Water Security and Sustainable Growth
Report of the OECD/GWP Task Force on Water Security & Sustainable Growth

Water Security 2015: Oxford University

Dr. Claudia Sadoff, Task Force Chair
Lead Economist, The World Bank
Securing Water, Sustaining Growth
The Findings of the GWP/OECD Task Force on Water Security & Sustainable Growth

- **Part of a Global Dialogue**' chaired by Angel Gurría, SG OECD & HE Ellen Johnson Sirleaf, President of Liberia, culminating in a High Level Panel at Korea WWF

- **Task Force Members** included representatives of: OECD, GWP, University of Oxford, IFPRI, IWMI, IIASA, University of Massachusetts, McMaster University, University of Manchester, VU University, University of Rio de Janeiro

- **Researchers** from University of Oxford, IFPRI, University of Massachusetts, McMaster University, VU University, University of North Carolina at Chapel Hill, Complutense University of Madrid, University of Southampton, Global Climate Forum
Securing Water, Sustaining Growth

The Findings of the GWP/OECD Task Force on Water Security & Sustainable Growth

**Objective**: To provide new evidence of the *relationship between water security & economic growth* – taking a risk-based approach

I. Analyze the dynamics of water security & growth

II. Quantify water-related risks and opportunities and their trajectories through time

III. Evaluate pathways towards water security
Conceptual Framework
Conceptual Framework

Growth, Wealth, Well-Being
Conceptual Framework

Water endowment
surface &
ground water

Wealth, health, living
A dynamic construct: As economic & social context evolves, water security challenge will evolve too.
Theoretical Analysis
Theoretical analysis: the dynamics of a ‘water poverty trap’

Conceptual/mathematical model of the dynamic behavior of an economy subject to water-related protective & productive investments

The trajectory of growth or decline depends on initial positions; water endowments & investments (within & outside the water sector)

A ‘tipping point’ exists where pressures will direct an economy either toward growth or poverty

Investing in the development, management & operation of water-related institutions & assets can act to insulate a country from adverse water-related risk (poverty traps)

Direction field for a system depicting the relation between wealth & water security:
• Arrows indicate the direction of the rate of change.
• Colors indicate the magnitude of the rate of change (red = rapid; blue = slow).
Correlation Analysis
Most of the world’s wealthy economies (green dots) face less hydrological variability & have made more investments in water management.

Pathways to water security will be more difficult & more costly in locations with complex hydrology (diagonal colors).

Early results, published in *Science* “Coping with the Curse of Freshwater Variability”
Global-level Econometric Analysis
Global-level econometric analysis

The connection between water security & economic growth is intuitively clear, but empirical evidence of this relationship is scarce

- It is difficult to find counterfactual situations to substantiate how water-related investments affect economic growth
- **Causal links run in both directions** between water investments & growth
- Water-related investments can increase well-being **without increasing economic growth** as it’s conventionally measured
- Two types of benefits (reduced losses and the production of goods) so they **enter the cost-benefit analysis on the benefit side of the equation**

Isn’t it ironic?
Because water is so important for so many reasons, it is difficult to statistically show the importance of water for economic growth
Global-level econometric analysis

We conceptualized water security as ‘protection from water-related drags on economic growth’

• Countries whose economic performance is strongly correlated to water security-related variables such as runoff, floods and droughts, are relatively water insecure

• Countries where growth is resilient these factors are relatively water secure
Global-level econometric analysis

To obtain empirical evidence of a statistically significant impact of hydro-climatic variables on per capita GDP growth, and to help identify the key drivers of those impacts, we performed an econometric analysis → a fixed-effects panel regression across 113 countries, 30+ years

\[ Y_{it} = \beta X_{it}^{exo} + \alpha_i + \gamma_t + \varepsilon_{it} \quad i = 1, \ldots, 113 \text{ and } t = 1980, \ldots, 2012 \]

Where \( Y_{it} \) represents the dependent variable (per capita GDP growth) of country \( i \) at time \( t \), \( \beta \) is the regression coefficient for each independent variable, \( X_{it}^{exo} \) represents the exogenous independent variables (hydro-climatic indices for basin \( i \) at time \( t \)), \( \alpha_i \) is the basin fixed effect meaning that it represents the time-invariant aspects of basin \( i \), \( \gamma_t \) represents the year fixed effects, and \( \varepsilon_{it} \) represents the time-variant factors. This model was used for all panel regression results.
Global-level econometric analysis

Result: water insecurity acts as a drag on growth
The relationship is causal and statistically significant

On average, global economies are vulnerable to changes in the availability of water and water-related hazards

Water security is therefore an investment in enabling growth
Global-level econometric analysis

Runoff was shown to have the most highly statistically significant effect on growth

- Runoff is representative of the general availability and variability of water
- Temperature is shown not to have been historically statistically significant for growth

Implications for the economic costs of climate change:

- Previous economic studies of the effects of climate change have focused primarily on temperature
- Empirical evidence suggests the need for greater emphasis on variability (in addition to water-related hazards)
- Without taking into account hydrological variability, the economic returns on adaptation investments in water security are likely to be underestimated
Global-level econometric analysis

Cumulative drought effects

To visualize the **cumulative effect of drought** over time, while accounting for baseline growth rate, we looked at the difference between the drought & non-drought growth rates.

In Malawi a 50% reduction in the drought effect led to a **20% higher per capita GDP** over 30 yr simulation.

Countries that would most benefit from reduction in drought effect (SSA, MNA, SAR, LAC)
Characteristics that influence vulnerability to water-related risks
a deeper investigation of selected factors that emerged in the preliminary analysis

The countries most economically vulnerable to hydro-climatic effects are those that have:

- High water stress
- Low incomes
- High % of agriculture in GDP

These countries are significantly more vulnerable to hydro-climatic conditions

Each aspect of vulnerability calls for a different policy response
Summary thoughts

- Water security has a causal, statistically significant impact at the global level
- Trajectories of wealth are strongly context-dependent; reflecting a dynamic relationship of natural endowment & hazards, policy & investment choices
- Protective & productive investments can help delink the water from growth
- Runoff and variability are at the heart of this relationship
- Most vulnerable countries: agriculture-dependent with low levels of water availability
- Still, not all investments in water security will be economic or desirable – robust CBA, social & environmental impact assessment, and effective regulations may be needed to meet social imperatives i.e., vulnerable, women & environment
Next Up:

I. Analyze the dynamics of water security & growth
II. Quantify water-related risks and opportunities & their trajectories through time
III. Evaluate pathways towards water security
Thank you