Weather extremes and fiscal risk management

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Brussels, 27.9.2016

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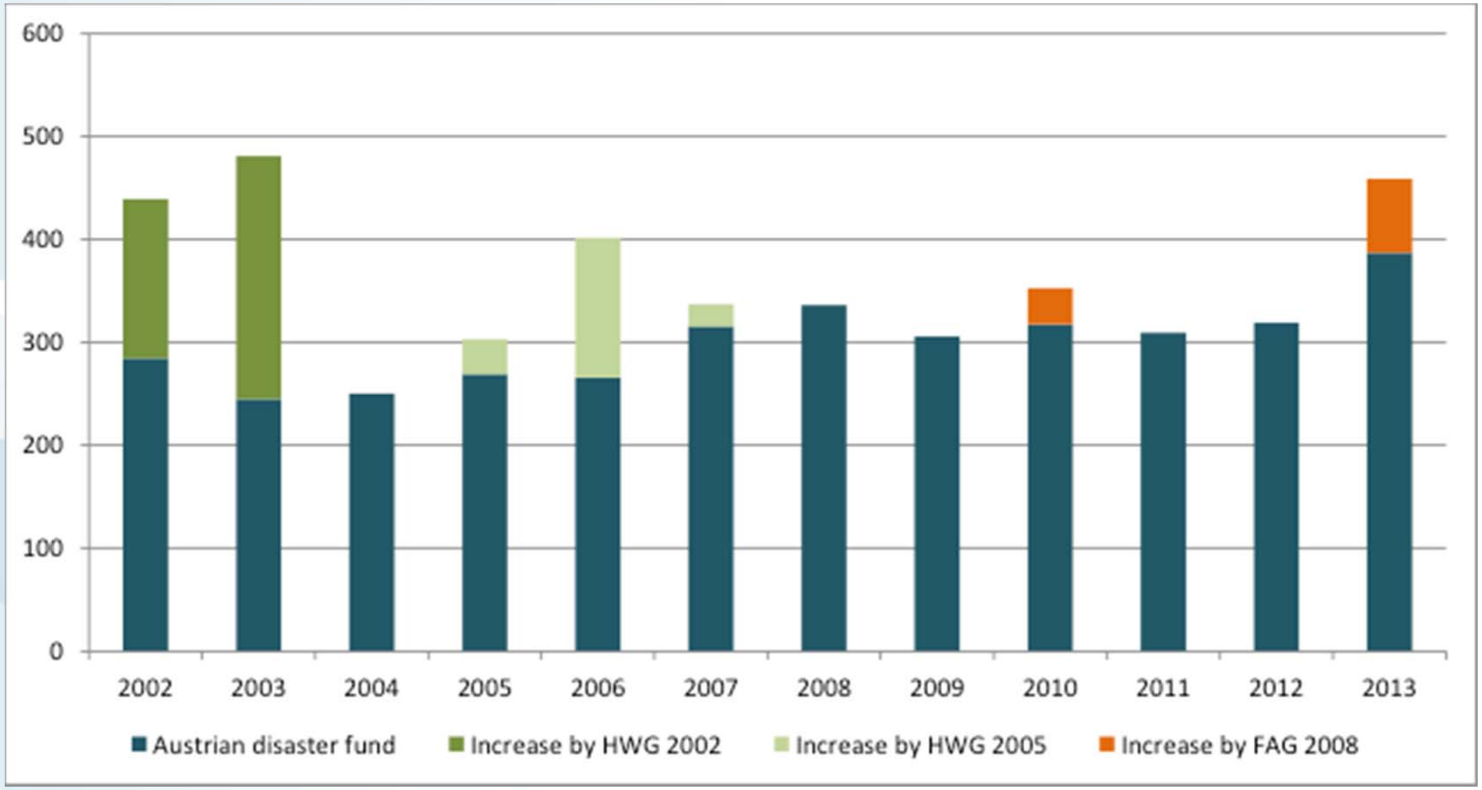
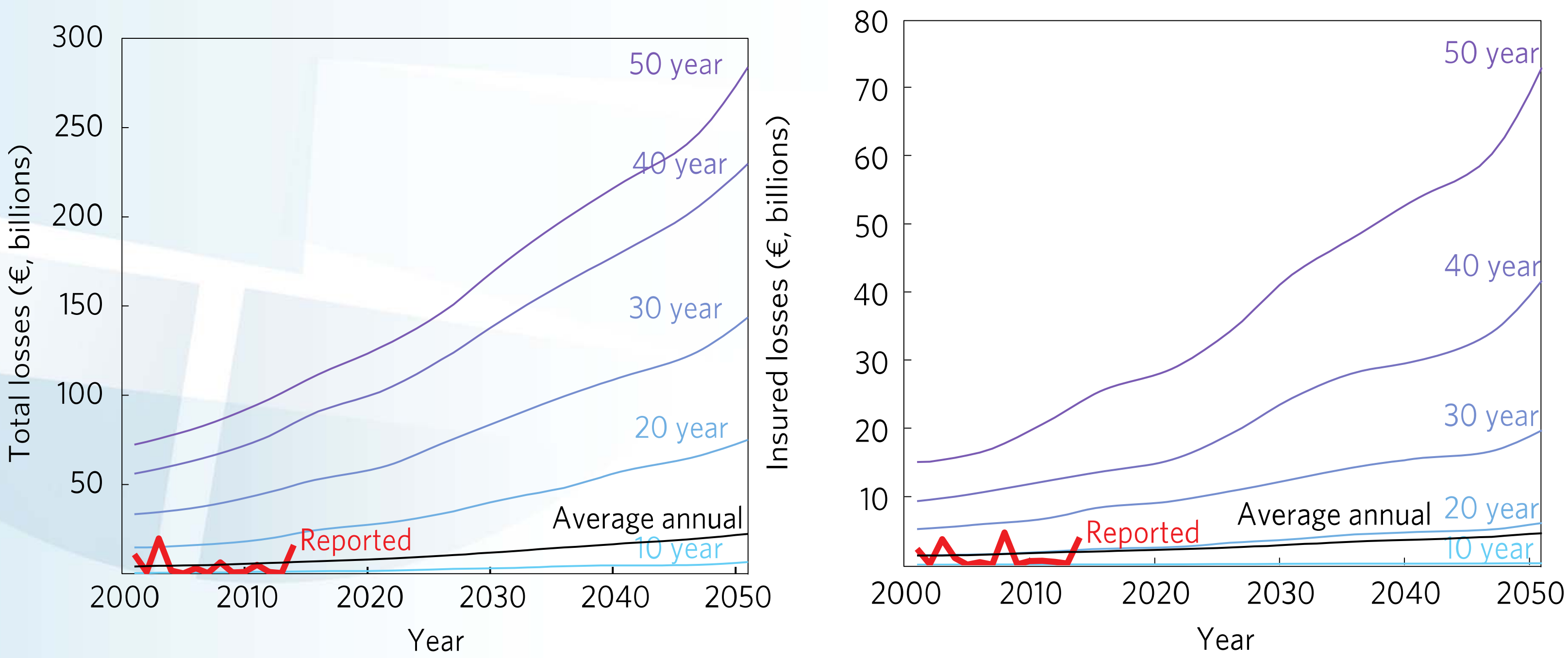
Adaptation problem
Budgetary implications of flooding (Austria)



Schinko et al., 2016

Adaptation problem
Total and insured flood losses on the rise (EU28)



Climate scenario: SRES A1B scenario (high emissions)

Jongman et al.,2014

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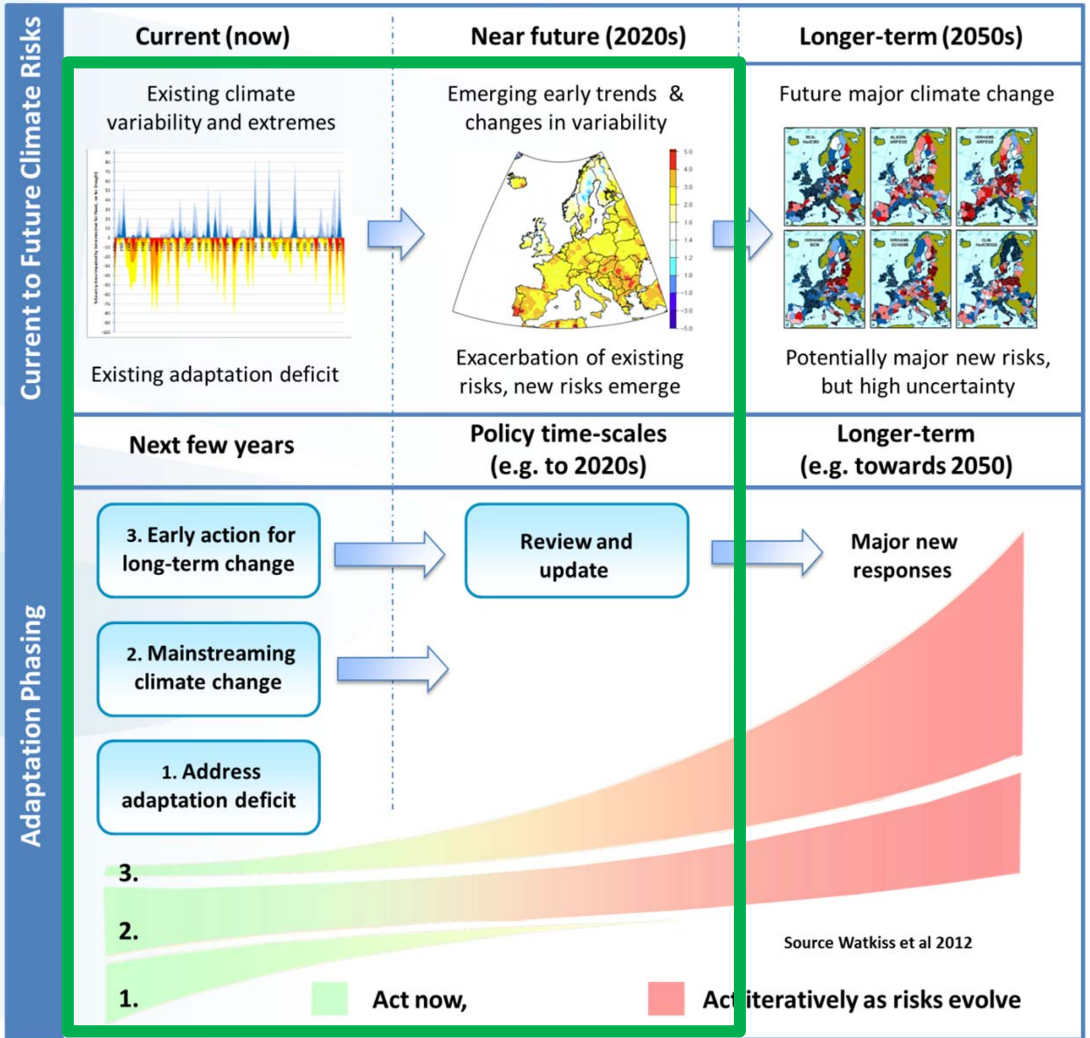
Balance sheet problem

	Direct	Contingent
Liabilities	Obligation in any event	Obligation if a particular event occurs
Explicit Government liability recognized by law or Contract	Foreign and domestic sovereign borrowing, expenditures by budget law and budget expenditures	State guarantees for non-sovereign borrowing and public and private sector entities, **reconstruction of public infrastructure**
Implicit A 'moral' obligation of the government	Future recurrent costs of public investment projects, pension and health care expenditure	Default of subnational government or public or private entities, **disaster relief**

Mechler and Hochrainer-Stigler, 2014

Iterative climate risk management framework for adaptation



Watkiss et al., 2012

Questions

- What are the levels of contingent liability due to future climate extremes (flooding in particular) and their primary drivers for EU member countries?
- How do they compare to other risks and liabilities?
- How to design an iterative climate risk management approach?

Methodological entry points

- IPCC, Working Group II, 2014

  “**Iterative risk management** is a useful framework for decision-making in complex situations characterized by large potential consequences, persistent uncertainties, long timeframes, potential for learning, and multiple climatic and non-climatic influences changing over time”

  “Economic thinking on adaptation has evolved from a focus on cost benefit analysis and identification of “best economic” adaptations to the development of **multi-metric evaluations** including the risk and uncertainty dimensions in order to provide support to decision makers.”

Three methodological suggestions

- Stochastic debt assessment
- Fiscal risk scorecard
- Co-generating an iterative policy process

Stochastic debt evaluation
Austria case

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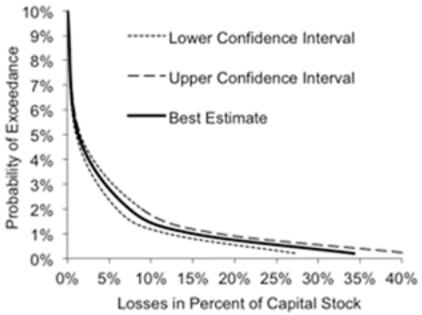
CATSIM: simulating and risk stress testing

Loss Distribution



Fiscal Resilience

Ex Post:

- Diversion from budget
- Foreign reserves
- Domestic bonds and credit
- Multilateral borrowing
- International borrowing
- Aid

Ex Ante:

- Reserve funds
- Sovereign insurance
- Catastrophe bonds

Fiscal vulnerability

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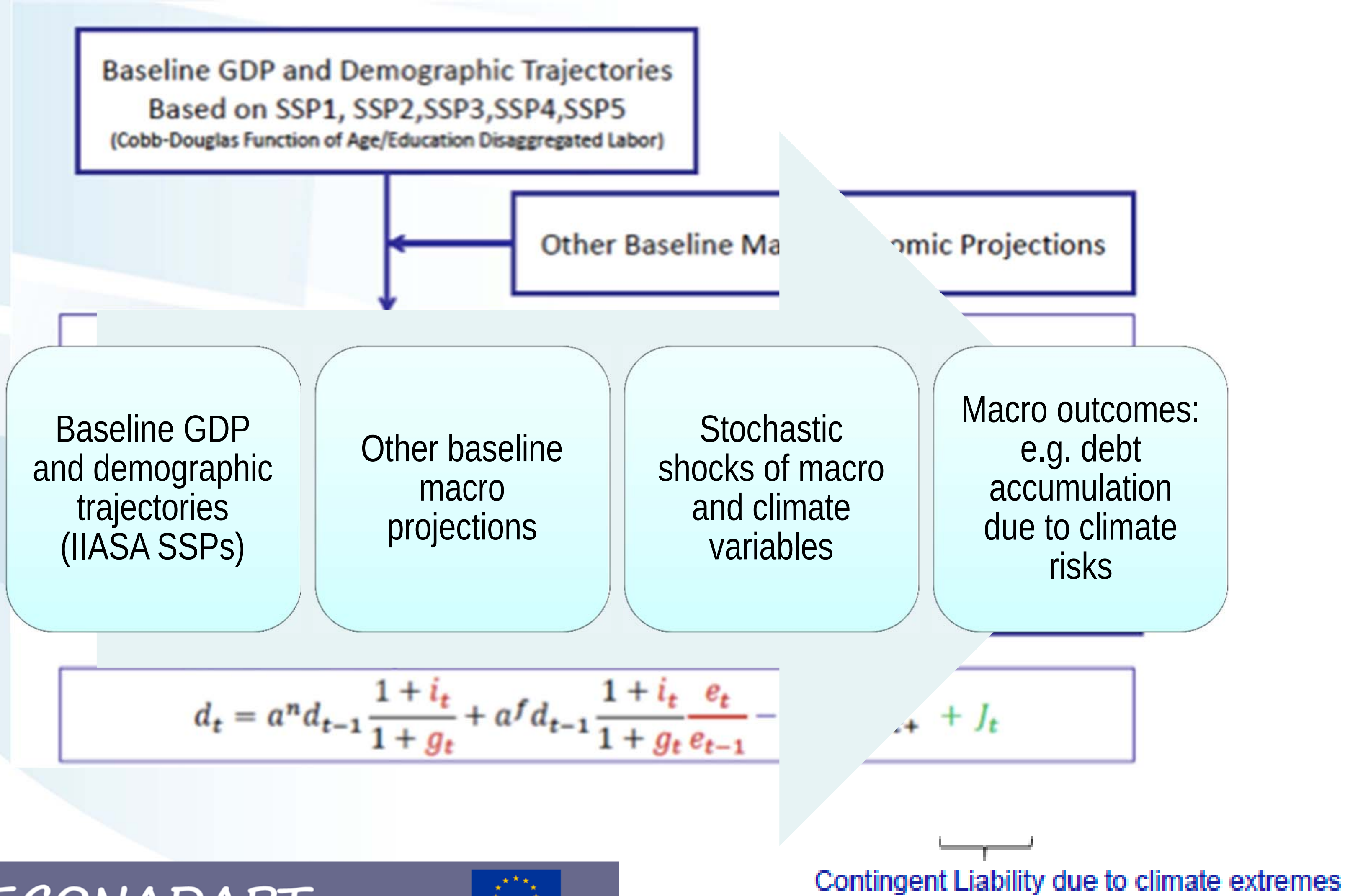
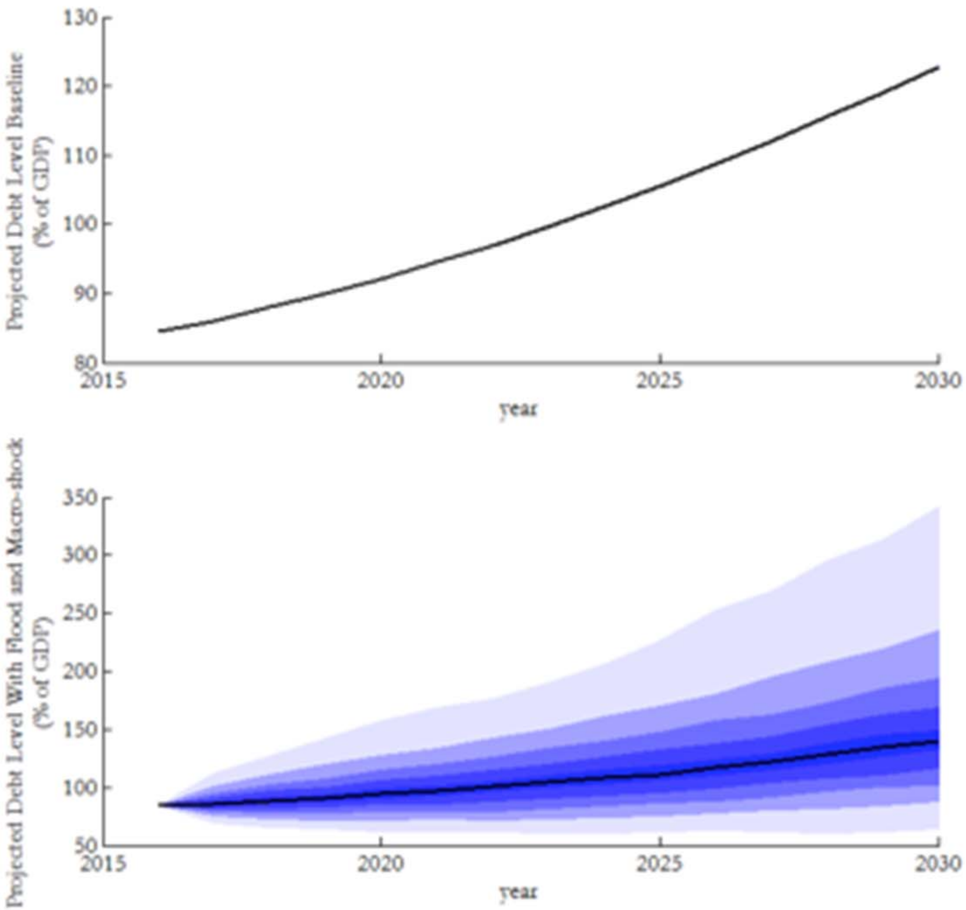
Stochastic Debt Evaluation



Mochizuki, 2015

Results-Austria



Baseline and stochastic debt trajectories for Austria under SSP2 scenario up to 2030
5th to 95th percentiles

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Climate change extreme risk

- Annual average loss (AAL) 2015
- AAL projected for 2050 (relative to the size of projected government expenditure),
- Current availability of catstrophe reserve fund and budgetary allocation
- Historical observations of average insured losses
- Availability of other budgetary mechanisms

Fiscal Risk Scorecard

- Underlying fiscal pressures
- Macroeconomic & fiscal variability
- Climate change extreme risk (DRM Fiscal Resilience)

Indicators: Underlying fiscal pressures

- Current debt-to-GDP,
- Primary balance needed to stabilize debt at 60% in year 2030 (also known as the S1 indicator),
- Projected increase in fiscal burden due to demography-related costs (ageing, health, longer-term care, education),
- Projected changes in the fiscal burden as a result of climate change mitigation.

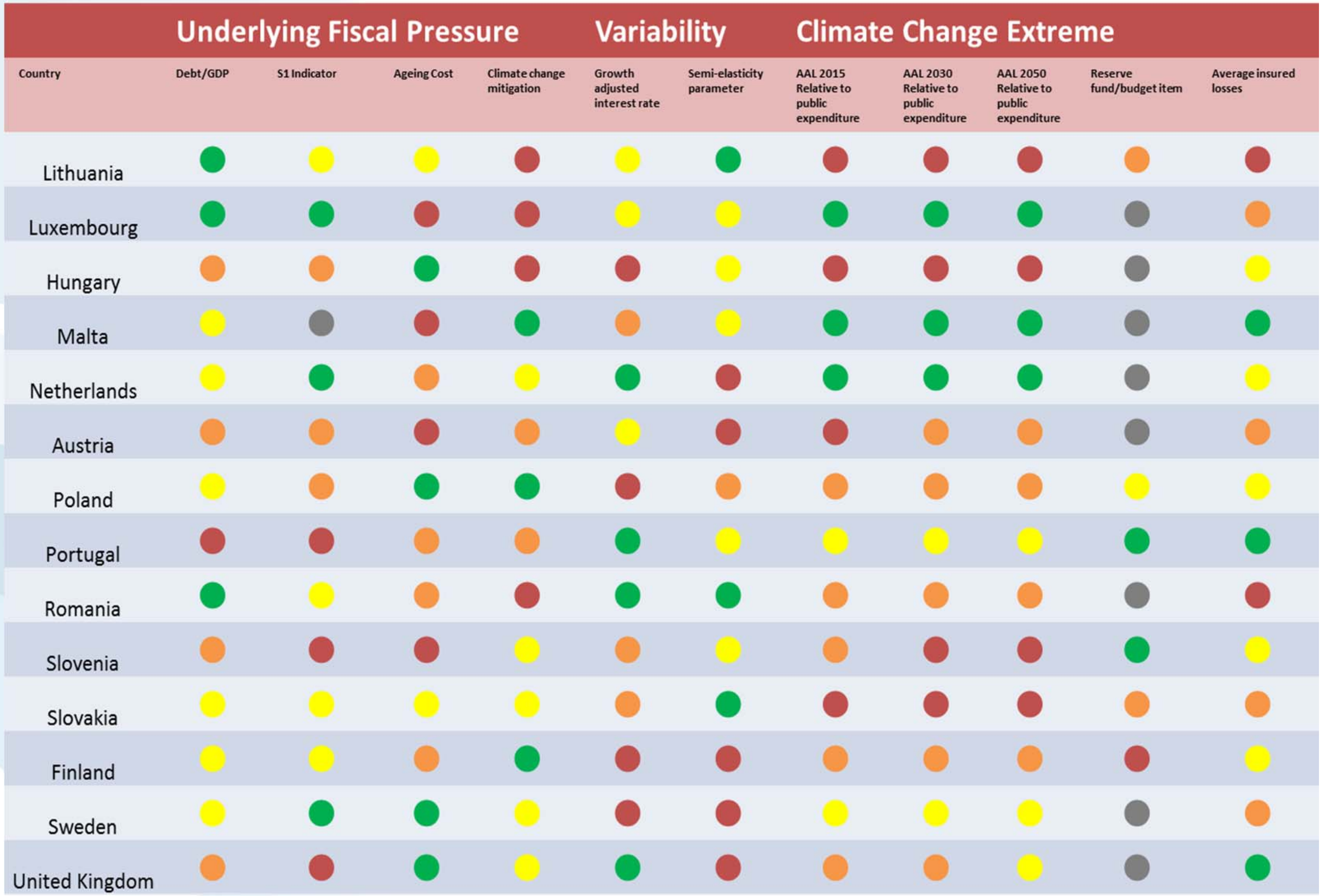
Indicators: macroeconomic and fiscal variability

- Growth adjusted interest rate
- Semi-budget elasticity parameters (response of budgetary expense and revenue to a percentage change in output)

Fiscal Risk Scorecard Results EU

Country	Underlying Fiscal Pressure: Debt/GDP	S1 Indicator	Ageing Cost	Climate change mitigation	Variability: Growth adjusted interest rate	Semi-elasticity parameter	Climate Change Extreme: AAL 2015 Relative to public expenditure	AAL 2030 Relative to public expenditure	AAL 2050 Relative to public expenditure	Reserve fund/budget item	Average insured losses
Belgium	red	red	red	orange	orange	red	orange	orange	orange	orange	green
Bulgaria	green	orange	yellow	green	orange	green	orange	orange	orange	orange	red
Czech Republic	green	yellow	orange	red	red	green	red	red	red	red	green
Denmark	yellow	green	green	yellow	yellow	red	yellow	yellow	yellow	grey	green
Germany	orange	green	red	green	green	orange	green	green	yellow	grey	orange
Estonia	green	green	green	green	yellow	yellow	red	red	red	orange	red
Ireland	red	red	red	red	green	orange	orange	orange	yellow	grey	green
Greece	red	yellow	yellow	green	red	yellow	yellow	yellow	yellow	grey	red
Spain	red	red	orange	orange	orange	orange	green	green	green	grey	orange
France	red	red	yellow	orange	green	red	yellow	yellow	yellow	grey	green
Croatia	orange	red	green	grey	orange	yellow	green	green	green	grey	red
Italy	red	orange	orange	yellow	yellow	orange	yellow	yellow	yellow	grey	yellow
Cyprus	red	grey	green	orange	orange	orange	grey	grey	grey	grey	orange
Latvia	green	yellow	yellow	red	yellow	green	red	red	red	orange	red

Fiscal Risk Scorecard Results EU



Results

- Economic risk from climate extremes (relative to the size of economic and public finance resources) high in some countries such as Hungary, Slovenia Latvia, Lithuania and Slovakia
- Countries also with some need for fiscal consolidation in the medium to long-term: proactive fiscal risk management especially important.
- Many EU member states still in the stages of designing and implementing climate change adaptation strategies
- Ample opportunities to consider iterative risk management processes, where state-of-the art scientific information on risk (hazard, exposure and vulnerability) is mainstreamed into economic and fiscal decision-making.

Towards iterative climate risk management

- In Austria current management of extremes the entry point - climate increment not clarified
- How to co-design an inclusive process to manage contingent climate-related disaster risks in light of dynamic risk processes and others stressors?

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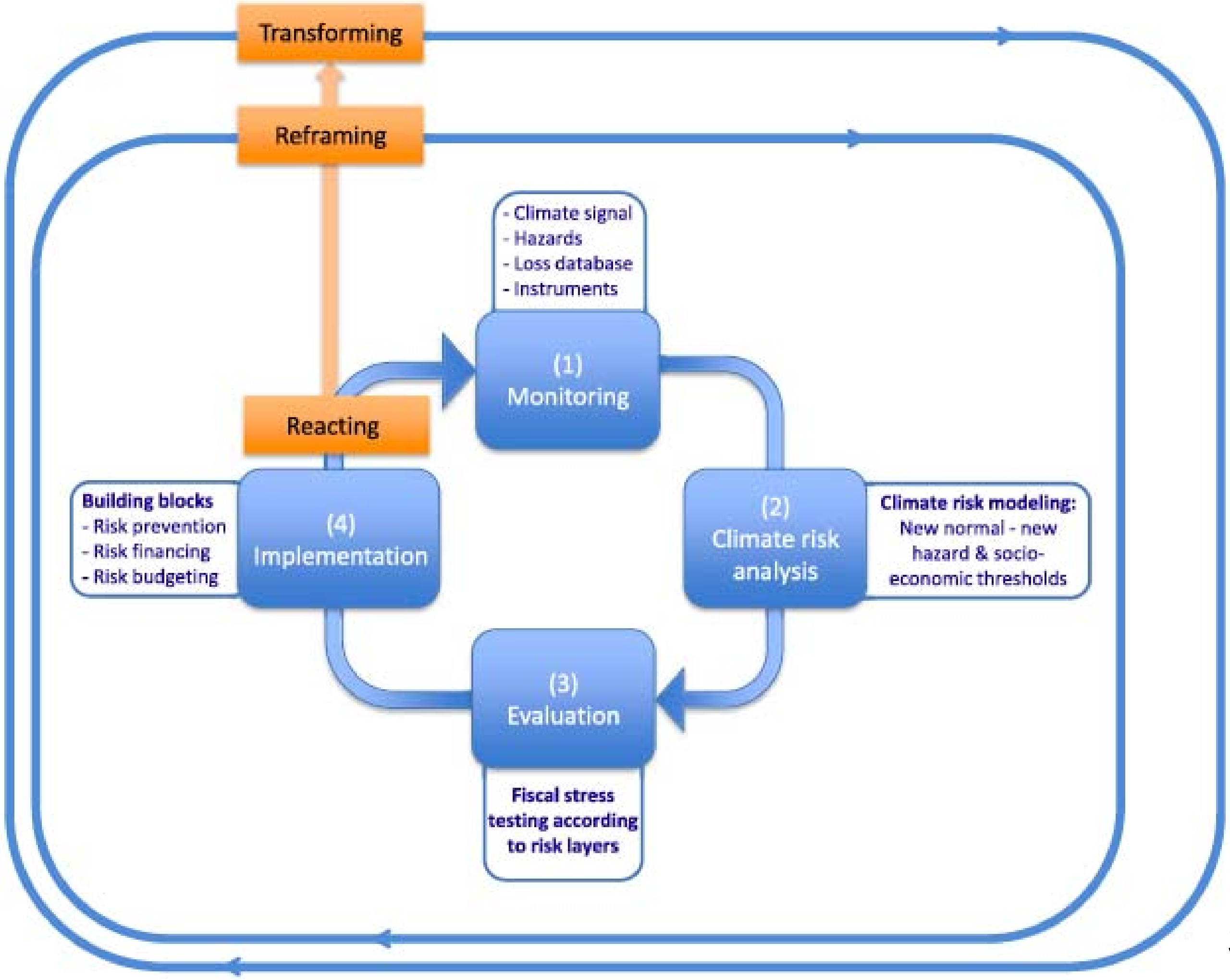
Iterative climate risk management applied to Austria



Schinko et al., 2016

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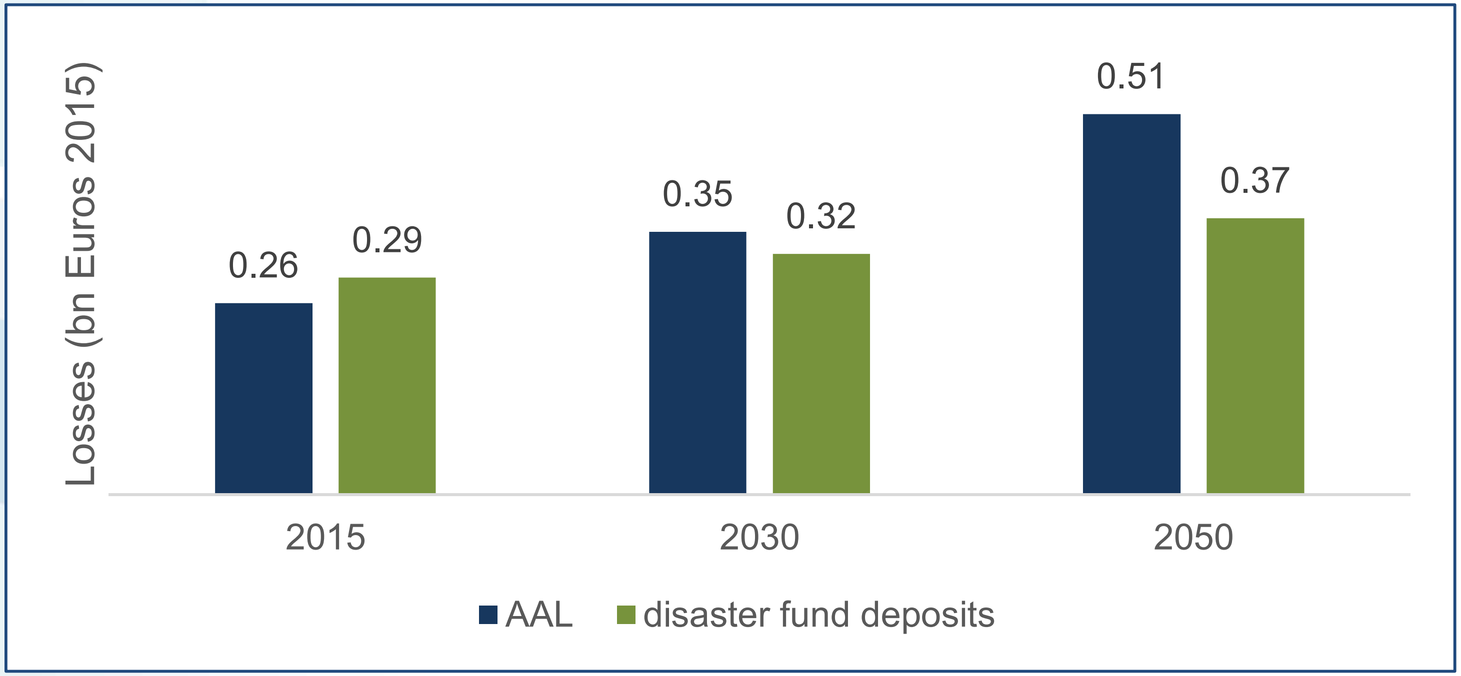
Projection of flood risks and catastrophe fund reserves



Schinko et al., 2016

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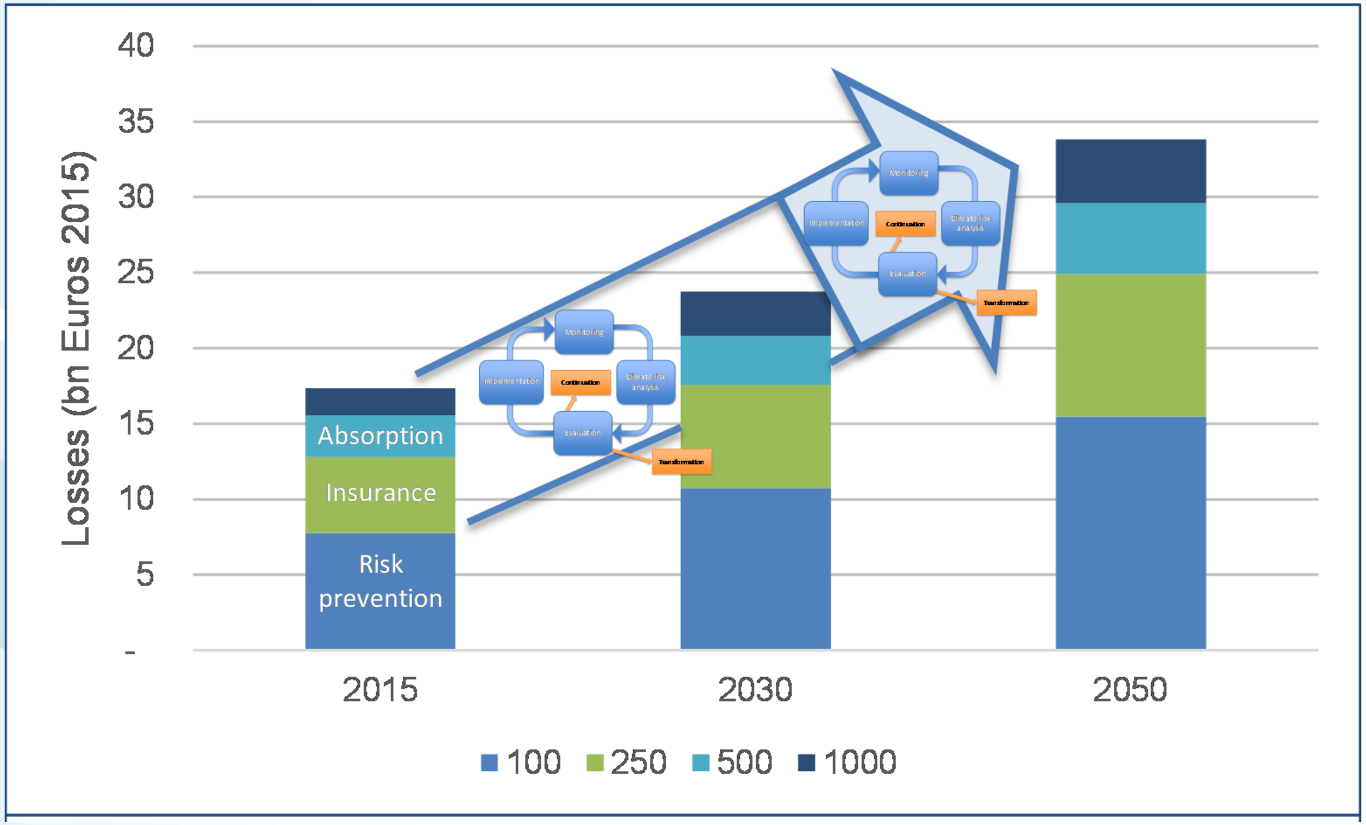
Iterative Climate Risk Management
Today's and future risk layers



Schinko et al., 2016

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Austria process

- Inclusive process with national-level institutions
  - Water and flood-risk authorities
  - EPA
  - Ministries of Finance, Environment and Interior Affairs
- Finance Ministry plans to build on analysis for qualitative 5 year budget projections of climate related risks

Beyond Austria: identifying risks, negotiating responsibilities


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  - Accessing the funds

The Funds

EU Solidarity Fund

Latest News

The European Union Solidarity Fund (EUSF) was set up to respond to major natural disasters and express European solidarity to disaster-stricken regions within Europe. The Fund was created as a reaction to the severe floods in Central Europe in the summer of 2002. Since then, it has been used for 63 disasters covering a range of different catastrophic events including floods, forest fires, earthquakes, storms and drought. 24 different European countries have been supported so far for an amount of over 3.7 billion €. Click for a list of all interventions en

How to apply?

Any application has to be received by the Commission within 12 weeks of the date of the first damage caused by the disaster.

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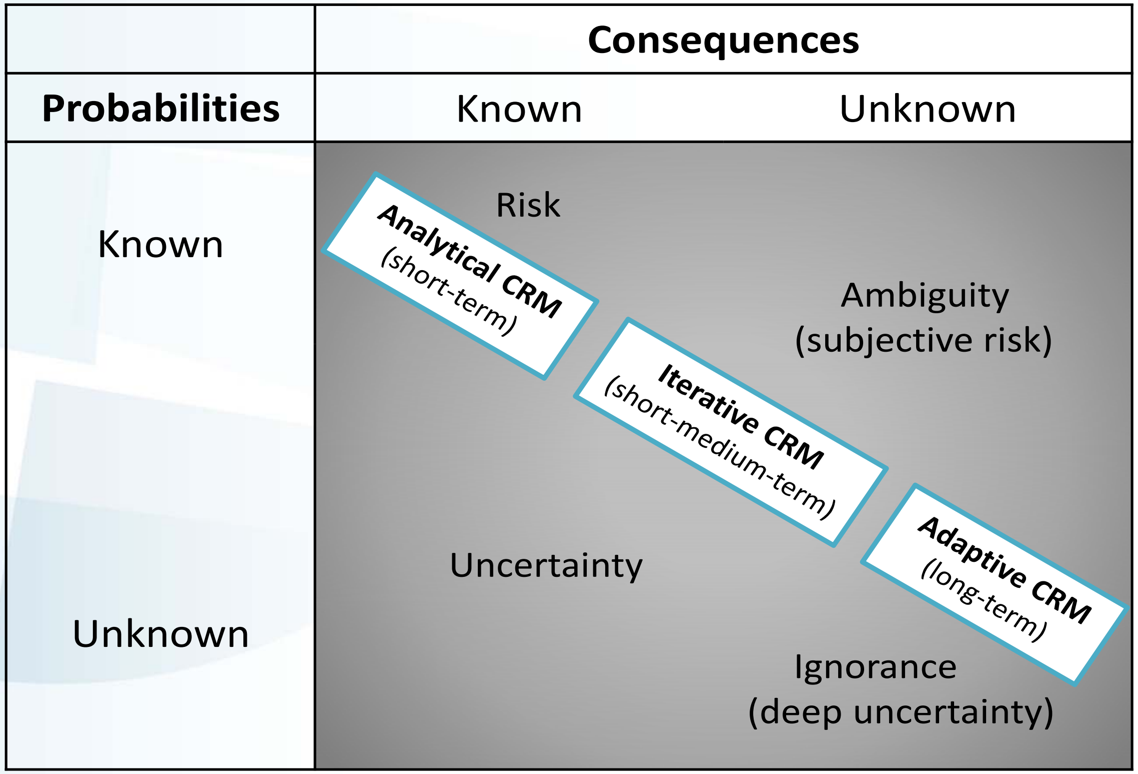
Next

- Evidence of risk layering at multiple levels
- Understanding usefulness of scorecard approach
- Concretise budget planning in Austria and EU

References

- Kuik, O., Scussolini, P., Mechler, R., Mochizuki, J., Hunt, A., Wellman, J. (2016). Assessing the economic case for adaptation to extreme events at different scales Deliverable 5.1. Econadapt project.
- Mochizuki, J., Mechler, R., Hochrainer-Stigler, S., Schinko, T. (2016). Pan-European Assessment of Fiscal Consequence of Climate Extremes. Deliverable 5.2. Econadapt project.
- Schinko, T., Mechler, R., Hochrainer-Stigler, S. (2016). A methodological framework to operationalize Climate Risk Management: Managing sovereign climate-related extreme event risk in Austria. Mitigation and Adaptation Strategies for Global Change. DOI 10.1007/s11027-016-9713-0

Iterative climate risk management
Dealing with risk and uncertainty



Schinko et al., 2016

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Criteria and indicators

Percentile thresholds for each indicator

[1st Quartile: Green, 2nd: Yellow, 3rd: Orange, 4th: Red])

- Debt/GDP (%) [43, 72, 92,177]
- S1 Indicator [1.1, 2.1, 3.3, 6.2]
- Increase in ageing related expenditure (% of GDP) [1.4, 4.1, 6.8, 12.6]
- Increase in climate mitigation cost (% of GDP) [0.02, 0.1, 0.2, 1]
- Growth adjusted interested rate (%) [17, 22, 37, 85]
- Budget semi-elasticity [0.44, 0.52, 0.56, 0.65]
- 100 year flood in 2015 relative to public expenditure (%) [0.4, 0.8, 2.4, 6]
- 100 year flood in 2030 relative to public expenditure (%) [0.3, 0.7, 3.7, 11]
- 100 year flood in 2050 relative to public expenditure (%) [0.3, 0.7, 7.4, 19]
- Reserve fund or budget item relative to AAL (%) [160, 360, 209, 660]
- Average insured damage (%) [2.6, 10.4, 24.8, 69

Stochastic Debt Evaluation

$$d_t = a^n d_{t-1} \frac{1 + i_t}{1 + g_t} + a^f d_{t-1} \frac{1 + i_t}{1 + g_t} \frac{e_t}{e_{t-1}} - b_t + c_t + J_t + f_t$$

d_t	=	Debt to GDP ratio in year t
a^n	=	Share of total debt denominated in national currency
a^f	=	Share of total debt denominated in foreign currency
i_t	=	Nominal implicit interest rate at year t
g_t	=	Nominal GDP growth rate at year t
e_t	=	Nominal exchange rate at year t
b_t	=	Structural primary balance over GDP in year t
c_t	=	Change in age-related costs over GDP in year t relative to base year
J_t	=	Reconstruction needs due to disasters over GDP.
f_t	=	Stock flow adjustment over GDP in year t

Data and Baseline assumptions used in this study

Item	Descriptions	Sources
Baseline GDP Growth	Production function approach using age and education disaggregated labors (SSP2)	Cuaresma (2015)
Baseline Population Growth	Projected population (SSP)	Samir and Lutz (2014)
Baseline long-run interest	Assumed to converge to 3% in T+10	European Commission (2014b)
Baseline GDP deflator	Assumed to converge to 2% in T+5	European Commission 2014b
Average maturity of debt	Assumed to be 8 years	EUROSTAT[1]
Semi-elasticity parameter of budget balance	Assumed to remain constant at 0.58.	Mourre et al. (2014)
Historical macroeconomic variables	Quarterly data on GDP growth, interest rates, and price indices	EUROSTAT
Historical observations of flood losses	Quarterly data on insured and uninsured losses	NatCat Service data[2]
Forecasted flood risk	Estimated based on A1B for illustration	Schinko et al. forthcoming
DRM policy parameters	Sources and allocation of disaster fund	Schinko et al. forthcoming
Baseline projections of ageing cost	Pension, health, longer-term care, education and unemployment	European Commission (2015)

[1] http://ec.europa.eu/eurostat.

[2] http://www.munichre.com/en/reinsurance/business/non-life/natcatservice/index.html.

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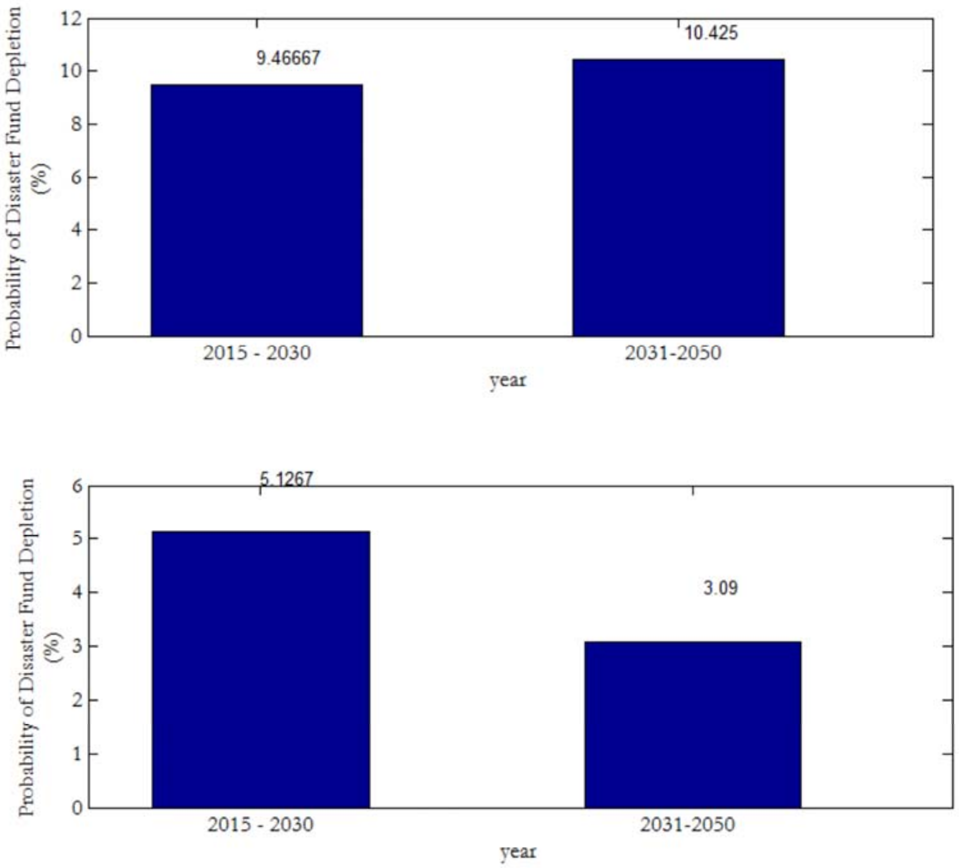
Results-Austria



Mean estimates of probability of disaster fund depletion with annual DRR investment of 50 million Euro

and 100 million Euro across 1000 scenarios

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