

Beyond the Tap: The Value of Alternative Water Sources for Climate Adaptation

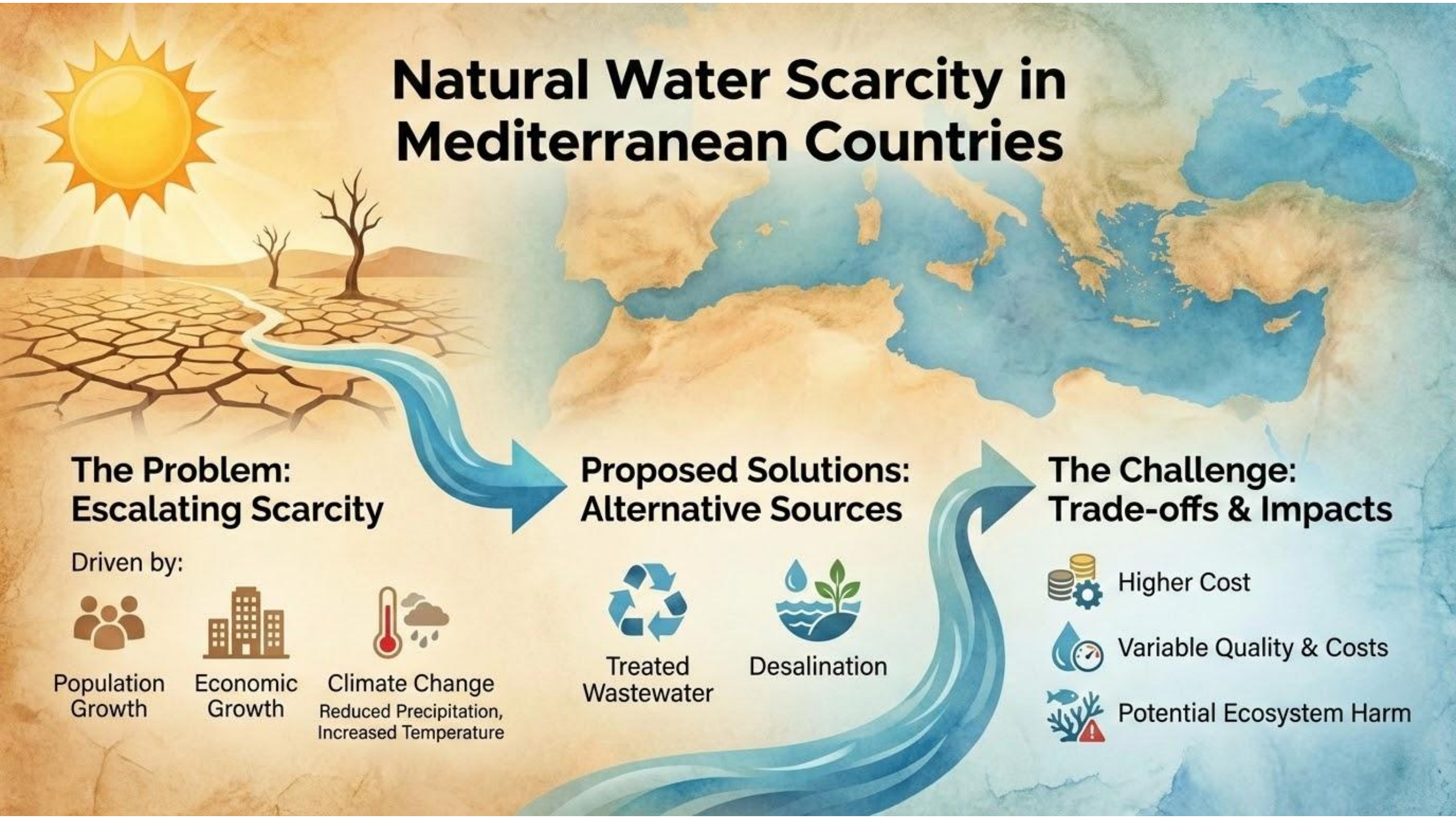
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Natural Water Scarcity in Mediterranean Countries



The Problem: Escalating Scarcity

Driven by:



Population Growth



Economic Growth



Climate Change
Reduced Precipitation,
Increased Temperature

Proposed Solutions: Alternative Sources



Treated Wastewater



Desalination

The Challenge: Trade-offs & Impacts



Higher Cost



Variable Quality & Costs



Potential Ecosystem Harm

Why This Study?

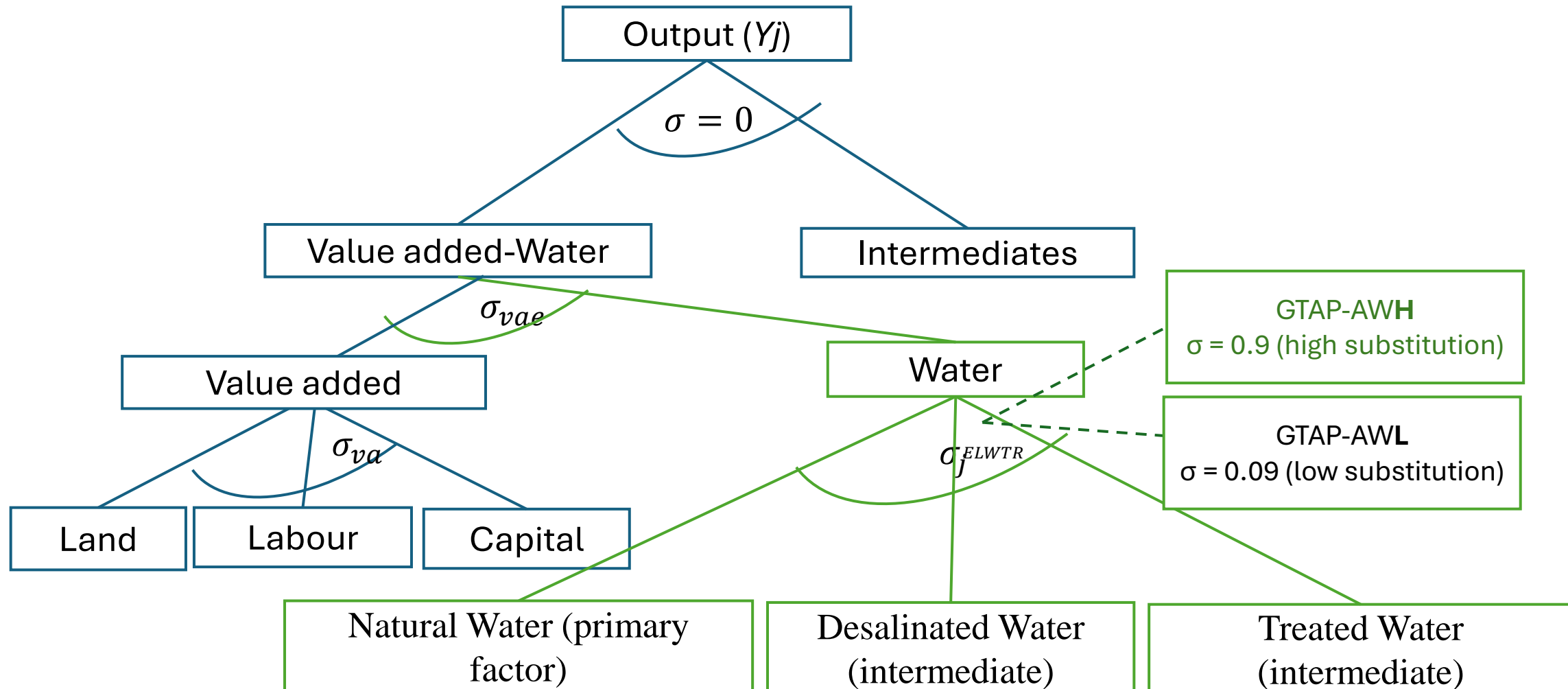
The Problem

- Population & income growth raise water demand
- Climate change intensifies natural water scarcity
- Mediterranean hardest hit: fastest warming region
- Water rarely integrated in climate policy
- Cross-sector economic impacts underestimated

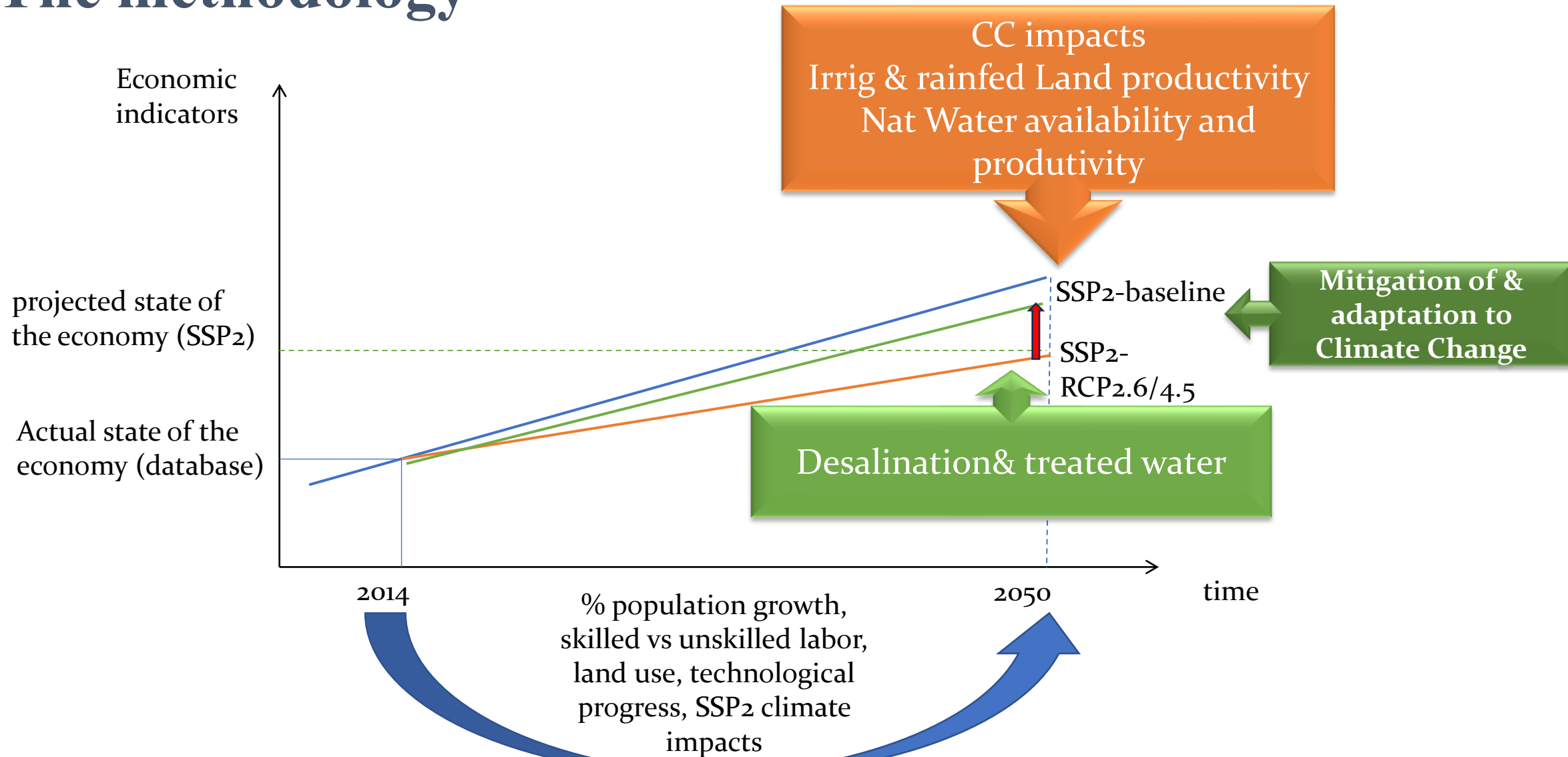
Our Contribution

- First global Computable General Equilibrium (CGE) model with explicit natural water + alternative water sources
- Models desalination & treated wastewater as economic sectors
- Captures agriculture, energy & international trade spillovers
- Focus on 11 Mediterranean Sea Basin countries within a global model (21 regions)
- Scenario: SSP2–RCP4.5 (most likely near-term trajectory)

Production Structure of the GTAP-AW model

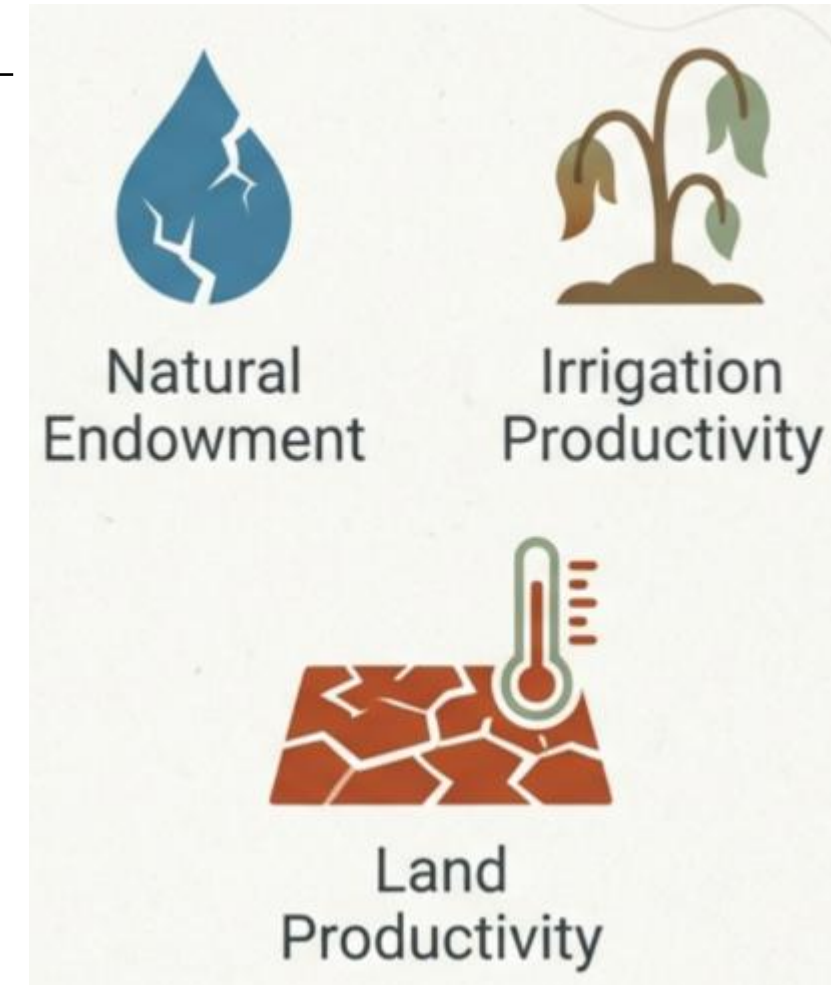


The methodology



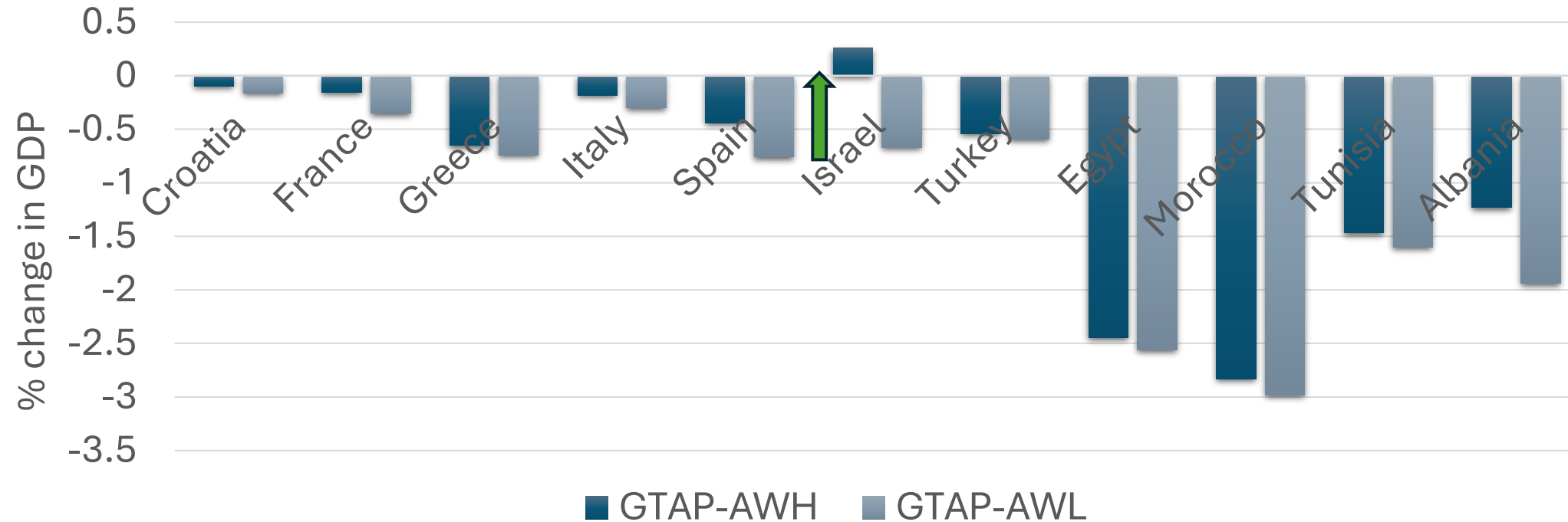
MODELING THE CLIMATE SHOCK (SSP2-RCP4.5) (% change vs 2014 baseline):

Country	Water availability	Water productivity in irrigation	Productivity of irrigated land	Productivity of rainfed land
Croatia	-9.91%	-19.57%	8.97%	8.74%
France	-11.96%	-19%	3.24%	0.28%
Greece	-20.18%	-11.58%	1.17%	3.71%
Italy	-12.32%	-16.27%	0.23%	-1.56%
Spain	-20.96%	-11.55%	-1.72%	-5.53%
Israel	-20.28%	-9.74%	0.44%	-0.7%
Turkey	-15.03%	-8.39%	2.37%	8.62%
Egypt	-1.89%	-4.04%	-1.4%	-12.51%
Morocco	-31.34%	-5.96%	2.17%	-7.99%
Tunisia	-26.20%	-7.9%	2.82%	-2.85%
Ethiopia	1.90%	-3.16%	2.35%	9.13%
Albania	-14.77%	-16.75%	6.46%	5.84%



Source: Burek et al. (2016); Fischer et al. (2021) — 5 GCMs × 3 GHMs ensemble average

The difference in percent change of GDP in 2050 in the SSP2-RCP4.5 scenario vs. the SSP2-Baseline by the GTAP-AW model version.



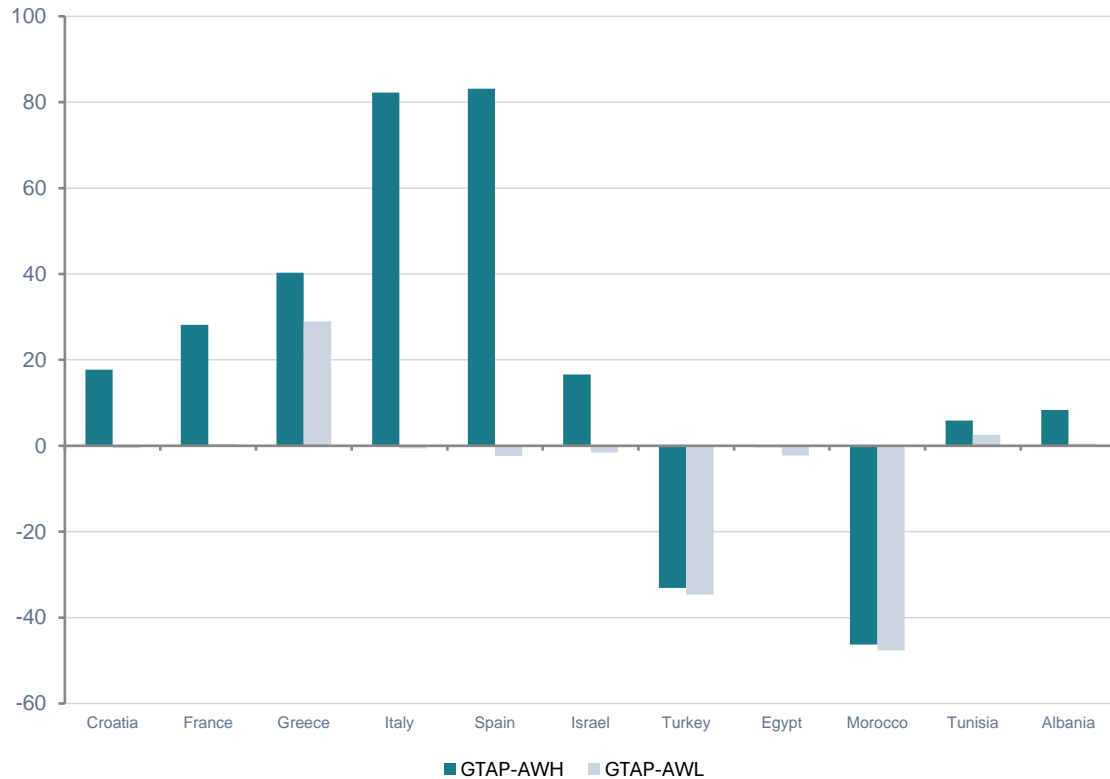
Main result: Alternative water availability systematically reduces GDP losses across Mediterranean countries.

Gains arise not because desalination and treated wastewater are cheap, but because they relax a binding natural water constraint.

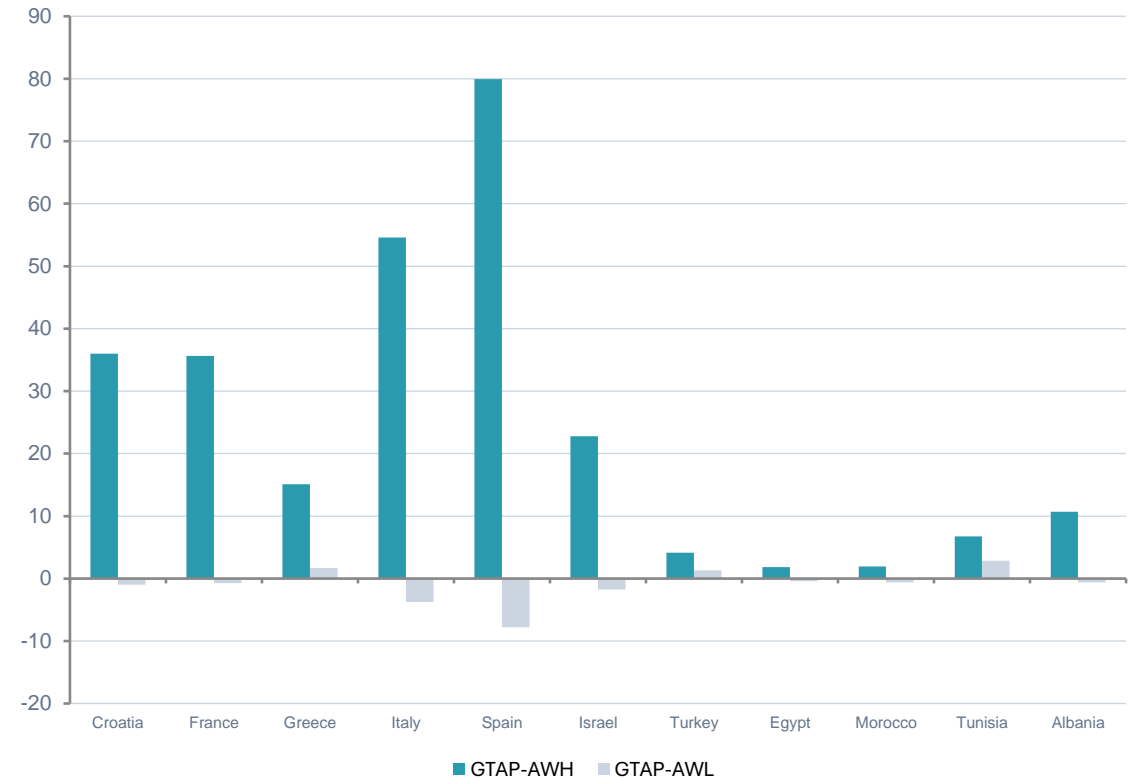
Mediterranean Countries Ramp Up Alternative Water

% change in sector output under SSP2–RCP4.5 vs baseline — GTAP-AWH vs AWL

Desalination Output



Treated Wastewater Output

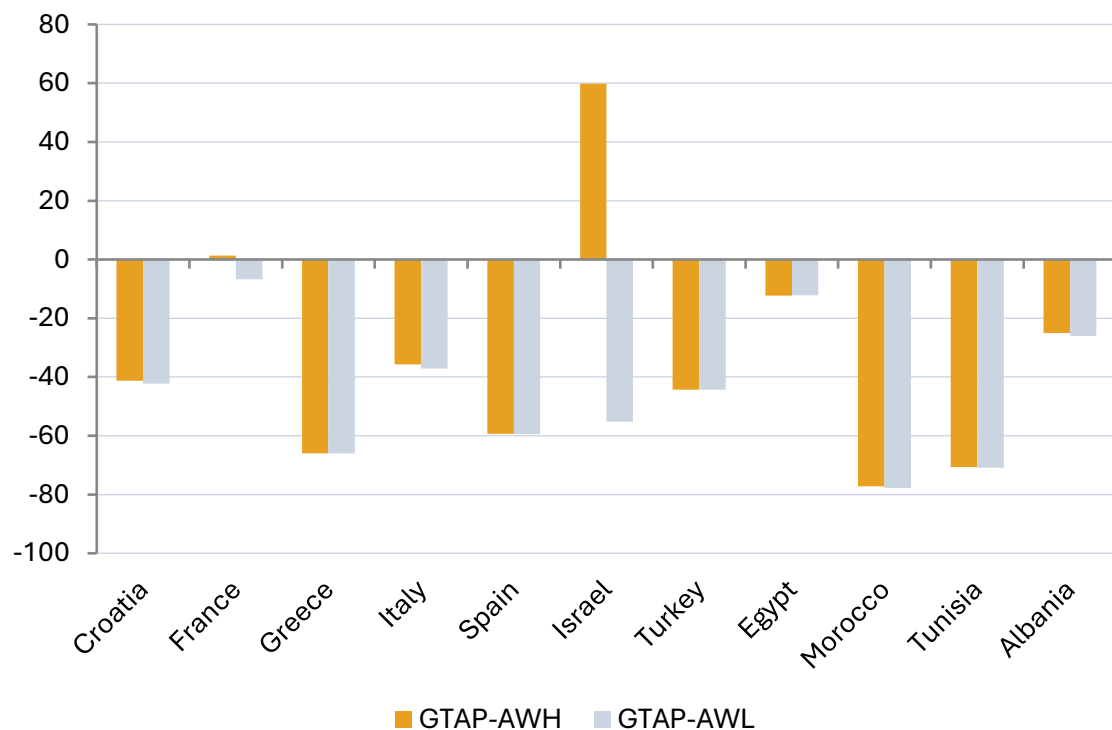


Italy & Spain: ~80% jump in desalination · Israel: largest change in absolute terms (already high baseline)

Agriculture: Mixed Gains

% change in sector output vs baseline (SSP2–RCP4.5)

Irrigated Agriculture



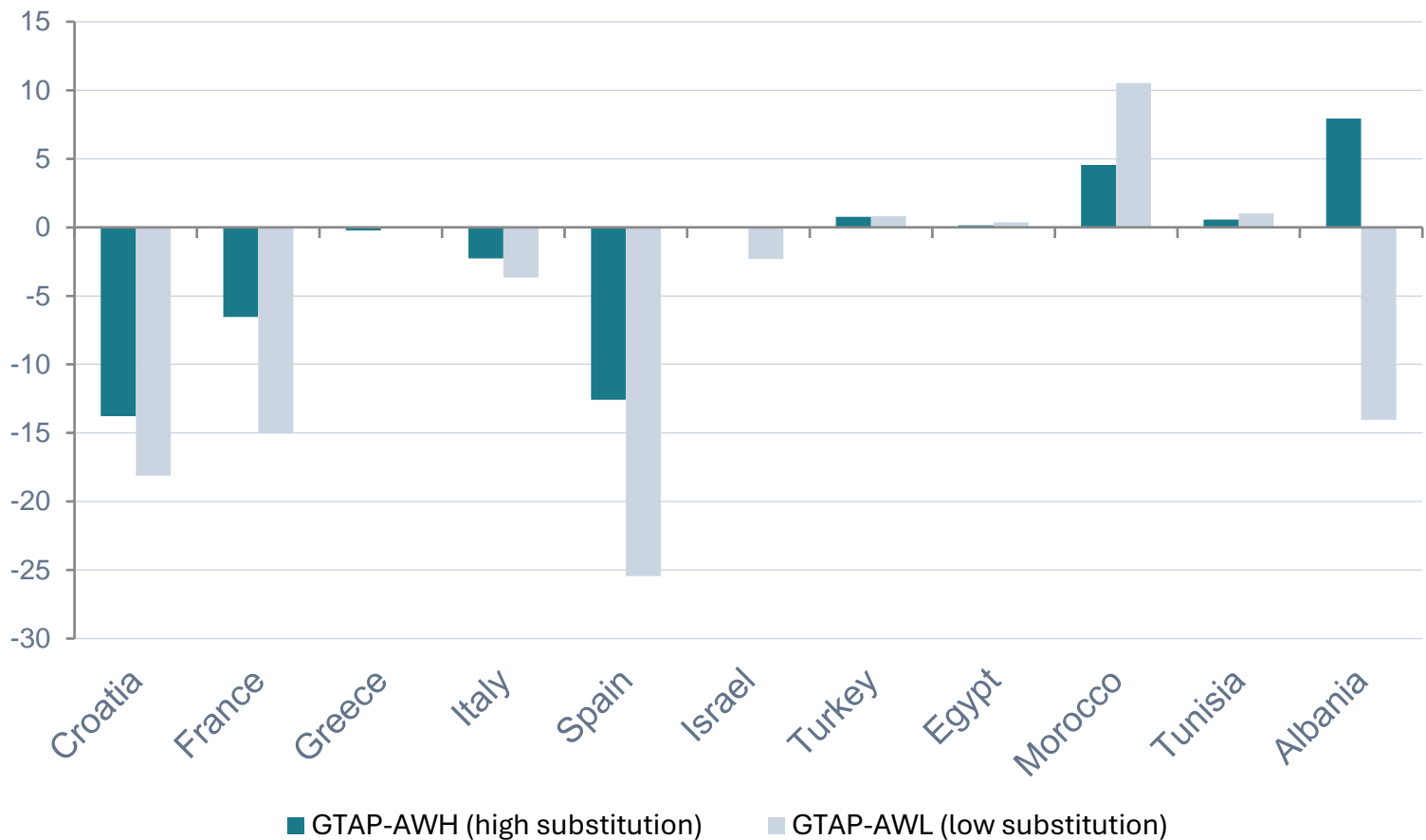
Rainfed Agriculture



Key insight: Israel & France reverse irrigated agric losses into gains. Rainfed farming benefits less — alternative water frees irrigated supply, reducing substitution pressure on rainfed.

Energy: carries much of the economy-wide gain

% change in electricity output vs baseline (SSP2–RCP4.5)



Why Energy?

- Water scarcity constrains hydropower & thermal cooling
- Alt. water releases natural water for energy related uses
- Albania (99% hydro): large recovery with AWH
- Not direct use of desalinated water — reallocation effect
- Energy sector = highest marginal value water use

Key Findings

1

GDP Protection

Alternative water sources consistently reduce climate-induced GDP losses across all Mediterranean countries. Israel: climate loss turns to gain (+0.26% vs -0.67%). Spain & France losses nearly halved.

2

Energy Sector is the Biggest Beneficiary

Water reallocation frees natural water for higher-value energy uses (than agriculture).

3

Substitution Elasticity Matters

The gap between AWH and AWL models reveals the economic stakes of alternative water technologies: higher substitutability = significantly better economic outcomes.

4

Global Spillovers Are Real

Water scarcity alters comparative advantage in agriculture & energy trade. Effects cascade beyond national borders.

Take-Home

Water policy IS climate policy.

Ignoring water in NDCs and climate strategies means leaving resilience on the table.

Alternative water is an economy-wide multiplier.

Its benefits flow from agriculture to energy to GDP — the full picture requires a CGE lens.

The water–energy nexus is the critical link.

Energy sector gains from water reallocation often exceed agricultural gains in water-stressed economies.

Substitution technology unlocks resilience.

Higher elasticity of substitution between water types = dramatically better economic outcomes under climate change. This substitution requires infrastructure that takes years to plan and build. It should start now