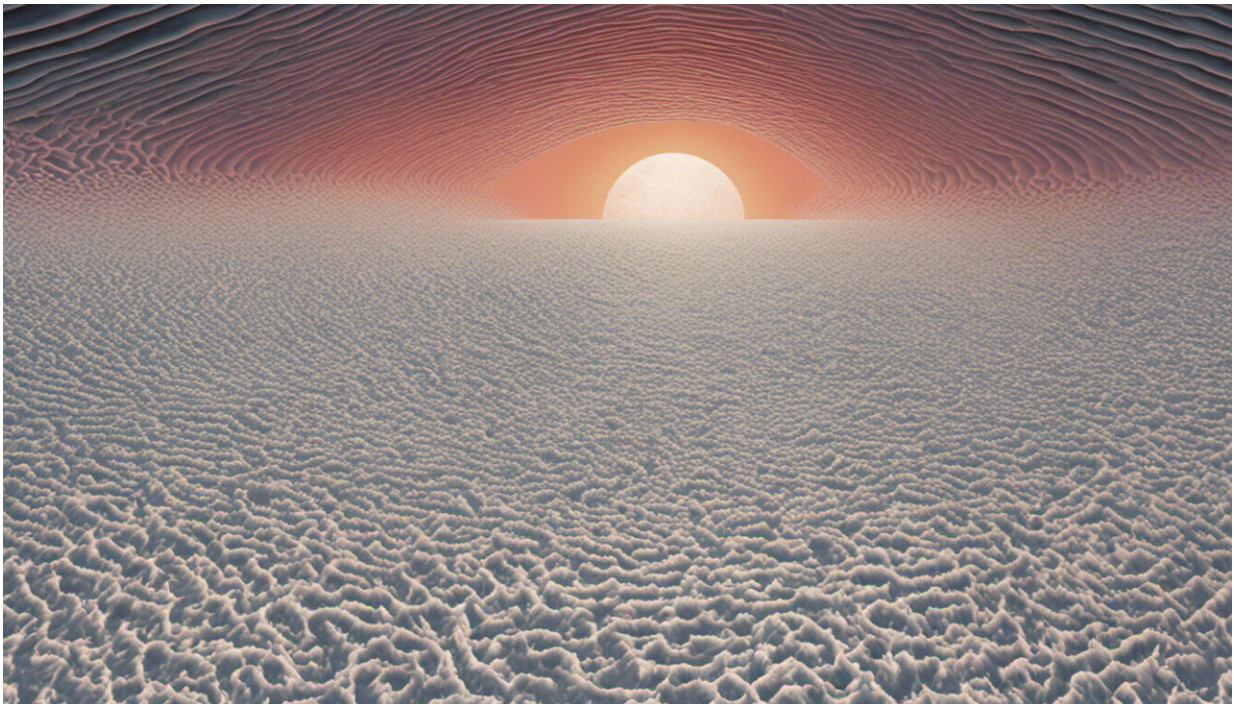


Researchers apply experimental economics to Mexican water scarcity

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Ariel Dinar considers himself transformed.

Prior to joining the University of California, Riverside as a professor of [environmental economics](#) and policy, Dinar spent 15 years working for the World Bank, where he spearheaded research and policy interventions

related to water management and climate change.

Yet over the past 10 years, he has increasingly gravitated toward a new strategy for testing the efficacy of environmental policy options: experimental economics.

Training his sights on Mexico, Dinar sought approaches to address the country's severely depleted aquifers, one of the consequences of a pervasive national electricity subsidy given in the early 1990s to farmers pumping groundwater for agricultural irrigation.

"In the case of Mexico, a tariff granting an electricity subsidy to farmers was implemented after the signing of NAFTA, or the North American Free Trade Agreement, between Mexico, the United States, and Canada," Dinar said.

"At the time, the Mexican government felt Mexican farmers wouldn't be able to compete in the free market because their farms tend to be smaller and they have access to less advanced technology," he added.

"Therefore, by providing Mexican farmers with a subsidy, the government thought it'd be able to help them compete more efficiently."

The tariff gave farmers a volumetric subsidy per unit of electricity consumed to pump groundwater for irrigation. But, Dinar explained, it quickly proved inequitable; large-scale farmers used more water, thus benefiting unfairly from the subsidy.

"The distribution was skewed," Dinar said, resulting in an unsustainable system that led to 101 of the country's 188 major aquifers being exploited to the point of overdraft. The tariff, he added, remains a salient example of a perverse policy, or a policy that fails to achieve its intended consequences and instead creates damage.

Reform is essential for water conservation, but making that reform strong enough to weather the inevitable political pushback from Mexico's agricultural sector requires a creative approach.

With that in mind, Dinar proposed and tested three potential policy interventions aimed to address the negative consequences of the electricity subsidy.

Joining him were two colleagues: Amnon Rapoport, distinguished professor of management in the School of Business Administration, and Edgar Tellez Foster, a senior environmental engineer at Chino Basin Watermaster who received his doctorate in environmental and natural resource economics and policy at UCR.

They first presented the reform tracks to UCR undergraduate students in a laboratory setting, publishing their findings in the *Journal of Behavioral and Experimental Economics* in June 2017.

The researchers then verified the results of the lab study by conducting a field experiment with 84 farmers from León in the Mexican state of Guanajuato, the results of which were published online last week in the *Journal of Behavioral Economics for Policy*.

Both experiments used a digital model to test a set of three policy interventions: the outright elimination of the subsidy, reduction of the subsidy's level, and a process called decoupling.

"With decoupling, we approached participants and told them: 'Suppose we have an account of how much money you received in subsidies over the years. Let's make a deal: From now on, you're not going to get a subsidy. You'll be paying the real price of electricity used to pump groundwater, but at the end of the year we're going to compensate you fully for the average of the annual subsidy sum you received over a

period of several years," Dinar said, likening the process to a system of delayed gratification.

"We wanted to see whether behavior would change, leading to eventual increased conservation of water via reduced pumping and the preservation of the aquifers for future generations," he added.

To assist with coordinating both studies, Dinar and Rapoport depended on Tellez Foster, a former exchange student from the National Autonomous University of Mexico who first came to UCR in 2009.

"I used to teach 'Introduction to Environmental Economics' at UCR," Dinar said. "Edgar would come to every class and sit right in front, raising his hand and answering questions. I knew I had to talk to him and figure out a way to work together."

A Mexico City native, Tellez Foster said many of Mexico's water issues stem from the disparity between where most of the country's water is located and where most of its economic activity occurs.

"The southern part of Mexico has a lot of water, but only about 10 percent of the country's economic activity occurs there," he said. "Most people live in the northern part of the country, which is a lot drier, so they rely on groundwater, which has become a source of a lot of problems."

Tellez Foster noted the clear difference between the two pools of participants—farmers were likely to have more awareness of, and personal interest in, the impacts of Mexican groundwater subsidies—but emphasized both pools were placed in identical simulations by the researchers.

After being divided into smaller groups of six, participants were asked to

digitally "withdraw" groundwater from a shared aquifer under the conditions of elimination, reduction, and decoupling.

The researchers found all three [policy interventions](#) (elimination, reduction, and decoupling) had positive implications for conservation, with both pools of participants opting to withdraw less water.

Elimination of the [subsidy](#) resulted in the largest reduction in requests for groundwater, although decoupling presented similar effects and, if implemented, could better shield reform efforts from political pushback, the researchers posited.

Comparing the behavioral patterns of students and farmers, Dinar said the two groups demonstrated similar trends but students quickly recognized the potential for "freeriding."

"If someone in the group pumped more than the average consistently, then that student was freeriding," Tellez Foster said. "We found students demonstrated freeriding more than [farmers](#); still, the experiment tells us that overall, there's willingness to cooperate within groups."

Going forward, Dinar plans to apply a similar experimental model to solve complex water management challenges in places like Spain and basins of Southeast Asia.

As for Tellez Foster? He now teaches "Introduction to Environmental Economics" at UCR.

"Things have really come full circle," he said. "I took 'Introduction to Environmental Economics' with Professor Dinar as an exchange student, and now I'm in my third year teaching it as the course lecturer. It's an introductory class, so it's not too heavy on theory, which gives me the opportunity show students how current events relate to what we're

studying."

More information: Edgar Tellez Foster et al. Groundwater and electricity consumption under alternative subsidies: Evidence from laboratory experiments, *Journal of Behavioral and Experimental Economics* (2017). [DOI: 10.1016/j.socec.2017.03.003](https://doi.org/10.1016/j.socec.2017.03.003)

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