Consiglio Nazionale delle Ricerche

IRCRES

ISTITUTO di RICERCA sulla CRESCITA ECONOMICA SOSTENIBILE
RESEARCH INSTITUTE on SUSTAINABLE ECONOMIC GROWTH

VIP moving

Enhancing safer working conditions: how can we assess what works and for whom?

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Invited session
"The economics of human risks and safety"
Organised by
Laurent Carnis and Martin Koning

Layout of the presentation

- **Occupational safety and health policies ant their evaluation**
- **Incentives for OSH and the case of the Inail ISI calls**
- **The research question(s)**
- **Evaluation challenges**
- The causal link to be detected **(theory of change for different measures)**
    - **safety**
    - **health**
    - **risk management models**
- Metrics for impact evaluation
- A preliminary assessment on management models

Partners of the project

Funding: Research collaboration projects (BRIC) 2019 by Inail

Internal INAIL supervising: Department of Medicine, Epidemiology, Occupational and Environmental Hygiene (S. Signorini & C. Colagiacomo)

Scientific coordinator: E. Ragazzi

Partner 1: CNR-IRCrES (L. Sella)

Partenr 2: Department of law and economic studies, "La Sapienza" University Rome (A. Castaldo)

INAIL
ISTITUTO NAZIONALE PER L'ASSICURAZIONE CONTRO GLI INFORTUNI SUL LAVORO

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DIPARTIMENTO DI STUDI GIURIDICI ED ECONOMICI
SAPIENZA UNIVERSITÀ DI ROMA

VIP moving

Valutazione degli Incentivi alla Prevenzione. MOdelli Valutativi sull'Impatto Generato dai bandi ISI

Occupational safety and health policies: definition

In general terms an OSH policy may be defined as a set of rules, actions and interventions targeting **firms** with the aim of improving the health and safety conditions of their workers and consequently reducing accidents and work-related diseases.

Many options (that may be used jointly if desired):

- **sermons** (information, training, assistance and advice)
- **sticks** (regulation enforced through supervision and sanctions)
- **carrots** (economic incentives for prevention)

Examples of the use of incentives are very scarce and they have never been evaluated.

Uniqueness of the Italian case

The general Italian law on OSH (*Testo Unico sulla salute e sicurezza sul lavoro*) explicitly includes the objective of experimental initiatives rooted in the firm social responsibility

This goal is pursued by **INAIL, the National Institute for Insurance against Accidents at Work**

«***INAIL funds**, with its own budget, also in the context of bilateralism and protocols with the trade associations and associations for the protection of invalids, **investment projects and training on health and safety at work**, addressed in particular at **small, medium and micro enterprises** and projects aimed at experimenting innovative solutions and organizational and management tools inspired by the **principles of corporate social responsibility***»

D.lgs. 81/2008, art. 11, co. 5

This was the basis for the launch of a wide programme of incentives for investments in safety and health, the **ISI calls** (Bandi ISI). It is the most long-lasting (12 years) and richly endowed (more than 2 billions€ over 10 years) experience in the field.

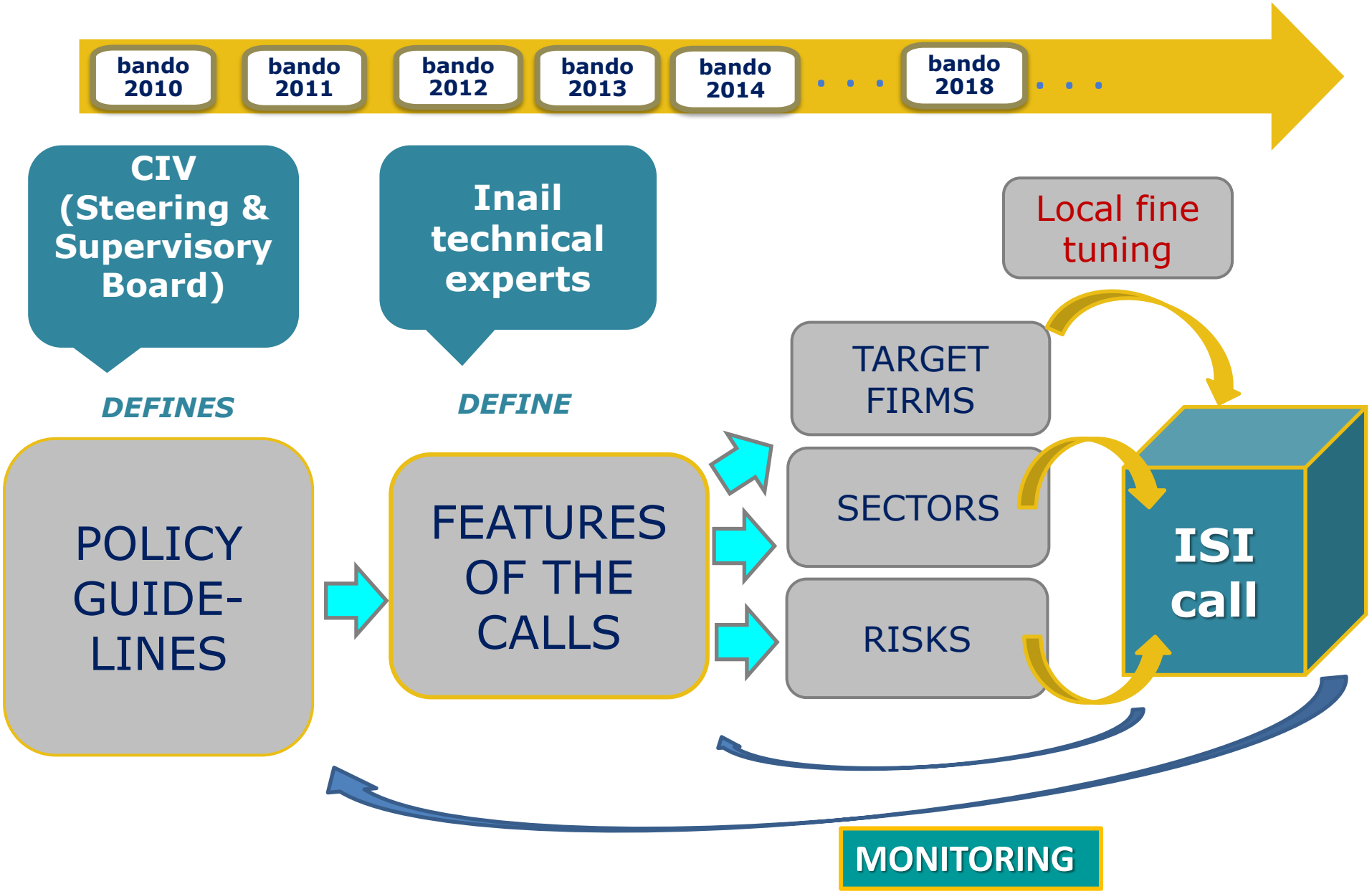
The ISI calls: features

- Yearly national calls, with a budget shared per region
- Incentives for (productive) investments that imply (also) an improvement of safety and health
- Not funding investments to comply with minimum requirements
- Grants covering up to 65% of the expenses and up to 130,000 €
- Targeting small and micro firms
- Based on applications by firms (click-day)

Eligibility is determined by a score based on priority criteria (on the firm and/or on the project) that vary every year and may also be differentiated at the regional level

- Applications are funded, after a detailed check on the project, on a first come – first served basis until regional budget is exhausted
- Only a small share of applications are funded

THE DESIGN OF ISI-INAIL CALLS



Self application

Guided compilation of the application

Authomatic calculation of the score

if the threshold is reached, a unique identification code is issued

ISI CLICK DAY

Chronological lists of eligible firms

.....

.....

.....

.....

.....

....

.....

.....

.....

1 The firm completes the application

Verification & payment

2 **And sends the project & the documents**

REPORTING

3 Technical and administrative verification by Inail

4 ADMISSION

PROJECT IMPLEMENTATION (24 MONTHS)

The numerosity of the ISI calls

YEAR	PARTICI- PANTS	SELECTED	CLICK-DAY SUCCESS %	ADMITTED LIQUIDATED	A-L / SELECTED %	BUDGET
2010	18.552	*1440*	*7,8%*	*842*	*58,5%*	*58.993.474*
2011	20.628	4316	20,9%	2118	49,1%	205.000.000
2012	13.128	3690	28,1%	1857	50,3%	155.352.313
2013	22.981	4211	18,3%	2753	65,4%	307.359.613
2014	22.981	3434	14,9%	2383	69,4%	267.427.404
2015	23.643	3382	14,3%	2404	71,1%	276.269.984
2016	21.068	4318	20,5%	2732	63,3%	244.507.756
2017	16.620	3740	22,5%	2281	61,0%	249.406.358
2018	16.696	5445	32,6%	3022	55,5%	370.069.300
Total	159.185	33976	21,3%	20392	55,5%	**2.134.386.202**

OSH policies: evaluation

Evaluation studies of OSH policies are very scarce. A recent survey conducted under the Regulatory Fitness and Performance Program *(REFIT – European commission 2017)* of ex post evaluation of the EU directives on health and safety at work concluded:

"given the current evidence and data sources, it is not possible to demonstrate links between regulatory activities and changes in the health and safety outcomes"

The European Agency EU-OSHA introduced firstly evaluation as a priority for 2013 – 2020 (*EU-OSHA 2013*)

«The lack of evaluation studies of interventions in the field of SSL is widely recognized. Studies are needed to assess feasibility and effectiveness»

Why so little evaluation?

- Lack of motivation (the attention of the voter is high, no political need to justify intervention in this field)
- Difficulties in impact evaluation

BUT

- RQn: Which is the good policy mix (sticks/carrots and sermons)? This is even more relevant since we work on a multidimensional objective (probability and impact, prevention and remediation) and for different targets (industries and firms) with different levels and types of risks **Comparative evaluation**
- RQ1: is one single policy instrument effective and for whom? Single evaluation **Focused evaluation**
- RP0: is it possible to have an effectiveness evaluation? **Methodological feasibility**
- RQ-1 Is it realistic to have an impact evaluation on a topic on which the public is so sensitive? No evaluation is possible without the full cooperation of the implementer

What about Italy?

Parliamentary Investigation Commission of the Senate. Intermediate relation 14/3/2016

The commission «*has established to conduct an activity of evaluation of the public policies in the sectors [...] identified in the institutive resolution of 4 December 2013.*»

CIV – Planning report 2019 – 2021

«*Implementation of a structured monitoring system, for each phase of the calls, to provide the CIV with evaluation elements on the effectiveness and efficiency of the incentive system with the aim of developing strategies [...] functional to the protection of health and workplace safety*»

Something is moving

Feasibility and criticalities

In the context of OSH policies ISI calls appear to be particularly adequate for **counterfactual impact evaluation**

Random assignment to treatment: the click-day mechanism randomly allocates the grants to a list of eligible candidates (minimum score requirement)

The process generates a **natural experiment**:

- **Treated firms**: those who were granted funding for the investment
- **Control group**: eligible applicants not selected by the click-day mechanism

However, there are some **methodological challenges, that we address in the VIP-Moving project**

General OSH challenges:

Identification of a clear causal link

1. The effectiveness of the investment (eg the purchase of a machinery) is **conditioned** by other factors (eg the level of awareness and competence of the worker, the intensity and duration of exposure to risk).

2. There are many **confounders**, to be considered in a **specific** way, in order not to frustrate the readability of the effect.

3 For investments to improve health conditions it is very difficult to determine the cause-effect relationship, for:

- the association with other chronic degenerative diseases
- and with pathologies linked to the worker's lifestyle,
- the **latency** time between exposure to risk and manifestation of disease that can reach some decades)

Feasible just a rough assessment on levels of pre and post-investment exposure (*output*) and then estimation of health effects (*outcome*) based on parameters deriving from previous clinical studies. **IDEAS?**

General OSH challenges:

Output and outcome variables

1. Output and outcome variables are represented by aleatory non deterministic variables. Accidents and illnesses are rare events, with very low frequency. Outcome variables may show low or zero variance, unless big samples are available.

2. To better detect the causal link between the investment and the outcomes, it is necessary to use metrics on accident (or illness) frequency and severity restricted to cases that are connected with the risk addressed by the investment. This requires high quality and interconnectable databases which is not the case… Very difficult to interconnect the taxonomy of type of investments (e.g., change of slipping soil, training), the risk (e.g., falling, bad posture in carrying out hard works), and the health event (broken bone, osteoarticular damage)

Specific ISI challenges:

A policy with several goals

1. The general objective is articulated in various specific measures (eg investment projects, projects for the adoption of organizational and control models, etc.), project that target specific, high risk sectors.

It is not possible to carry out a generic "evaluation of ISI calls", but it is necessary to design multiple assessments for the different measures.

2. The main (declared) goal of reducing the incidence of accidents and illness is accompanied by an (undeclared) goal of supporting the renewal of the SME system. The policy was launched in 2010, during the great crisis. In literature may be found evidence of the connection between occupational safety and technological progress ((Blank et al., 1996b; Sari et al., 2004), that give support to this twin objective. BUT this implies also that, above all for the investment lines connected to the purchase of machinery, the safety purpose of the investment is not always prevalent

Specific ISI challenges:

Self application and external validity

The mechanism of assignment to the treatment based on the click-day allows to assimilate the exercise to an experimental evaluation design. It compares the companies that have applied but have not obtained the grant, with those that have been funded.

However, the self-selection into the experiment does not allow us to assume that companies that apply to be treated (similar to volunteers in a social or health experiment) are representative of the universe of target companies.

In such conditions it is therefore necessary to assess the extent to which the results obtained in the impact assessment can be extended to the entire audience of recipients (**external validity of the evaluation**).

Which variables explain the choice to apply?

Specific ISI challenges:

External validity

Which variables explain the choice to apply?

This will be a future research extension.

- We will explore the features of no-shows: companies that have the ticket for the click-day, so are eligible, but do not participate, or are selected but they do not send the documents. They might represent eligible companies not interested in the call
- We will run a survey on non participant firms
- We will work on the cultural attitude towards OSH. The socio-cultural variables able to explain different OSH performances, may also be used to understand the decision to apply

Specific ISI challenges:

Attrition and alternative treatment

Since a substantial share of the sample of companies that were successful at the click day does not obtain the payment, there are problems of attrition and interruption of treatment.

It is essential to investigate the causes of dispersion (less and less attributable to the difficulties of the process), as they could represent a bias in the observed impact. The risk of bias is high in the following cases:

- Firms going bankrupt or closed.
- Firms that have obtained alternative incentives to carry out the investment
- Crime and corruption

THE PROBLEM OF ATTRITION

Attrition

YEAR	PARTICI PANTS	SELECTED	ADMITTED LIQUIDATED	A-L / SELECTED %	TOTAL ATTRITION
2010	18.552	*1440*	*842*	*58,5%*	**41,5%**
2011	20.628	4316	2118	49,1%	**50,9%**
2012	13.128	3690	1857	50,3%	**49,7%**
2013	22.981	4211	2753	65,4%	**34,6%**
2014	22.981	3434	2383	69,4%	**30,6%**
2015	23.643	3382	2404	71,1%	**28,9%**
2016	21.068	4318	2732	63,3%	**36,7%**
2017	16.620	3740	2281	61,0%	**39,0%**
2018	16.696	5445	3022	55,5%	**44,5%**
Total	159.185	33976	20392	55,5%	**44,5%**

Attrition is huge! What determines it?

Does it bias our results on impact?

Different causes and different biases.

CONTROLS

A taxonomy of participant firms
Non-Eligible
No shows
Not Selected
Drop-outs
Not admitted
Admitted under investigation
Admitted Drop-Outs
Admitted failed
Admitted and liquidated

ATTRITION

TREATED

A taxonomy of firms applying to the ISI calls

Label	Definition	Notes
Non Eligible	Firms that do not score high enough to be admitted to the Click-Day	Could be used to describe the features of non-eligible companies showing interest into the call. We just have fragmented information.
No shows	Firms that – having scored higher than the threshold – are given the possibility to participate at the Click-Day but do not attend it.	Could be used to describe the features of **eligible companies not showing interest into the call (**decision to apply). We just have fragmented information.
Not selected	Eligible firms that attend the Click-Day but apply too late and are excluded from the process.	This group is the best candidate as **control group. CAUTION**: Not selected firms may apply in future calls and be funded at that point.
Drop-outs	Selected firms that fail to provide the required documents relating to the project	Could be used to describe the features of **eligible companies not showing interest into the call** (decision to apply).

A taxonomy of firms applying to the ISI calls (2)

Label	Definition	Notes
Not admitted	Selected firms whose projects are rejected for technical or administrative reasons	This group is interesting for process evaluation, to improve the policy implementation
Admitted under investigation	Firms whose file is still under verification.	Small residual and transitory category.
Admitted drop-outs	Selected firms that have successfully passed the Click-Day and the first verification step but fail to present the follow-up documents on the project.	We don't know anything about the reasons of this behaviour, that could give many hints on the sources of behaviour. Future research will include a survey on this group.
Admitted failed	The project is rejected after the ex-post verification.	We have information on the reasons for the rejection.
Admitted and liquidated	Firms successfully implementing the project and receiving the full amount of the incentive.	These companies are our **treated group**.

YEAR	NON ELIGIBLE NO SHOWS	NOT SELECTED	DROP-OUT	NOT ADM.ITTED TECH.NICAL	NOT ADMITTED ADMINISTRATIVE	NOT ADM. TECH. AND ADMIN.	ADMI. UNDER I NVESTIGATION	ADMITTED DROP-OUTS	ADMITTED FAILED	ADMITTED LIQUIDATED	TOTAL APPLICANTS
2010	17.112	0	1	171	41	124	18	170	73	842	18.552
2011	5.657	16.312	451	621	87	213	52	648	126	2.118	26.285
2012	4.636	9.438	333	537	86	247	48	465	117	1.857	17.764
2013	9.092	18.770	266	447	78	186	47	345	89	2.753	32.073
2014	4.250	19.547	181	357	79	140	26	221	47	2.383	27.231
2015	4.342	20.261	184	274	107	133	31	207	42	2.404	27.985
2016	3.547	16.750	295	289	272	322	45	291	72	2.732	24.615
2017	2.540	12.880	263	462	209	271	79	143	32	2.281	19.160
2018	1.928	11.251	454	456	304	289	786	105	29	3.022	18.624
Total	53.104	125.209	2.428	3.614	1.263	1.925	1.132	2.595	627	20.392	212.289

THE CAUSAL LINK TO BE DETECTED

Theory of change: aspects affecting the change in OSH

SUBJECTIVE FACTORS (the worker):

- Awareness
- Compliance to rules
- general health status and lifestyle

OBJECTIVE FACTORS (the work environment):

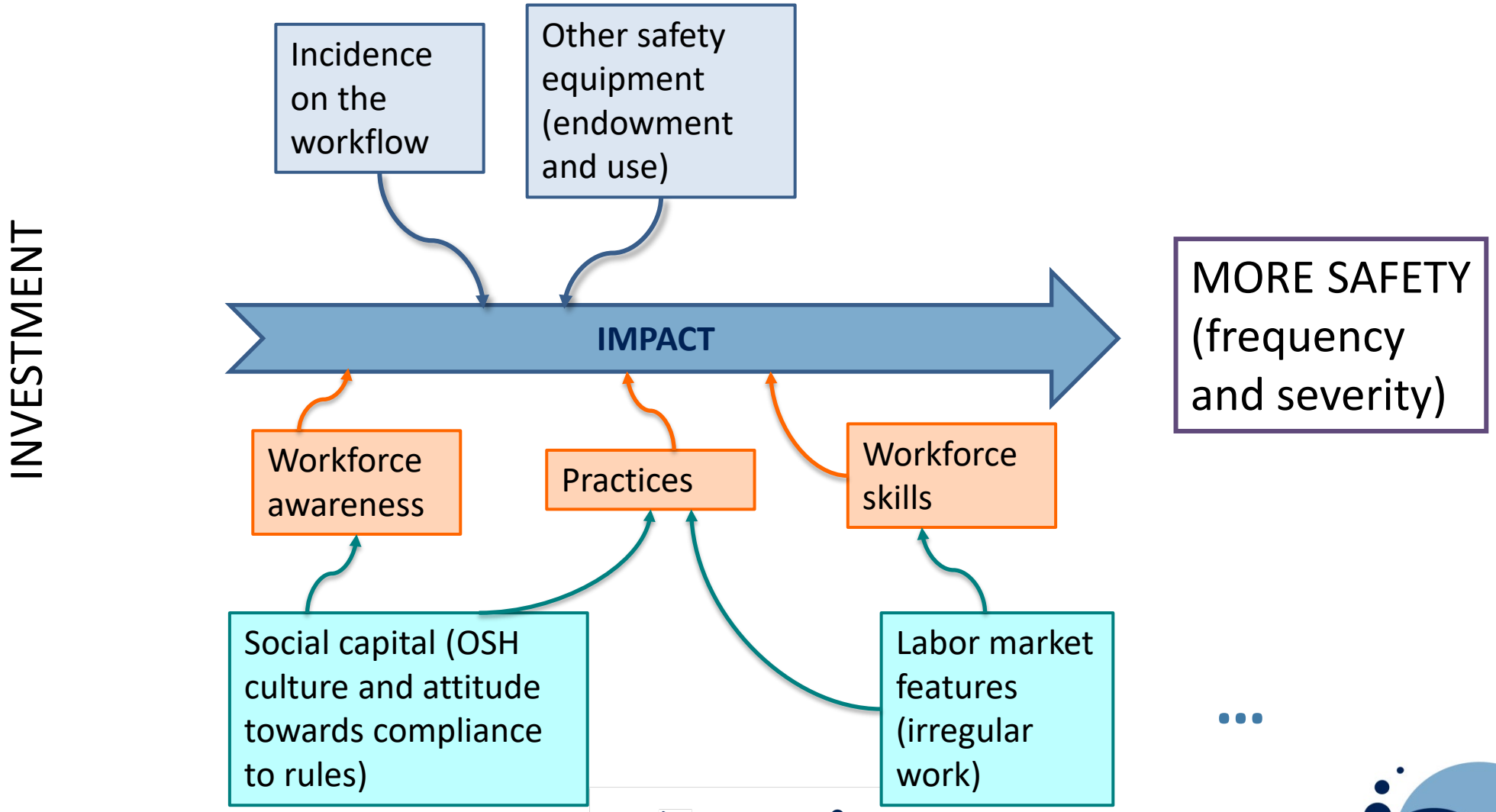
- Equipment of safe assets
- Endowment of safety devices
- Risk management
- General cultural attitude towards safety, compliance to rules, …

OCCUPATIONAL SAFETY AND HEALTH

PROBABILITY (FREQUENCY)

IMPACT (SEVERITY)

Theory of change: investments to reduce accidents



Social capital: Proxies for conditioning variables

In a previous work we tested the capacity of social capital variables to preview the territorial bias.

The TB is the deviation of the incidence of accidents in a territory from what one could expect knowing its industrial composition.

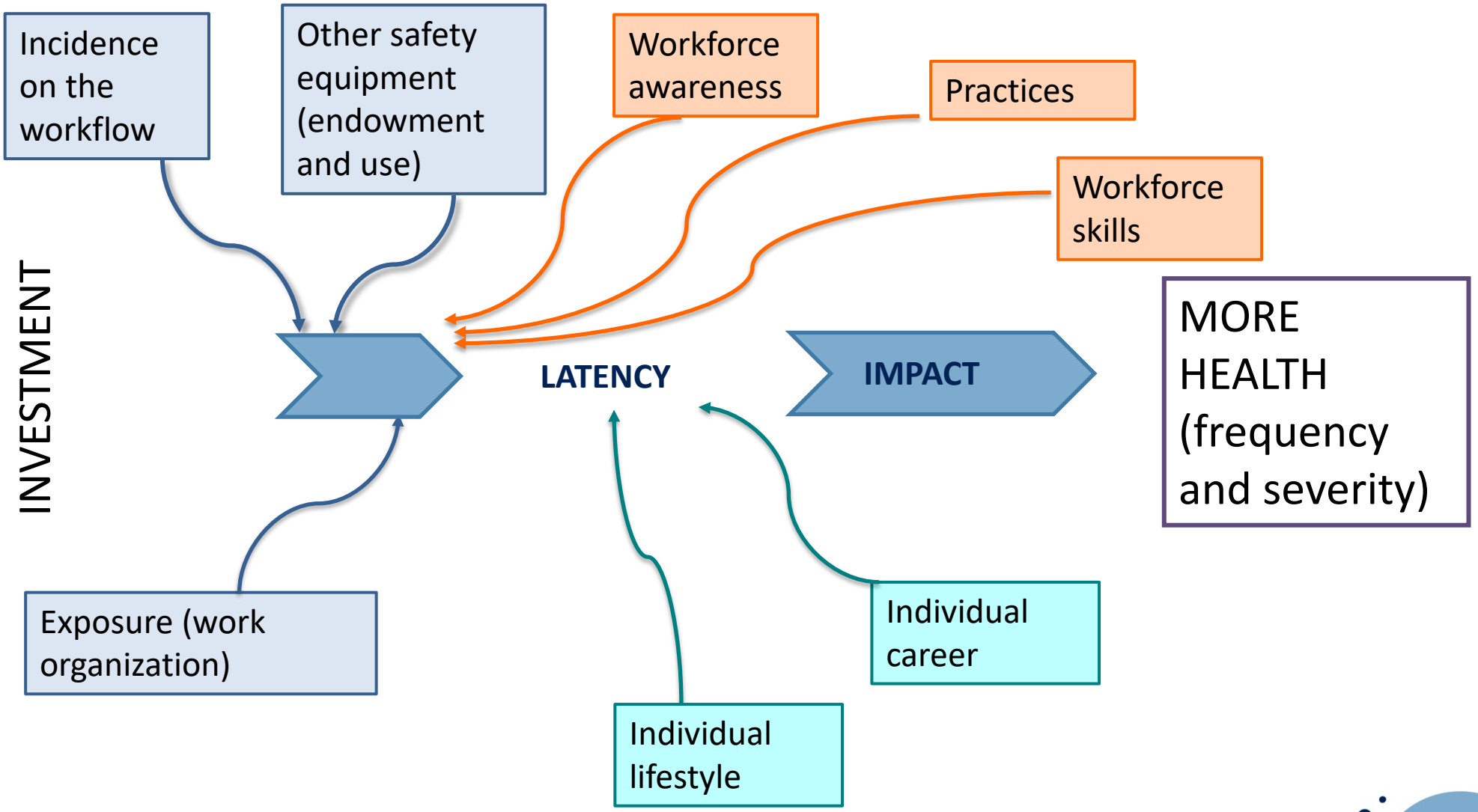
We tested a **wide list of variables**, mainly referring to “social capital” concepts as determinants of the territorial heterogeneity

- Only few variables over a wide list result (moderately) significant

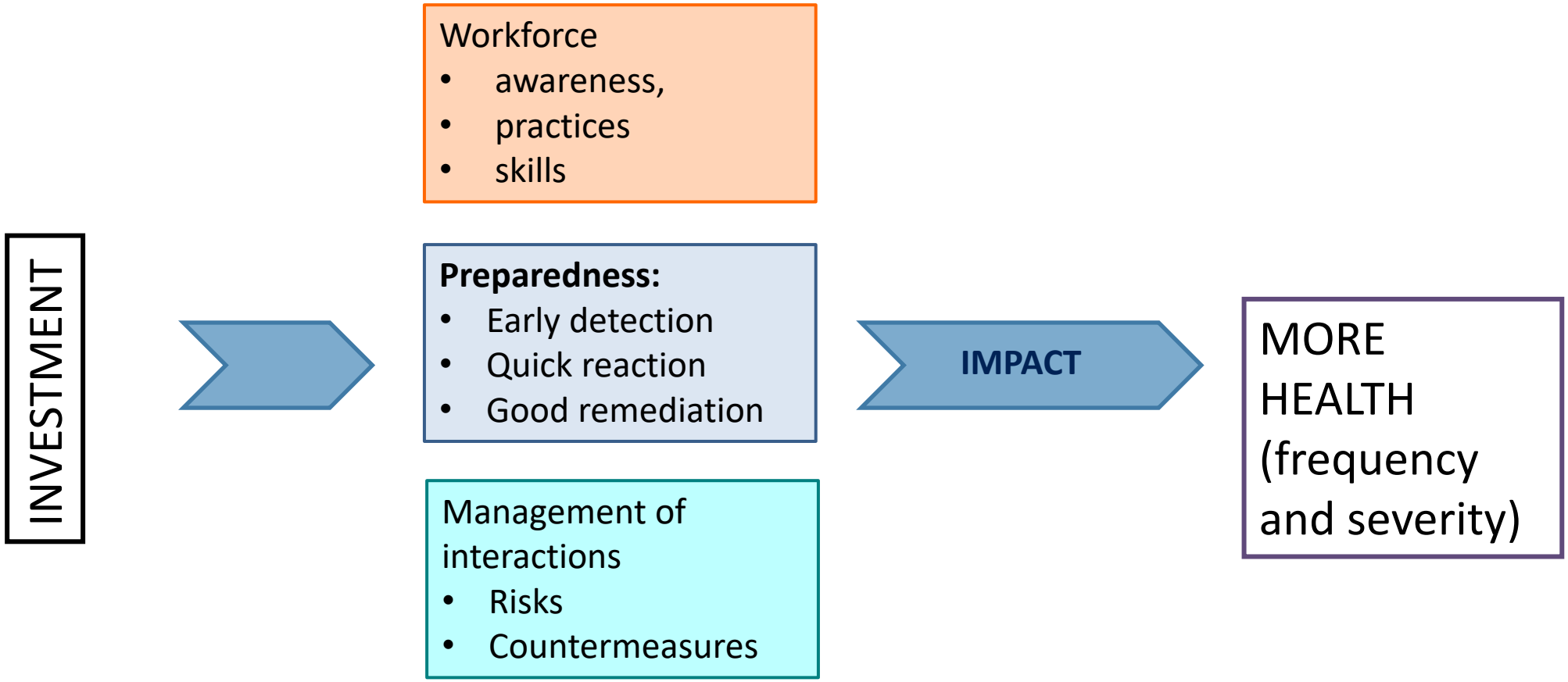
  ➡ **it is very difficult to seize the cultural attitude of a territory towards OSH**

- This attitude seems to be better described by variables concerning **individual behavior** and **criminal activity**, which emerge as two dimensions to be further investigated
- We miss variables able to describe the compliance with norms: suggestions?

Theory of change: investments to reduce illness



Theory of change: OSH management systems (Standards)



INDICATORS

Dimensions of risk — Frequency and severity

Literature on risk analysis identifies two dimensions of risk:

- **Probability**: how likely is the adverse event?
- **Impact**: which consequences will result from the adverse event?

These two dimensions of risk apply to OSH:

- Probability may be studied through the observed relative **frequency** of accidents or professional diseases
- Impact may be analyzed observing the **severity** of consequences of accidents or professional diseases *(number of days off work, permanent health consequences, death)*

Describing occupational risk

Indicators

Based on these two dimensions of risk (**probability** and **impact**) we identified 3 metrics:

$$\textbf{Frequency index}\ (F\_I_i) = \frac{Indemnified\ accidents_i}{Employees_i} \cdot 1000$$

$$\textbf{Severity Share}\ (S\_S_i) = \frac{Severe\ accidents_{ij}}{Indemnified\ accidents_i} \cdot 100$$

$$\textbf{Severity Index}\ (S\_I_i) = \frac{Severe\ accidents_i}{Employees_i} \cdot 1000 = F\_I_i \cdot S\_S_i\ /100$$

Where i = firm

Severe Accidents = Accidents >30 days prognosis + permanent outcomes + fatal

Thresholds to **define low/medium/ high risk**: may be calculated using 40th/60th percentiles across industries (based on Inail, 2021)

	Low	Medium	High
FI	0-11,6	11,6-17,3	over 17,3
SS	0-33,6	33,6-35,5	over 35,5
SI	0-39,2	3,9-57	over 5,7

These thresholds are our reference values to define low/medium/high risk

Sectoral specificities

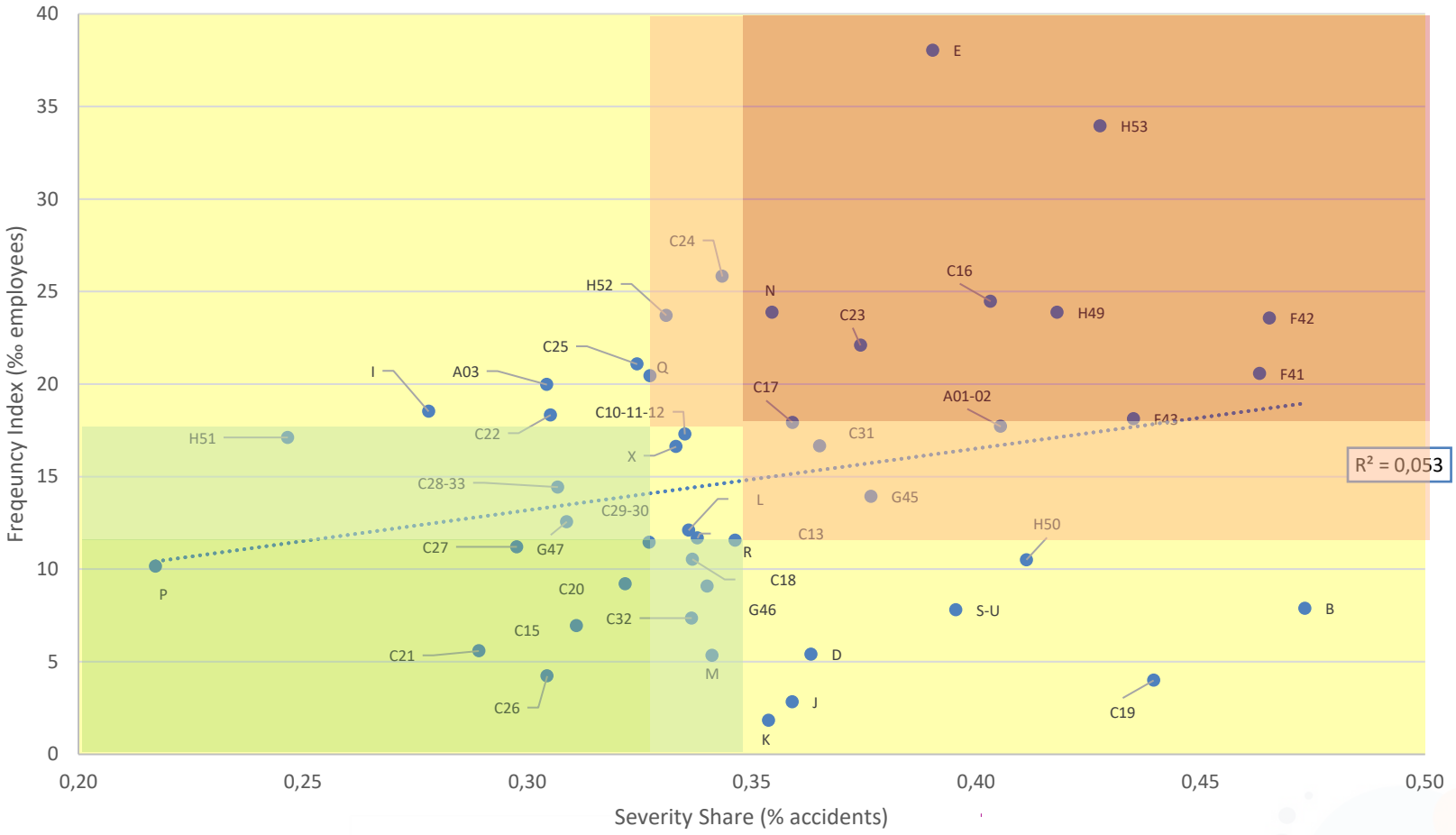
Risk levels

We notice:

- a **wide dispersion** (very different situations) …
- … over a **slightly positive trend**

(i.e., high risk industries show problems on both probability and impact)

Sectoral map of occupational risk in Italy in 2018



Reference codes for Sectors

A01-02 Agriculture and forestry	E Water supply; sewerage; waste management and remediation activities
A03 Fishing and aquaculture	F41 Construction of buildings
B Mining and quarrying	F42 Civil engineering
C10-11-12 Manufacture of food products, beverages, and tobacco products	F43 Specialised construction activities
C13 Textile industries	G45 Wholesale and retail trade and repair of motor vehicles and motorcycles
C15 Manufacture of leather and related products	G46 Wholesale trade, except of motor vehicles and motorcycles
C16 Manufacture of wood and of products of wood and cork, except furniture	G47 Retail trade, except of motor vehicles and motorcycles
C17 Manufacture of paper and paper products	H49 Land transport and transport via pipelines
C18 Printing and reproduction of recorded media	H50 Water transport
C19 Manufacture of coke and refined petroleum products	H51 Air transport
C20 Manufacture of chemicals and chemical products	H52 Warehousing and support activities for transportation
C21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	H53 Postal and courier activities
C22 Manufacture of rubber and plastic products	I Accommodation and food service activities
C23 Manufacture of other non-metallic mineral products	J Information and communication services
C24 Metallurgy	K Financial and insurance services
C25 Manufacture of fabricated metal products, except machinery and equipment	L Real estate activities
C26 Manufacture of computer, electronic and optical products	M Professional scientific and technical services
C27 Manufacture of electrical appliances, non-electrical household appliances	N Renting, leasing, and support service activities
C28-33 Manufacture of machinery and equipment, and repair and installation equipment	P Education
C29-30 Manufacture of motor vehicles, trailers and other means of transport	Q Human health and social work activities
C31 Manufacture of furniture	R Arts, sports, entertainment and recreation activities
C32 Other manufacturing	S-U Activities of extraterritorial organisations and bodies
D Electricity, gas, steam and air conditioning supply	X Not defined

Colours refer to the risk level in terms of severity

Territorial specificities

Regions

We observe

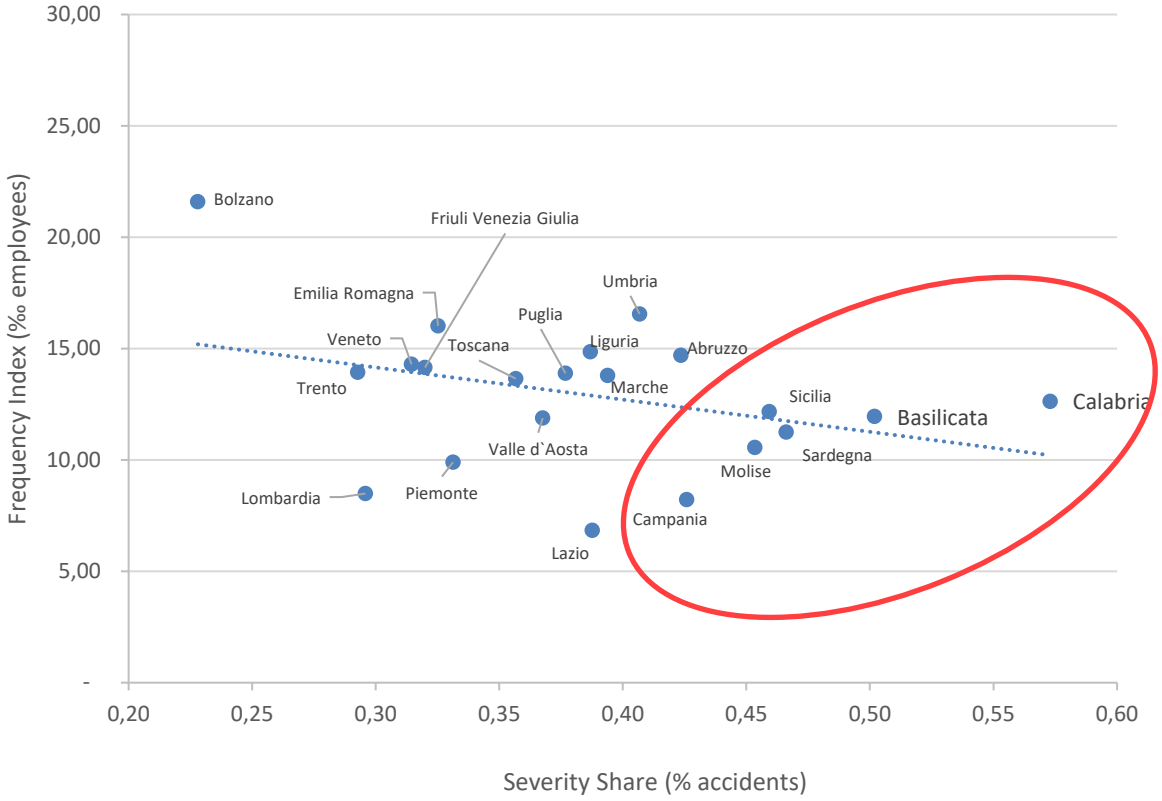
- high heterogeneity
- slightly negative trend
- **spatial regularity**: all southern regions show low FI and high SS

→ **STRONG CONCERN OF:**

- **UNDERREPORTING** less serious accidents
- **OVERREPORTING** serious accidents

in some Regions

No estimation on the size of underreporting, but phenomenon highly connected with irregular work.



Other metrics

Literature identifies other possible metrics to study the effect of OSH policies:

- **Compensations**: These include for example economic compensations paid to workers or the discounts on insurance rates for best performers. They are a viable alternative to the frequency indexes.
- **Positive Performance Indicators**: composite indicators that take into account the positive actions against OSH risk undertaken by the firm (Gallagher et al., 2001). But these metrics are based on inputs of security and not on outcomes, which makes them bad candidates for impact evaluation.

Safety bias

Concept

Practitioners and literature acknowledge **two main determinants of occupational risk at the firm level**: sector and size.

- If the characteristics of the evaluated unit (firm, territory) as far as size and were the only determinants of heterogeneity …
- … then it would be possible to foresee the number of (serious) accidents per firm (province), by
  - Calculating the **FI (SI) calculated at the national level** for that industry and size class to find an expected value
  - Comparing it to the observed one you obtain the **safety bias**.

We did that exercise at the territorial level (Province) calculating a **territorial bias**. We actually observed a **huge difference between the real and expected (serious) accidents** (which could be explained by local social, cultural and economic features of the territory).

OSH risk determinants

Sector and Size

Practitioners and literature acknowledge **two main determinants of occupational risk at the firm level**: sector and size. Both of them proxy other dimensions

Sector proxing the following dimensions:

- specific **nature of the job** (Abdalla et al., 2017)
- specific **nature of job tasks** (ILO, 2001),
- **type of workers** involved (Abdalla et al., 2017),
- involvement within the **informal sector** (Buckley et al., 2016)

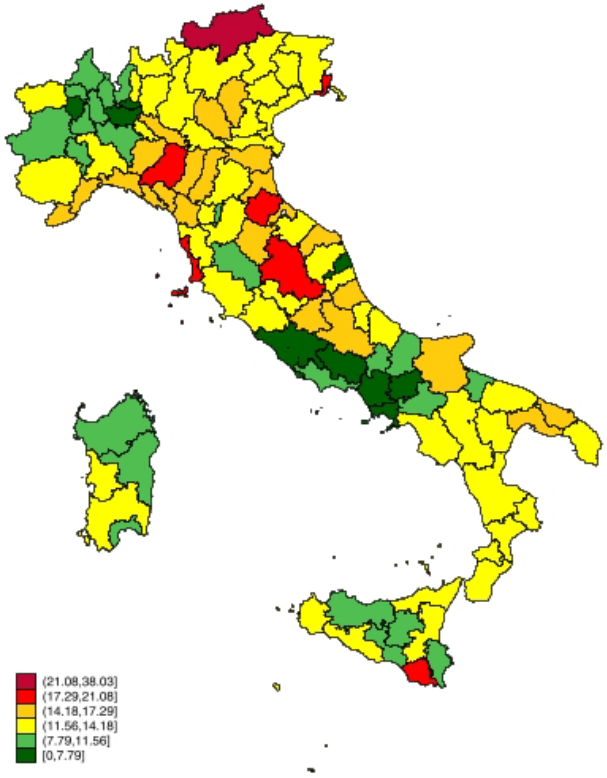
Size proxing the following dimensions:

- **resources** (ILO, 2020; Walters & Wadsworth, 2016),
- **formal/informal management structure** (Hasle and Limborg, 2006),
- **awarness** of OSH,
- pressure due to **position in the Global Supply chain** (ILO, 2005),
- involvement within the **informal sector** (ILO, 2020)

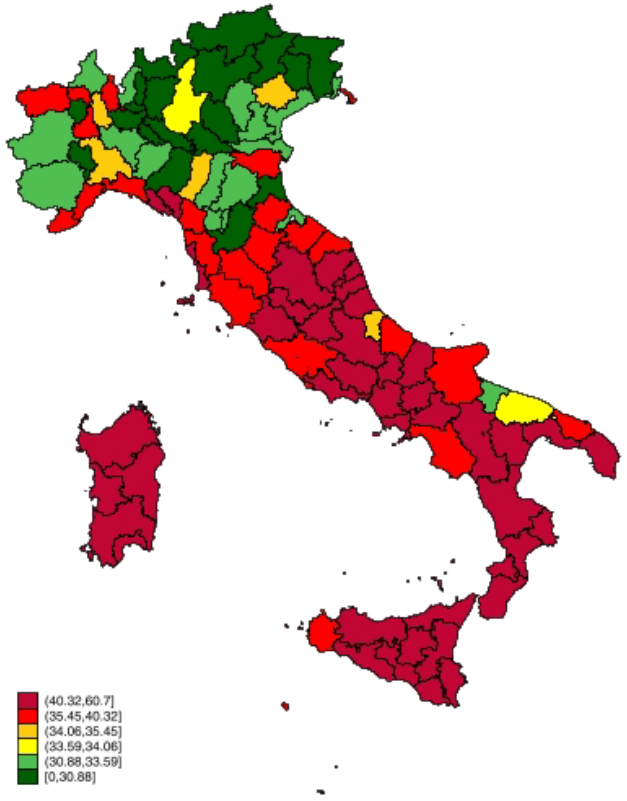
Territorial specificities for FI SI SS

Provinces

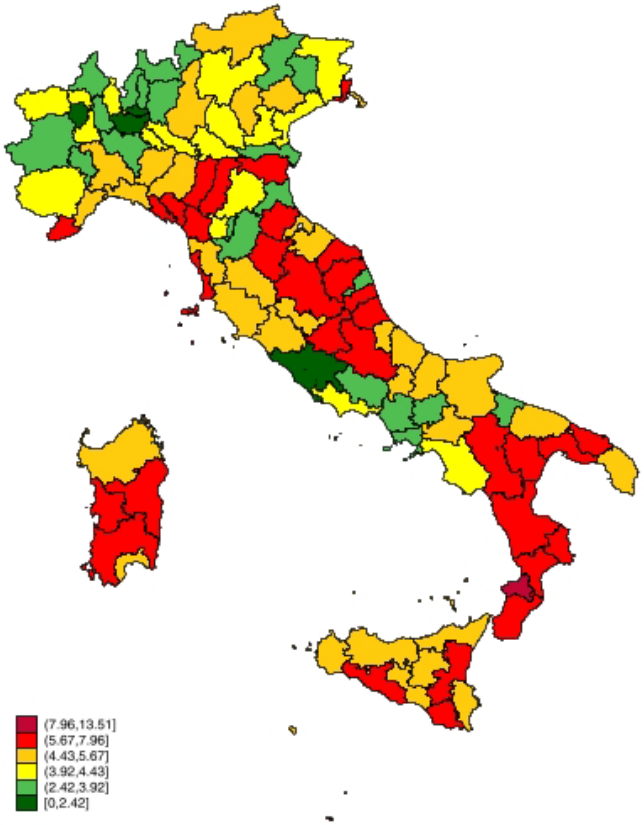
The original metrics were not very meaningful (very different pictures and no clear pattern)



Frequency Index



Severity Share



Severity Index

The color range is based on the values calculated for Q_{20}, Q_{40}, Q_{50}, Q_{60}, Q_{80} of industry ranking of each indicator. GREEN: LOW RISK YELLOW: MEDIUM RISK RED: HIGH RISK

Territorial bias Definition

- N_acc_{ij} = Real indemnified accidents in province i and industry j
- N_sev_{ij} = Severe accidents in province i and industry j
- $F\_I_{*j} = \frac{Indemnified\ accidents_{*j}}{Employees_{*j}} \cdot 1000$ and $S\_I_{*j} = \frac{Severe\ accidents_{*j}}{Employees_{*j}} \cdot 1000$
  indexes calculated at the national level
- $EN\_acc_{ij} = F\_I_{*j} \cdot Employees_{ij}$ and $EN\_sev_{ij} = S\_I_{*j} \cdot Employees_{ij}$
  Expected accidents (total and severe) per industry and province
- $EN\_acc_{i*} = \sum_j EN\_acc_{ij}$ and $EN\_sev_{i*} = \sum_j EN\_sev_{ij}$
  Expected accidents (total and severe) per province for all industries
- $TB\_acc_{i*} = N\_acc_{i*} - EN\_acc_{i*}$ **Territorial bias on accidents**
- $TB\_sev_{i*} = N\_sev_{i*} - EN\_sev_{i*}$ **Territorial bias on severe accidents**

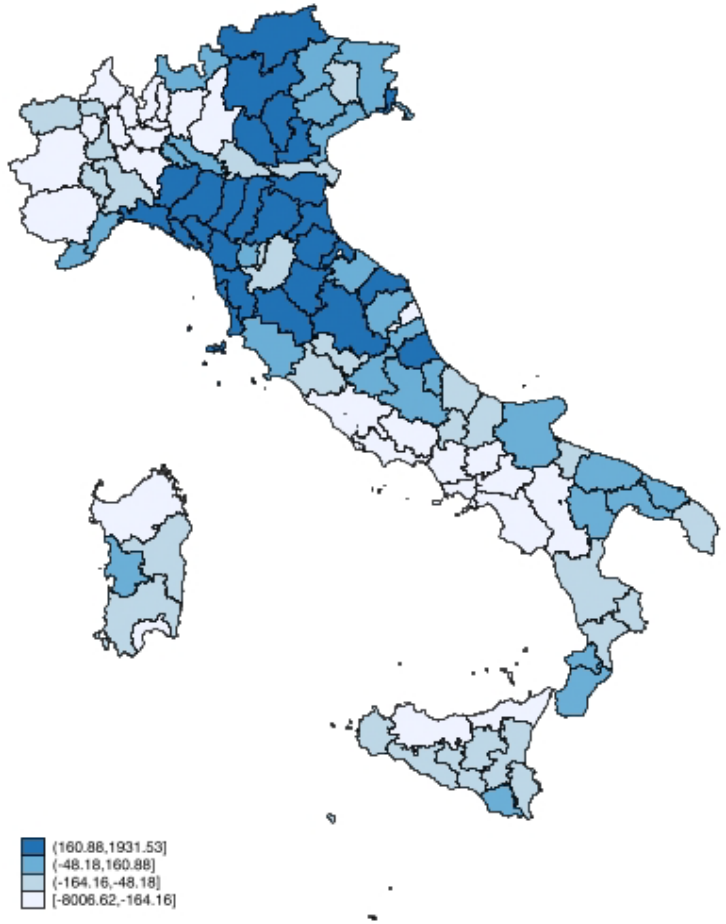
May be used to calculate expected values of FI, SS, and SI

TBs may be plotted on a map, or used as dependent variable of a model to assess the variables that determine heterogeneity

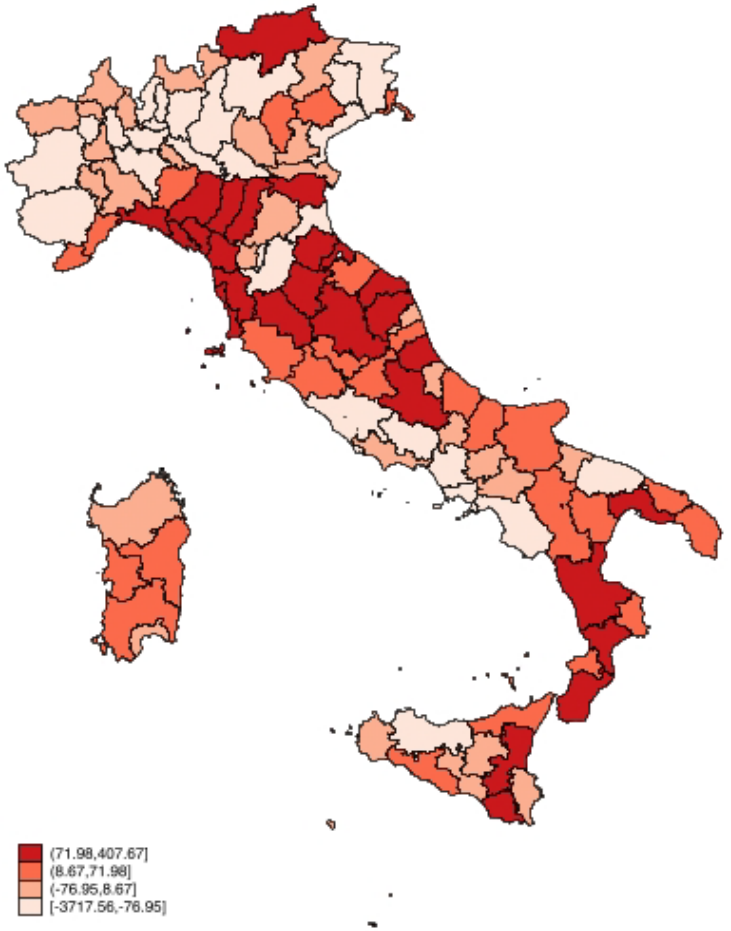
Territorial bias

Maps

ACCIDENTS



SERIOUS ACCIDENTS



More intense shades mean larger TBs, i.e. real accidents are much more than expected

Very high correlation

A preliminary exercise on RMS

Just to show the feasibility of an impact evaluation I'll show some preliminary results focusing on investment for **risk management systems.** These are sets of actions undertaken by a firm to improve its preparedness to manage the emergencies and to reduce risks.

These sets of actions are included as requirements in standards and guidelines.

The ISI calls may fund the costs to implement a system and to get the certification.

We expect that a firm adopting a RMS shows a small reduction in all types of accidents.

We will start our evaluation exercise by RMS for this, because the theory of change is simpler and they imply an easier management of the huge accidents data-base.

- We will include all accidents labelled as "positive" after verification
- We will exclude "on the road" accidents (those incurred while travelling from home to the firm), which usually are not affected by RMS
- We will evaluate firms applying to 2013 ISI call for the line RMS
- We will compare "non selected" with admitted&liquidated" firms

A preliminary exercise on MS

Differerence-in-difference model is applied to estimate the impact of ISI Calls 2012 (Click Day 2013) on the Frequency Index, using panel data (Obs: 127,448 PATs across 10 years from 2010-2019)

$$Y_{it} = \beta_0 + \beta_1 Year_{it} + \beta_2 Treated_{it} + \beta_3 DID_{it} + \beta_4 Z_{it} + u_{it}$$

Y_{it}: frequency index of company *i* at time *t*
$Year_{it}$: dummies equal to 1 when company is observed after the year 2015, 0 if otherwise
$Treated_{it}$: dummies equal to 1 if the company is Admitted Liquidated by ISI Call 2013, = 0 otherwise
DID_{it}: difference-in-difference variable (interaction between $Year_{it}$ and $Treated_{it}$)
Z_{it} : control variables of individual characteristics (gender and year of birth)
u_{it}: i.i.d error term

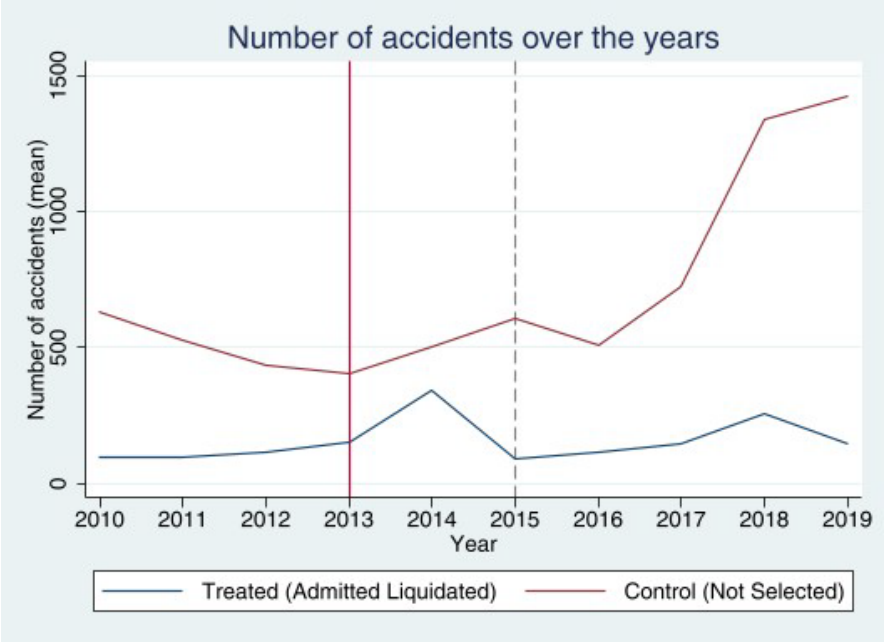
Note 1: company is calculated at PAT level (PAT=Territorial insurance position), which is the unique code of insurance against accidents registered by the company at INAIL. This code is provided to each company location where there is competent INAIL office

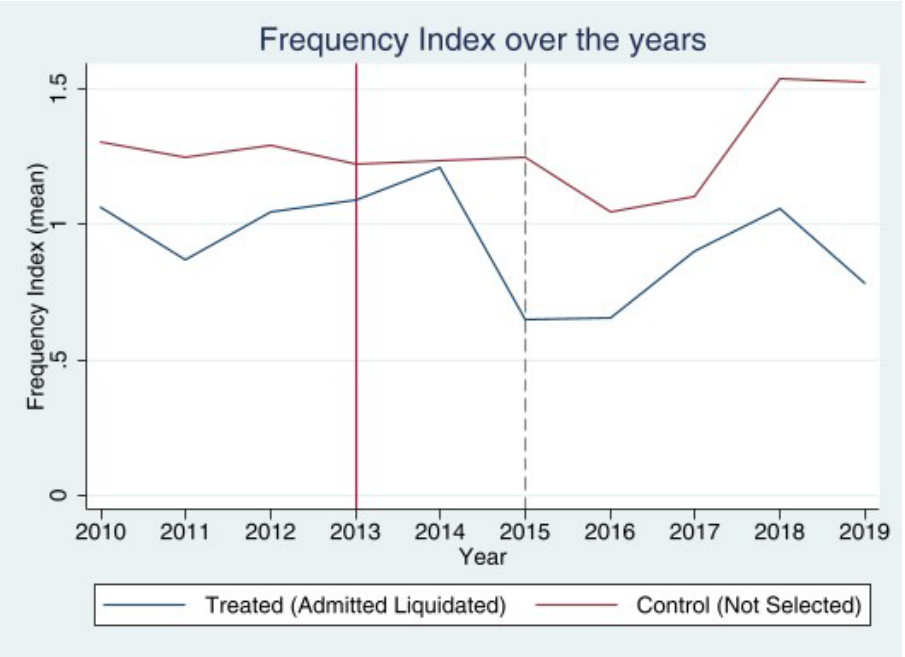
Note 2: The time of ISI Call is 2012, where the selection process (Click-Day) starts and finishes in 2013. Note that it took 2 years, until 2015 for the admitted companies to receive the funds.

A preliminary exercise on MS

We compare the accident level of all companies that are interested in ISI Call 2013.

Treated group: companies that are admitted and liquidated vs **Control group**: companies that are not selected





A preliminary exercise on MS

Statistics about the Treated/Control groups

	Number of PAT		Number of accidents		Number of employees		Frequency Index (mean)	
	Admitted Liquidated	Not Selected	Admitted Liquidated	Not Selected	Admitted Liquidated	Not Selected	Admitted Liquidated	Not Selected
2010	1302	4221	134846	2925504	111288.3	414696.5	1.062	1.306
2011	1249	4186	119918	2401722	115138.3	428992.5	0.869	1.248
2012	1230	4092	147337	1807050	116707.9	409316.3	1.047	1.290
2013	1132	3803	159113	1458765	113618.6	392693.7	1.092	1.221
2014	1068	3546	287355	1663482	108914.1	399086.8	1.210	1.235
2015	958	3513	86629	1877460	91700.44	399746.7	0.648	1.244
2016	910	3394	96817	1715612	88517.56	453510.3	0.654	1.043
2017	905	3230	141367	2116970	94262.08	495805.9	0.902	1.104
2018	906	3418	207326	4482427	95476.66	673085.9	1.060	1.539
2019	805	2991	104352	4379725	78990.95	631932.2	0.780	1.528
Total	10465	36394	1485060	2.48e+07	1014615	4698867	0.510	0.575

DID results on Frequency Index, year 2015

Immediate effect: when the funds are being liquidated (ISI Call in 2012 – selection in 2013)

	Before 2015	After 2015	Total
Control	24637	77798	102435
Treated	7441	17216	24657
Total	32078	95014	

Variables	Model 1	Model 2
Year 2015	-0.903***	0.0233
	(0.0124)	(0.0224)
Treated	-0.210***	-0.211***
	(0.0225)	(0.0315)
DID 2015	0.128***	-0.269***
	(0.0267)	(0.0471)
Gender (1=M, 0=F)		-0.720***
		(0.0320)
Year of birth		0.00185**
		(0.000877)
Constant	1.262***	-1.025
	(0.0108)	(1.728)
Observations	127,092	59,505
R-squared	0.048	0.012

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

Long-term effect: 2 years after the funds being liquidated (ISI Call in 2012 – selection in 2013)

	Before	After	
Control	33371	69064	102435
Treated	9801	14856	24657
Total	43172	83920	

Variables	Model 1	Model 2
Year 2017	-0.972***	0.162***
	(0.0113)	(0.0249)
Treated	-0.276***	-0.276***
	(0.0194)	(0.0273)
DID 2017	0.234***	-0.196***
	(0.0247)	(0.0529)
Gender (1=M, 0=F)		-0.721***
		(0.0320)
Year of birth		0.000955
		(0.000877)
Constant	1.231***	0.713
	(0.00924)	(1.729)
Observations	127,092	59,505
R-squared	0.064	0.012

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.

Main limitations of these results

These results are very rough; probably we underestimated the impact; in fact:

- The sample is too small. We will work on a pooling of different calls to improve this.
- We did not check yet for NS firms participating to later calls and being AL.
- RMS may be designed for a specific productive unit, for a specific job, but also for the entire firm. So, we should also verify the results using data on the whole firm
- There are other technical issues (*PAT accentrata*) some firms manage OHS insurance in a unique PAT, this causes a phenomenon of export/import of accidents that has to be managed. If this occurs in high-risk sectors (it is the case for building), this will be relevant in our estimates

Comments and imitations of these results

NEVERTHELESS

- Results (which are probably underestimated for the reasons above) show a positive impact on the reduction of accidents, once you control for individual characteristics.
- The impact is not a temporary effect, but may still be detected 2 years after the investment.

It is important to prove the role of these "**soft touch**" policies which are completely in line with the philosophy behind the ISI calls to leverage corporate social responsibility. Because on the contrary the tendency is to call for harder and harder penalties (sticks).

Conclusive remarks

My conclusions are more a reflection over an experience than conclusions!

- Huge methodological challenges for the identification of the causal link
- This imposes to:
    - Restrict the perimeter of the evaluation (but this will also reduce sample size!)
    - A great work on administrative data-bases
    - Limit the quantitative evaluation to safety and to RQ1
- Different indicators may give very different pictures of the situation
- This is linked to the different role of the two dimensions of risk (probability and impact)…
- … but happens also because the indicators suffer differently of dimensions conditioning the impact (underreporting and overreporting, irregular work)

⟹ Important to use the best indicator for each evaluation and always check the robustness of results with different indicators.

Thank-you for your attention

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