Reducing Waste, Changing Habits: The Effect of U.S. Organics Diversion Programs on Food Purchases

1 Introduction

Food waste accounts for 21.6% of the material in U.S. municipal landfills (Environment America, 2021) and approximately 8% of global greenhouse gas (GHG) emissions. Food waste in solid waste landfills decomposes quickly, contributing to 58% of the fugitive methane emissions released into the atmosphere (EPA, 2023). It generates more methane emissions than any other landfilled material, making it a target for rapid source of methane reductions.

Diverting food waste from landfills (largely) eliminates those emissions because proper composting generates minimal GHG emissions. In the U.S., diversion of food waste and yard trimmings from landfills with composting programs have become increasingly common, experiencing significant growth over the two past decades. In 2005, fewer than 50 U.S. communities offered curbside food waste collection, where households place bins at the curb for pickup. As of 2023, 710 communities and 14.9 million households had access to these programs, a 49% increase in household access from 2021 to 2023 (BioCycle, 2023).

Active management of food waste into a separate vessel is likely to increase household awareness of food waste, resulting in a change in food purchases. It is not unclear whether this will result in decreased or increased household food purchases. A household might cut down their food purchases in realization of unutilized food, or they could increase their food purchases if they perceive their food waste, now inflicting lessened environmental damage, has a lower environmental cost thereby making the social cost of their waste lower.

This paper examines the impact of curbside organics diversion programs implemented in various cities on household food purchases.Our findings indicate that voluntary curbside organics programs increase household food expenditures by $3.02 per month, while mandatory programs add an additional $5.52 per month to this increase. Overall, the full impact of mandatory programs on household food expenditures amounts to $8.54 per month, representing 13.4% of the average household's monthly food spending.

2 Methodology and Data

Our analysis focuses on 297 cities with populations exceeding 100,000, examining two main curbside organics diversion programs: mandatory, which requires residents to separate organics from waste, and voluntary, which offers curbside food waste pickup without the obligation to separate organics. The mandatory programs included San Francisco (CA, Oct 2009) and Seattle (WA, Jan 2015), and voluntary programs were conducted in Berkeley (CA, Jan 2007), Costa Mesa Sanitary District (CA, July 2015), Minneapolis (MN, April 2015), Portland (OR, Oct 2011), and San Antonio (TX, Jan 2016).

This study uses NielsenIQ Consumer Panel Data from the Kilts Center at the Booth School of Business at the University of Chicago, spanning January 2004 to February 2020,

before the massive shutdowns due to COVID-19. The dataset consists of a longitudinal panel consisting of 40,000 to 60,000 households, tracking both unit and dollar purchases at the UPC level for each household during each shopping trip. We aggregate to the household-city-year-month level. To examine the impact of curbside composting programs on food purchases, we first estimate a Difference-in-Difference (DiD) model:

$$Y_{ict} = \alpha + \beta_1 Mandate_{ct} + \beta_2 Voluntary_{ct} + X_{ict} + \gamma_i + \theta_t + \epsilon_{ict}, \quad (1)$$

where the dependent variable was the dollar amount of food items accepted by curbside programs – fresh produce, dairy, meat, and deli items – both separately and in total, for household i, residing in city c in year-month t. The variables $Mandate_{ct}$ and $Voluntary_{ct}$ are binary indicators for whether the city c has implemented a mandatory/voluntary organics program by year-month t. Household characteristics, X_{ict}, include race, Hispanic origins, presence of children, heads' highest education attainment, household income level, and household size. γ_i and θ_t indicate household and year-month fixed effects, respectively. Standard errors are clustered at the city level.

Given the variation in policy adoption timing across cities and concerns about biased estimates arising from previously treated units serving as controls for later-treated ones (Goodman-Bacon, 2021), we employed the method of Callaway and Sant'Anna (2021) to estimate the group-time average treatment effects of mandatory composting program in a group-time event study.

3 Preliminary Results

The DiD estimation shows that voluntary programs increase household food expenditures by $3.02 per month, including $1.4 from fresh produce and $2.24 from deli items. On top of this increase, mandatory curbside organics programs add $5.52 per month on top of the voluntary programs, with significant increase of $1.80 for fresh produce, $2.42 for dairy, and $0.41 for meat, while $0.9 increase for deli items were not significant. Overall, the full impact of mandatory programs on household food expenditures amounts to $8.54 per month, representing 13.4% of the average household's monthly food spending. The group-time average treatment effects aligned with the DiD estimates, and the parallel trend assumption was validated through the event study design. The environmental gains are somewhat offset by the increased food demand. These unintended effects provide valuable insights for future policymaking.

References

BioCycle. (2023, September). BioCycle Nationwide Survey: Residential Food Waste Collection Access In The U.S. Retrieved January 17, 2025, from https://www.biocycle.net/residential-food-waste-collection-access-in-u-s/

Callaway, B., & Sant'Anna, P. H. C. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics*, *225*(2), 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001

Environment America. (2021, September). *Trash in America: Moving from destructive consumption towards a zero-waste system* (tech. rep.). Retrieved January 9, 2025, from https://environmentamerica.org/center/resources/trash-in-america-2/

EPA. (2023, October). Quantifying Methane Emissions from Landfilled Food Waste. Retrieved January 9, 2025, from https://www.epa.gov/land-research/quantifying-methane-emissions-landfilled-food-waste

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*(2), 254–277. https://doi.org/10.1016/j.jeconom.2021.03.014