

Discussion of Jacquelyn Pless
“Are ‘Complementary Policies’ Substitutes? Evidence from
R&D Subsidies in the UK”

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An Excellent Paper that Addresses An Important Question

What is the complementarity (or substitutability) between policies providing incentives for R&D?

First quasi-experimental study on this issue, in the UK.

Important because governments typically use several policies (at the same time too).

Main finding: Tax credits and grants are complements for small firms; substitutes for large firms.

Main Explanation: small firms can overcome fixed costs; large firms are subsidized on infra-marginal projects.

Motivation: Widespread and Diverse R&D Policies

Businesses spend a lot of resources on R&D... and the government already intervenes heavily.

Large **variety** of policies target **innovation and R&D**

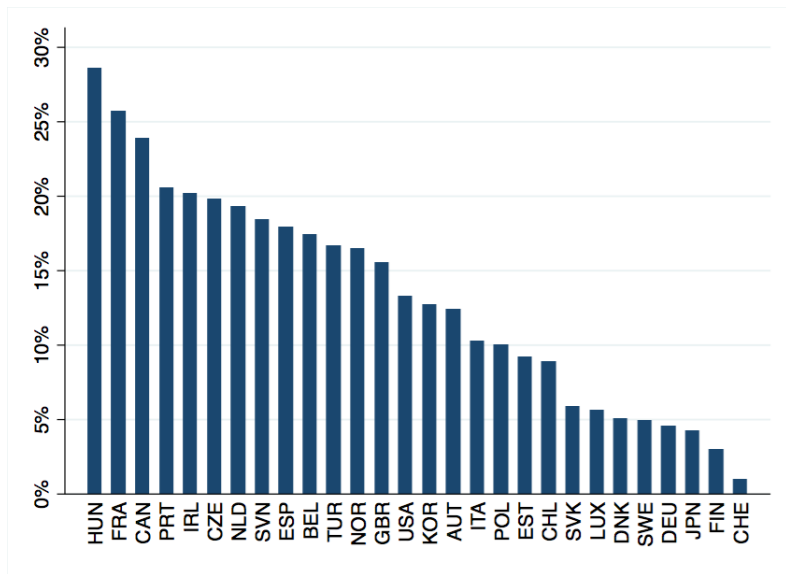
Tax credits, deductions, grants, contracts, direct funding in FFRDCs, Universities, Firms, small business, start-ups..

Large variety of policies across countries as well.

R&D policies are widespread, not fully understood, & very costly:

- ▶ “Intramural” R&D cost \$35 billion (2014).
- ▶ “Extramural” R&D: tax credit \$11 bil in 2012, contracting with non FFRDCs 50,6 billion, NSF-NIH \$40 billion (econ grant: 0.0025%)

Share of Government Funding in Business R&D



Is the amount spent by government correlated with better productivity?

Analysis:

Innovate UK:

Provides direct grants through competitions;

More generous for small firms (cutoffs at 50 employees and max turnover or balance sheet total of 10 Ml).

The R&D Tax Credit Scheme:

Available to all firms conducting R&D in the UK

Particularly generous for SMEs

Enhanced losses can be surrendered for a payable tax credit if the SME does not earn profits (important!)

Big increases of deduction rates for SMEs in 2008, 2011, 2012.

Eligibility discontinuity: New employment threshold in 2008 turned previously “large” firms into SMEs for the R&D tax credit.

An ambitious and careful analysis

Great use of a lot of policy variation.

Very comprehensive data thanks to multiple data matches:

Innovate UK's Transparency Database; Bureau van Dijk's Financial Analysis Made Easy (FAME); UK's Community Innovation Survey (CIS), Business Enterprise Research and Development (BERD) data, & Business Structure Database.

Able to look at detailed R&D and innovation info thanks to the CIS.

E.g.: look directly at indivisible and big investments.

Difference-in-discontinuity design finds complementarity between grants and tax credits for small firms

Difference-in-discontinuity design for small firms in the Innovate UK grants program:

RDD: $R\&D \text{ expenditures} = \beta X + \gamma \text{above employment discontinuity}$

Diff-in-disc: Do RDD before and after the R&D tax credit change.

If grant and tax credits are complements, effect in RDD should increase after tax credit increases.

Validity tests: i) firms do not seem to manipulate reported size; ii) treated and untreated firms' covariates not significantly different around threshold; iii) covariates do not change at the threshold.

Increasing returns to more subsidies? No evidence for that.

RDD for large firms finds substitutability between grants and tax credits for larger firms

Use that R&D tax credits more generous below 500 employees threshold.

Compare effects of receiving grant on R&D expenditures for firms above and below tax credit generosity threshold.

Use OLS: even if grant receipt is endogenous, endogeneity should be “similar” just above and below the tax credit threshold.

Also test using IV: IV is interaction of total direct subsidy funding allocated to the firm's industry in that year \times driving distance between firm's headquarters and grant-making agency.

Tax credit per se has large effects on R&D expenditures. But higher R&D tax credits dampen effect of the grant.

Further Analysis

Sector heterogeneity?

LATE estimator generalizable?

Patent outcomes directly? Are innovation outcomes currently “self-reported”?

Size is endogenous – not at the discontinuity thresholds perhaps, but in general.

Designing Better R&D Policies

Current paper focuses (correctly so) on size. There are other heterogeneities in firms' research productivity too.

Take young firms at start of their lifecycle. How much of the variation in subsequent innovation quantity & quality can we explain based on observables?

Observables: age, assets, past investments, sales, state FE, year FE, sector FE (+ all interactions), and even past innovations:

R^2 not above 0.3, improves with age (as info revealed).

Conditional on these observables, many “outlier” firms.

Two ways of possibly addressing asymmetric info problem:

Direct screening: what the NSF and VCs try to do. Done by the government with public procurement. Hard, not scalable.

Indirect screening: Design a menu of options (implemented by taxes and subsidies), let firms self-select! “Easy” to decentralize and scalable.

Designing Better R&D Policies: Mechanism Design

Firms have **heterogeneous**, stochastic productivities.

Productivity: efficiency of converting R&D inputs into innovation output.

Uncertainty about R&D returns.

Spillovers between firms: one firm's innovations affect other firms.

Firm productivity is **private information**.

1) **Mechanism design: no a priori restriction on policy tools.**

Characterize constrained efficient allocations.

Implementation.

2) Quantitative Investigation using Patent data + Longitudinal Business Database (LBD) data.

3) Losses from “simpler” policies (e.g.: linear age-dependent...).

Designing Better R&D Policies: Mechanism Design (II)

Optimal Policies depend on i) size; ii) age:

Nonlinearly, non-separably.

Rewards good performance, conditional on age: Performance conditioned.

Loss from “current” policies is large; the more so the larger positive spillovers between firms.