EUROPEAN CONFERENCE ON QUALITY IN OFFICIAL STATISTICS

2024 ESTORIL - PORTUGAL

INSTITUTO NACIONAL DE ESTATÍSTICA
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Location of physical assets – addressing one of the main data gaps in assessment of climate-related risks

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Motivation and contribution

- The **assessment of climate-related physical risks** has seen significant advancements, driven by improvements in climate modelling and the increased availability of geospatial data, enabling identification of climate-related risk at precise locations.
- Studies rely primarily on the location of a company's registered address, neglecting the broader exposure of key physical assets, therefore leading to **possible mismeasurements** of climate-related physical risk exposures.
- The primary obstacle remains the **lack of suitable data**. Available sources typically have limited coverage, often confined to specific types of entities, and provide minimal or no information at the plant level.
- **National data sources on business statistics** might contribute to addressing this data gap, in particular data collected on enterprise and their local units (LOUs) under the **European business statistics (EBS).** We utilise a **unique French dataset** comprising 250,000 firms with more than one facility, covering approximately 900,000 locations in France.
- We expand the methodology for physical risk assessment presented in the Statistical paper of the ESCB STC EG on climate change and statistics (April 2024) to account for multiple locations on **example of river floods and a drought metric.**
- We provide various methods for **distributing the value of physical assets across different company's locations** and illustrate the potential inaccuracies in measuring climate risks by applying the ESCB's statistical climate indicators methodology.

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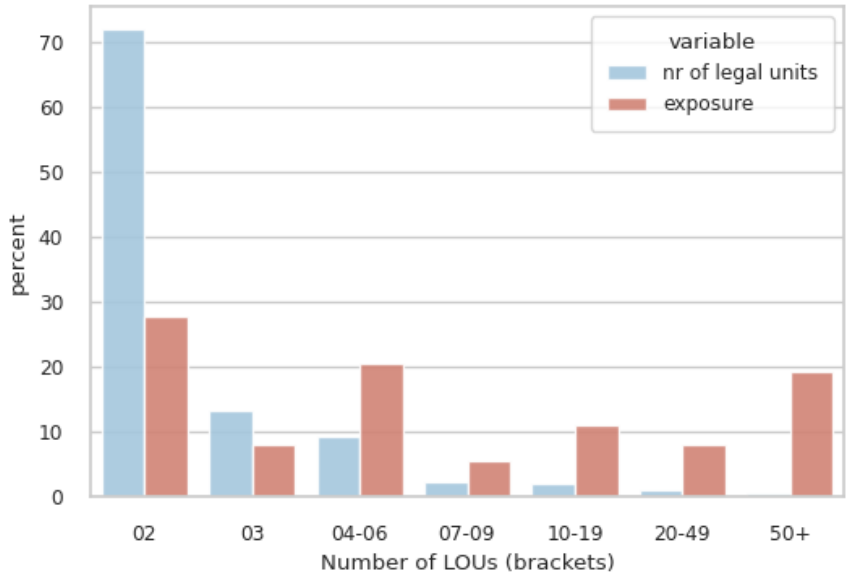
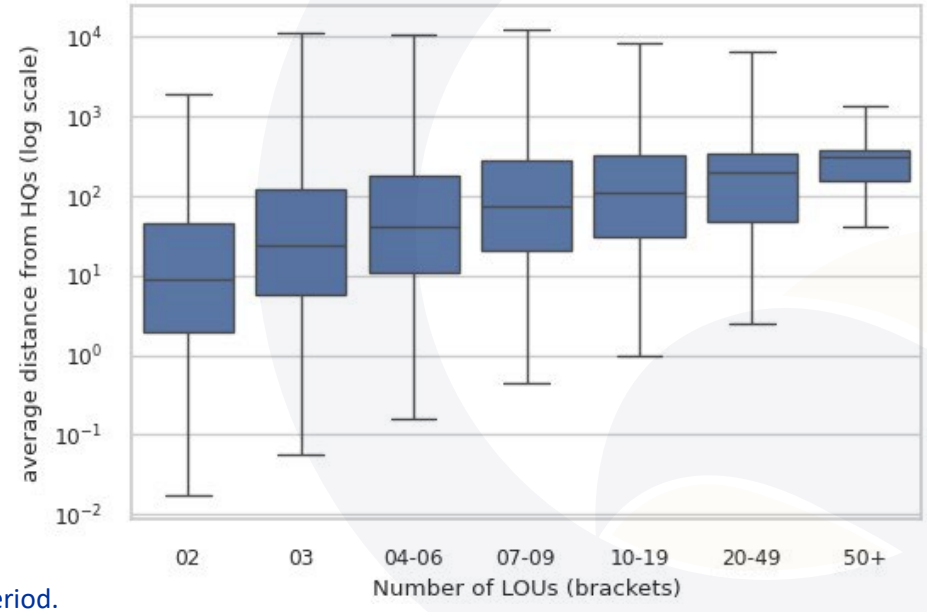
- Although multi-establishment firms represent only around 10% of business population, they account for 37% of the domestic financial exposure in France.

- The local units of these firms are, on average, much further away from their headquarters, often situated in areas potentially exposed to different hazards.

Distribution of multi-establishment firms
number of firms and financial exposures



Distribution of multi-establishment firms
average distance from the headquarters (km)



Sources: Own calculations based on SIRENE, FIBEN, AnaCredit, SHSS, RIAD. December 2022 reference period.
Notes: Sample based on headquarters of French NFCs with multiple locations. Indicators cover Deposit-taking corporations except central banks (S122), Non-Money market funds investment funds (S124), Insurance corporations & Pension funds (S128, S129) and all instruments (debt securities, equities, loans).

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French dataset

The French dataset comprises the following sources:

- The **SIRENE** directory from the French National Institute of Statistics and Economic Studies (INSEE) which offers information on local and legal units, including their location
- The **FIBEN** database from the Banque de France, which provides detailed legal unit-level balance sheet data

It is a **valuable data source** and robust country study:

- The **largest country** in the EU in terms of territory
- **Good coverage** of firm-level data and **rich set of variables**: relevant information not only at the legal unit level (e.g. total assets, revenues and tangible fixed assets) but also for local units (employment and NACE sector)
- **Geocoded information** on the location of businesses is available for both headquarters and local units
- Availability of **company identifiers** allows linking with the ESCB's Register of Institutions and Affiliates Data (RIAD) and with the granular ESCB datasets on loans (AnaCredit) and securities (SHSS)

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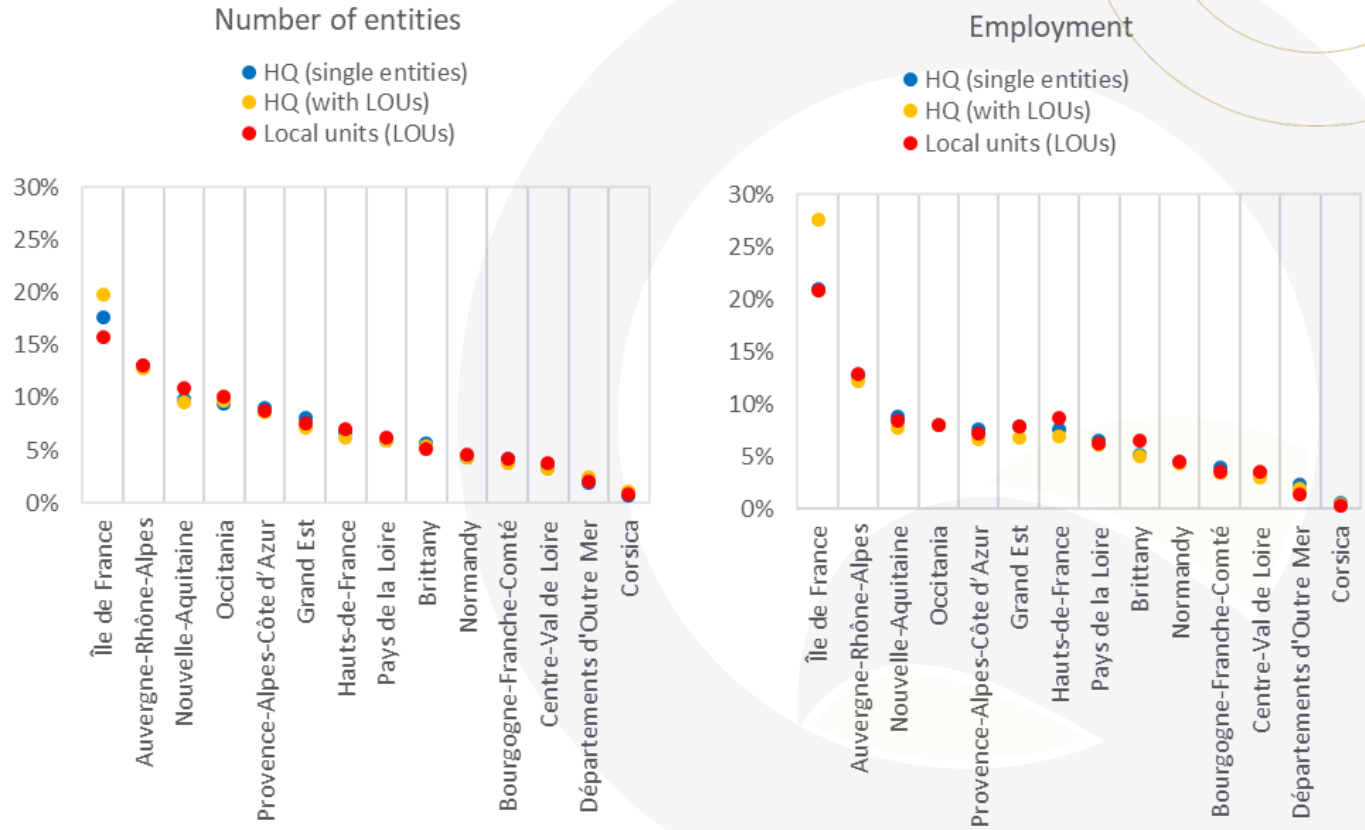
French dataset: geographical distribution

- Both headquarters and local units are concentrated in the Île-de-France region and Auvergne-Rhône-Alpes.
- Examining the regional distribution among **solo-establishment firms, headquarters of multi-establishment firms, and their local units**, we observe a similar share of each region in terms of number and employment across these three types of entities.
- The only exception is **the Paris and its suburbs** (Île-de-France), which unsurprisingly tends to have **a higher number of headquarters compared to local units**. This is particularly true for multi-establishment headquarters, which also tend to be larger in terms of employment.

Distribution of the entities by NUTS1 regions and entity type



Sources: Own calculations based on SIRENE.

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Methodological framework: physical risk assessment

- The ESCB indicators are developed based on harmonised public climate datasets for a wide range of hazards. They are developed by **integrating firm-level data with climate information and the portfolios of their creditors**. In the first step, the impact of natural hazards on firms' financial health is evaluated, specifically their ability to service debt. This information is then connected to the portfolios of euro area financial institutions, providing insights into the exposure to climate risk within the financial system.

- **The ESCB methodology** assesses risk at a company's registered address, **assuming all physical assets are located at the headquarters**. It does NOT necessarily lead to underestimation of physical risk exposures. If a headquarters is in a flood-prone area while its local units are not, the assumption that all assets are at the HQs can lead to overestimation of risk.

- Two types of indicators that capture risk in different terms are presented:
  i) **risk scores** that categorise exposure from low to high risk
  ii) **expected loss indicators** which measure potential impact of a natural hazard in monetary terms.

- We select two hazards with distinct characteristics and geographical scopes. We use the historical baseline for both, noting that while the intensification of these hazards is expected under climate scenarios, the geographical scope remains similar to current at-risk areas.
  i) **river flooding**, analysed at a high granularity of 100m
  ii) **Consecutive Dry Days (CDD)**, which capture drought conditions at approximately 12 km resolution.

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Methodological framework: distribution of physical assets across LOUs

- Due to the absence of local unit-level data at the euro area level, **the ESCB physical risk indicators assume that all activities and tangible assets are situated at the headquarters**. It constitutes our benchmark where all HQs are assigned weight 1 and the LOUs are disregarded.

- In our datasets, information on tangible fixed assets is not available at local unit level. Thus, we construct different **proxies to distribute the assets across local units** based on employment and sectoral data. Additionally, we include a simple weighting method that allocates assets equally across all local units within a firm.

- The results are computed using the following types of weights applied to **distribute the physical assets across company locations**:
  i) **weight HQs** – disregarding LOUs
  ii) **weight equal** – capturing the effect of the geographical distribution of risk, assuming the same value of assets at each LOU
  iii) **weight sector-region wages** – based on Eurostat NUTS2 region and NACE2 sector averages
  iv) **weight LOU employment** – based on a mid-point of employee brackets, available at local unit level.

- To **disentangle the effect of accounting for location,** we split into three type of entities :
  i) single establishments
  ii) HQ of multi-establishments
  iii) local units of multi-establishment HQs.

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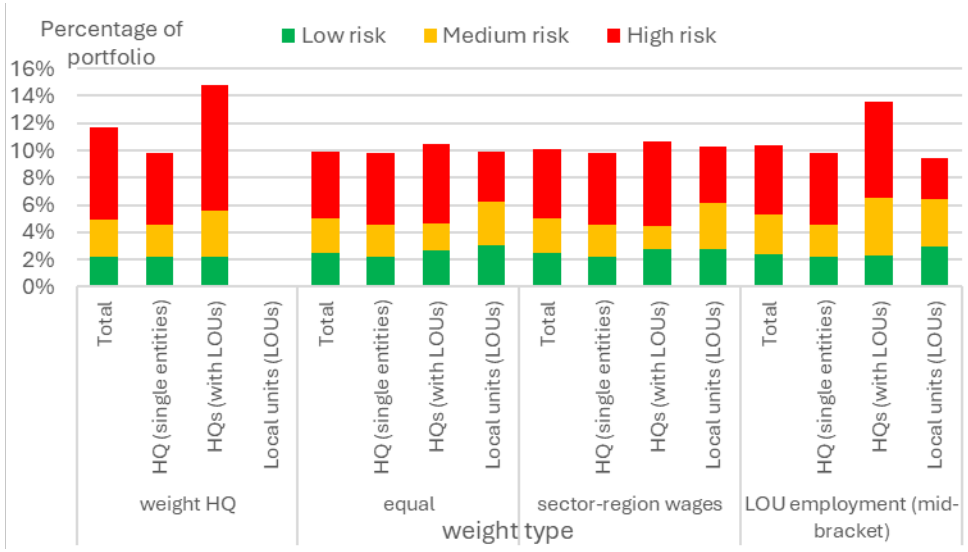
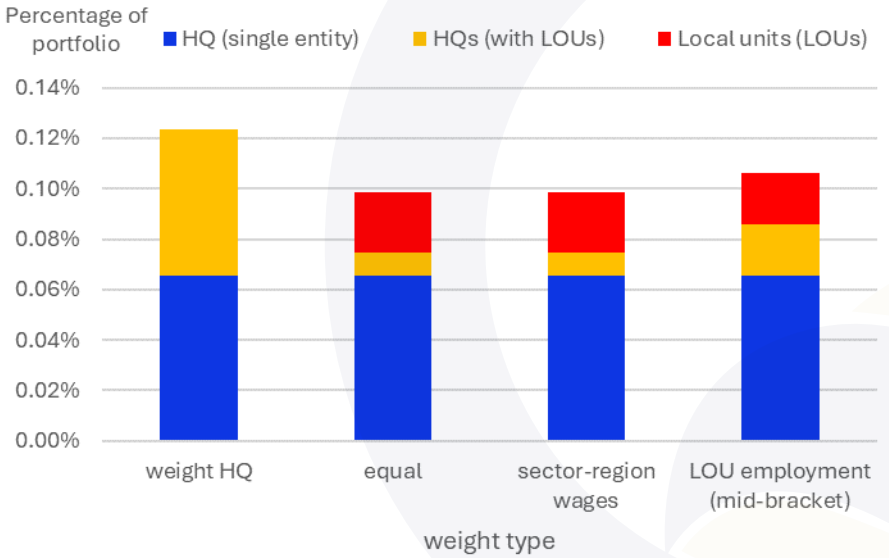
Results: river flooding

- **HQs appear to be located slightly more frequently in flood-prone areas** than their local units.
- Applying weights constructed from aggregated regional data yields very similar results, indicating **little variation between regions**.
- Using employment weights at the LOU level shows an even more pronounced risk at the HQs, suggesting **higher employment levels at HQs**.

Risk scores for river flooding



Expected loss indicator: Normalised exposure at risk (NEAR) for river flooding



Sources: Own calculations based on SIRENE, FIBEN, AnaCredit, SHSS, RIAD and Delft University of Technology (TUD). December 2022 reference period. Hazard data refer to historical baseline (1971-2000).
Notes: Indicators cover Deposit-taking corporations except central banks (S122), Non-Money market funds investment funds (S124), Insurance corporations & Pension funds (S128, S129) and all instruments (debt securities, equities, loans). Sample restricted to French firms with loans, debt securities, and equity held by French financial institutions. Only domestic local units, excluding French overseas territories not covered by the European hazard maps.

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Conclusions:

- While France has the largest territory in the EU, the exposure to physical hazards is relatively homogeneous across its European territory. Additionally, the distribution of local units across regions is similar to that of headquarters. Therefore, **at an aggregated country level, assigning physical risk identified at the headquarters to the entire firm leads to similar results as accounting for each location.**

- At the same time, **there can be significant dispersion across firms**, and individual locations cannot be disregarded when assessing risk at the individual firm level.

- The aggregated country results suggest the reliability of the statistical methodology of the ESCB climate indicators, which is based on a **large sample of firms**. However, the robustness of these findings **should be validated across a broader set of countries**.

Future work:

- Inclusion of **overseas territories**: potential underestimation of physical risk in France due the exclusion of overseas territories, which have distinct natural disaster profiles (approximately 4,000 local units / 0.6% of the sample of firms are located over 1,500 km from their headquarters).

- Use of **alternative weighting schemes for allocating physical assets** across local units, e.g. better proxies for tangible fixed assets, estimating asset exposures based on nightlight intensity and population data.

- The findings should be validated across a **broader set of countries**: country-specific factors might influence the geographic distribution of headquarters and their local units. However, the lack of standardisation of data across countries presents a significant challenge, necessitating **considerable effort to ensure a fully harmonised analysis at the EU level.**

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