

Dynamic pricing superior to organic waste bans in preventing climate change

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Robert Sanders, assistant professor of Marketing and Analytics at the Rady School. Sanders estimated food waste and inventories indirectly using the shelf lives, sales data and production process knowledge gained from interviews with grocery store employees. Credit: UC San Diego's Rady School of Management.

While composting and organic waste ban policies are gaining popularity

across the United States, a new study from the University of California San Diego's Rady School of Management finds dynamic pricing could be the most effective way for grocery chains to keep perishables out of landfills, reducing food waste by 21% or more.

During decomposition, organic [waste](#) releases methane, a potent greenhouse gas. Globally, [food waste](#) releases up to 10% of worldwide annual greenhouse gas emissions, which has caught the attention of lawmakers working to slow global warming. Last year, California rolled out a residential composting program and the state's legislature recently introduced a bill to reign in "sell by" dates from manufactures, which prompts consumers to needlessly throw out [food](#).

More than 10 percent of food waste comes from grocery retailers that throw out surplus perishables past their expiration date. The Rady School of Management study, to be published in *Marketing Science*, evaluates two of the most popular programs targeted at businesses and residents to divert waste from landfills: organic waste bans, which have been introduced in nine U.S. states including California and dynamic [pricing](#), which is more popular outside the U.S.

The organic waste ban in California, for example, requires businesses generating at least two cubic yards of waste to recycle their organic waste by composting or donation. Aside from diverting waste away from landfills, policymakers hope that the higher disposal costs incentivize business to directly reduce waste—rather than just divert it away from landfills—much like a waste tax would do.

Dynamic pricing, on the other hand, spurs retailers to throw less food out to begin with by applying an algorithm that determines when [grocery stores](#) should reduce the price of perishables depending on their inventory and expiration date. With dynamic pricing, vendors can change the price of food multiple times a day, compared to static pricing

in which products have the same price all day, typically from the moment they arrive on the shelf until they expire.

Dynamic pricing reduces food waste and makes healthy food more affordable

"Oddly enough, fewer than 25% of U.S. grocery retailers offer any kind of dynamic pricing at all, while most hotels and airlines will discount rooms and seats when they have a surplus," said the paper's author, Robert Sanders, an assistant professor of marketing and analytics at the Rady School. "However, this research shows that the increased price flexibility of discounting food that is about to expire significantly reduces food waste and increases profit margins among retailers."

Sanders' analysis shows that dynamic pricing reduces waste by 21% on average while increasing grocery chains' gross margins by 3%. In contrast, an organic waste ban, even if it increased the cost of sending perishables to a landfill by ten times the amount it does today, reduces waste by only 4% and decreases gross margins about 1%.

"If regulators want to directly reduce grocery-store waste, they should incentivize grocery chains to adopt dynamic pricing over imposing organic waste bans or waste taxes," Sanders said. "It is also a market-based solution that the retailers themselves could implement."

An added benefit of dynamic pricing is that it makes perishables, which are less processed and generally healthier, more affordable, slightly benefiting consumers overall. On the other hand, organic waste bans slightly harm consumers by reducing retailers' inventories, which can lead to stockouts.

Grocers create food waste because it is profitable to

do so

The paper's analysis of dynamic pricing is based on a structural [economic model](#) that characterizes a grocery retailer's behavior, as grocers have to decide how much product to order before they know how much will sell prior to hitting its expiration date. To test the predictions of the model, Sanders used data from the artisanal bread category of Pick 'n Save, a large Midwestern grocery chain.

The dataset includes product prices, quantities, product production costs, shelf lives and consumer arrivals timestamped to the nearest minute. Sanders estimated waste and inventories indirectly using the shelf lives, sales data and production process knowledge gained from interviews with store employees.

Using these [data sets](#), his descriptive analysis shows that the retailer generates high waste because it is profitable to do so: when gross [profit margins](#) are higher, the retailer stocks its shelves more fully to make sure it doesn't miss out on sales, but as a result, waste increases.

Sanders then compared the impacts of dynamic pricing, if it were to be implemented across the Pick 'n Save grocery chain in the bread category, to those of static pricing for the same category in all 97 Pick 'n Save stores with a bakery.

"The results show that if a self-interested, profit-maximizing grocery retailer adopted [dynamic pricing](#), they could end up benefiting its own profits, its customers and society more broadly by changing its prices so that they dynamically reflect the time-varying opportunity costs of perishables," Sanders said.

The model's data was then compared to another economic model that assessed the impacts of waste bans for Pick 'n Save's bread category—if

the bans increased the price of sending organic waste to a landfill from the current cost of \$32 per ton of [organic waste](#) to \$320 per ton (equivalent to a tenfold increase in disposal costs).

Sanders increased the cost of disposing waste in the model to explore the relationship between disposal costs and the amount of waste generated.

"I find waste is very inelastic with respect to the disposal cost," he said. "Even if we dial up the disposal costs tenfold, which is unlikely and on the extreme end, we still don't see the waste reduction that policymakers might hope for."

He added, "Of course, waste bans could still be helpful if businesses comply and divert waste from the landfills, but the best and first thing to do is reduce the overall amount of waste generated to begin with. Dynamic pricing would likely lead to much larger reductions in retailer food waste."

More information: Dynamic Pricing and Organic Waste Bans: A Study of Grocery Retailers' Incentives to Reduce Food Waste, *Marketing Science* (2023).

Provided by University of California - San Diego

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