



*Supplement of*

## **Econometric modelling for estimating direct flood damage to firms: a micro-scale approach using post-event records in Italy**

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## Supplement material

### S1. Detailed data collection

The information of the damage is derived from the declarations filled in by citizens after the flood, claiming for national compensation. In this regard, the information collected for the various case studies is different, for two main reasons: (i) case studies refer to different years and regions, with different regulations and standards for data collection, and (ii) collected data were previously pre-processed by the different authorities (from local to regional) in charge of damage compensation (Table 1). In Italy, although the recording of damage suffered in case of any natural disaster by public and private structures is required since 1992 (Law 225/1992) (Pogliani et al. 2021), only in 2013 (with the D.L. 93/2013) the National Civil Protection Authority introduced criteria to standardise and homogenise post-event reports. Thus, for the event of Lodi, which occurred in 2002, the damage survey was conducted in a “non-standardised” way, with ad-hoc forms developed by the Municipal Authority; however, it was possible to access the original papery forms compiled by citizens, containing detailed descriptions of both the affected economic activities and the damage types (Molinari et al. 2019). For the case of Secchia, after the event, activities owners were asked to fill in the standardised forms to quantify the compensation demand (Carisi et al. 2018); the requests for compensation are fully available on the website of the authority ([www.regione.emilia-romagna.it/commissario/alluvione/2016/](http://www.regione.emilia-romagna.it/commissario/alluvione/2016/)).

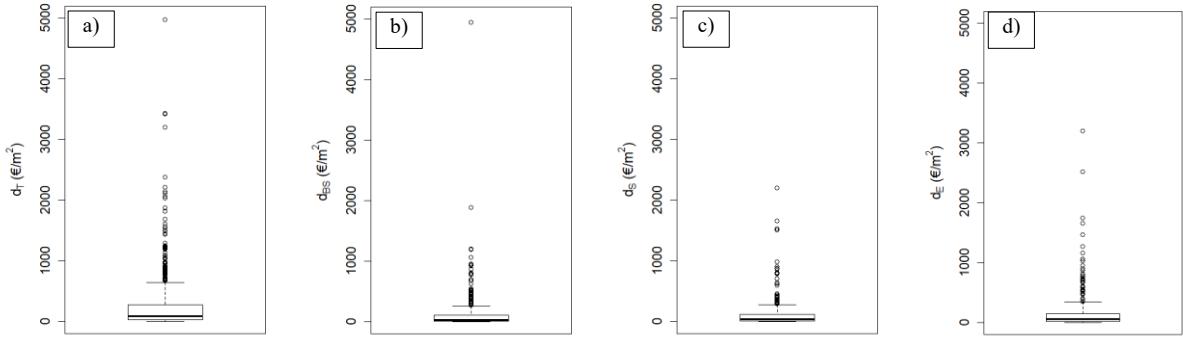
Data regarding the case studies of Enza, Misa and Sardegna were instead obtained in tabular form, the so-called “C tables”, that are standardised tables developed by the National Civil Protection Authority for damage survey to economic activities.

The main information reported in the claims is the cost incurred by the activities owners to fix the damage. Depending on the case studies, this value is indicated for different elements characterizing the activity, which we aggregated into three main damage “components”: structure, equipment, and stock. In the claims is reported the NACE code and the address. The latter was used to geo-localise the activities. In addition, GIS based tools were applied to derive the footprint area of the building in which the activity is located, by processing information on localisation included in the regional topographic geodatabases (i.e. the footprint areas of the buildings).

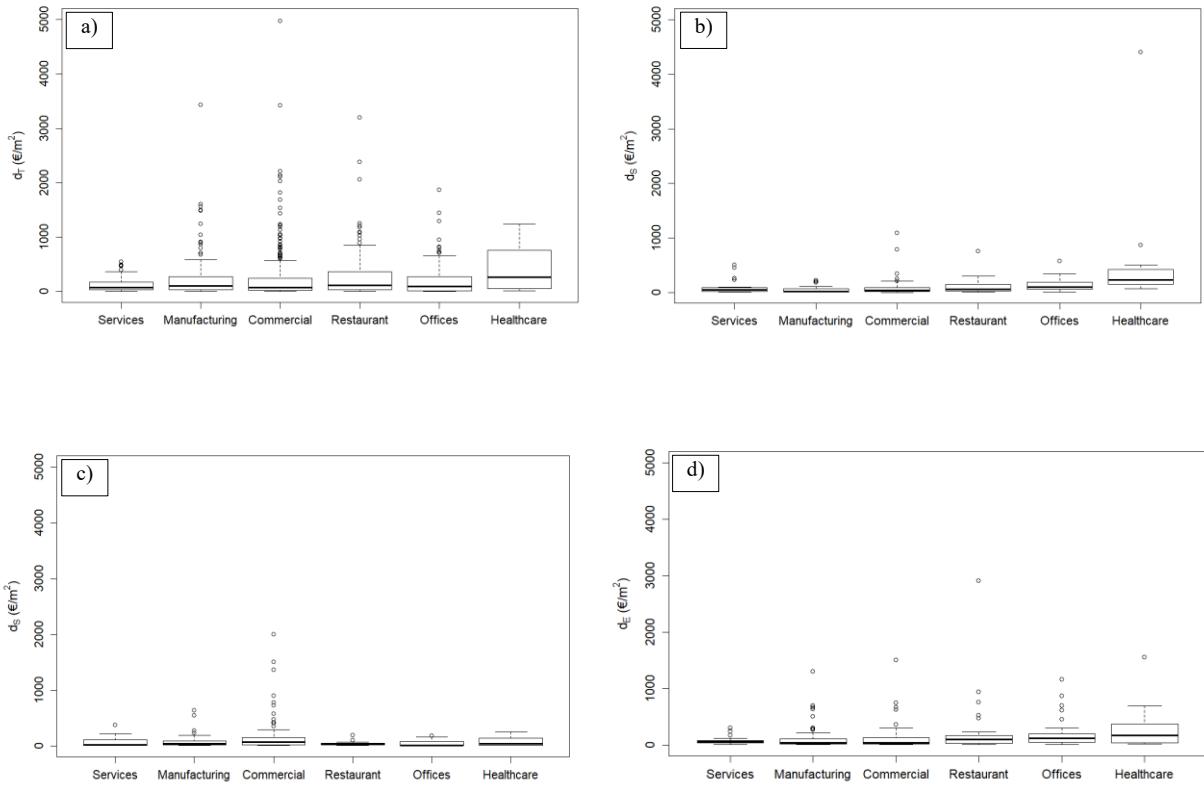
**Table S1.** Information about the case studies and the economic activities affected by floods.

Case study	Event date	Source	Form and level of processing	Localised in topographic DB
Lodi	Nov-02	Municipality	Paper - original	64
Sardegna	Oct-13	Region	Digital - partly filtered	153
Secchia	Jan-14	Region	Digital - partly filtered	87
Enza	Dec-17	Region	Digital - partly filtered	21
Misa	Sep - 22	Region	Digital - partly filtered	487

## S2. Boxplot in a linear scale



**Figure S1 :** Boxplot of the unitary damage by component (up to 5000 €/m<sup>2</sup>); **(a)** distribution of the unitary total damage ( $d_{\text{I}}$ ), **(b)** distribution of the unitary damage to the structure of the building ( $d_{\text{BS}}$ ); **(c)** distribution of the unitary damage to the stock ( $d_{\text{S}}$ ); **(d)** distribution of the unitary damage to the equipment ( $d_{\text{E}}$ ).



**Figure S2:** Boxplot of the unitary damage by component and by economic category (up to 5000 €/m<sup>2</sup>); **(a)** unitary total damage ( $d_{\text{I}}$ ); **(b)** unitary damage to the structure ( $d_{\text{BS}}$ ); **(c)** unitary damage to the stock ( $d_{\text{S}}$ ); **(d)** unitary damage to the equipment ( $d_{\text{E}}$ ).