



**Presenter's Name:** Jihane BRIJI  
**Author's Name(s):** Jihane BRIJI, Abdelouahab MAAROUF  
**Research Title:** Impact of Water Management Policy on Water Stress under Climate Change: The Case of Morocco – A Synthetic Control Approach  
**Institution:** Faculty of Legal, Economic and Social Sciences of Agdal, Mohamed V University, Morocco  
**Email Address:** Jihane\_briji@um5.ac.ma



## Introduction

Morocco is facing mounting and multidimensional challenges in water availability and management due to the combined pressures of climate change, rapid demographic growth, and expanding economic activities. Renewable freshwater resources are estimated at around 22 billion m<sup>3</sup> per year, consisting of approximately 18 billion m<sup>3</sup> of surface water and 4 billion m<sup>3</sup> of groundwater, yet these volumes are increasingly insufficient to meet national needs.

Over the past six decades, the country has experienced a dramatic decline in per-capita renewable water availability, dropping from about 2 560 m<sup>3</sup>/person/year in 1960 to roughly 620 m<sup>3</sup> today. This sharp reduction places Morocco well below the international threshold of water stress (1 000 m<sup>3</sup>/year) and dangerously close to the threshold of absolute water scarcity (500 m<sup>3</sup>/year).

In parallel, Morocco has experienced recurrent and severe rainfall deficits, which have directly affected its hydraulic infrastructure. National dam-reservoir storage levels have steadily decreased, reaching an average of 34 % of capacity in mid-2025, one of the lowest levels recorded in recent decades. These hydro-climatic trends, combined with rising urban, agricultural and industrial water demands, indicate a structural rather than temporary deterioration of water security.

Taken together, these figures highlight a clear shift from episodic water shortages to chronic and systemic water stress, signalling the erosion of the country's traditional water-availability buffer. This context underscores the urgency of strengthening demand-management strategies and accelerating the adoption of more resilient and adaptive water-policy instruments. It is within this framework that the present study evaluates the effectiveness of the post-2000 water-policy interventions, examining their influence on national water-stress levels under conditions of heightened climate variability.

## Methodology

This study evaluates the impact of Morocco's water-demand management policies using the Synthetic Control Method (SCM), a technique that constructs a data-driven counterfactual to estimate what Morocco's water-stress trajectory would have been in the absence of the 2000 reforms. The analysis spans 1990–2020, with 2000 defined as the treatment year marking the implementation of major national water-policy measures.

The outcome variable is the level of water stress, reflecting the pressure exerted by water withdrawals relative to available renewable freshwater resources. The treatment variable is a composite index combining renewable freshwater resources per capita and annual freshwater withdrawals, which captures both the supply constraints and the intensity of water demand.

To ensure a credible estimation of the policy's effect, the model integrates key control variables—namely temperature anomalies, precipitation variations, and population growth rate—in order to account for climatic variability and demographic pressures that could independently influence water stress.

These controls help isolate the net effect of policy interventions from climate-induced or demographic shifts.

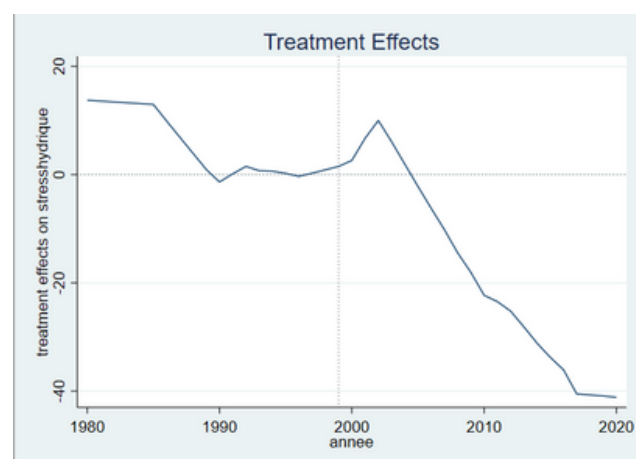
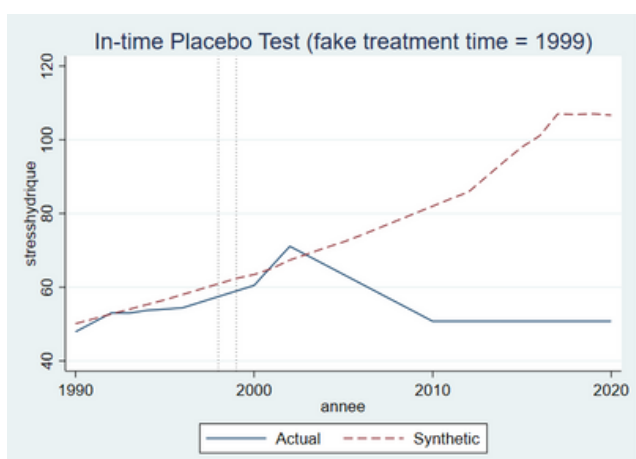
The donor pool is composed of Mediterranean countries sharing similar climatic and hydrological conditions. This group provides the basis for constructing a synthetic Morocco whose pre-2000 water-stress pattern closely matches the observed data, allowing for a meaningful comparison in the post-intervention period.

## Results and discussion

The pre-2000 fit is strong (RMSE = 0.83; R<sup>2</sup> = 0.89), confirming the validity of the synthetic control.

After 2000, Morocco shows a persistent 19% reduction in water stress relative to its synthetic counterpart, a result reinforced by donor-exclusion and placebo robustness tests.

Treated Unit	:	MOROCCO	Treatment Time	:	2000
Number of Control Units	=	13	Root Mean Squared Error	=	0.82986
Number of Covariates	=	4	R-squared	=	0.89132



Figures generated by the author using the Synthetic Control Method in Stata

[ Caption ] Observed vs. synthetic water stress levels: the divergence after 2000 highlights the policy impact.

## Conclusions and Recommendations

The empirical analysis demonstrates that Morocco's 2000 water-demand management policies have generated a substantial and sustained reduction in national water stress, as evidenced by the widening gap between Morocco's trajectory and that of its synthetic control. This divergence becomes even more pronounced during years of severe drought, highlighting the effectiveness of these policies in enhancing the country's resilience to climatic shocks and improving its adaptive capacity in a context of increasing hydrological variability.

These results underscore the critical role of demand-management instruments, including efficiency-oriented measures, improved allocation mechanisms, and conservation incentives. They also emphasize the necessity of reinforcing policy efforts through the expansion of non-conventional water resources—such as desalination, wastewater reuse, and groundwater recharge—to secure long-term water availability.

Overall, the study provides robust causal evidence supporting Morocco's strategic shift in water governance since 2000. It offers valuable insights for policymakers in Morocco and other water-stressed regions seeking to design integrated, climate-resilient water-management strategies capable of addressing current and future scarcity challenges.



## Acknowledgement

I gratefully acknowledge the support of my supervisors and colleagues who contributed valuable feedback throughout this research process. I also thank the institutions that provided the data used in this study, including the World Bank, FAO AQUASTAT, and the Climate Knowledge Portal. My appreciation extends to the organizers of this event for offering an opportunity to present and discuss this work. Any remaining errors are my own.