Effects of Grocery Bag Regulations on Grocery Sales and Shopping Behaviors:

Evidence of Natural Experiments in the United States

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Objectives

To estimate the effect of grocery-bag regulations on the sales of plastic garbage bags to determine the perverse impacts of these regulations.

Introduction

Widespread regulations of using disposable grocery bags have emerged around the world in recent years (Clapp & Swanston, 2009). Welfare gains of disposable bag policies could be overstated if people ignore potential increases in unregulated plastic bag consumption. Taylor (2019) shows that the banning of plastic carryout bags leads to a decrease in 50 million pounds of plastic carryout bags following an offset of a 12-million-pound increase in trash bag purchases.

This study delves deeper into the effects of plastic bag regulations in Washington D.C., Montgomery County (MD), San Luis Obispo County (CA), and Santa Clara County (CA). The geographical illustration of study areas is shown in Figure 1, and their plastic bag regulations are summarized in Table 1.
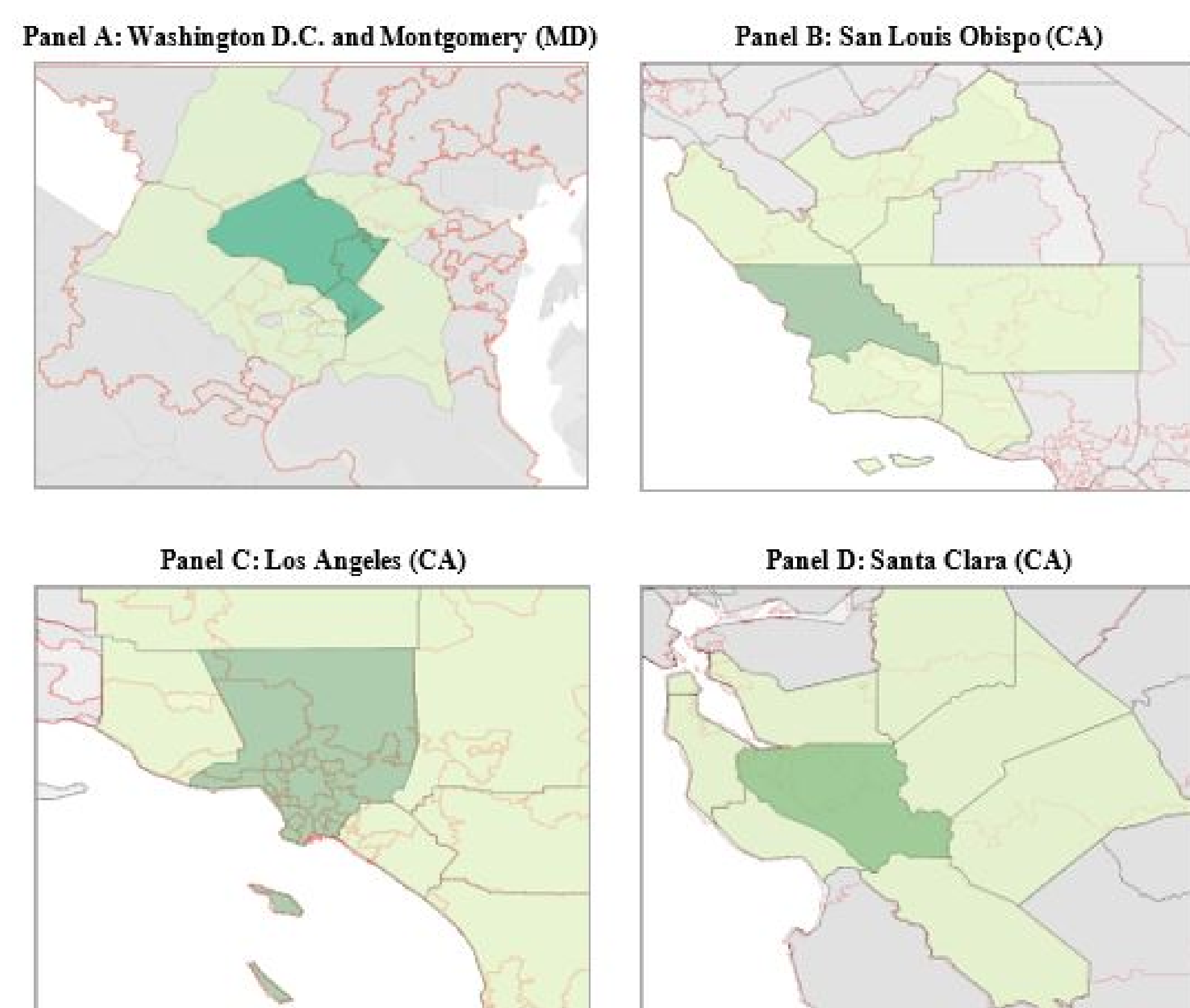

Figure 1:Geographical illustration of study areas

Table 1:Regulations on bags in the study areas

Policy type	County (State)	Effective year
$0.05 for paper and plastic bags	Washington D.C.	January 1, 2010
$0.05 for paper and plastic bags	Montgomery County (MD)	January 1, 2012
$0.10 for paper bags + plastic bag ban	San Luis Obispo County (CA)	October 1, 2012
$0.15 for paper bags + plastic bag ban	Santa Clara County (CA)	January 1, 2012

Data

The study period is from 2006 to 2014. The primary data sources of this study are Nielsen retail scanner data, county-level household income data from Internal Revenue Service, and population density data from U.S. Census Bureau (Table 2).

Table 2:Data sources

Data	Duration	Source
Retail scanner data	2006-2014	Nielsen
Adjusted gross income	1989-2016	Internal Revenue Service
Population density	2000-2018	U.S. Census Bureau

Identification Strategy

This study applies a generalized synthetic control method (GSCM) (Xu, 2017) to estimate changes in the sales of different types of trash bags with the retail scanner and census data. The generalized synthetic control model extends the conventional synthetic control model with interactive fixed effects model and can be expressed as:

$$Y_{it} = \delta_{it} D_{it} + X'_{it}\beta + \lambda'_i f_t + u_{it} \qquad (1)$$

Y_{it}: the sales of 4-, 8-, 13-, above 13-gallon trash bags per store in county i in month t.
D_{it} equals 1 if county i has been exposed to the treatment prior to time t and equals 0 otherwise.
δ_{it} is the heterogeneous treatment effect on county i at time t.
X_{it}: a set of controls for county i at time t (unit price, household income, population density).
$f_t = [f_{1t}, ..., f_{rt}]'$ is an vector of unobserved common factors.
$\lambda_i = [\lambda_{1i}, ..., \lambda_{ir}]'$ is an vector of unknown factor loadings.
u_{it} is an idiosyncratic error term.

Results

Figure 2 shows a comparison among raw controls, synthetic control, and treated counties, indicating that sales of 4-gallon trash bags in the treated counties are higher than their synthetic controls except for Santa Clara. Due to limited space, trend plots for other types of trash bags are available by request. The average difference between treated counties and synthetic control for each type of trash bag is shown in Figure 3.
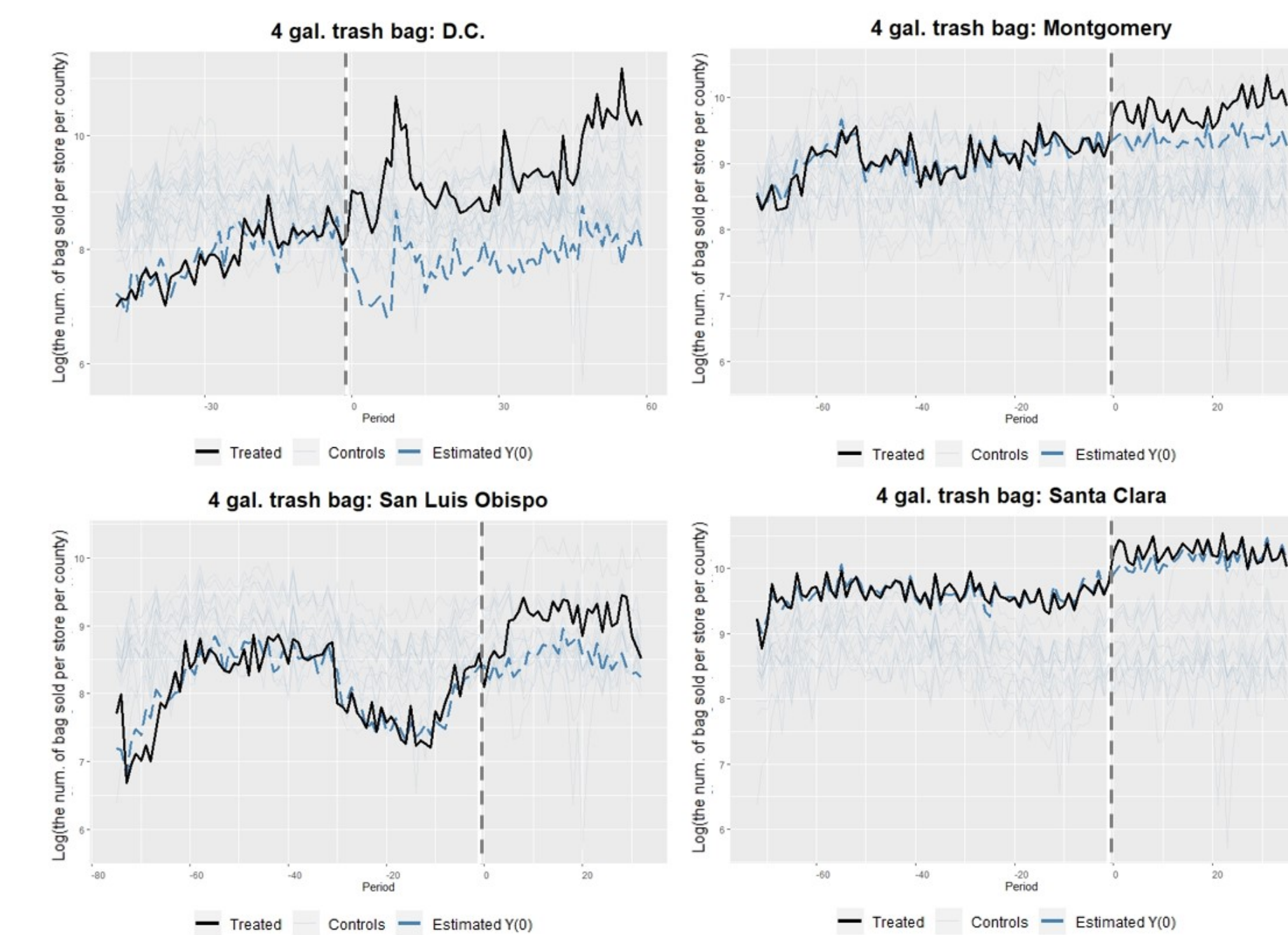

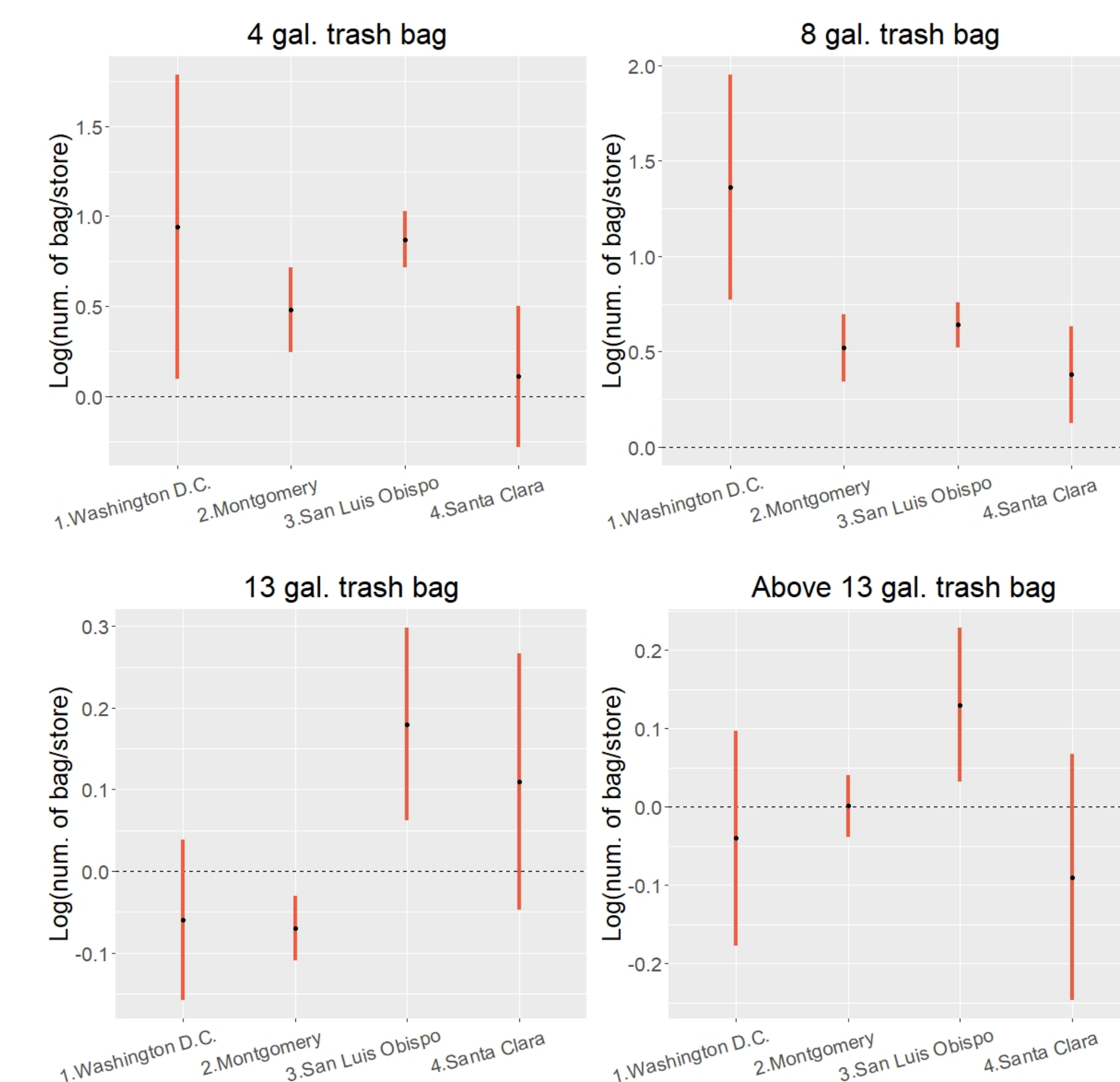Figure 2:Synthetic control trends: sales of 4-gal. trash bags

Figure 3:GSCM results for different types of trash bags

Conclusion

The result of the generalized synthetic control method shows that the grocery bag legislations significantly increase the sales of 4-gallon plastic trash bags in the area of Washington D.C. and Montgomery County (MD) by 65%, and San Luis Obispo County (CA) by 395%. The sales of 8-gallon plastic trash bags have a similar increasing effect in Washington D.C. and San Luis Obispo County (CA), but there is no same impact for the sales of 13-gallon and above 13-gallon plastic trash bags among all the study areas. The future work will focus on the policy effect on the number of grocery trips, the average expenditure per trip, and potential spatial spillover effects on grocery sales in neighboring counties.

References

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