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The ex-post assessment of policy programs impact

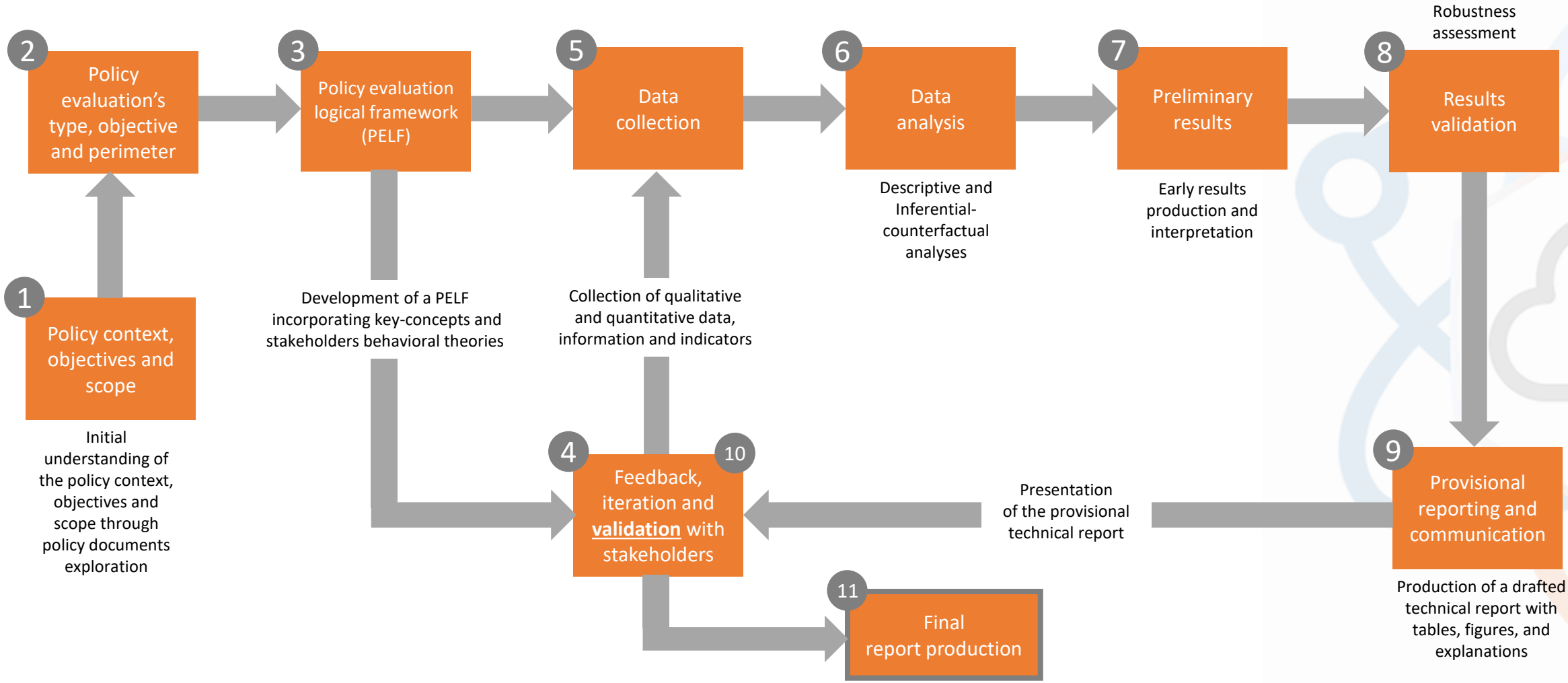
Logic, steps, guidelines

FOSSR
Fostering Open Science in Social Science Research
Innovative tools and services to investigate economic and societal change

Giovanni Cerulli, CNR-IRCrES

Introduction

- Assessing the impact of **policy programs post-implementation** is vital for informed **decision-making**
- A deep understanding of it requires a *synthesis* of both **qualitative** and **quantitative** methods and analyses
- The impact assessment is a **learning process**, entailing continuous feedback and adaptation to the environment (for example, the policy stakeholders)
- Here, we elucidate the **main steps** needed for correctly carrying out policy ex-post impact assessment



Ex-post program evaluation: main steps

2 Policy evaluation objectives and perimeter

Define objectives

Clarify the specific goals—whether evaluating *efficiency*, *equity*, or *sustainability.* This entails the definition of the policy **targeted outcomes**

Perimeter definition

Clearly outline the **setting** of the assessment (considering, for example, time, resources, and data constraints)

3 Elaborating a Policy Evaluation Logical Framework (PELF)

Key Concepts and Theories

Identify and emphasize the **foundational characters** shaping the policy program, including **theories** about stakeholder behaviours

Causal Pathways

Dipict the **cause-and-effect relationships**, detailing how inputs lead to outputs and eventual outcomes

4 Validation of the PELF with stakeholders

- Open interaction
- Questionnaires
- Focus groups

5 Data Collection and Preparation

Quantitative Methods

- **Surveys and Questionnaires:** Utilize structured surveys for numerical data collection
- **Data pre-processing:** Make data ready to be used for analysis
- **Secondary Data:** Leverage available datasets and official statistics for a broader context

Qualitative Methods

- **Interviews:** Conduct in-depth interviews to capture nuanced insights
- **Focus Groups:** Organize discussions to explore diverse perspectives
- **Document Analysis:** Review reports and case studies for qualitative depth

6 Data Analysis

Descriptive qualitative and quantitative evidence

- Descriptive statistics, by tables and charts

Counterfactual statistical/econometric methods

- **Experimental methods:** based on Randomized Control Trials (RCT)
- **Quasi-experimental methods:** based on observational data

7 Analysis of preliminary results

- **Visual** reporting of the results
- Comments, interpretation and **narrative** building
- Development of detailed **case studies** for a rich, context-specific understanding

8 Results validation

Robustness

- Cross-verify results from different methods to enhance credibility

Divergence Analysis

- Explore areas of divergence between qualitative and quantitative data for a more comprehensive understanding

9 Provisional reporting and communication

Integration

Blend findings from both qualitative and quantitative analyses in a drafted comprehensive Report including methodology, findings, and recommendations

Highlighting main findings

Identify and put into emphasis **synthetic sentences** summarizing main findings for a cohesive narrative

10 Stakeholder Engagement

Communicate results through presentations and workshops to encourage feedback and discussion with stakeholders

Continuous Improvement

Seek feedback for refining assessment methods

Adaptation

Use feedback to adapt the approach for future assessments and enhance overall quality

11 Final report

Summarize Key Points

Recap the key elements of the assessment process

Highlight Significance

Emphasize the importance of a combined qualitative/quantitative approach for given results more credibility

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DESIGNING EX-POST ASSESSMENT OF CORPORATE RDI POLICIES

Conceptualization, Indicators and Modeling

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Summary of this presentation

- Policy description
- Rationale for corporate RDI support and causes of policy failure/success
- Conceptualization: logical framework, behavioral modeling and indicators
- Counterfactual econometric methods for RDI ex-post evaluation
- Learning and risk analysis for RDI policies
- Some open questions of ex-post program evaluation

Policy description

Type of measure

Corporate RDI competitive project-funding using *direct financial support* (Grants and Subsidized loans). We abstract from policies based on "fiscal measures" and from any other non-competitive project-based incentive scheme.

Type of ex-post impact analysis

Input (or R&D) and "innovative" output additionality. We abstract from support downstream effects on profitability/productivity and from "behavioral" additionality

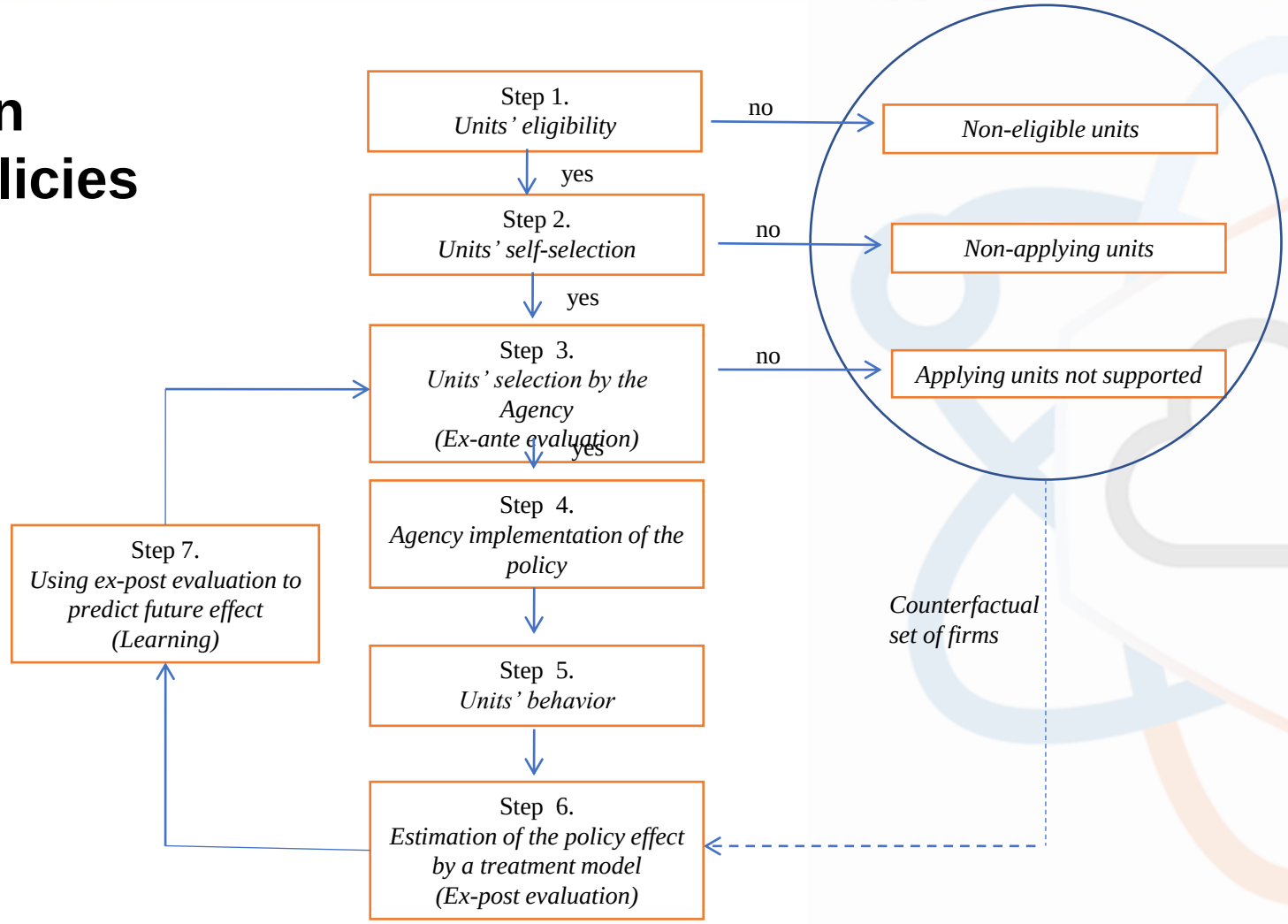
Rationale for corporate RDI support and causes of policy failure/success

Why subsidizing R&D?

- RDI activity is generally characterized by *low appropriability* of results (Nelson, 1959; Arrow, 1962)
- RDI activity is plagued by highly uncertain returns and this strengthens the *information asymmetries* between RDI fund borrowers and financers. (Bhattacharya and Ritter, 1985).
- R&D also *lacks tangible assets* that can be used as collaterals for lenders (Bester, 1985; Mansfield,1977; Berger and Udell, 1998; Harhoff, 1998)
- RDI is an *irreversible* activity and this produces relevant "sunk costs" (Stiglitz and Weiss, 1981)
- *Systemic failures* (e.g., Martin and Scott, 2000; Mowery, 1995; Metcalfe, 2005; Malerba, 2009).

Conceptualization: logical framework, behavioral modeling, indicators

Logical Framework for the design of ex-post assessment of RDI policies



Firm self-selection

Step	General factor	Specific factor	Indicator
Firm self-selection	*Opportunities*	Opportunities costs	Time (or resources) subtracted to other activities
		Private information disclosure	Project measure of imitative easiness
	Bureaucracy	Administrative commitment	Administrative and managerial costs
		Public delays in taking decision	Time from project application to acceptance/refusal (past experience)

$$I_F = I_F[X_1, u_F]$$

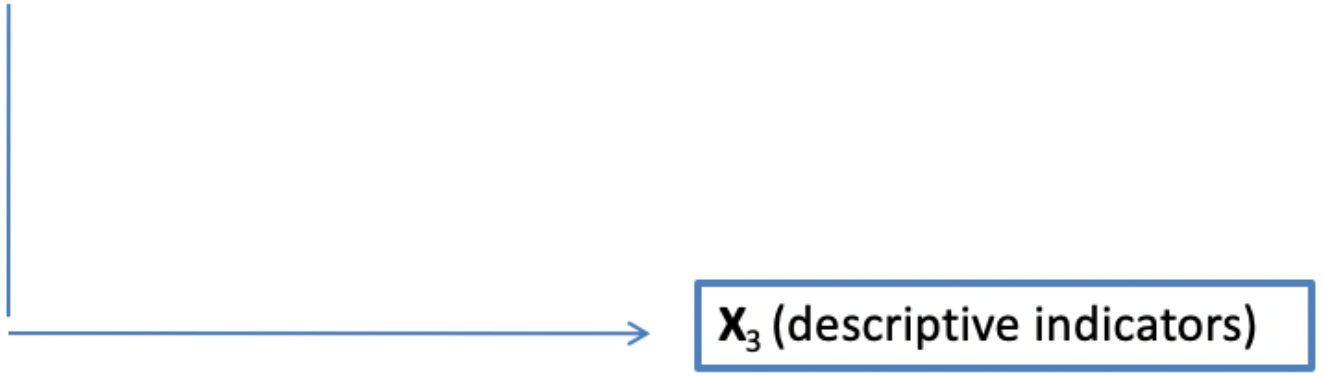
Agency selection

Step	General factor	Specific factor	Indicator
Agency selection	*Firm economic and financial soundness*	Financial structure	Cash-flow Debt Equity
		Scale economies	Size
		Scope economies	Presence of more than one line of business
		Cost structure	Labour/capital intensity
		Human capital	Employees' education level
		Business experience	Age
		Access to networks	Be part of national or foreign groups
		Exposure to competitiveness	Export-intensity
		Sector	Sectoral indicator
		Region	Regional indicator
	Firm and project quality in terms of RDI	RDI quality of the project	Technical board assessment (multifaceted projects scores)
		RDI quality of the firm	Stock of knowledge (as cumulated R&D spending) Pre-treatment level of patenting activity Presence of previous RDI support
	Project consistency with welfare objectives	Project capacity to meet external objectives	Technical board assessment on this facet Direct assessment via project analysis

$$I_A = I_A(\mathbf{X}_2, u_A)$$

Agency implementation

Step	General factor	Specific factor	Indicator
Agency implementation of policy	*Management*	Managerial costs of the program	Administrative costs
		Timing	Time passing from issuing to selecting to provision of funds (by instalments)
		Funds availability	Amount of funds by time
	Control	Monitoring	Costs of monitoring



Firm RDI behavior

Step	General factor	Specific factor	Indicator
Firm RDI behaviour	*Financial*	Funds availability	Cash-flow Debt Equity Venture capital
		Technological policy tools	Presence or level of RDI subsidies
		Other policy tools	Presence or level of non-RDI subsidies
	Economic	Scale economies	Size
		Scope economies	Presence of more than one line of business
		Structure of cost	Labour/capital intensity
		Opportunity costs	Costs of alternative investments (ICT, fixed capital formation, human capital)
	Knowledge-based	Stock of knowledge	Cumulated R&D spending
		Innovative activity	R&D outlay Patenting activity Innovative turnover
		Technological opportunities	Sector
		Human capital	Employees' education level
		Access to networks	Be part of national or foreign groups RDI collaborations
		Spillovers	Sectoral (cumulated) R&D expenditure (or patenting activity)
	Experience	Life-cycle	Age
		Previous RDI support	Presence or level of past RDI subsidies
		Previous non-RDI support	Presence or level of past non-RDI subsidies
	Market	Industrial organization	Firm market power Sectoral concentration Product differentiation
		State of demand	Past turnovers
		Macroeconomic conditions	Time dummies
		Appropriability conditions	Sectoral patenting intensity
		Exposure to competitiveness	Export intensity
		Geography	Regional location

A general treatment model

Define: $d = I_A \cdot I_F$

where d is in this case a binary indicator (tacking 1 for supported and 0 for non-supported units). In a counterfactual setting, where both supported and non-supported firms are needed for evaluation purposes, we have that:

$R = R(H, \mathbf{X}_4, v)$ *with:*

$H = I_A \cdot I_F \cdot S = d \cdot S$ *if the level of the subsidy S is known*
$H = d$ *if the level of the subsidy S is unknown*

In the second case (binary treatment setting), the model reduces to this system of equations:

$$\begin{cases} d = d(\mathbf{X}_1, \mathbf{X}_2, u) \\ R = R(d, \mathbf{X}_4, v) \end{cases}$$

Observe that variables $\mathbf{X}_3$ can be arbitrarily included into one of the two equations to complete the model.

Counterfactual econometric methods for RDI ex-post evaluation

Socio-economic program ex-post evaluation via counterfactual analysis

Treatment assignment is randomized

↓

Experimental setting

↓

No selection bias

↓

Simple treated-untreated contrast

Treatment assignment is not randomized

↓

Non-Experimental (or observational data) setting

↓

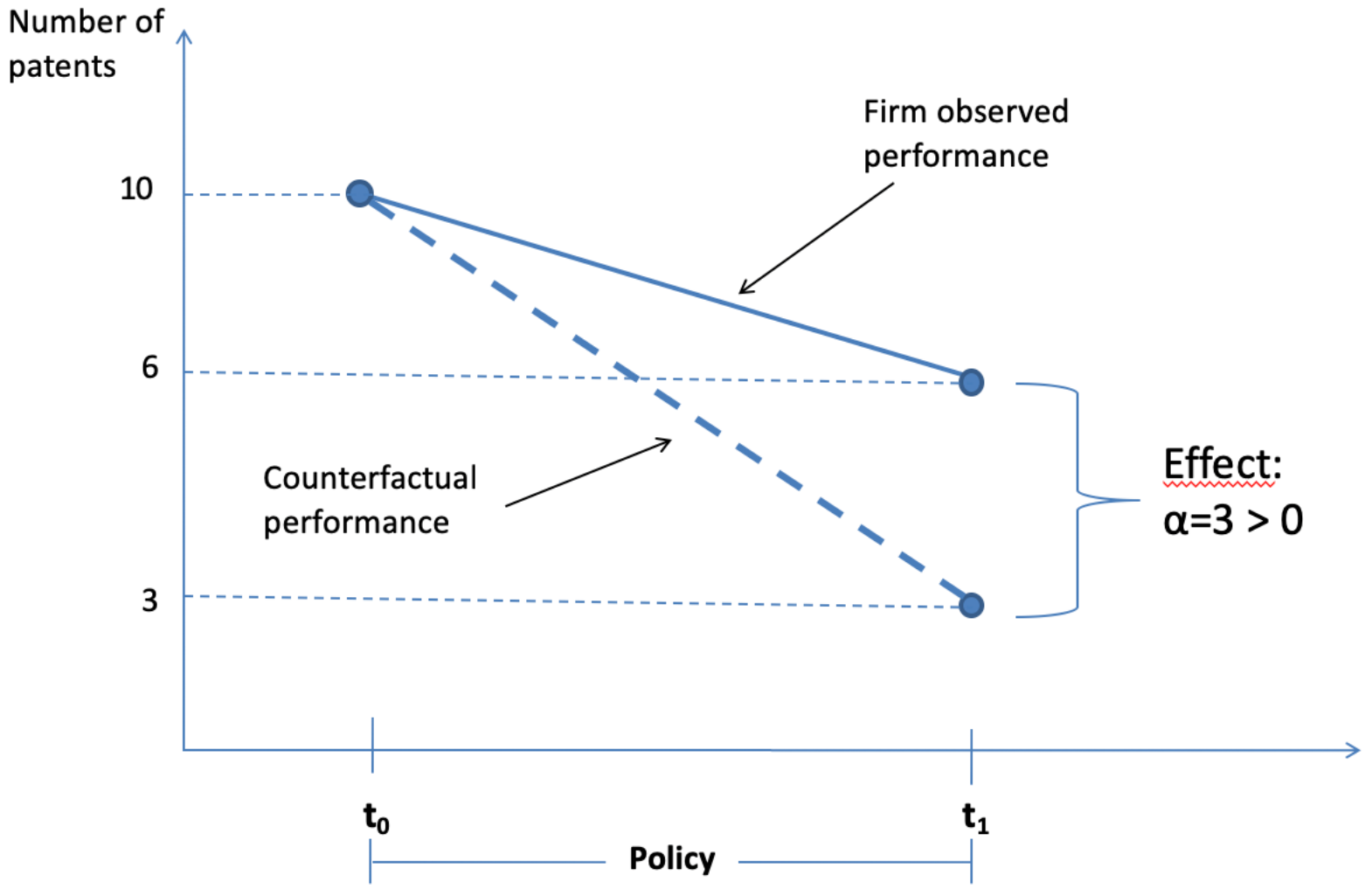
Selection bias

↓

Counterfactual methods

Why do we make use of a "counterfactual analysis"?

An instructional example



Observed Effect = Causal Direct Effect + Selection Bias

DIM = (Average outcome on *treated*) – (Average outcome on *untreated*)

- If the policy is randomized --- > **causal direct effect = DIM ---- > Selection Bias = 0**
- If the policy is not randomized --- > **causal direct effect ≠ DIM ---- > Selection Bias ≠ 0**

The origin of the selection bias

Self-selection

It regards the choice of the individuals to apply for a specific program. This entails a cost-benefit calculus, as applying for a policy program can be costly to some extent. This choice may not be assumed to be done at random, as firms are "*endogenously*" involved in this decision.

Selection mechanism

It is more intuitively following a non random assignment, as the agency is generally characterized by the pursuit of various objectives, such as *direct* (on target-variable) and *indirect* (welfare) objectives. For instance , in order to maximize the final effect of an investment supporting program, the agency could apply the principle of "picking-the-winner", that is choosing to support those firms having an already high propensity to invest. This is a sufficient condition to make the sample of beneficiaries far from be randomly built. Similar conclusions can be drawn from other type of policy contexts.

Selection on Observables vs. Selection on Unobservables

On the part of the evaluator the factors affecting the non random assignment of beneficiaries could have an ***observable*** or an ***unobservable*** nature defining two situations:

Selection on observables

In this case the analyst knows what drives the *self-selection* of individuals and the *selection* of the agency. The knowledge of **x**, the structural variables that are supposed to drive the non-random assignment to treatment, are assumed to be sufficient to identify the actual effect of the program.

Selection on unobservables

In this case factors driving the non random assignment are impossible or difficult to observe, then the only knowledge of the vector **x** is not sufficient to identify the effect of the policy.

These two pre-assumptions ask for "*different methodologies*" to identify the actual effect of policy programs

An assessment of *advantages* and *drawbacks* of methods for econometric evaluation of policy programs

A definitive answer to which is the alleged “best” method to apply is far from being found.

Each method presents relative *advantages* and *drawbacks* that the analyst, according to his specific context of analysis, has to ponder very carefully.

By and large, at least three elements are necessary to consider in program evaluation before choosing a specific econometric approach:

1. **program institutional set-up and operation**
2. **subjects’ behaviour and interaction**
3. **data availability and consistency**

Relative advantages and drawbacks of the econometric methods for estimating causal effects in program evaluation

Method	Advantage	Drawback
Control Function Regression	*Selection on observables* *No distributional hypothesis*	*No good under selection on unobservables* *Linearity*
Matching	*Selection on observables* *No distributional hypothesis* *No linearity* (non parametric)	*No good under selection on unobservables* *Availability of "good twins"*
Reweighting	*Selection on observables* *No distributional hypothesis*	*No good under selection on unobservables* *Choice of the weights*
Selection Model	*Selection on observables and unobservables*	*Fully parametric (u and v have a bivariate normal distribution)* *Linearity*
Instrumental Variables	*Selection on observables and unobservables* *No distributional hypothesis*	*Need for at least one instrument (i.e., one "exclusion restriction")* *Linearity*
Regression Discontinuity Design	*Selection on observables (sharp RD) and also on unobservables (fuzzy RD)* *No distributional hypothesis* *Extendable to non-parametric techniques*	*Knowledge of a good "forcing or selecting variable" (s)* *Choice of the cut-off and of the right window*
Difference-In-Differences	*Selection on unobservables* *No distributional hypothesis*	*Specific form of the error term* *Need for before/after treatment observation* *Linearity*

Learning and risk- analysis for RDI policies

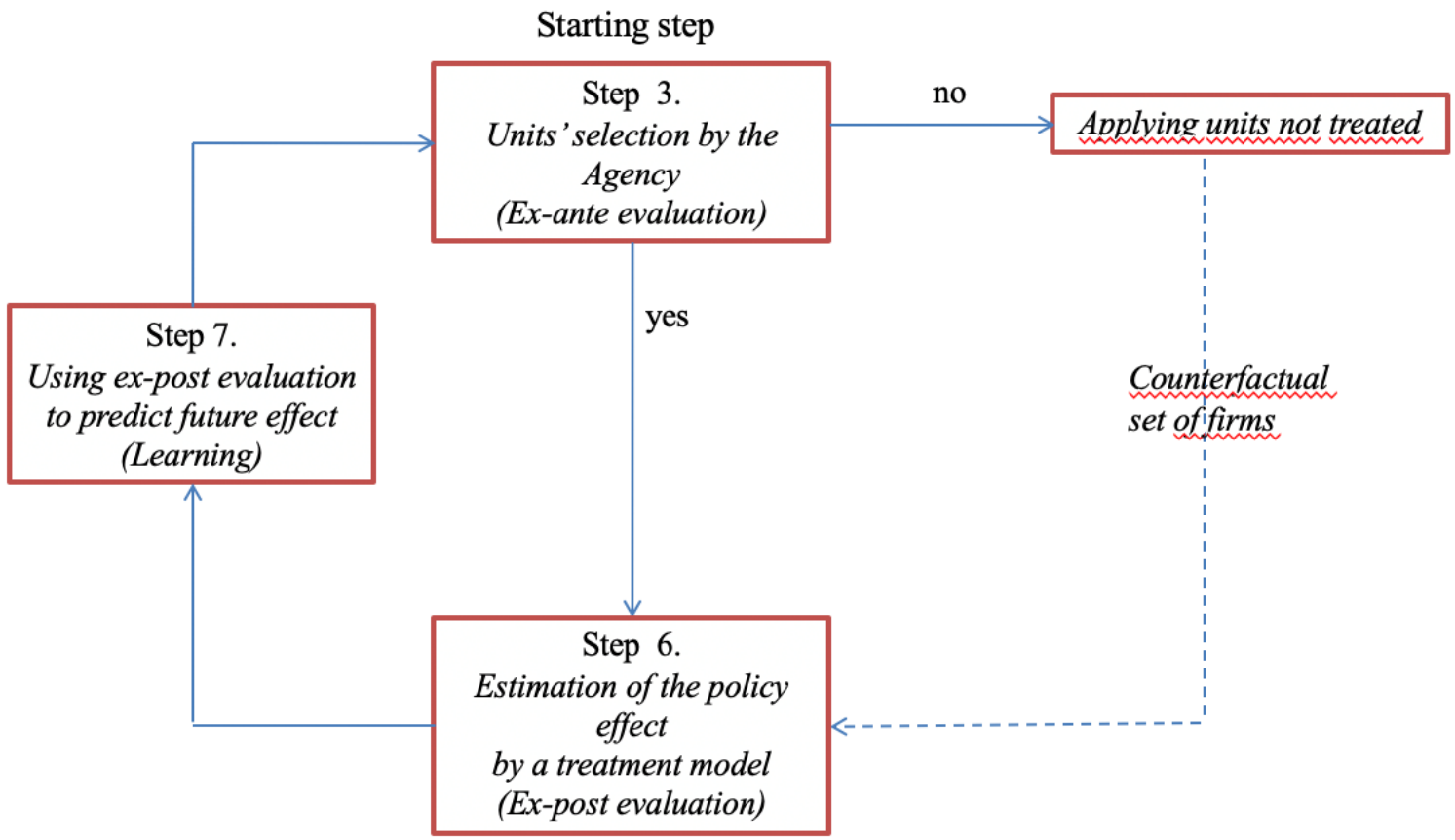
- When a public authority decides to entrust private entities with public money it assumes a **responsibility** towards the community.

- Since many alternative uses of the same amount of money are generally possible, any **misuse** of a sum allocated to a given purpose is seen as a waste (especially under severe budget constraints).

- This means that a public agency supporting private entities with money **bears a risk**, similar to that of a *bank* providing a private company with a loan, as the company might ultimately be unable to pay back the credit.

- it seems appropriate to refer to the literature on ***credit-risk assessment*** in order to derive a related approach to risk assessment in the case *of public support*.

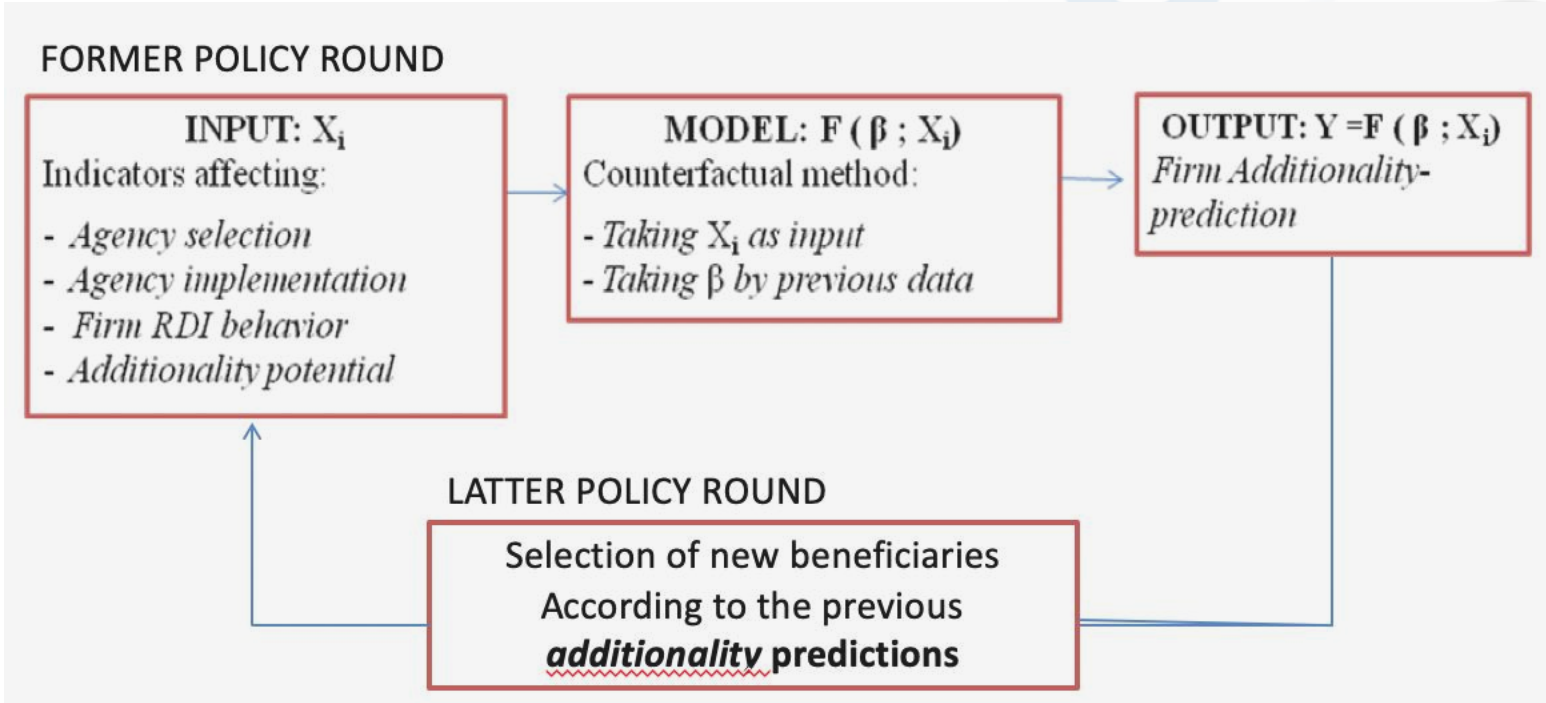
Learning in the *Logical Framework*



IMPROVING EX-ANTE CHOICE OF BENEFICIARIES BY EXPLOITING PAST EX-POST EVALUATION

- **different set of indicators**: not only financial indicators
- **different estimation model**: counterfactual treatment models
- **different prediction output**: level of firm additionality instead of failure probability

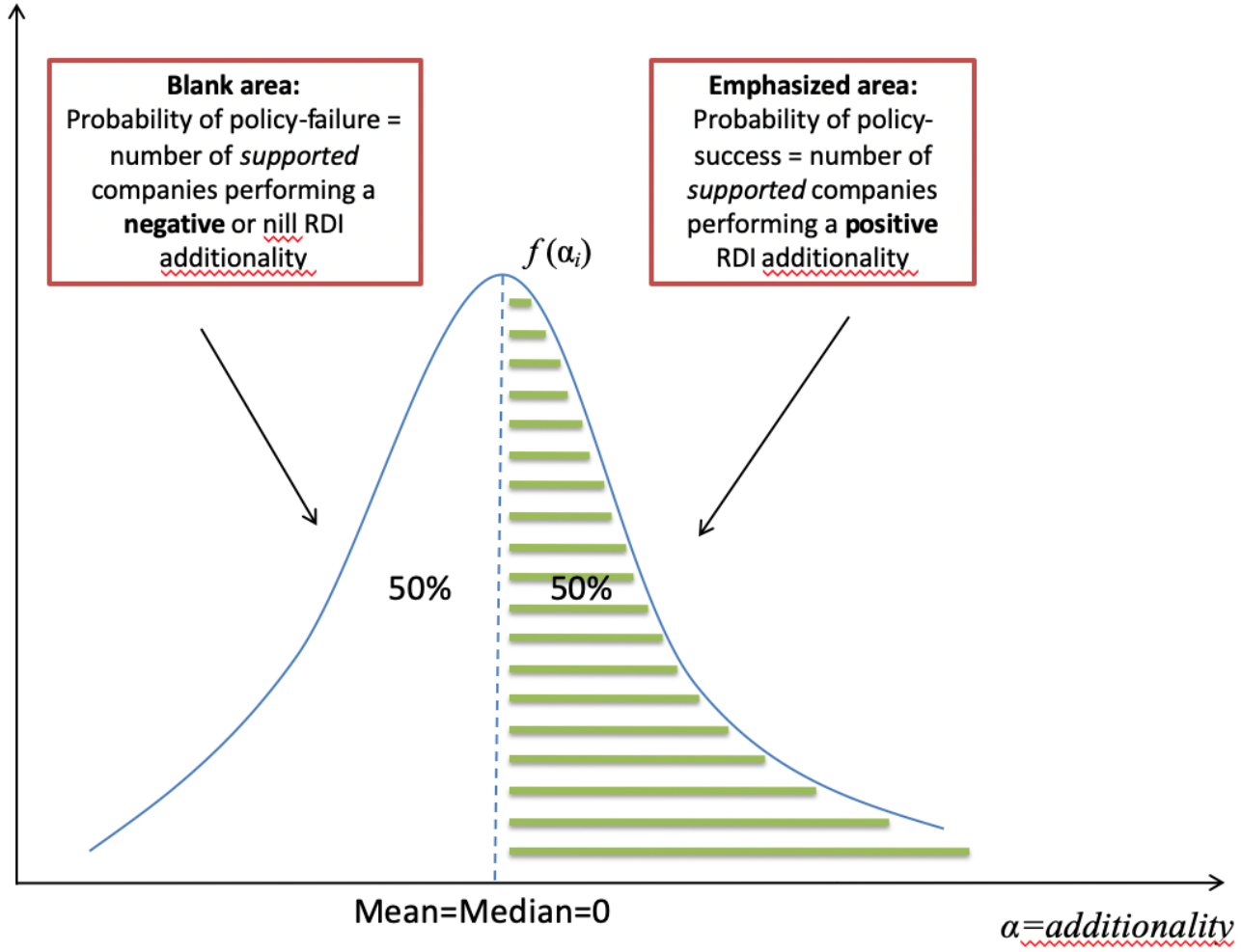
Policy Learning →



RDI policy-risk analysis and its link with firm-specific effect

- The literature on policy evaluation (not only RDI) focuses on estimation of **AVERAGE EFFECT** of the policy (α)
- But estimating idiosyncratic firm-specific effects (***heterogeneous effect***) is key both for *POLICY LEARNING* and *RISK ANALYSIS*
- Indeed, I will show you how relying just on an *average* (or *mean*) *effect* might lead to misleading (or very partial) conclusions about the policy effect

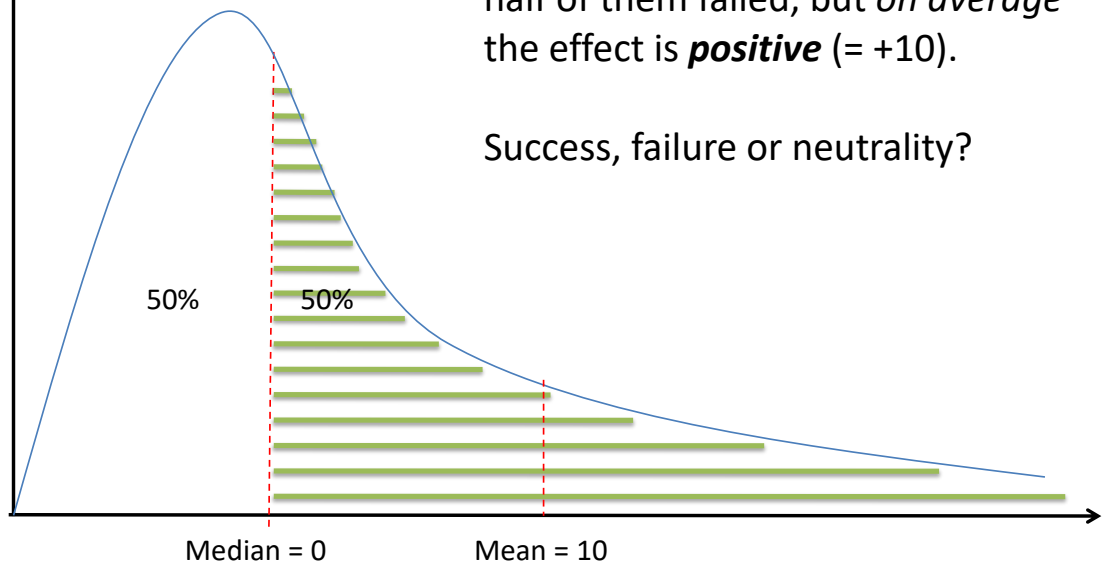
Distribution of policy-effects (*additionality*) and policy probability of success/failure



Why it is important to estimate effect distribution (heterogeneous effects)

Paradox: Half of supported succeed, half of them failed, but *on average* the effect is ***positive*** (= +10).

Success, failure or neutrality?

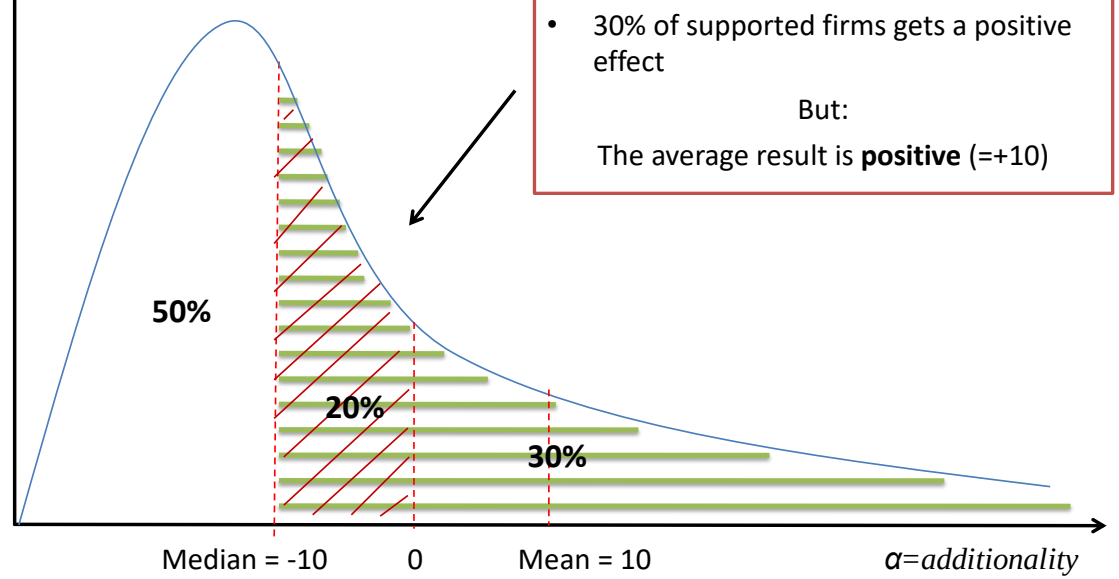


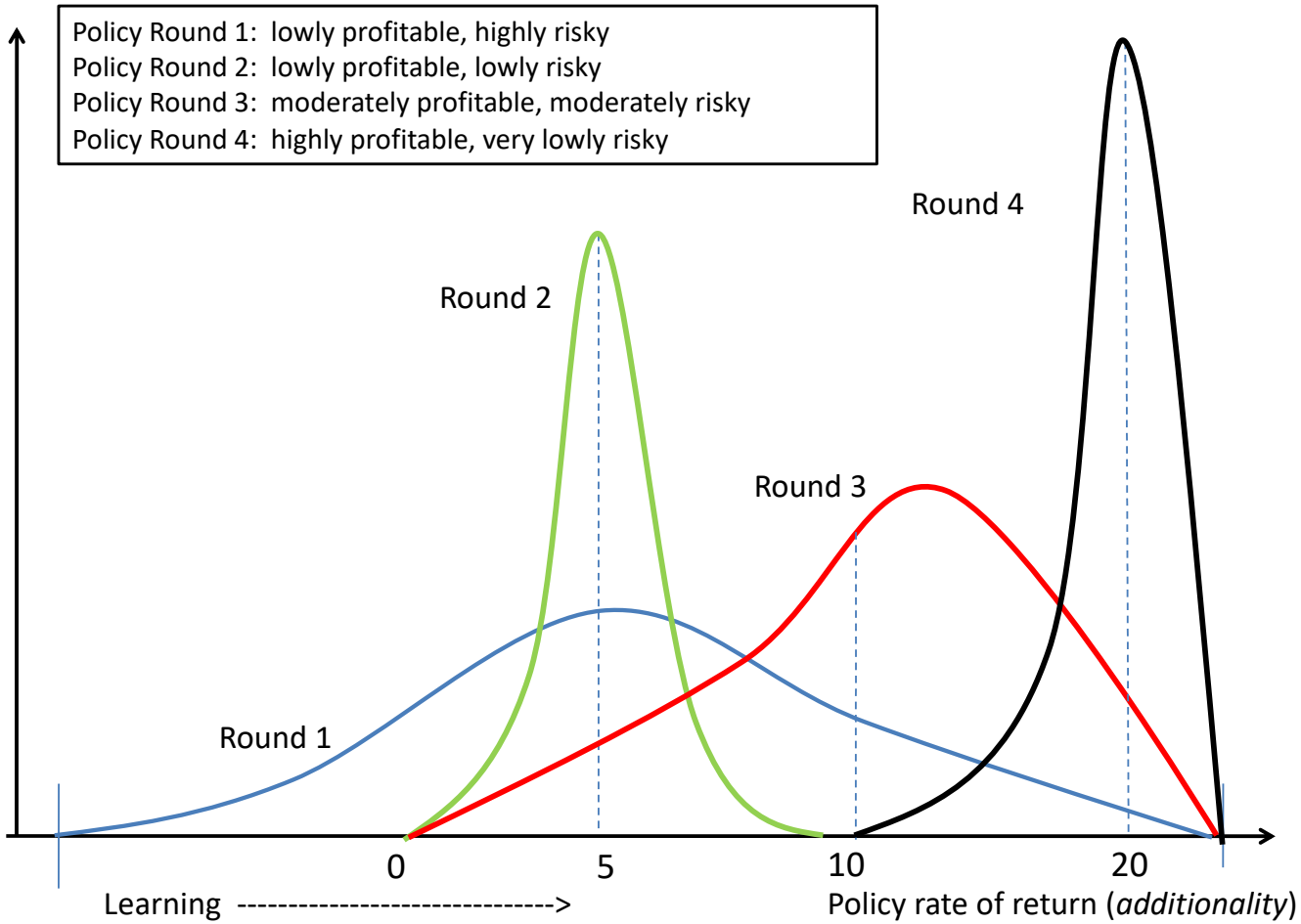
Why it is important to estimate effect distribution (heterogeneous effects)

- 70% of supported firms get a negative effect (50% + 20%)
- 30% of supported firms gets a positive effect

But:

The average result is **positive** (=+10)




Policy Round 1: lowly profitable, highly risky
Policy Round 2: lowly profitable, lowly risky
Policy Round 3: moderately profitable, moderately risky
Policy Round 4: highly profitable, very lowly risky
Round 4
Round 2
Round 3
Round 1
0
5
10
20
Learning ---------->
Policy rate of return (*additionality*)

Some comments

- All things equal, both the **RETURN** and the **VARIANCE** of the RDI policy effect might depend on agency *SELECTION*.
- In principle, higher return and lower riskiness seem to be preferable.
- But: the peculiar characteristics of the program and of the beneficiaries (size, sector, location, RDI experience, age, etc.) highly constrain both policy **return** and **risk**.
- Country comparisons would be of great interest in showing their different combination of return and riskiness

Some open questions in ex-post program evaluation

- *Role of unobservables*
- *Heterogeneity*
- *Subsidy measurement*
- *Multiple and mix of treatment*
- *Long-term effect*
- *Relation between input and output additionality*
- *Policy spillovers*
- *Data availability*
- *Policy full cost-benefit analysis*
- *General robustness*

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