



POLITECNICO
MILANO 1863



19-30 April 2021

An analysis of Italian damage data to economic activities

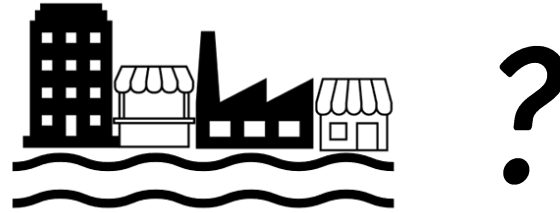
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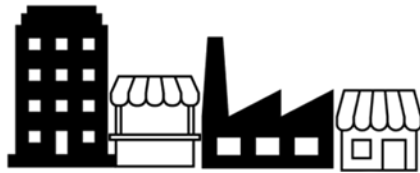
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How to assess flood damage to economic activities in Italy?



Main Challenges



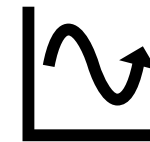
VARIABILITY

Different types and characteristics of activities



DATA

Scarcity and poor quality of information about economic activities and about damage



MODELS

Absence of a method to assess damage to economic activity in Italy

AIM

- 1 To obtain a **portrait of physical damage** to economic activities
- 2 To study the relation between damage and the main **damage explanatory variables**
- 3 To study the relation between observed damage and the exposed value of the activity, in order to evaluate the **relative damage**.



HOW

- Collection of damage data from different Italian case studies
- Analysis of data
- Evaluation of exposed value using public data

Damage data are derived from **citizens' claims**, then processed. Collected by:



Polimi + Unibo



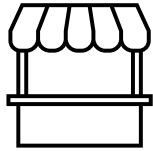
+ CNR



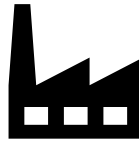
Consiglio Nazionale
delle Ricerche

Case study	Event date	N data	Source	Form and level of processing	Information					
					Total damage divided in components	Water level h	Activity type	N empl.	surface in form	Surface TDB
Lodi (Polimi)	nov-02	89	Municipality	Paper - original	x	x	x	-	-	x
Secchia (Unibo)	jan-14	226	Region	Digital - partly filtered	x	x	x	x	-	x
Enza (Unibo)	dec-17	46	Region	Digital - partly filtered	x	x	x	-	x	x
Sardegna (CNR)	oct-13	637	Region	Digital - partly filtered	x	x	x	-	x	x
Campania (Polimi)	oct-15	1284	DPC	Digital - filtered	x	-	-	-	x	-
Calabria15 (Polimi)	nov-15	65	DPC	Digital - filtered	x	-	-	-	x	-
Calabria16 (Polimi)	nov-16	19	DPC	Digital - filtered	x	-	-	-	x	-
Calabria18 (Polimi)	jun-18	20	DPC	Digital - filtered	x	-	-	-	x	-
Sicilia (Polimi)	mar-15	36	DPC	Digital - filtered	x	-	-	-	x	-
Liguria (Polimi)	oct-18	12	DPC	Digital - filtered	no stock	-	x	-	-	-

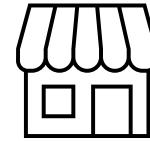
4 Macro-categories of activities



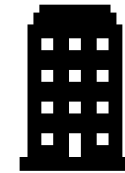
Commercial
(NACE G - Wholesale
and retail trade
activities)



Manufacturing
(NACE C -
Manufacturing
activities)

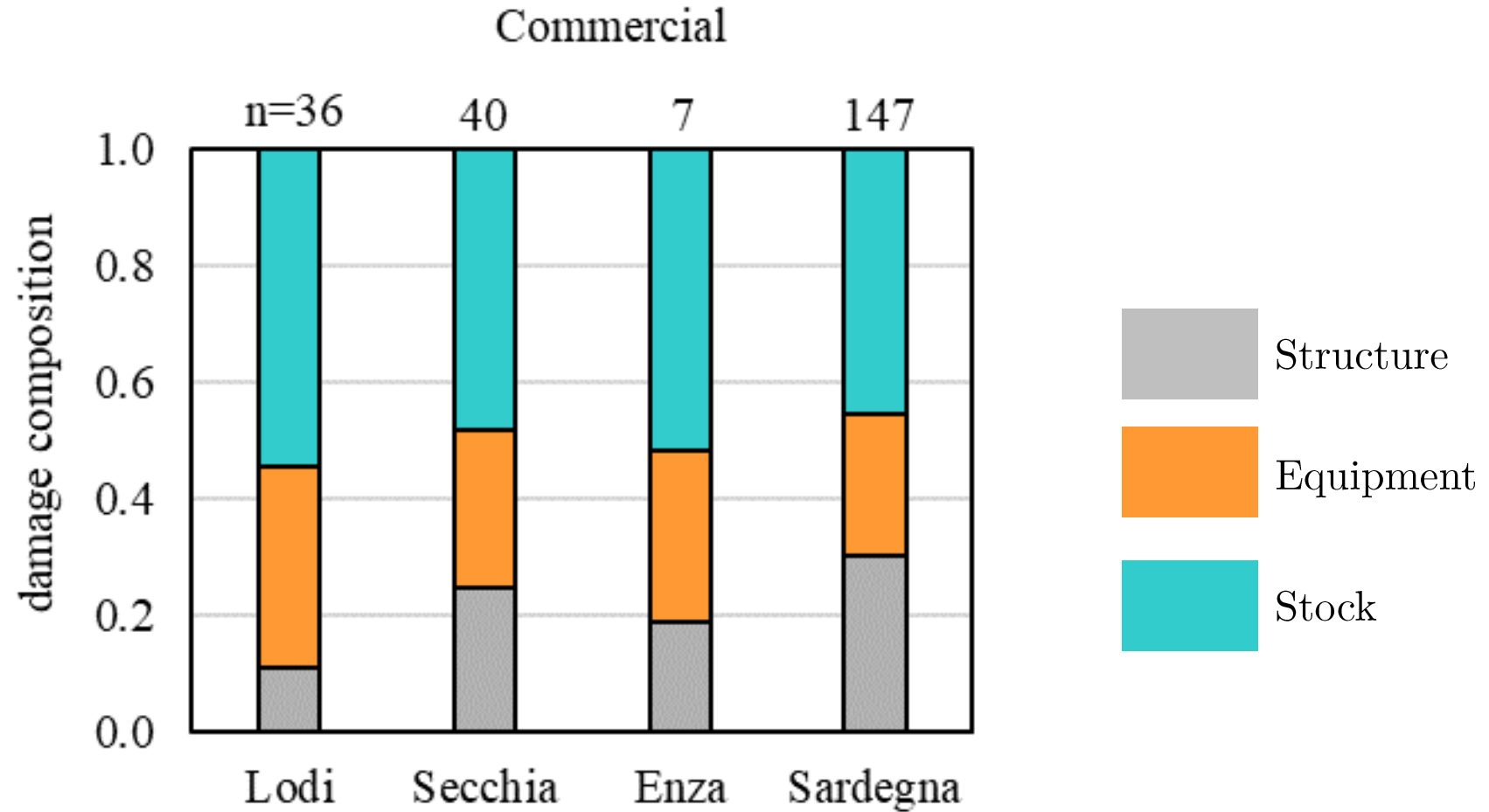


Restaurant
(NACE I -
Accommodation and
food service activities)

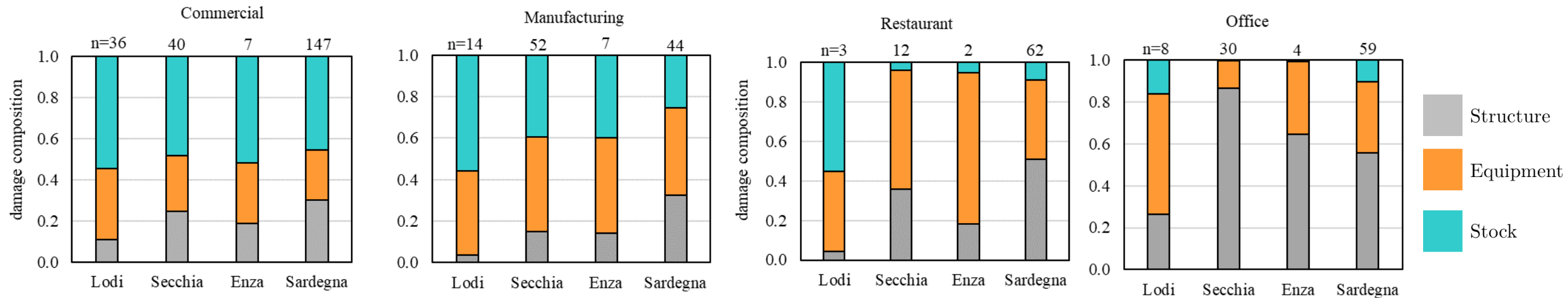


Office
(NACE L+M+N
Real estate, professional
and administrative
activities)

Used data: Lodi, Secchia, Enza and Sardegna



1. Portrait of damage: composition of damage



→ **Commerce:** around 20% structure, 30% equipment and 50% stock

→ **Manufacturing:** around 16% structure, 44% equipment and 40% stock

→ **Restaurant:** around 27% structure, 54% equipment and 18% stock

→ **Office:** around 68% structure, 29% equipment and 3% stock

→ Empirical evidence about the most important components of damage per activity type.

SECCHIA (28 claims)

Damage component	Type of damage	Frequency	%
STRUCTURE	Costs for structural works (building and system works)	1	4
	Finishing (building and system works)	13	46
	Technical expenses (technical, geological, administrative)	13	46
EQUIPMENT	Supply of new goods	17	61
	Costs for disposal	14	50
	Costs for repair	15	54
	Transport costs	3	11
	Test costs	2	7
	Technical costs	15	54
STOCK	Repurchase of raw and ancillary materials	1	4
	Repurchase of semi-finished and finished goods	8	29

LODI (89 claims)

Damage component	Damaged elements	Frequency	%
STRUCTURE	external plaster & coatings	8	9
	internal plaster & coatings	44	49
	floor	16	18
	doors	11	12
	windows	1	1
	gates	3	3
	electrical systems	29	33
	heating systems	8	9
	telephone systems	6	7
	water systems	1	1
	sanitary systems	2	2
EQUIPMENT	other svstems	1	1
	furniture	49	55
	office equipment (computers, printers)	26	29
	materials for carrving out the activitv	28	31
	instruments for service and commercial activities	34	38
	machinery for productive enterprises	6	7
	service facilities of sports facilities	2	2
	loss of contracts	1	1
	other non-compensable damages	12	13
	unidentifiable property	7	8
	vehicles	10	11
STOCK	stock for production (as packaging, spare parts, uniforms)	13	15
	raw materials	5	6
	semi-finished products	7	8
	finished products/products for sale	34	38

Conceptual model

$$D_{\text{component}} = f(\text{activity type}, \text{activity dimension}, \text{water depth})$$

D = absolute damage (€)

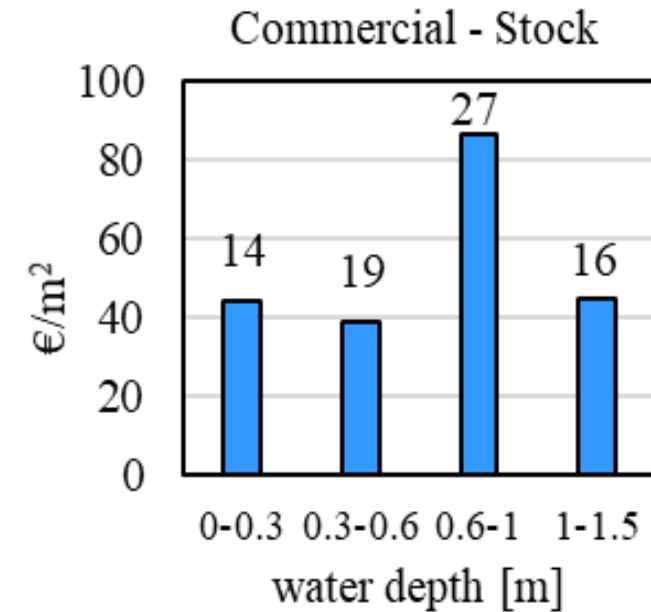
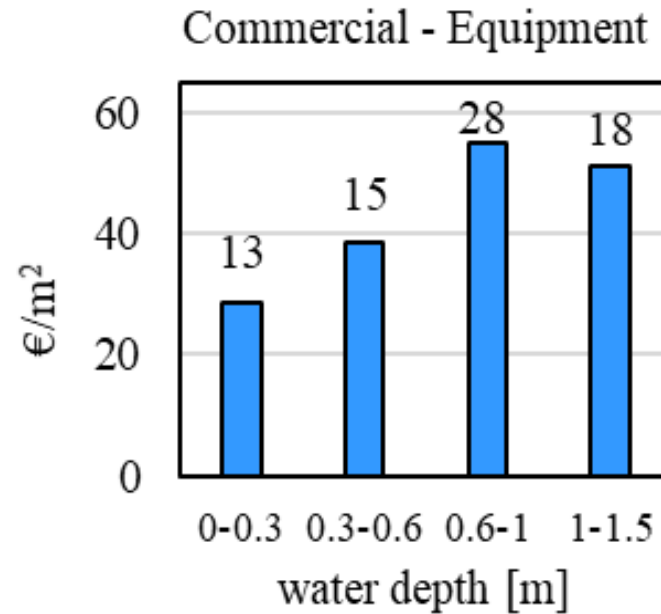
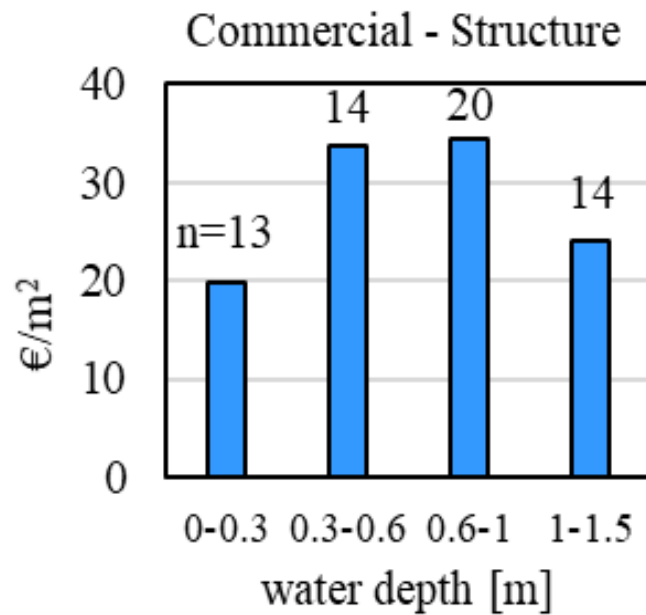
Component → Structure, Equipment, Stock

Activity type → NACE code, group of NACE codes

Activity dimension → Surface, Number of employees

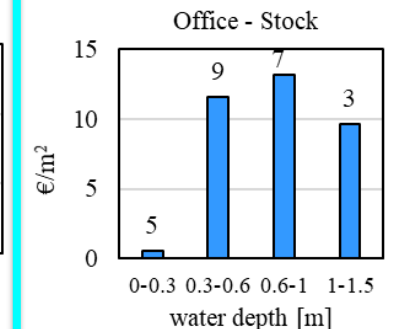
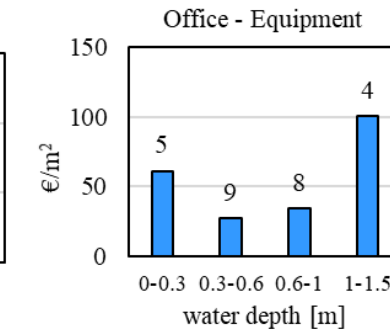
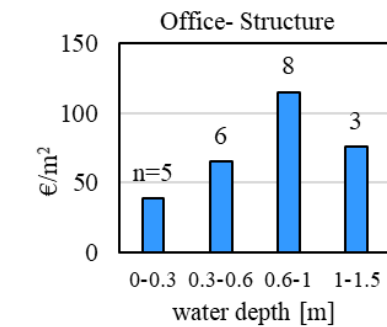
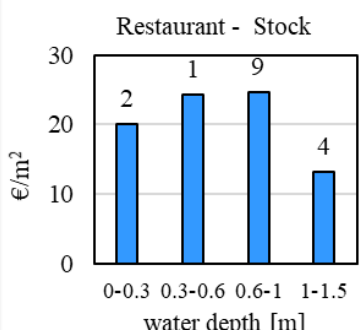
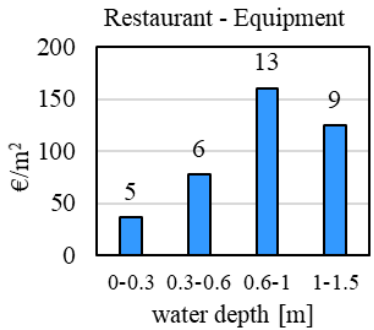
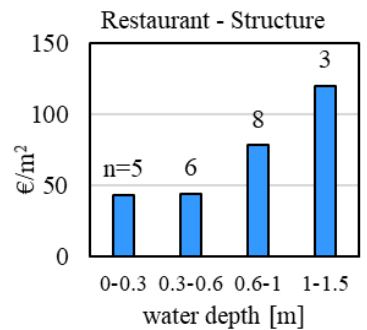
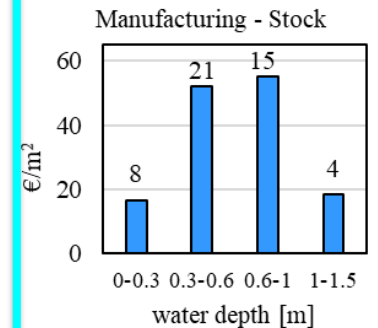
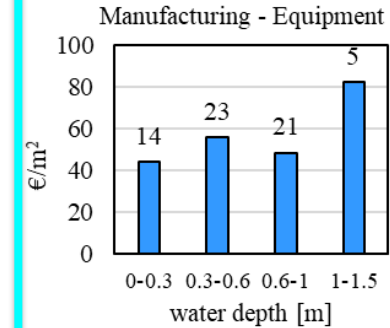
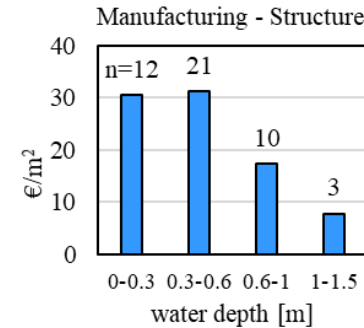
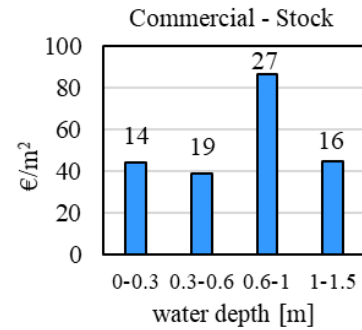
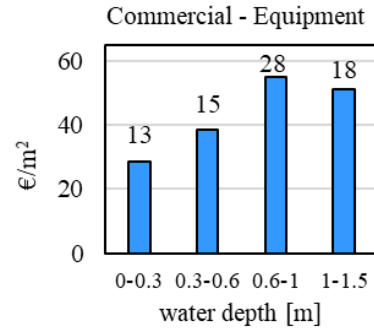
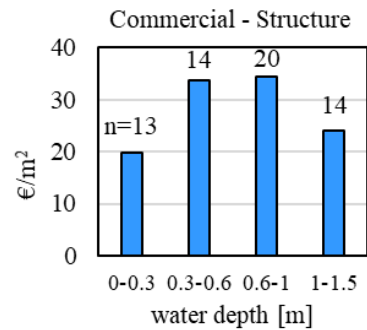
Used data: Lodi, Secchia, Enza and Sardegna

Water depth



2. Damage and its explanatory variables

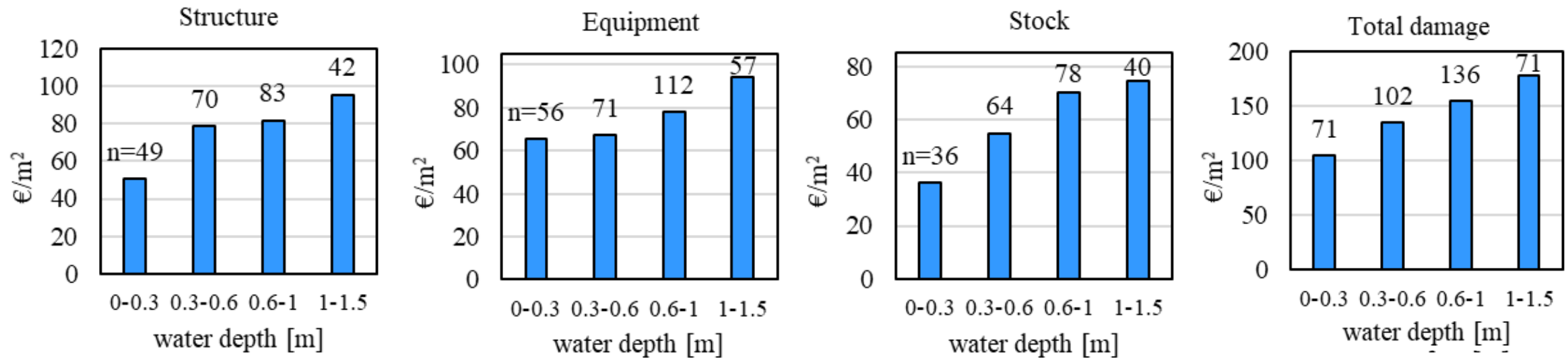
Water depth



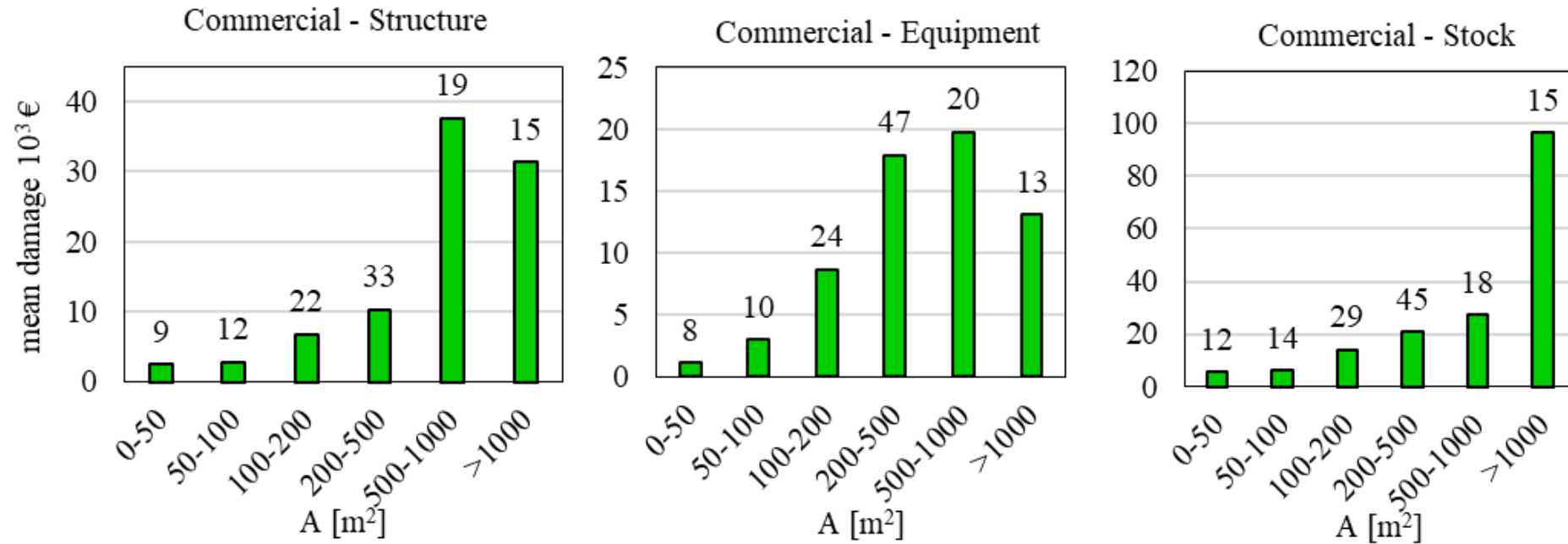
Absence of evidence of increasing trend damage-water depth for category Manufacturing and component stock. Why?

Water depth

No distinction of activity type → more data

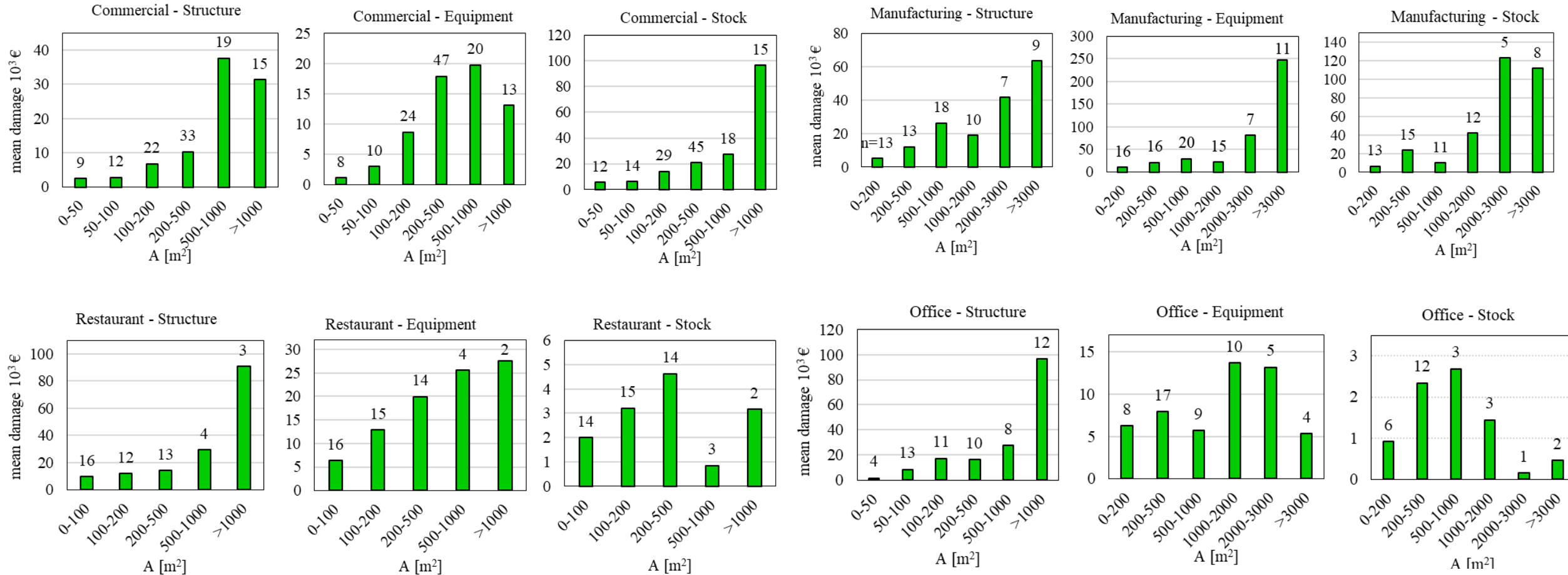


Activity surface



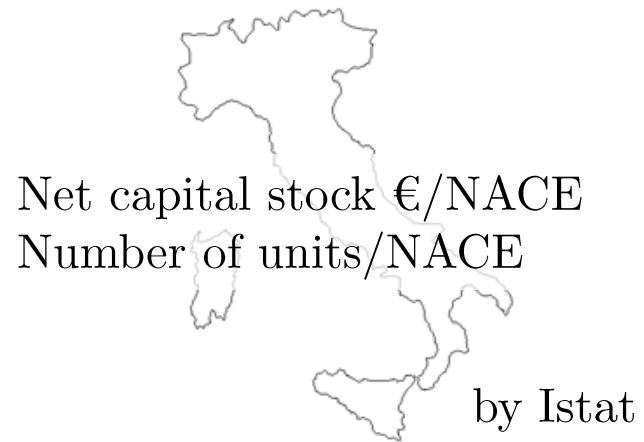
2. Damage and its explanatory variables

Activity surface



→ Increasing trend damage – surface more evident.

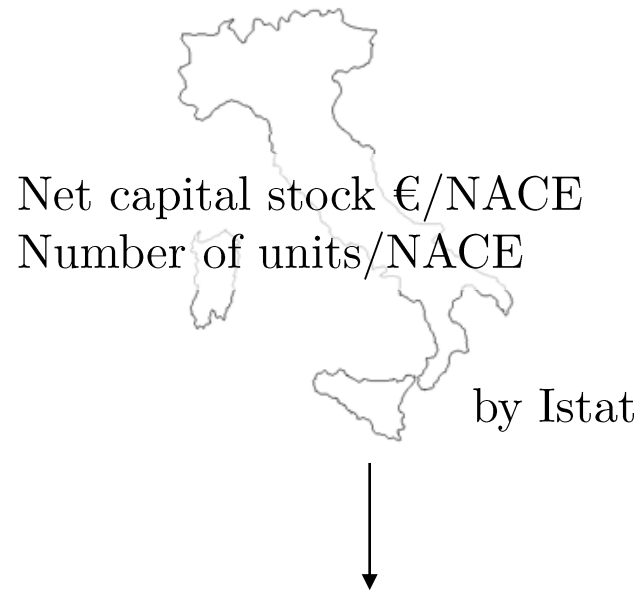
How to compute exposed value?



NET CAPITAL STOCK=the sum of the written-down values of all the fixed assets still in use

- Total constructions
 - dwellings
 - other buildings and structure
- Machinery and equipment and weapons systems
 - transport equipment
 - ict equipment
 - computer hardware
 - telecommunication equipment
 - other machinery and equipment and weapons systems
- Cultivated biological resources
- Intellectual property products

How to compute exposed value?

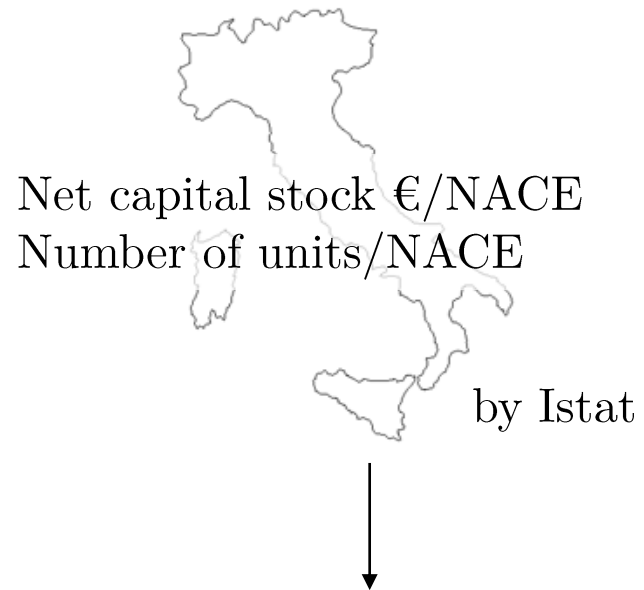


For NACE category	Value of structure €/unit Value of equipment €/unit
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NET CAPITAL STOCK=the sum of the written-down values of all the fixed assets still in use

- Total constructions
 - dwellings
 - { other buildings and structure }
- STRUCTURE**
- EQUIPMENT**
- Machinery and equipment and weapons systems
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 - ict equipment
 - computer hardware
 - telecommunication equipment
 - other machinery and equipment and weapons systems
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 - Intellectual property products

How to compute exposed value?



Activity type	Average exposed value Million €/unit	
	Structure	Equipment
Manufacturing	0.28	0.56
Commercial	0.08	0.05
Restaurant	0.24	0.05
Office	0.35	0.09

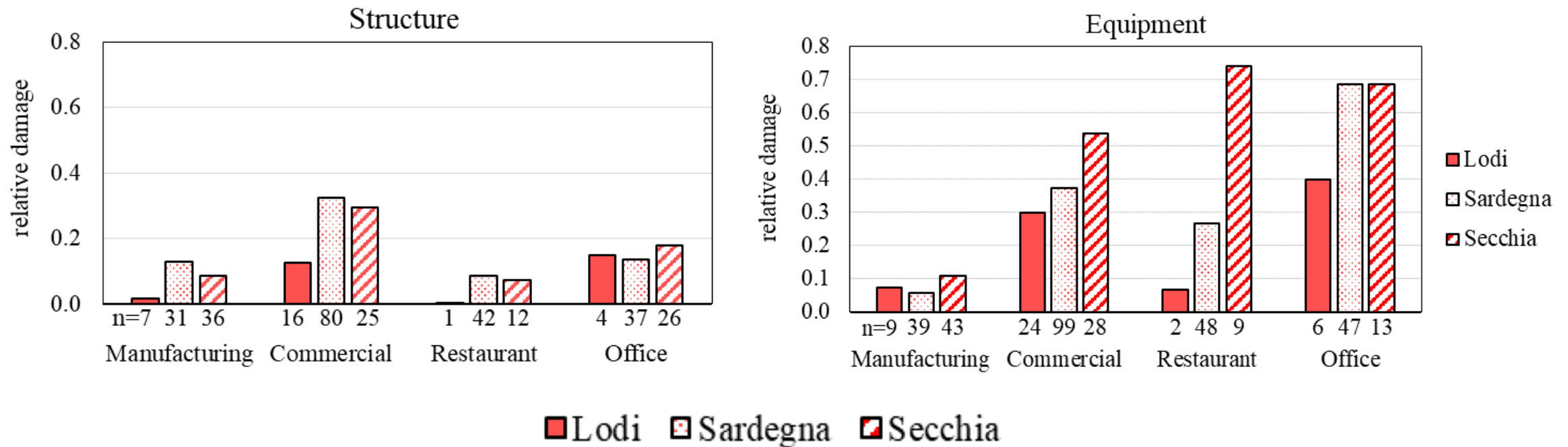
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 - Cultivated biological resources
 - Intellectual property products

3. Damage and exposed value

Used data: Lodi, Sardegna, Secchia

$$\text{d relative damage} = \text{Damage} / \text{Exposed value}$$



→ Representation of magnitude of damage related to the exposed value



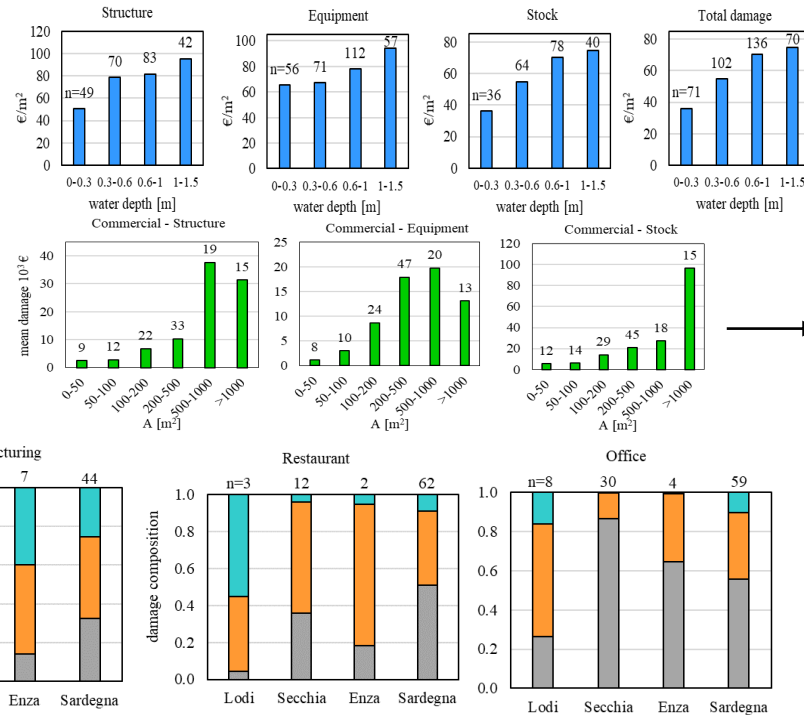
Do we have a
model?

INPUT

OUTPUT

Activity type
Water depth
Surface

Damage component	Type of damage	Frequency	%
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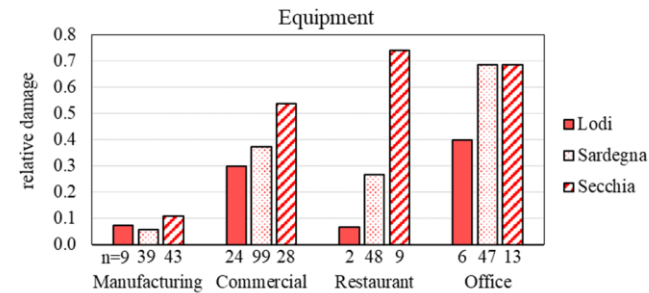
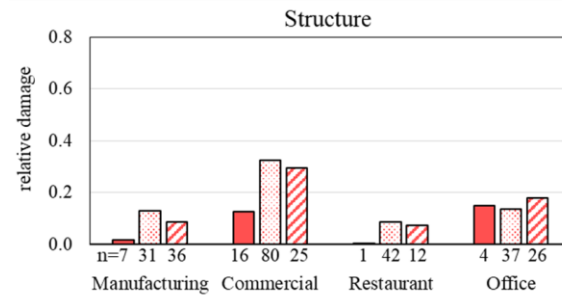


Better knowledge of
damage mechanism
and damage
composition
e.g. Commerce:
20% structure, 30%
equipment and 50% stock.

INPUT

OUTPUT

Activity type

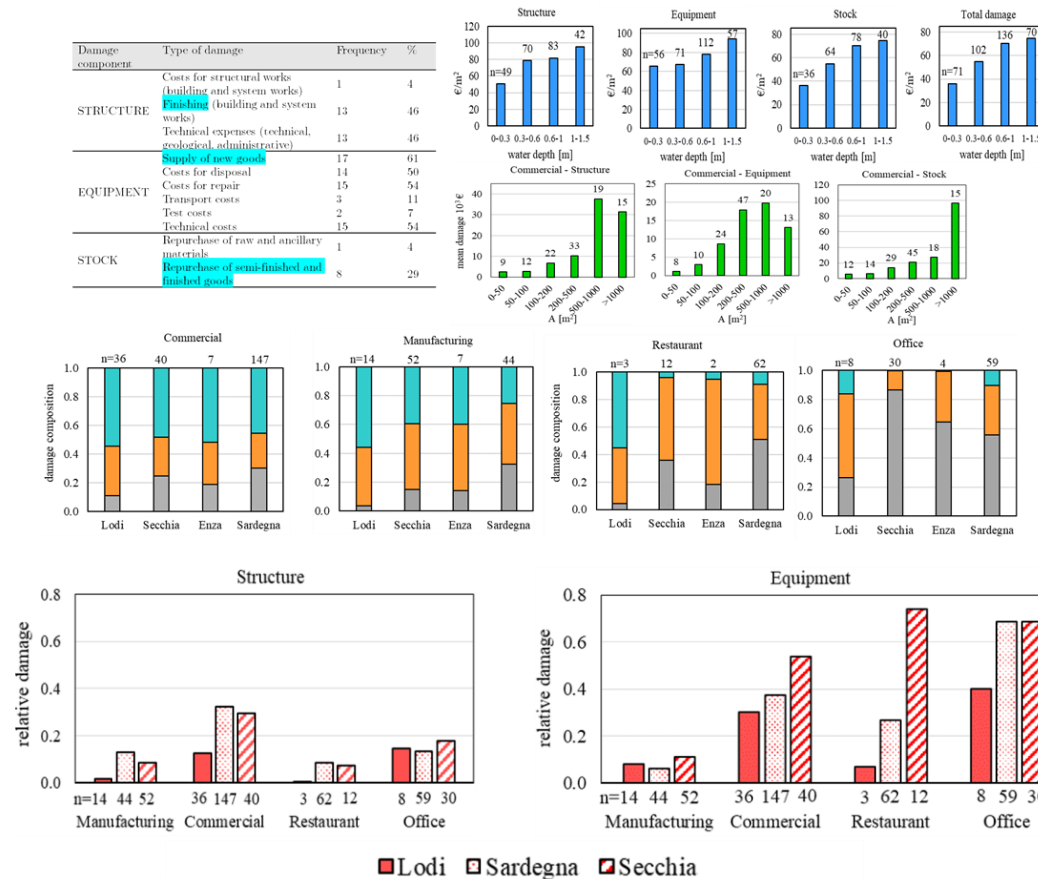


Order of magnitude of
relative damage
(e.g. Commerce: structure
 $d=0.25$, equipment $d=0.40$)

INPUT

OUTPUT

Activity type
Water depth
Activity surface



Better knowledge of
damage mechanism

Idea of the composition
of damage

Magnitude of relative
damage



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Thank you for your attention!