+3
  - Same information on innovative behaviour in *t*+3

- We excluded multi-treated firms (46 respondent firms) who also received other subsidies than those analysed here

Inverse probability weighting

- For each firm that was included in the survey we calculate a weight equal to the inverse of its probability of response and then use it in the stage of estimation of the ATT.

- The contribution of each respondent is directly proportional to the "rarity" of information provided by the same unit. In order to estimate the probability of response we use the variables that have been already used in the matched sampling (sector, province, legal form, number of employees), as well as the variable identifying the treatment.

$$\pi_i = \Pr(I = 1|X, T = 1)$$

X is the set of covariates and *I* a dichotomous variable taking value of 1 if the *i*th agent is a respondent and 0 otherwise.

The weight w_i is given by $1/\pi_i$.

(weighted) Matching

- We have improved the matching between treated and controls by calculating a new propensity score $p(x) \stackrel{\text{def}}{=} \Pr(T = 1|X = x).$ that includes the information collected through the survey (i.e. we have updated the probability of being treated given the additional relevant covariates defined on survey data)

- → Treated-control matches are identified not only on the basis of the firms' structural features described above, but also on the basis of the number and type of relationships with universities, innovation services providers and other manufacturing enterprises that these firms had before the policy!

- Each unit x_i is weighted with w_i

- We perform a Nearest neighbour matching (Becker and Ichino, 2002), and we impose an exact match for treatment year and lagged value of the outcome variable(s). We considered only firms in common support.