Economics for Prevention and Preparedness – Investing in Disaster Risk Management

INVESTING IN DISASTER RISK REDUCTION IN SOUTH EASTERN EUROPE - WORKSHOP

25 October 2022, Dubrovnik
Investing in Disaster Risk Management

Collaboration between European Commission (led by DG ECHO with several participating DGs) and the World Bank with expertise from Global Earthquake Model Foundation and JBA Risk Management and several experts from research institutes and universities across Europe and the USA: https://ec.europa.eu/echo/field-blogs/videos/economics-disaster-prevention-and-preparedness_en
Evidence to inform investments in DRM

1. How can you understand the scale of disaster risk across the EU?
2. Understanding the benefits of different DRM investments
3. How are countries prepared to finance post-disaster expenses?
1. Understanding disaster risk across EU MS - modelled economic losses for earthquake and floods

**Seismic risk outputs**: annual average economic loss (NUTS3)

**Flood risk outputs**: average annual economic loss (admin level 1)
1. Understanding disaster risk across EU MS

Example – Flood risk modelling

Top 10 countries

- Residential
- Commercial
- Industrial
- Healthcare
- Education

<table>
<thead>
<tr>
<th>Country</th>
<th>2020</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>France</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Italy</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Austria</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Spain</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Sweden</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Poland</td>
<td>1</td>
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<tr>
<td>Czech R.</td>
<td>0.5</td>
<td>0.5</td>
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<td>Romania</td>
<td>0.5</td>
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<tr>
<td>Neth.</td>
<td>0.5</td>
<td>0.5</td>
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1. Understanding disaster risk across EU MS - Countries with highest estimated AAL in EUR million

- **Germany**: 240 (Earthquake), 7,853 (Floods)
- **Netherlands**: 798
- **Belgium**: 119
- **France**: 302 (Earthquake), 5,362 (Floods)
- **Spain**: 217 (Earthquake), 1,327 (Floods)
- **Italy**: 6,039 (Earthquake), 1,972
- **Austria**: 229 (Earthquake), 1,527
- **Czech Republic**: 799
- **Sweden**: 1,047
- **Poland**: 949
- **Romania**: 512 (Earthquake), 616 (Floods)
- **Bulgaria**: 227
- **Greece**: 1,085
- **Cyprus**: 225

The map indicates the countries with the highest estimated AAL in EUR million for both Earthquake and Floods, with specific numbers highlighted in the text.
2. Investing in DRM
Building the economic case for investing in DRM

<table>
<thead>
<tr>
<th>Natural Hazard Mitigation Saves: 2018 Interim Report</th>
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<tbody>
<tr>
<td>![Image of damaged building]</td>
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</table>

### National Benefit-Cost Ratio Per Peril

<table>
<thead>
<tr>
<th></th>
<th>Exceed common code requirements</th>
<th>Meet common code requirements</th>
<th>Utilities and transportation funded</th>
<th>Federally funded</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Hazard Benefit-Cost Ratio</strong></td>
<td>4:1</td>
<td>11:1</td>
<td>4:1</td>
<td>6:1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Peril</th>
<th>Overall Benefit-Cost Ratio</th>
</tr>
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<tbody>
<tr>
<td>Riverine Flood</td>
<td>5:1</td>
</tr>
<tr>
<td>Hurricane Surge</td>
<td>7:1</td>
</tr>
<tr>
<td>Wind</td>
<td>5:1</td>
</tr>
<tr>
<td>Earthquake</td>
<td>4:1</td>
</tr>
<tr>
<td>Wildland-Urban Interface Fire</td>
<td>4:1</td>
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</table>
2. Investing in DRM
Understanding the benefits of different DRM investments

74 case studies cover a variety of sectors, types of DRR investments, and countries (different development/income levels and locations)
2. Investing in DRM
Understanding the benefits of different DRM investments

The Triple Dividend of Resilience methodology

1st Dividend
Avoided losses
(saved lives, reduced damages to buildings & losses from economic flows...)

2nd Dividend
Unlocking economic potential
(business and capital investment, land value, agricultural productivity...)

3rd Dividend
Generating development co-benefits
(ecosystem services, energy efficiency...)

ODI/World Bank/GFDRR
2. Investing in DRM
Key findings across different hazards and investments

Investing in prevention and preparedness makes economic sense

Benefit-cost ratios were calculated for various hazards and investments, including:

- Floods
- Earthquakes
- Heatwaves
- Wildfires

Benefit-cost ratios almost always exceeded 1, they typically ranged from 2 to 10, with several investments with BCRs over 20

- consistent with findings in the literature for low- and middle-income countries and for the United States

See page 19 of *Investment in Disaster Risk Management in Europe Makes Economic Sense*
2. Investing in DRM
Countries can reap multiple benefits!

Integrated or “smart” investments bring substantial benefits!

- Link to climate change, e.g., seismic retrofitting with energy efficiency
- Link to green measures and nature-based solutions
- Link to no-regret investments like early warning

Even when there is no disaster, the 2nd and 3rd dividends yield benefits, and these can be substantial

- Avoid losses
- Unlock economic potentials
- Generate co-benefits
2. Investing in DRM
Examples of DRM CBA results

Benefits of **capacity building of civil protection** show benefits up to 2 times higher than the costs in **Albania** and **Croatia** respectively.

**Flood early warning in Belgium** yielded BCR ranged from 0.5 to 5.2 for various scenarios modelled, a net benefit of around **EUR 350** and **90 million**, serving more than **1 million people**.

**BCRs higher than 1 for green solutions** (depending on intervention)
**Green roofs** in Vienna with various co-benefits, such as **energy efficiency improvements**, **ecosystem protection**, and **stormwater runoff reduction**.

**Decision Support Tools (BCR: 5.8)** - Decision support tools in Austria reduce forest fires due to **climate change** and promote **sustainable forest management** and ecosystem services from forestry.

**Wildland-urban interface management (BCR: 2.1 - 3.1)**, Upgrading the **wildland-urban interface** in Portugal brings numerous **social and economic co-benefits** for ecosystem, communities, and industries.

**Fuel break in forests (BCR: 11.9)**. Fuel breaks implemented in the forests of Portugal reduce losses significantly while **increasing land purchase and sales in wood industry**.
2. Enabling civil protection agencies contribute to scaling up investments in DRM

**They face challenges...**

- **Finance and resources**: Limited financial resources; no centralized information about accessing EU funds for disaster risk management

- **Institutional framework**: Lack of stakeholder coordination on investments

- **Technical capacity and knowledge frameworks**: Technical and human capacity challenges hindering informed decisions

**but there are also opportunities**

- **Raise political and public awareness** about benefits of DRR to increase funding allocations
- **Provide CP agencies with access to various sources of financing for ex-ante investments**

- **Strengthen cross-sectoral coordination** on investments in prevention and preparedness
- **Expand** cross-border/volunteers’ coordination on prevention and preparedness

- **Support agencies with pool of experts**, robust evidence, risk data and tools
- **Support knowledge exchange** and sharing of best practices on prevention and preparedness
3. Understanding the Financial and Economic Footprint

- Large disasters have a significant impact on the **economy, government expenditures and revenues**, as governments typically bare a large portion of financial liabilities.

*Economic damage caused by weather and climate-related extreme events in Europe*

*Source: NatCatSERVICE*

- However, it is difficult to isolate and track the impacts of disasters on economic and fiscal variables due to numerous factors that affect the economy beyond disasters.

- One way to better understand the impacts of disasters is through **macro-economic and fiscal modeling**.
3. Macro-economic and fiscal model

Economic Impact

Catastrophe Modeling
Simulate 1,000 realizations of floods & earthquakes events in the next 30 years
Considers uncertainty in disaster occurrence and losses

Funding Gap
Risk financing instruments

GDP data input

Economic and fiscal model

Risk financing instruments
3. Macro-economic and fiscal model
Risk financing arrangements

**Types of instruments reviewed:**

- National reserve funds (including dedicated and general contingency funds), contingency lines of credit, households and public asset insurance
- EU-level EUSF and EUCPM

**Treatment of DRF instruments:**

- Assumptions for the EUSF, size of contingency funds and reserve funds
- Emergency response cost (for floods and earthquakes)
- Share of insured public assets
- Losses covered by governments: **low and high-liability scenarios**

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**Risk financing instruments**

<table>
<thead>
<tr>
<th>Frequency of event</th>
<th>Severity of impact</th>
<th>Disaster risks</th>
<th>Risk financing instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Major</td>
<td>High risk layer</td>
<td>Catastrophe insurance</td>
</tr>
<tr>
<td>Low</td>
<td>Major</td>
<td>Medium risk layer</td>
<td>Contingent credit</td>
</tr>
<tr>
<td>High</td>
<td>Minor</td>
<td>Low risk layer</td>
<td>Contingency budget, national reserves, annual budget allocation</td>
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**Data sources:** EUROSTAT, government (e.g. ministries of finance), academic research and publicly available analytics, insurance market research (AXCO and XPRIMM)
3. Macro-economic and fiscal model
Funding Gap Analysis - EU MS wide and Case Studies

- **Explore the proportion of the future losses** from earthquakes and floods that existing financial instruments held by EU MS can cover, and what proportion remains to be financed through budget reallocations, borrowing, additional taxation or external assistance (that is, the funding gap).

- **Develop scenarios** of Governments’ low and high-liability and model different financial response strategies

- **Country case studies** (Austria, Croatia, France, Romania) as well as **aggregated results** at EU level
3. Macro-economic and fiscal model
Key findings and recommendations

• **Impact of major disasters** (100-year return period) can exceed 7% of GDP (low government liability scenario) and 17% of GDP (high government liability scenario)

• **Each year:** there is a 10% chance that EU has an earthquake and flood that will exhaust existing finance; and 96% of liabilities covered through ad hoc financing *(e.g., budget cuts)*

• **At the EU level,** the financing gap can exceed EUR 10 billion in any given year and be as high as EUR 50 billion for very severe events

• **Emergency response** costs can be substantial

• **Residential assets form 50% of overall losses,** but only 30% of EU MS have over half the population covered by catastrophe insurance. **Increases to 59-79% when public assets included**

• **DRF arrangements, policies, and strategies across EU MS are limited,** no EU-level DRFI strategy. → **Pre-arranged risk financing can help** manage government liabilities and reduce the time it takes to recover (esp. emergency costs)

• Liability generated from **public and housing assets** accounts for 59% of total liabilities in low-liability scenario and 78% in high-liability scenario → **need to improve availability of financial protection for public assets while also incentivize residential assets insurance**
3. Capacity for post-disaster recovery and reconstruction

Assessment of damages, losses, and needs

Overarching recovery and reconstruction strategy

Action plans, sector/area-specific planning, specific programs

222 Thousand
Houses to reconstruct or to repair
3. Challenge – How to Establish a Coherent Framework?

Smarter & sustainable – right sizing, right-placing, modernization

Key Activities and Priority Projects

- Reconstruction Needs and Challenges for Revitalization
  - People and Economy
  - Infrastructure and Services
  - Environment
  - Institutions and Governance

- Green
- Resilient
- Inclusive

Funding Sources and Strategic Reforms/Plans

- Local/regional level
- National/sectoral level
- EU level (with diff. instruments)
- International cooperation

Overarching vision with expected outcomes
# 3. International and National Good Practice

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<thead>
<tr>
<th><strong>2011 Great East Japan Earthquake &amp; Tsunami (M. 9.1)</strong></th>
<th><strong>The City of Križevci</strong> - the first city in Croatia with two solar power plants fully financed by local citizens as small investors – they launched first crowd-investing initiative in Croatia to finance community energy projects. Thanks to this, solar PV systems have been installed on top of Križevci’s Development Center and Technology Park’s administrative building, and a public library.</th>
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<tbody>
<tr>
<td>Coastal and rural communities invested in green infrastructure which provided effective and comprehensive approach to health promotion and sustainable recovery.</td>
<td></td>
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<tr>
<td><strong>2010 Chile Earthquake (M. 8.8)</strong></td>
<td><strong>2014 Croatia floods</strong> - Rehabilitation was done via systemic approach of both reconstructing measures (such as landslide remediation and strengthening of the embankment), with the enforcement of urgent <em>no regret</em> revitalization measures, which included the construction of a berm along the bank of the embankment.</td>
</tr>
<tr>
<td>DRM protocols went through a complete overhaul following the 2010 disaster, including strictly enforcing construction standards and building codes—requiring buildings to withstand 9.0-magnitude earthquakes— and strengthening and investing in new early warning systems.</td>
<td><strong>Entrepreneurial spirit of laid-off Kamensko Textile factory female workers in Zagreb</strong> - After Kamensko’s textile factory went bankrupt and laid off workers, almost exclusively middle-aged women, it was hard for them to find new employment. Women formed Kamensko association to work together and support. The self-organized association offers sewing, tailoring and clothing repair services, working on donated sewing machines and employing other socially vulnerable female workers.</td>
</tr>
<tr>
<td><strong>2011 Christchurch Earthquake (M. 6.3)</strong></td>
<td><strong>Pazin</strong> was the first Croatian city to introduce participatory budgeting as an innovation in local public services delivery, while <strong>Sisak</strong> was the first to introduce the application &quot;MyBudget&quot; through which citizens can submit suggestions on how to distribute funds.</td>
</tr>
<tr>
<td>Christchurch City Council launched a public engagement campaign to maximize the community's involvement in the redevelopment of central part of Christchurch, soliciting over 100,000 redevelopment ideas. These ideas were incorporated into the final draft of the recovery plan.</td>
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<tr>
<td><strong>1995 Kobe Earthquake (M. 7.1)</strong></td>
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<tr>
<td>Long-term economic support through taxation and funding to support three main activities: livelihood restoration fund loans; increased rent subsidies; and assistance for voluntary activities, events to revitalize commercial areas, community buildings, etc.</td>
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</tr>
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</table>
Istanbul - Enhanced response & seismic risk reduction

**Strengthening Emergency Management Capacity**
- Communication improved
- Emergency Management Information System Established
- New command control centers built
- Equipment and training provided for provincial agencies
- First INSARAG certified S&R team!
- 70,000 volunteers & 285,000 student-teachers-parents trained

**Seismic Risk Mitigation - Public Buildings**
- 1,077 schools (2 million students & teachers)
- 18 hospitals and 61 polyclinics (10,000 beds)
- 38 dormitories, 22 social service buildings, 54 admin buildings
- Inventory & retrofitting designs for historical heritage buildings
- Public awareness reached out to 3 Mil. People

**Building Code Enforcement**
- 3,631 engineers trained
- Building and occupancy permitting streamlined in two pilot municipalities
- Data management systems & call centers established
- Technical staff & decision makers trained
Investing in disaster resilience makes not only economic sense and provides numerous co-benefits for the environment, societies and beyond.

Pre-arranged finance can help manage the financial and economic impacts posed by disasters.

Civil protection agencies are critical for scaling up prevention and preparedness, and to achieve resilient recovery, their capacity needs to be strengthened.

Key Take-Aways for investing in DRM:

- Invest in understanding risks, gaps (including capacities) and opportunities.
Opportunities Going Forward
Phase 2 of Economics of Disaster Prevention and Preparedness

1. Promote reforms and investments to scale up prevention and risk reduction as part of green recovery
2. Invest in integrated ("smart") and multi-hazard investments linking DRM and climate change agenda
3. Use evidence-based approaches for prioritization/planning, and implementation/monitoring of DRR investments

1. Continue to develop CP capacities, linking prevention, preparedness and response
2. Improve understanding of risk and enable risk-informed planning at different levels/led by different stakeholders
3. Improve institutional and stakeholder coordination for a whole-of-society approach

1. Develop a disaster risk financing strategy (with new sources of funding)
2. Enable response to future shocks by integrating financial resilience into the Green Deal agenda and Green Recovery
3. Improve data for financial resilience to enable decision-making and use of different instruments
Thank you!

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