POLITECNICO DI MILANO

"Turn the light on": the certification effect of selective subsidies, founders' human capital, and new technology-based firms' access to R&D alliances

L. Grilli, Samuele Murtinu

Politecnico di Milano, Department of Management, Economics and Industrial Engineering

Università Cattolica del Sacro Cuore, Institute of Economic Policy

New Technology-based Firms (NTBFs)

➡ Dynamic efficiency, i.e. introduction into economic systems of drastic innovations (e.g. Schumpeter mark I)

➡ Exploit otherwise unused "knowledge" (see knowledge spillover theory of entrepreneurship, Acs et al. 2009 *SBE*)
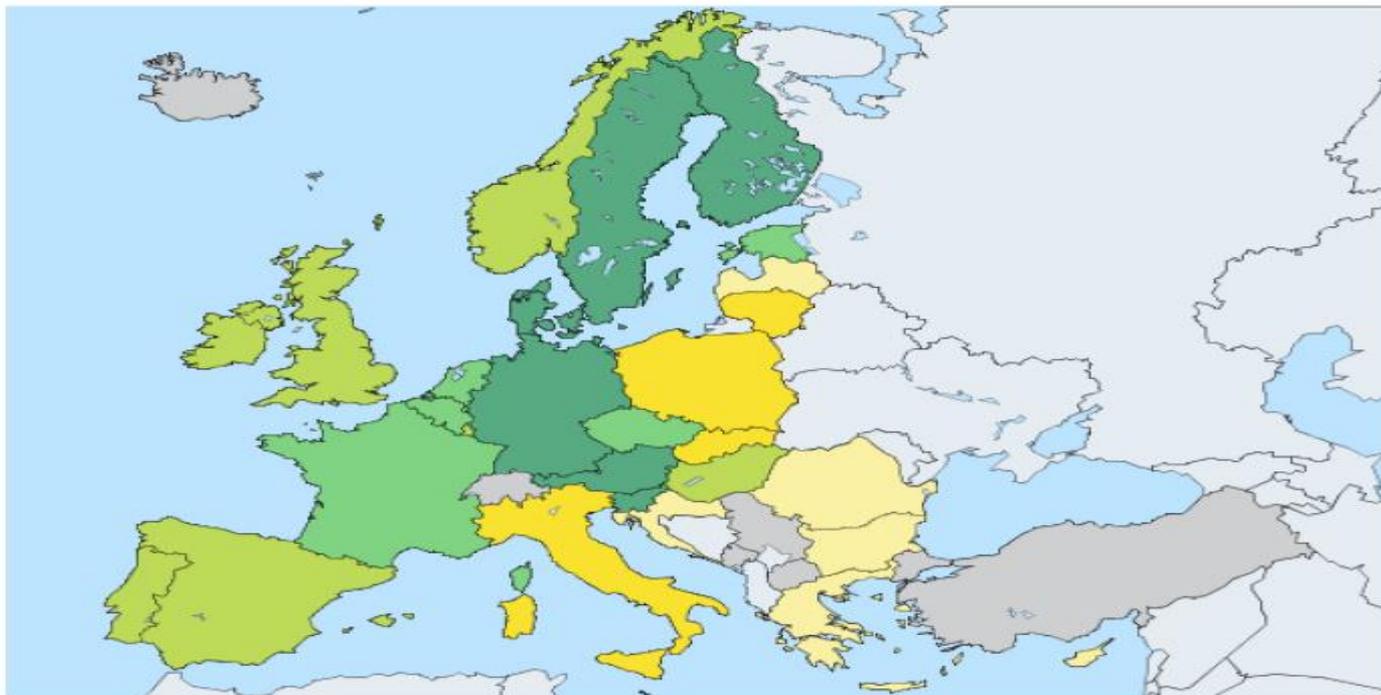
➡ Powerful engine for economic growth (Aghion and Howitt 1992 *E*; Bruce A. Kirchhoff's various papers).

Avg (EU-27) 2012: ~2%

Total R&D expenditure
% of GDP - 2012

Legend
- 0.46 - 0.75
- 0.75 - 1.27
- 1.27 - 1.72
- 1.72 - 2.29
- 2.29 - 3.55
- Not available

~ > 3%: DK; FI; SE.

Source: Eurostat

Europe 2020 agenda (European Commission, 2010: p. 10):

"Innovation: R&D spending in Europe is below 2%, compared to 2.6% in the US and 3.4% in Japan, mainly as a result of lower levels of private investment. It is not only the absolute amounts spent on R&D that count – Europe needs to focus on the impact and composition of research spending and to improve the conditions for private sector R&D in the EU. Our smaller share of high-tech firms explains half of our gap with the US."
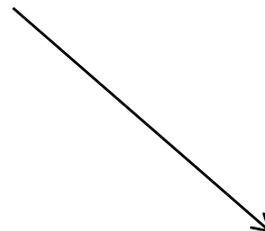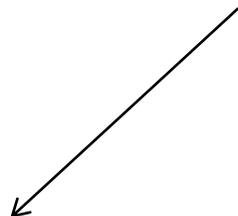
1. Improve the conditions for private sector R&D
2. Increase the share of high-tech firms

Can public policy play a role?

NTBFs invest less than the social optimum

2 reasons

Spillovers/lack of complementary assets

Capital market imperfections

Hall 2002 *OREP*, Teece 1986 *RP*

Carpenter & Petersen 2002 *EJ*, Revest & Sapio 2012 *SBE*

Public direct "hands-on" intervention into the market

2 broad typologies of subsidies to firms

"Selective" (e.g. grants)

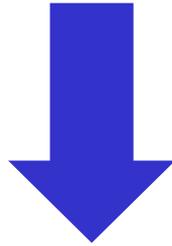"Automatic" (e.g. fiscal incentives)

Stylized fact: Previous empirical evidence highlights a more beneficial effect of *selective* rather than *automatic* subsidies to NTBFs on a wide spectrum of firm performance measures (as to Italy: Colombo et al. 2011 *EL;* 2013 *ICC*; Grilli and Murtinu 2012 *P*)
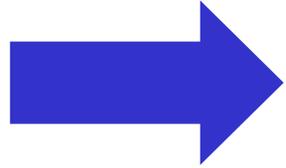
"certification effect" (i.e. "halo" effect, see Lerner 1999, JB and 2002 EJ)

Policy

Signal

- "Certification effect" of selective subsidies towards NTBFs almost never tested "directly" but always presumed "indirectly" looking at superior performance of recipient firms (Lerner 1999, *JB*) or claimed theoretically (Kleer 2010, *RP)*

-How does it work? Is it "automatic" or there are specific characteristics of the recipient firms that magnifies it? Is contingent to specific third parties

Policy

Signal

Third parties

Is automatic?
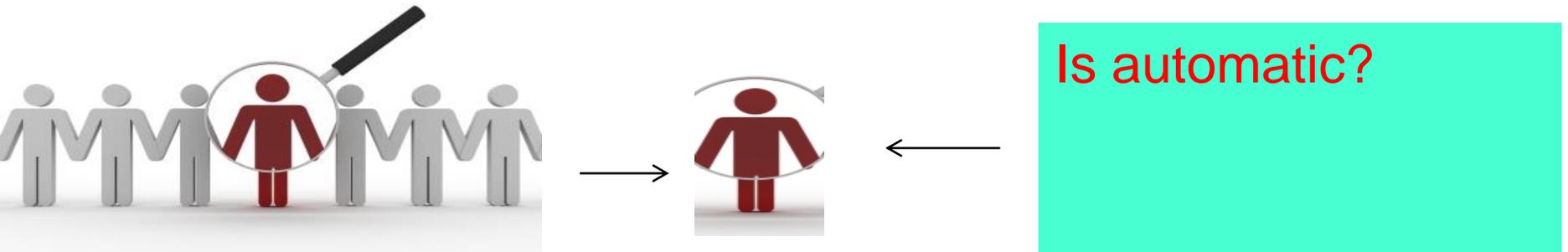
What we do: we dig into the "certification effect" in order to investigate why and how it works in practice. **We take into consideration R&D alliance partner which may be pivotal for NTBF success**

- By means of R&D alliances, NTBFs add value to their activity through knowledge creation and development, joint technology development and/or incremental learning (Narula and Dunning, 1998), technological upgrading and catch-up (Mathews, 2002), exploitation of complementary know-how of partner firms (Kogut, 1988; Das and Teng, 2000) and reduction of diseconomies of scale (Kleinknecht and Reijnen, 1992).

- Accordingly, in the last years, central governments increasingly try to foster R&D alliances involving NTBFs (European Commission, 2003, 2013; Hottenrott and Lopes-Bento, 2014).

H1: NTBFs that receive a selective subsidy are more likely to establish an R&D alliance.

H2: Founding teams endowed with a higher level of technical education are more likely to receive a selective subsidy.

H3: Founding teams' technical education positively moderates a firm's ability to exploit the signal of the selective subsidy through an R&D alliance with an university or a public research organization.

H4: Industry-specific work experience of founding teams positively moderates a firm's ability to exploit the signal of the selective subsidy through an R&D alliance with a corporate partner.

977 Italian NTBFs (RITA dataset, Politecnico di Milano).

RITA database originates from two types of sources:
- financial and accounting data (extracted from the AIDA and CERVED commercial databases)
- series of surveys administrated in the years 2000-2010. As to the variables of interest for this work, data relate to: i) the human capital characteristics of the firms' founders; and ii) the full history of the subsidies received by NTBFs from national governmental bodies.

Almost **10%** of sample firms receive a **selective subsidy** (before having eventually established their first R&D alliance)

Probit model

$$Pr(R\&D\ Alliance_i) = \alpha_0 + \alpha_1\ Selective\ Subsidy_i + \eta Z + \varepsilon_{i1}. \tag{I}$$

Probit model with sample selection (Van de Ven and Van Pragg, 1981)

$$Pr(Selective\ Subsidy_i) = \beta_0 + \beta_1\ Technical\ Education_i + \beta_2\ Industry\text{-}Specific\ Work\ Experience_i$$
$$+ \beta_3\ Regional\ PA\ Expenditure_i + \eta V + \varepsilon_{i2}; \tag{II-a}$$

$$Pr(R\&D\ Alliance_i\ |\ Selective\ Subsidy_i=1) = \gamma_0 + \gamma_1\ Technical\ Education_i + \gamma_2\ Industry\text{-}Specific\ Work\ Experience_i + \eta V + \varepsilon_{i3}. \tag{II-b}$$

Exclusion restriction: yearly expenditures for final consumption of Italian public administrations (PAs) at regional (NUTS 2) level (source: Italian National Institute of Statistics). Selective subsidies and regional expenditures of PAs are typically substitutes (Cassette and Paty, 2010), at least in Italy (Cooke, 2001).

Table V. Selective subsidies as quality signal by easing NTBFs' access to R&D alliances.

	Column I	Column II	Column III
	R&D Alliance	**Corporate R&D Alliance**	**University R&D Alliance**
Selective Subsidy	0.4046***	0.3032**	0.6960***
	(0.1404)	(0.1545)	(0.1579)
Economic Education	0.1380***	0.1509***	0.0722
	(0.0506)	(0.0516)	(0.0724)
Technical Education	0.0672***	0.0449**	0.1258***
	(0.0197)	(0.0212)	(0.0242)
Industry-Specific Work Experience	-0.0022	0.0025	-0.0101
	(0.0064)	(0.0067)	(0.0083)
LogFounders	0.3763***	0.3616***	0.5082***
	(0.1103)	(0.1168)	(0.1372)
Management Experience	-0.0338	0.0018	-0.0911
	(0.1059)	(0.1105)	(0.1366)
Constant	-0.7732***	-0.8242***	-1.6774***
	(0.1537)	(0.1626)	(0.1987)
Industry dummies	Yes	Yes	Yes
Pseudo R^2	0.0373	0.0314	0.0987
Obs.	914	831	689

H1. Marginal effects of being supported by a selective subsidy: +16.03% (R&D alliances), +11.87% (corporate R&D alliances), +24.85% (university R&D alliances)

H2. Marginal effects of *Technical Education* are +0.9% (at 5%), +0.78% (at 10%) and +0.67% (not statistically significant

H3. *Technical Education* does not moderate the likelihood for an NTBF to establish an R&D alliance with an university after being awarded with a selective subsidy.

H4. Marginal effect of *Industry-Specific work experience* on *Corporate R&D Alliances* is equal to +0.26% (at 5%)

	Column I	Column II	Column III
Panel A: Dependent Variable: Selective Subsidy			
Economic Education	0.0352	-0.0190	0.0827
	(0.0629)	(0.0782)	(0.0801)
Technical Education	0.0617***	0.0526**	0.0408
	(0.0225)	(0.0260)	(0.0259)
Industry-Specific Work Experience	-0.0008	-0.0064	-0.0031
	(0.0079)	(0.0092)	(0.0088)
LogFounders	0.0513	-0.0317	0.0566
	(0.1276)	(0.1585)	(0.1454)
Management Experience	-0.0790	-0.0114	-0.0271
	(0.0869)	(0.1537)	(0.1010)
Regional Public Administration Expenditure	-0.0080**	-0.0063*	-0.0068*
	(0.0034)	(0.0035)	(0.0039)
Constant	-1.3802***	-1.2678***	-1.3054***
	(0.1969)	(0.2494)	(0.2208)
Industry dummies	Yes	Yes	Yes
Panel B: Dependent Variable: R&D Alliance	**R&D Alliance**	**Corporate R&D Alliance**	**University R&D Alliance**
Economic Education	0.0379	-0.0045	-0.0001
	(0.1035)	(0.1269)	(0.1130)
Technical Education	0.0049	-0.0143	0.0210
	(0.0298)	(0.0315)	(0.0322)
Industry-Specific Work Experience	0.0232*	0.0284**	0.0179
	(0.0123)	(0.0130)	(0.0122)
LogFounders	0.1621	0.1437	0.1089
	(0.1594)	(0.2137)	(0.1722)
Management Experience	-0.1862*	-0.1673	-0.1318
	(0.1098)	(0.2035)	(0.1267)
Constant	1.5660***	1.5619***	1.4145***
	(0.2005)	(0.3047)	(0.2117)
Industry dummies	Yes	Yes	Yes

- **Empirical support to Lerner's (1999, p. 293) _certification hypothesis_**, i.e. 'public awards convey information to investors': Selective subsidies exerts a signal for NTBFs towards third parties.

- Founders' human capital moderates the strength of the signal but with important differences according to the type of human capital's endowment of the founding team and the identity of potential partners. While certain founders' characteristics are needed to _switch on the signal_ (technical education), other characteristics allow the firm to _exploit it (e.g._ specific work experience towards corporate partners). **The heterogeneity of competencies of the founding is a plus for an NTBF.**

THE END