Is cap-and-trade causing more greenhouse gas emissions in disadvantaged communities?

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Abstract

There is mounting concern that market-based climate change policies may be causing disproportionately more greenhouse gas emissions near disadvantaged communities. This paper uses facility-level reported greenhouse gas emissions data to examine the environmental justice consequences of California's cap-and-trade policy, the second largest such program in the world. I do not find that this policy has led to relatively more greenhouse gas emissions in disadvantaged communities. If anything, statistically noisy evidence suggests that emissions have fallen more in disadvantaged communities since the start of the program to 2015.

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1 Introduction

Socially and economically disadvantaged individuals tend to experience more harm from environmental conditions (Mohai, Pellow and Roberts, 2009). Climate change is no exception. Recent studies on climate change impacts project considerable social and economic inequality under anthropogenic climate change, both across (Dell, Jones and Olken, 2012; Burke, Hsiang and Miguel, 2015; Dingel, Meng and Hsiang, 2018) and within (Burgess et al., 2013; Houser et al., 2015) countries. However, much less is known about how policies that mitigate climate change may themselves affect inequality. Because greenhouse gases (GHG) spread evenly around the planet and do not directly yield localized effects, the primary environmental justice concern is not about local GHG emissions per se. Rather, GHG emissions are often co-produced alongside local pollutants, such as particulates, carbon monoxide, and nitrogen oxides. Climate policies may lead to greater environmental inequality if they induce more GHG emissions near disadvantaged communities (Solomon and Lee, 2000; Kaswan, 2008; Stavins, 2008; Ringquist, 2011; Boyce and Pastor, 2013)

In light of this, environmental justice concerns are now at the center of many climate policy debates. Recent efforts to introduce a carbon tax in the U.S. State of Washington failed in part due to environmental justice critiques.[1] Similar debates are occurring about the European Union Emissions Trade System, the continent's flagship climate policy.[2] No where has this issue been more hotly contested than in California, where the future of the state's pioneering cap-and-trade program has recently been questioned on equity grounds.[3] In particular, critics argued that the flexibility of using permit markets to meet regulatory requirements may allow polluting facilities near disadvantaged communities to increase GHG emissions.

Can cap-and-trade cause more GHG emissions in disadvantaged communities? Conceptually, there is no obvious answer. When functioning correctly, market-based incentives employed by cap-and-trade directs greater emissions reduction from cheaper, dirtier polluting facilities in the state. If such facilities tend to be located near disadvantaged communities, then these communities should experience a larger decline in emissions under cap-and-trade than under non-market-based climate policies. Indeed, existing studies of another California cap-and-trade program for NOx pollution

[1]See http://grist.org/election-2016/washington-carbon-tax-732/
[2]See https://www.tni.org/files/download/scrap_the_ets18feb.pdf
[3]See http://www.latimes.com/politics/la-pol-ca-offsets-environmental-justice-20170313-story.html

have found that lower income households are either not affected (Fowlie, Holland and Mansur, 2012) or may actually benefit from emissions trading (Grainger and Ruangmas, 2018). On the other hand, if lower cost facilities are not located near disadvantaged communities, then cap-and-trade may increase emissions from these facilities compared to a non-market based regulation.[4]

This paper examines whether California's cap-and-trade program has caused relatively more GHG emissions in disadvantaged communities compared to other communities. To do this, I gather facility-level on-site GHG emissions data for all cap-and-trade regulated facilities in California since the start of the cap-and-trade program. I then compare average emission trends in zip codes that contain a "disadvantaged communities" as defined by the California Environmental Protection Agency, against zip codes that do not contain such communities.

I do not find statistically significance evidence that California's cap-and-trade program has led to more GHG emissions in disadvantaged communities. The statistically noisy difference in average emission trends suggests that disadvantaged communities have experienced a greater decline in GHG emissions since the start of the program in 2013.

2 Data sources

Emissions I obtain facility-level GHG emissions data collected under Californias Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (MRR) from the Air Resources Board.[5] This data covers the 2012-2015 period.[6] In order to calculate a greenhouse gas emissions variable that corresponds most closely to emissions produced at the facility, I take the sum of GHG emissions (from biogenic and non-biogenic sources) resulting from on-site combustion.[7] Emissions data is then aggregated to the zip code level.

Zip code definition of a "disadvantaged community" I use the legal definition of a "disadvantaged community" following California Senate Bill 535.[8] Specifically, I follow the California

[4]Additionally, it is possible that the distribution of more free permits to polluters near disadvantaged communities increases pollution over a longer period by subsidizing those polluters to stay in business.

[5] Available here: https://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/ghg-reports.htm

[6] MRR data is available since 2008. However, 2008-2010 and 2011-2015 data are not consistently reported and thus cannot be directed compared. Furthermore, in 2011 there were potential issues with potential double-counting of emissions from natural gas distribution. As a consequence, I restrict our sample period to 2012-2015.

[7]This is also known as "Scope 1" emissions. I exclude "Scope 2" emissions associated with purchased electricity and emissions contained in the fuel sold by fuel suppliers.

[8]This is the definition used for distributing cap-and-trade auction revenue funds to disadvantaged communities.

Environmental Protection agency (CalEPA) and Air Resources Board (ARB) definition of a zip code as being disadvantaged if it contains all or part of a "Disadvantaged Community Census Tracts" (DACs) with a CalEnviroScreen score in the top 25th percentile.[9]

3 Results

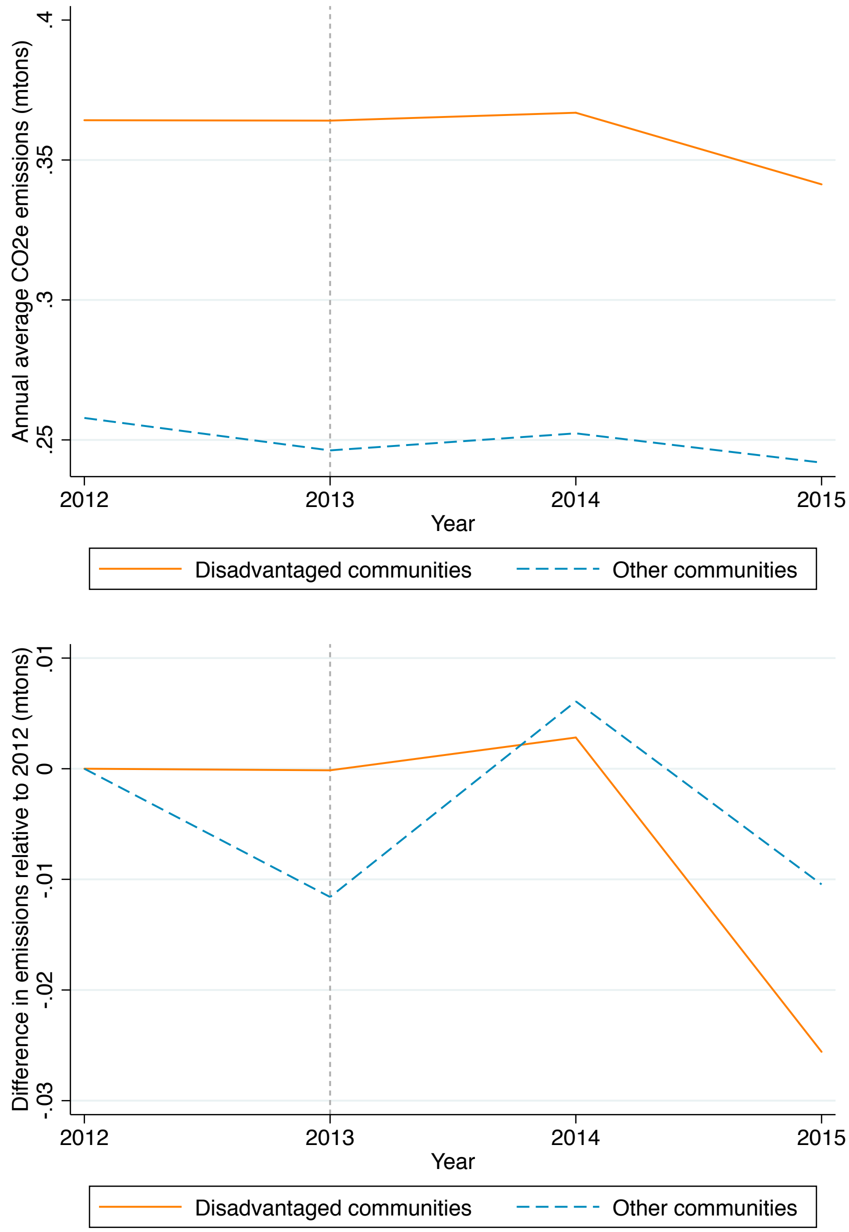
The top panel of Figure 1 shows average emissions for disadvantaged and non-disadvantaged zip codes. Throughout 2012-2015, average on-site emissions (in annual megatons of CO_2 equivalent) produced in zip codes with disadvantaged communities were consistently higher than average emissions in zip codes that do not contain disadvantaged communities. This is consistent with a prior study showing that disadvantaged communities tend to be located near a greater number of GHG emitting facilities and near the largest GHG emitting facilities Cushing et al. (2018). However, such evidence does not necessarily imply that cap-and-trade has changed environmental inequality.

The evidence in the top panel of Figure 1, however, does not support the argument that cap-and-trade has led to relatively more GHG emissions near disadvantaged communities. That key question is fundamentally about whether cap-and-trade has caused the gap in nearby emissions between disadvantaged and other communities to converge. To test that claim, I calculate the change in average emissions for each group relative to 2012 levels, the year just before the start of the cap-and-trade program, and examine whether disadvantaged and non-disadvantaged communities have experienced different emission trends. A greater drop in emissions for disadvantaged communities compared to other communities would suggest that cap-and-trade has caused emission differences to narrow across the two groups.

These trends are shown in the bottom panel of Figure 1. By and large, the annual change in emissions across disadvantaged and non-disadvantaged communities look similar. Over the 2012-2015 period, it appears that emissions in disadvantaged communities have declined slightly more than that of other communities. However, a t-test does not detect a statistically significant difference in average 2012-2015 GHG emission trends across disadvantaged and non-disadvantaged communities. That test, conducted for subsamples with unequal variances, shows a mean difference of -0.013 mtons of GHG emissions per year with a t-value of 0.53.

[9]Available here: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/535investments.htm

Figure 1: Emission trends for disadvantaged and other communities (2012-2015)



Notes: Top panel shows average annual on-site GHG emissions produced in zip codes that contain (orange, solid line) and do not contain (blue, dashed line) a disadvantaged community over 2012-2015. Bottom panel shows change in average emissions since 2012.

4 Conclusion

Pollution tends to hurt disadvantaged communities the most. As such, existing environmental policies should be carefully evaluated on environmental justice grounds. Using recent facility-level emissions data, I do not find statistical evidence that California's cap-and-trade program has led to more greenhouse gas emissions in disadvantaged communities during 2012-2015. If anything, the evidence suggests that disadvantaged communities may have experienced on average a greater decline in emissions since the start of the cap-and-trade program than other communities. This finding, however, does not obviate the need for additional policies that more directly address environmental justice concerns associated with local pollution. Such policies should exist in tandem with California's existing cap-and-trade policy.

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