Voluntary Information Programs and Environmental Regulation: Evidence from 'Spare the Air'

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Introduction

- Voluntary programs and environmental quality
  - Community Right-to-Know Act
  - Climate Wise
- Mostly target firms, but could be profit maximizing
- Hinge on consumer altruism → voluntarily forgo consumption despite no direct incentive

"Spare the Air" and ozone regulation

- *ozone = f (NOx, VOC, weather, solar_radiation)*
- Automobile emissions are precursors to ozone
  - 49% of Bay Area, Sacramento Valley, and San Joaquin Valley NOx from on-road mobile sources
- AQS based on "3-year average of the fourth-highest daily maximum "
- Traditional regulation: shift entire distribution of NOx, VOC
- Alternative: focus on episodic conditions
  - If forecasted ozone exceeds AQS, issue STA to encourage trip reduction
    - Widely publicized
    - Free-fare on BART since 2004
  - Trip reductions:
    - Lower ozone precursors
    - Lower ozone levels
    - Increase AQS attainment

Goal of project

- Goal 1: Impact of STA on commuting behaviors
  - Test of altruism
  - Voluntary programs and environment
- Goal 2: Impact of STA on ozone
  - 8-hour standard contested
    - Increased marginal abatement costs
    - Natural variability
    - Climate change predicts ozone increases
  - Ozone outreach programs, such as STA, may be more efficient tool
    - Implemented in Sacramento, Atlanta, Charlotte, Houston, Pittsburgh, …

Economic theory

- Individuals receive value from contribution [warm-glow, existence value]
  - Value increases with pollution
- 3 choices: drive alone, public transit, no trip
- 2 types of trips: commuting, discretionary
- Fact: ozone peaks late afternoon
- Intuitive prediction except:
  - STA signal as health risk [Neidell]
    - Most exposure from public transit
  - Free-rider issue: reduce traffic and travel time

Economic theory

- Commuting trips
  - No option to cancel trip
  - Health effects minimal

  →Contribute if warm-glow outweighs reduced travel time
- Discretionary trips
  - Option to cancel trip
  - Health effects largest during mid-day

  →Cancel over drive alone if warm-glow outweighs reduced travel time

  →Public transit if warm-glow net of health effects outweighs reduced travel time
    - Increase in public transit least likely during peak ozone period

Methodology

- Endogeneity of STAs
- Solution: regression discontinuity design (RDD)
  - $oz^f_{rt} = f\,(oz_{rt-1}, weather^f_{rt}, solrad_t) \geq trg\}$
    $trg=.081\ ppm \geq 2003,\ trg=.084\ ppm \leq 2002$
    $STA_t = 1\{oz^f_t = \max_t (oz_{rt})\}$
  - If days above trigger ≈ days below, discontinuity in transportation = effect of STA
- $y_{kt} = \beta * STA_t + \delta_0 * oz^f_t + \delta_1 * X_t + \theta_k + \mu_t + \varepsilon_{kt}$
  if $trg-\Delta \leq oz^f_t \leq trg+\Delta;\ \Delta=.01$ or $.02$ ppm
- Also diff-in-diff using *SCAQMD*
- Overall and by time of day

Data

- STAs and ozone forecasts from BAAQMD
  - June 1 to October 15
  - 2001-2004
- Traffic data from Freeway Performance Measurement System (PeMS)
  - Real-time traffic flow at 92 monitors in BAAQMD; 50 in SCAQMD
  - Aggregate 5 minute intervals to 1 hour
- BART
  - Hourly entrances for all stations
  - Free fares in 2004
- Daily pollution from CARB
- Observed and forecasted weather from NCDC

Data

year	STA=1	All obs. STA=0	+/- .02 of trigger STA=0	+/- .01 of trigger STA=0
2001	4	130	23	7
2002	7	127	32	8
2003	9	125	63	21
2004	3	131	38	8
Total	23	513	156	44

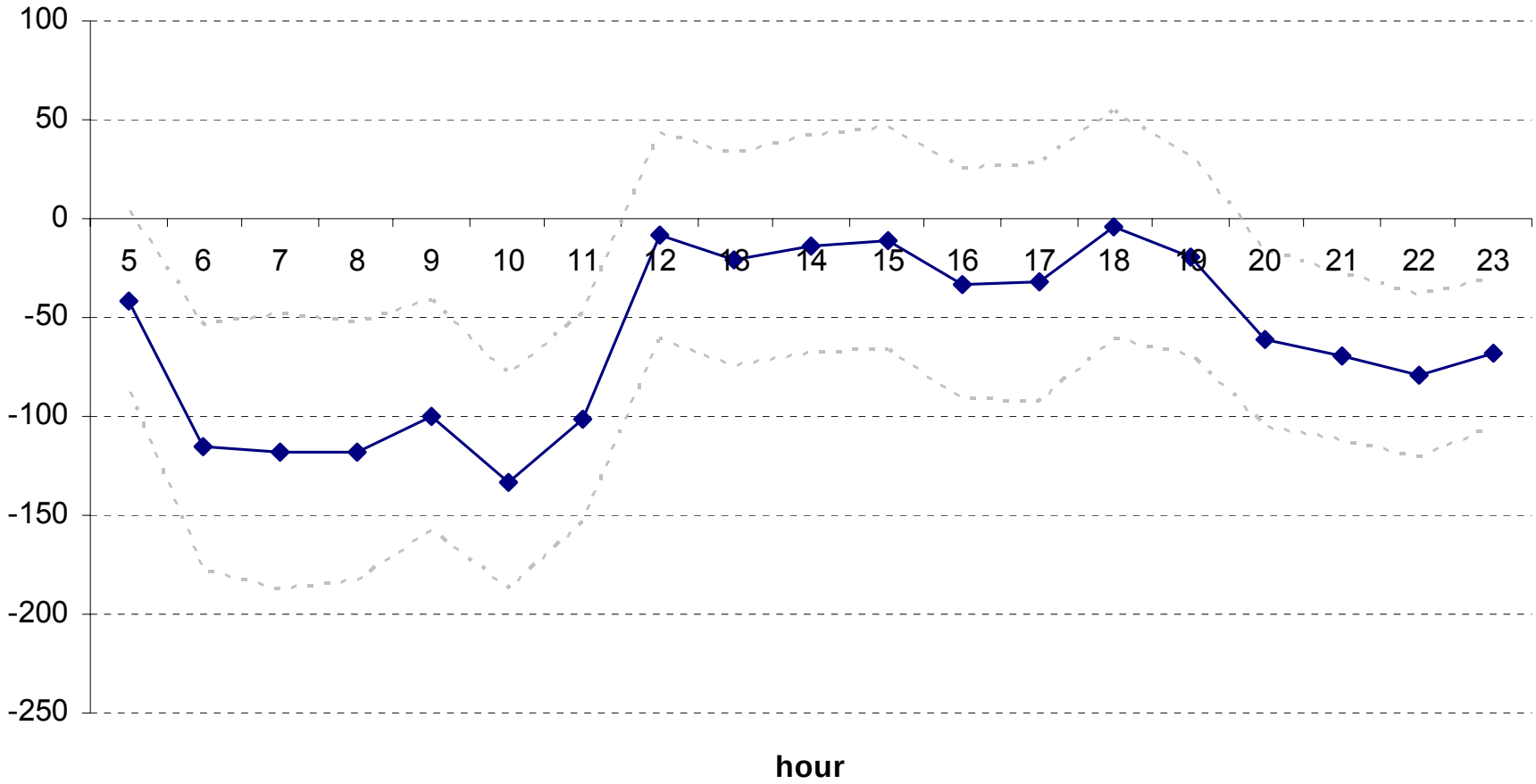
Covariate balance

	1 mean	2 All obs	3 +/- .02 of trigger	4 +/- .01 of trigger
precipitation	0.184	-0.069	0.024	0.023
max. temperature	81.92	2.115**	0.148	-0.255
precipitation (in.) (lag)	0.184	-0.096	-0.009	-0.006
max. temperature (lag)	82.015	1.733**	0.13	-0.082
forecast max. temp.	81.524	2.079**	0.286	0.262
forecast sunny	0.637	0.865**	-0.035	-0.257
forecast partly cloudy	0.326	-0.80**	0.036	0.268
holiday (lag)	0.024	0.13	0.221	-0.091
weekday	0.707	0.273	0.16	0.017

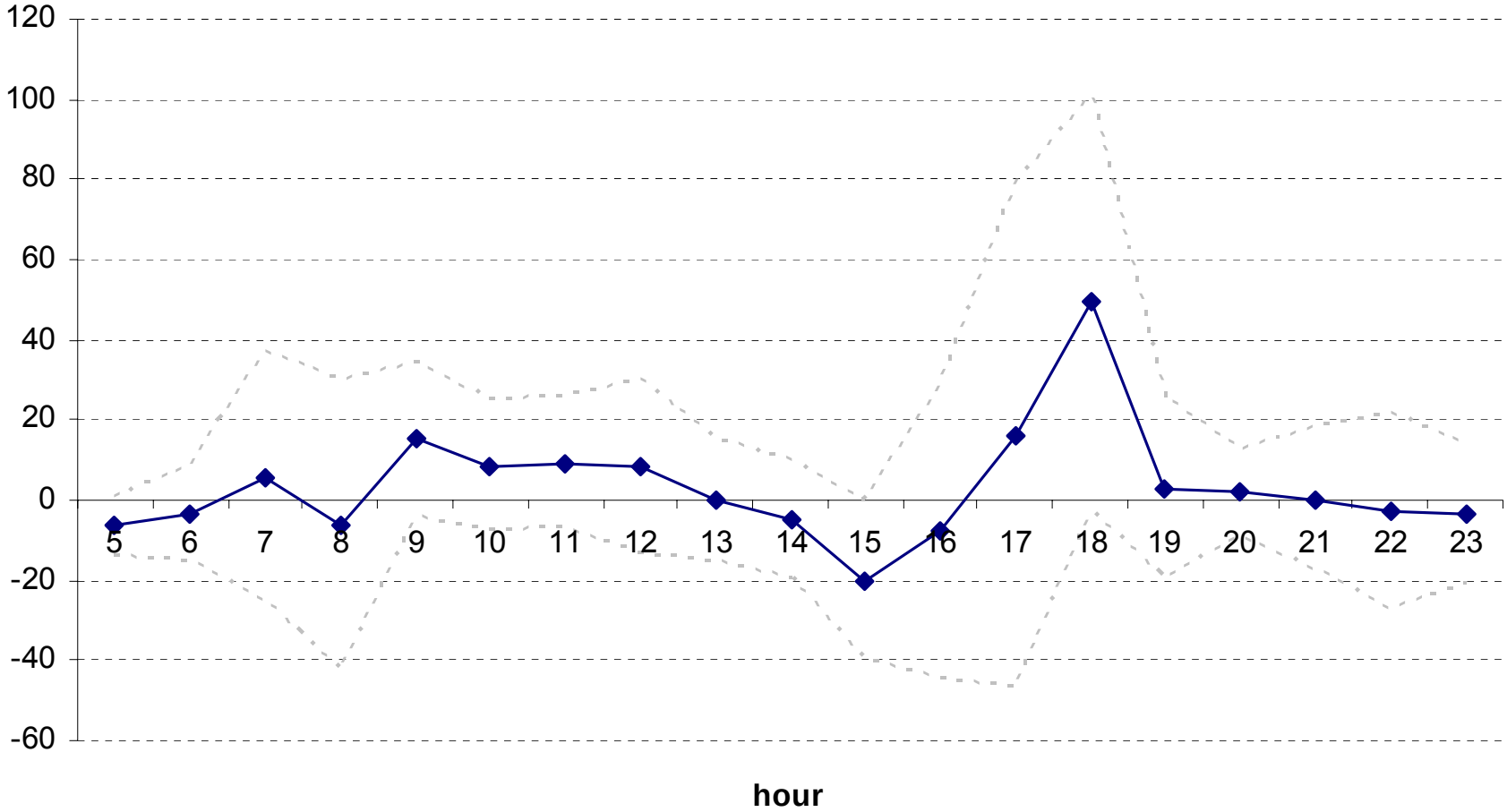
Effect of STA on all day traffic and BART

	1 all obs	2 +/- .02 of trigger	3 +/- .01 of trigger
A. Traffic			
monitor random effect	-1106.0	-2332.3**	-2001.0*
	-1.7%	-3.5%	-3.1%
monitor fixed effect	-995.2	-2111.7*	-1683.4
	-1.5%	-3.2%	-2.6%
Observations	70805	24073	8768
# of days	536	179	67
# of monitors	142	142	142
B. BART			
station random effect	34.6	40.3	29.4
	0.6%	0.7%	0.5%
station fixed effect	32.5	41.4	39.2
	0.5%	0.7%	0.6%
Observations	21391	7160	2520
# of days	536	179	67
# of stations	43	43	43

Effect of STA on Traffic by Hour (±.02 of trigger)



Effect of STA on BART by Hour (± .02 of trigger)



Effect of STA on 1-hour and 8-hour ozone

	1 all obs	2 +/- .02 of trigger	3 +/- .01 of trigger
A. 1-hour ozone			
monitor random effect	0.003*	-0.001	-0.001
	5.6%	-2.2%	-2.6%
monitor fixed effect	0.003*	-0.001	-0.002
	5.4%	-2.3%	-3.0%
Observations	6406	2139	777
# of days	536	179	65
# of monitors	12	12	12
B. 8-hour ozone			
monitor random effect	0.003*	-0.001	-0.002
	6.3%	-2.0%	-4.0%
monitor fixed effect	0.003*	-0.001	-0.002
	6.1%	-2.1%	-4.5%
Observations	6406	2139	777
# of days	536	179	67
# of monitors	12	12	12

Conclusion

- Individuals respond to STAs…

  …but not in sufficient volume
  - Impact of further outreach unclear because of counter-incentives
  - Free fare significant loss in gov't revenue, increase in complaints
  - If no effect in Bay Area, where could it work?
- Costs to consumer from switching unknown
- Generalize to other voluntary programs?