

# **Disasters and Economic Welfare: Can National Savings Help Explain Post-disaster Changes in Consumption?**

**Reinhard Mechler (IIASA)**

9<sup>th</sup> IIASA-DPRI Forum on Integrated Disaster Risk Management  
*Scientific Challenges in Implementing Integrated Disaster Risk Management (IDRiM)  
in a Changing World*

Kyoto University, October 12-16 2009

# Synopsis of macroeconomic perspectives on natural disasters

<b>Position 1</b> <b>“Natural disasters are setbacks for economic growth”</b>	<b>Position 2</b> <b>“Disasters have no effects on economic growth”</b>
<p>Methodologies involving</p> <ul style="list-style-type: none"> <li>•Supply side focus</li> <li>•Model projections</li> </ul> <p>• Almost all studies focus on GDP, yet</p> <ul style="list-style-type: none"> <li>• disasters destroy stocks, which does not factor into national accounting,</li> <li>• actually reconstruction adds positively to GDP etc.</li> <li>• normally consumption is used to derive utility</li> </ul> <p>Murlidharan and Shah (2001); Freeman et al. (2002); Mechler (2004); Cuaresma, Hlouskova, Obersteiner (2004); Hochrainer (2006); Noy, (2009); Okuyama (2009)</p>	<p>Methodologies involving</p> <ul style="list-style-type: none"> <li>•Supply and demand side</li> <li>•Empirical evidence</li> </ul>

Source: Adapted from Zenklusen, 2007

## Research hypotheses

---

- Disasters lead to dissavings, reducing the (potential) capital stock, thus lowering consumption over the longer term!
- “Depreciating” savings by asset losses should better explain post disaster changes in consumption!

# Equivalence of savings and present value of consumption

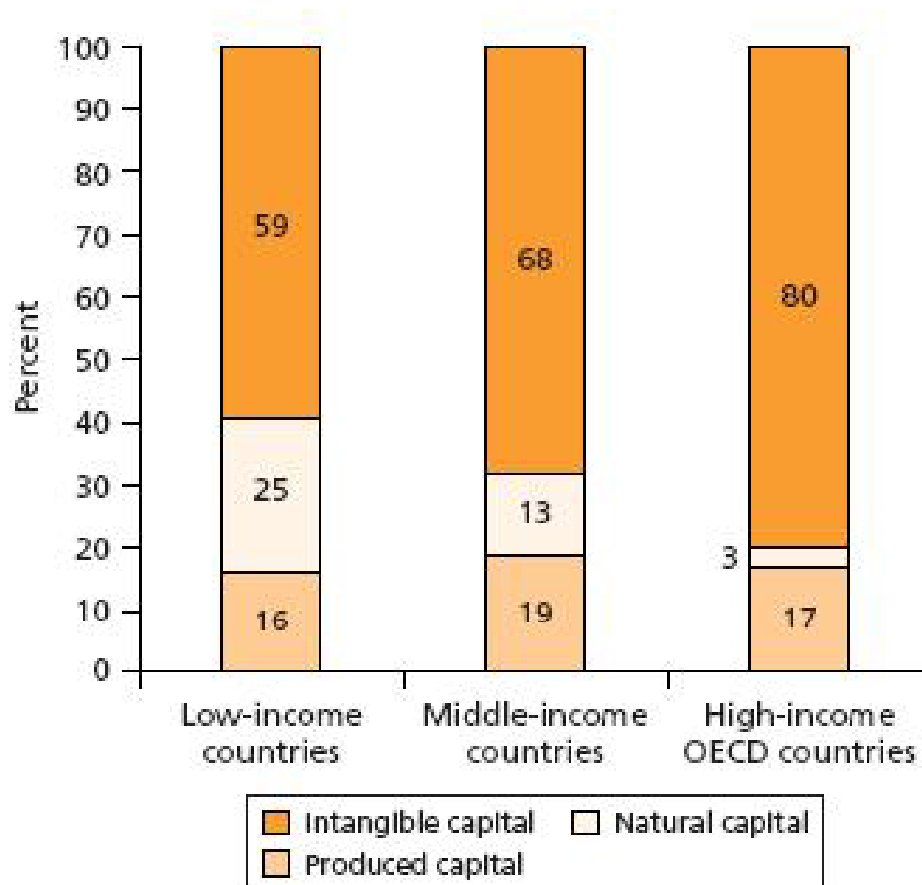
---

- Savings in  $t=0$  should equal present value of future per capita consumption changes

$$S_0 = \sum_{t=1}^T \frac{1}{(1+r)^t} \left( \frac{C_t}{N_t} - \frac{C_{t-1}}{N_{t-1}} \right)$$

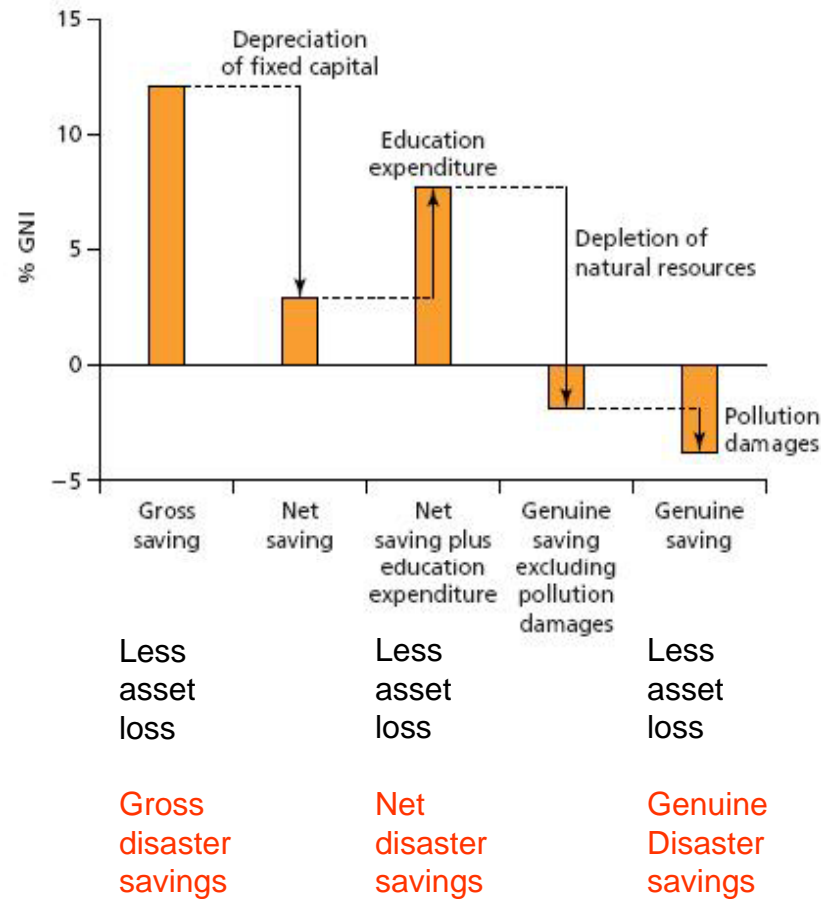
- Can be tested econometrically: simple bivariate regression

# Composition of “Capital” and Disasters



- Disasters directly affect people and capital
- Composition differs with regard to development
- What do capital stock losses mean for follow-on effects= flows?

# Calculating genuine and disaster adjusted savings



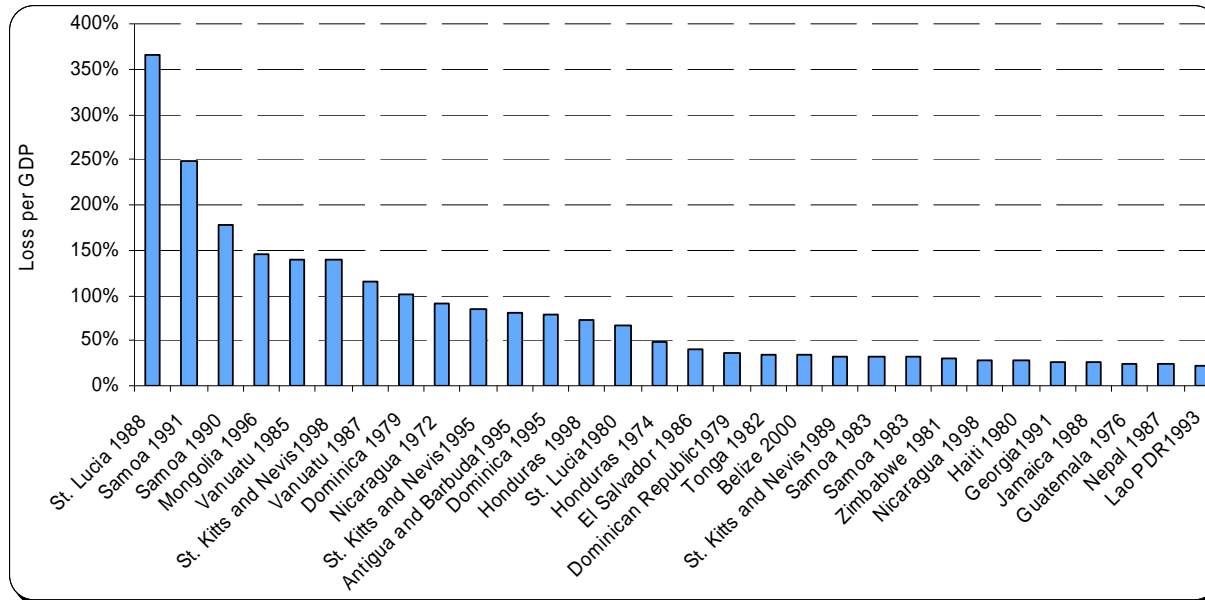
Source: Modified based on World Bank, 2006

## Econometric analysis: savings and disasters

---

- Gross and net savings measure increment to produced capital
- Genuine savings suggest to better measure increment to total capital, including
  - Intangible: human and social
  - Natural capital
- We suggest to adjust for disaster asset losses: exogenous capital depreciation

# Sample: Loss > 1%/GDP over time horizon 1970-2000



We focus on 220 worst events out of 17,000 recorded in EMDAT disaster database

30 largest monetary disaster losses since 1970  
Source: own calculations based on data by EMDAT (CRED, 2009); Munich Re, 2008.

## Total reported losses are not K losses per se

---

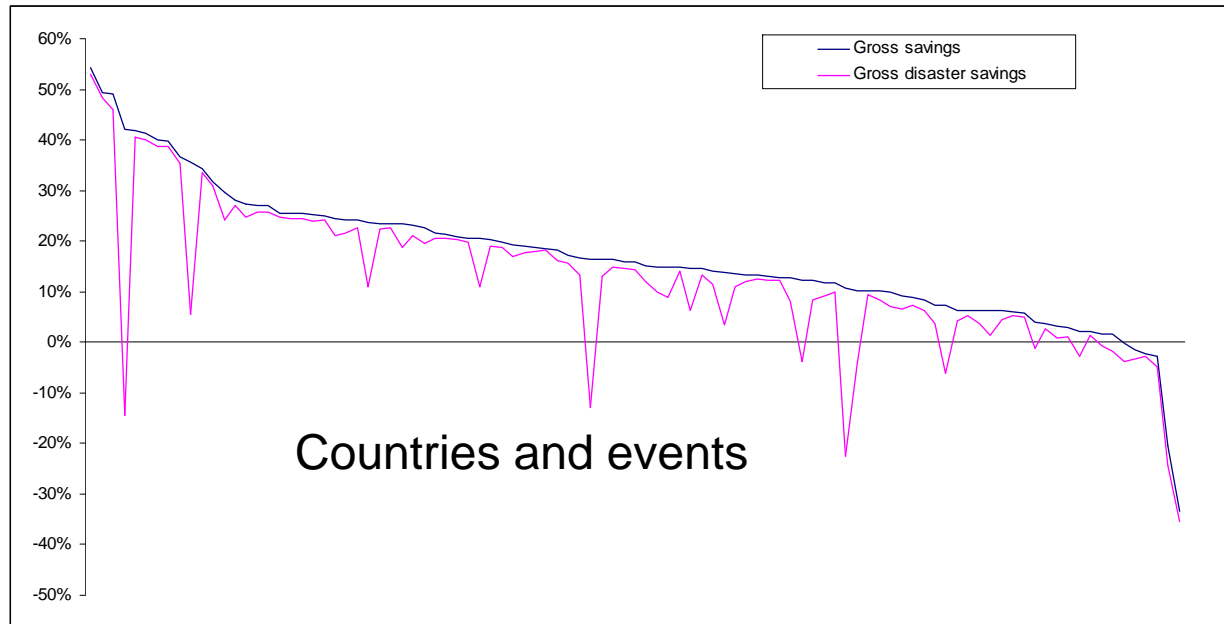
Portion of total loss considered as direct, capital stock loss based on country cases

Event	Capital stock losses (productive sector and infrastructure) as a share of total loss
Hurricane Stan in El Salvador, 2005	36%
Hurricane Stan in Guatemala, 2005	30%
Hurricane Mitch in Honduras 1998	48%
Hurricane Mitch in Nicaragua 1998	29%
Earthquake in El Salvador, 2001	21%
Arithmetic Average	33%
<b>Parameter used in this study</b>	<b>35%</b>

Sources: ECLAC 1999, 2002; Telford et al., 2004; CRED, 2009

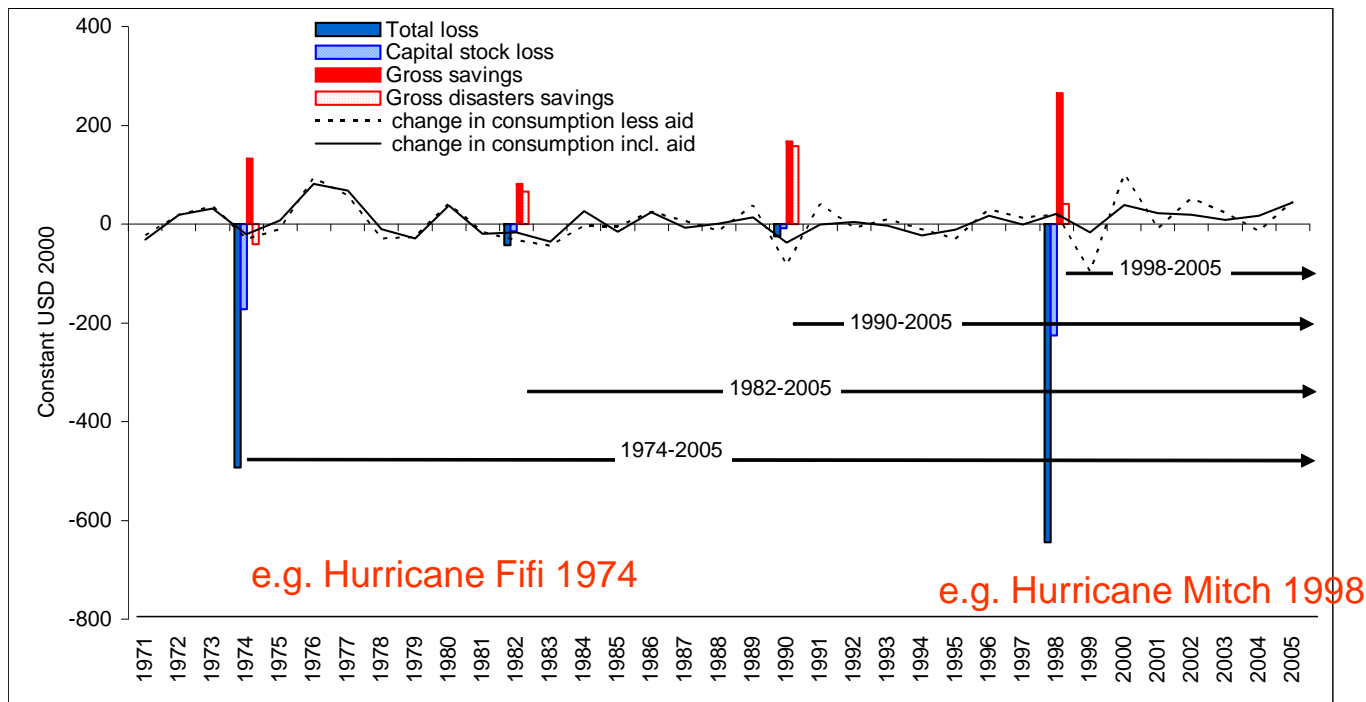
# Savings and disaster savings over whole sample

---



Gross and gross disaster savings for the whole sample (as a share of GNI in the year before the event)

# Calculation algorithm for Honduras



Disaster losses and changes in consumption in Honduras with and without aid  
Note: Values in 2000 constant USD per capita.

## Regression results for the whole sample (N=99)

Model	Gross savings	Gross disaster savings	Net savings	Net disaster savings	Genuine savings	Genuine disaster savings
	PV dConsumption in per cent of per capita income of the year before the event					
Constant	0.061	0.104***	0.124***	0.155***	0.137***	0.166***
Savings Coefficient	0.692***	0.585***	0.654***	0.560***	0.621***	0.518***
R Square	0.129	0.122	0.100	0.098	0.087	0.085

Significance at the \* 10% level; \*\* 5% level; \*\*\* 1% level

- Savings are all highly significant and most of constants similarly so
- R squares in line with other findings with about 13%, 10%, and 9% of the consumption change explained by savings measures respectively in the baseline year
- Coefficients are of right order of magnitude (ideally they should be 1) ranging from 0.7 to 0.5 compared to a range of 0.4 to 1.3 reported in World Bank (2006).
- Not in line with the literature: explanatory power decreases from gross to net to genuine savings.

## Regression results for the fixed time horizon of 15 years (N=43)

---

Model	Gross savings	Gross disaster savings	Net savings	Net disaster savings	Genuine savings	Genuine disaster savings
	PV dConsumption in per cent of per capita income of the year before the event					
Constant	0.001	0.027	0.035	0.055**	0.044*	0.070***
Savings Coefficient	0.437*	0.344**	0.470*	0.374*	0.670***	0.556***
R Square	0.085	0.074	0.076	0.068	0.170	0.153

- Can be explained by the flexible time horizon chosen out of necessity to keep the number of observations as large as possible.
- For fixed 15 year time horizon, R square actually doubles for genuine savings.
- **BUT: disaster K losses do not better explain variation in consumption**

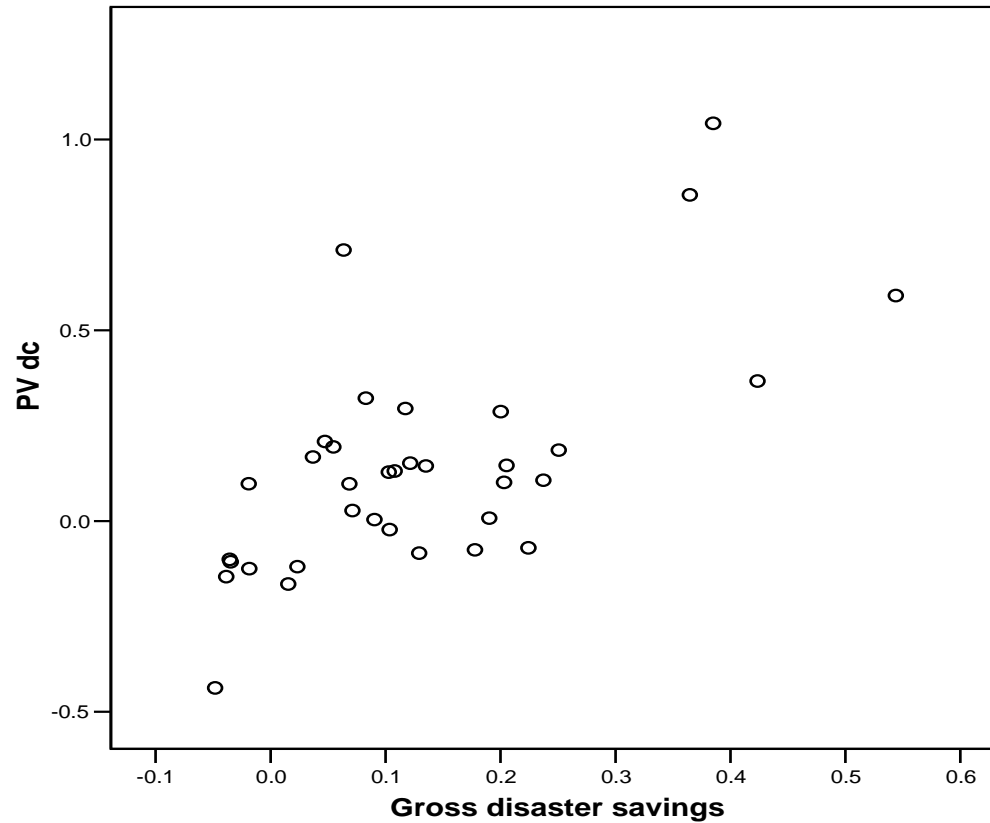
## Model results for the low income sample, sudden hydrometeorological events (N=35)

Model	Gross savings	Gross disaster savings	Net savings	Net disaster savings	Genuine savings	Genuine disaster savings
	PV dConsumption in per cent of per capita income of the year before the event					
Constant	-0.094	-0.043	-0.001	0.046	0.042	0.073
Savings Coefficient	1.414***	1.403***	1.434***	1.471***	1.148***	1.323***
R Square	0.421	0.434	0.378	0.405	0.195	0.240

- Coefficients increase to above 1.
- Overall, the statistically explained variation also increases substantially to, e.g., a R square of 0.42 for gross savings
- **AND: disaster adjustment finally makes a difference and explained variation increases by about 1%, 2.5% and 4.5% for gross savings, net savings and genuine savings, respectively**

## Gross disaster savings vs. the change in consumption for the low income sample, sudden hydrometeorological events (as a share of GNI)

---



# Findings

---

- **Statistical evidence that disaster losses lead to welfare losses (as measured by consumption)**
- **But only for low income group and sudden hydrometeorological events**
- **Including disaster losses helps to better explain variations in post-disaster consumption changes**
- **Contrary to the literature genuine savings explained less of the variation of consumption changes**
- **Important data problems and bias for many, highly exposed low income countries, for which there are no genuine savings data**

WPS4988

POLICY RESEARCH WORKING PAPER

4988

Public Disclosure Authorized

Public Disclosure Authorized

Disasters and Economic Welfare  
Can National Savings Help Explain Post-disaster Changes  
in Consumption?

*Reinhard Meckler*

The World Bank  
Sustainable Development Network  
Global Facility for Disaster Reduction and Recovery Unit  
July 2009

