

# Senior Project

Department of Economics



“Influence of Resident Preferences on the “Greenness” of  
Counties;  
Election Results and co2 Emissions”

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Abstract

As climate change becomes an increasingly important issue, discussions on the topic have proven to be as political as they are environmental. This is largely due to the growing divide amongst Republicans and Democrats on its validity and importance. Many Republicans, including President Donald Trump, have made it clear that environmental spending is not a priority. This is a stark difference from the Obama administration, which oversaw increased commitment on behalf of the US, to address climate change globally. For independent and moderate voters who prioritize environmental issues one way or the other, this growing divide might have a major effect on future voting decisions. Without Federal help, local politicians may play an important role in reducing greenhouse gas emissions. However, there is little evidence that proves or disproves the ability of local governments to combat climate change. While there is extensive research on federal and state environmental policies, county level studies are limited. In one of the few studies which has analyzed voting decisions and emissions, House and Senate election results were used as a proxy for preferences. In this study, I use county level election results from the 2012 presidential election. While Congressional voting results may better represent local party affiliations, time restrictions influenced my decision to use presidential election results as a proxy. This study would benefit from a time series analysis, and the inclusion of more variables. However, the results did align with past literature. I found that zip-codes which were a part of a county where Obama received more votes than Mitt Romney had, on average, 2.3 less metric tons of co2 emissions per year.

## Table of Contents

- IV. Introduction
- VIII. Research Question
- VIII. Review of Literature
- X. Theoretical Model
- XI. Data
- XII. Empirical Model
- XIII. Results
- XIV. Conclusion
- XV. Data Table
- XVI. Citations

- I. Introduction

There is no question that Earth has gone through many climate cycles in its long history. According to the National Aeronautics Space Administration (NASA), there have been 7 cycles of glacial advance and retreat in the past 650,000 years, with the last ice age ending around 7,000 years ago (Climate Change). What makes the current warming period interesting is the consensus amongst climate scientists that it is due to human activities. In fact, this consensus is believed to be around 97 percent (Climate change).

What factors indicate human activity is to blame? There are several reasons, most of which stem from the amount of greenhouse gases created by human activity. Qiancheng Ma, a research scientist for NASA describes the effect of these gases in a 1998 science brief. "These gases are commonly referred to as "greenhouse gases" because they let in most of the incoming solar radiation that heats Earth's surface, yet prevent part of the outgoing thermal radiation from escaping to space, thus trapping some of the surface heat energy (Ma)." The most prevalent greenhouse gas is carbon dioxide (CO<sub>2</sub>), which accounts for more than 80 percent of emissions. Methane and nitrous oxide gases are common as well, combining for another 17 percent, with fluorinated gases contributing 3 percent (Overview, EPA). Each of these gasses is emitted through a different process. Understanding these differences is important when analyzing the greenhouse gas problem.

Not only is carbon dioxide the most prevalent of all greenhouse gasses, but it is also the most well-known. This is probably since CO<sub>2</sub> is a result of burning fossil fuels and is emitted from car exhausts and factories. CO<sub>2</sub> is also produced naturally by plants and wildlife, but not at the harmful levels that are a result of human activity. Methane, the second most emitted greenhouse gas, is released during the production and transport of coal, natural gas, and oil.

Methane is also the byproduct of some agricultural practices and livestock. Nitrous Oxide is emitted through the burning of fossil fuels and through industrial processes. Fluorinated gases consist of hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. None of these gases are naturally occurring, and they are extremely powerful. Fluorinated gases have been emitted at low levels thus far, but due to their potency, they are often referred to as High Global Warming Potential Gases (High GWP). Each of these gases' effect on climate change is judged based on the same criteria; (1) how much it is in the atmosphere, (2) how long they stay in the atmosphere, and (3) how strongly they impact global temperatures (Overview, EPA).

Since the majority of greenhouse gasses are a result of the burning of fossil fuels and other human activity, emissions are heavily concentrated to areas with the largest human populations. This fact points to large cities as the main source of greenhouse gas emissions, specifically CO<sub>2</sub>. In a 2011 study by the United Nations Human Settlement Program, researchers found that while the world's cities use just 2 percent of the Earth's landmass, they are the source of 70 percent of greenhouse gas emissions (Hot Cities). This might seem like a staggering number at first glance, but it could be a positive statistic in the fight against climate change. If cities are responsible for such a large portion of emissions, then environmental innovations made at the city level will have an enormous impact on the world's total level of emissions. Certain cities are already taking measures to address this issue. In 1993 the Cities for Climate Protection was initiated. It was the first international program which aimed to reduce emissions through actions taken by local governments, rather than at the federal level. Member cities use a 5 milestone process of; (1) measurement, (2) commitment, (3) planning,

(4) implementing, and (5) monitoring (CPP Campaign). In the United States alone, there are more than 150 CPP cities. Actions taken by CPP cities have shown to lead to substantial cost savings. One often cited example is Denver, which replaced all of its traffic and “don’t-walk” lights with more energy efficient LED lights in 1996. The initial investment of \$1.6 million was quickly recovered, as the move saved Denver more than \$5 million annually on energy spending (Fay). There is little evidence to suggest however, that actions like these have a direct impact on the environment (Fay). It is hard to tell if CPP is an effective program or if CPP cities are just more open to climate change related initiatives. If the residents of a certain city desire programs like CPP, it is likely that these people were already more environmentally responsible. This could account for much of CPP’s success. It is hard to prove either way, so it would be useful to study the effect of resident preferences on local CO<sub>2</sub> emissions in both CPP cities and non CPP cities. As far as we know, these action plans do little to regulate emissions. They seem to be most effective is raising public awareness (Fay).

Regardless of their effectiveness, CPP plans show a desire and willingness to take action in the fight against climate change; a desire which has been inconsistent at the Federal level. This is largely because of how much Republicans and Democrats differ on environmental issues. A 2013 article in The Guardian highlighted this divide, and claimed the 112<sup>th</sup> Congress was “the most hostile to environmental causes in 40 years (GoldenBerg).” This may come as a surprise to many, as then President, Barack Obama, was a strong proponent of the Clean Power Plan, which aims to reduce carbon dioxide emissions from electrical power generation by 32 percent within twenty-five years relative to 2005 levels. Although Obama was more environmentally progressive than most presidents before him, the Republican majority House of

Representatives differed greatly. Republicans have long been skeptical of climate change, but not until recently have they had to actively oppose such a high volume of newly proposed environmental regulations. Basically, as Democrats increasingly prioritized environmental issues, many Republicans have adopted more hardline stances. This is may be especially true in the years to come.

In January of 2017 Donald Trump was inaugurated as the 45<sup>th</sup> President of the United States. Trump has made many controversial statements about climate change since it became a mainstream issue. On November 6th 2012 he tweeted “The concept of global warming was created by and for the Chinese to make U.S. manufacturing non-competitive,” (Trump). As President, his rhetoric has softened, but his actions have been cause for concern amongst environmentally conscious constituents. Trump nominated Scott Pruitt to lead the Environmental Protection Agency (EPA). Pruitt, a climate change skeptic, was formerly the attorney general of Oklahoma. In this role, Pruitt sued the EPA more than a dozen times, usually on behalf of the oil industry (Volcovici). However, leadership may not be the biggest problem facing the EPA. In March of 2017, the Trump administration proposed budget cuts which included a 31 percent cut to the agency’s budget. This cut would not only eliminate more than 3000 jobs, but it could hinder the EPA’s ability to identify and address climate change, as research funding would be drastically reduced. When asked about climate change spending Mick Mulvaney, Trump’s budget director, responded “we consider that to be a waste of your money,” and “I think the president is fairly straightforward. We’re not spending money on that,” (Volcovici). However worrisome, Trump’s presidency is still in its infancy, and there is no guarantee this extreme budget cut will pass. Regardless, Trump’s election and rhetoric help

illustrate the growing divide between Republicans and Democrats on global warming. For independent and moderate voters who prioritize environmental issues one way or the other, this growing divide might have a major effect on future voting decisions. Without federal support, local politicians may have to take steps to address climate change locally.

## II. Research Question

The purpose of this study is to analyze the impact of voter preferences on CO<sub>2</sub> emissions. Does electing environmentally conscious politicians translate to lower emissions at the local level?

## III. Review of Literature

Adam Millard-Ball (2012), offers the first quantitative analysis on the impacts of climate plans. There are many models used in this study. They include OLS regressions, and a probit model, amongst others. Ball uses 8 dependent variables, and groups his independent variables into treatment variables, and control variables. The study finds that cities with climate change plans do have lower emissions than those who don't. However, there is no reason to believe these lower emissions are a result of the plans. These cities might have action plans in place because the residents were more aware to begin with. These more aware residents may already strive to use less emissions. This reiterates the question of how residents impact the environment with the choices they make and the products they consume (Millard).

If people demand more "green products," then suppliers should be more inclined to produce them. Kahn and Vaughn (2009) examines the hypothesis that green markets are geographically concentrated. This should help researchers study the correlation between



“green cities” and their residents, thus helping us understand the possible reverse causality mentioned in the Millard-Ball paper. To represent “green products,” Kahn and Vaughn examine areas where “green vehicles’ are prominent, specifically the Toyota Prius. He then compares these areas to “green cities,” which he classifies as areas with a high concentration of LEED Registered Buildings. To illustrate the patterns, they observed, a Tiebout sorting model is used. After green clusters are identified, a linear regression is used control for other covariates that might explain the prevalence of “green vehicles” in “green cities” besides environmental awareness reasons. The study finds that green consumers tend to cluster in coastal and urban environments. These areas are also found to be the most environmentally friendly. Since these communities are not always wealthier than average, it appears certain consumers do prioritize the environment when making consumption decisions. This may confirm the belief that certain cities are green because of its residents’ choices, rather than individual city action plans. While this study is insightful, more products such as solar panels, should be considered in future studies. Also, this study does little to analyze environmental impact (Kahn).

One of the biggest ways residents can make “choices” that reflect their desires, besides purchasing decisions, is through voting. As Kahn and Vaughn addressed consumer behavior and its effect on emissions, there are a few studies that attempt to analyze voter behavior in a similar way. Matthew Benton (2011) conducted a study which analyzed consumer preferences for environmental regulation, and the effect of pro-environment voting on “toxic emissions.” Benton studied these issues at the county level. He used House and Senate voting records as his measure for environmental preferences. Using OLS models, in addition to time series models, Benton analyzed how changes in environmental preferences effected “toxic

emissions.” He found that changing from anti-regulation politicians to pro-regulation politicians, resulted in a decrease in local emissions. Over the course of a 3-4 year period, this decrease could be substantial.

#### IV. Theoretical Model

In the United States, voting, along with purchasing decisions, is perhaps the most important way people attempt to influence the society they live in. In our current political system, each party’s candidates generally share many beliefs. The ethos of each party includes opinions which are generally uniform among the party’s members. For example, most people would agree that Democrats prefer a more progressive tax system, while Republicans value tax cuts and lower overall rates. This does not mean every politician falls in line with these beliefs, just that these views describe the majority. There is a similar separation regarding environmental issues. Largely, Democrats are likely to favor increased environmental regulations, while Republican lawmakers usually side with deregulation. The League of Conservation Voters is a political advocacy organization which releases an annual list congress members ranked on how they vote regarding environmental issues. This list confirms the Republican and Democrat split on environmental issues. Based on previous literature, I expect, on average, that counties in which Obama won to have lower emissions when compared to similar counties in which Romney won.

Population density and income are two more metrics which are often used when analyzing local environmental quality. These two measures are similar, in that past literature has found a possible U-shaped relationship between them and environmental quality. Income, has a normal U shaped relationship, while population density may have an inverted U. This

because environmentally efficient goods are a luxury good. Only at a certain level of income will consumers begin to spend more on efficient items. Think hybrid cars, solar panels, etc.

#### V. Data

The Cool Climate Network is program of the Renewable and Appropriate Energy Laboratory (RAEL), at the University of California, Berkeley. Developed in 2013, the program uses extensive carbon footprint research to develop emissions data for every zip-code in the United States. The emissions metric used is co2, the most common greenhouse gas. It is measured in metric tons per year. Total co2 is measured, however, it is also broken up into separate categories. Due to time restrictions, this study will examine total co2 per zip code. In addition, demographic data is included in the Cool Climate data set. Population density and per household income, are two of the demographic measures included in this study. Income is measured in dollars, while population density is measured in square miles.

The US Department of the Interior (DOI) collects presidential election data at the county level. On *data.gov*, the DOI makes this data free and easy to download. This data is widely available, but a government source seemed the most reliable for a federal election. I downloaded 2012 presidential election data to use as my proxy for residential preferences.

#### VI. Empirical Model

An OLS model is sufficient for this study. The hope is that a linear regression identifies relationships between my dependent and independent variables, which confirm the theoretical model. The model is seen below:

$$totalco2 = \beta_0 + \beta_1 popden_i + \beta_2 popden^2_i + \beta_3 incperhouse_i + \beta_4 incperhouse^2_i + \beta_5 Vote_i + u$$

My dependent variable is totalco2. This measures total co2 emitted in every US zip-code, as estimated by the Cool Climate Network's carbon footprint calculator. The independent variables are population density (popden), population density squared (popden<sup>2</sup>), income per house (incperhouse), income per house squared (incperhouse<sup>2</sup>), and vote. Population density and income per house are squared to test for the u-shaped relationship established through past literature. Vote a dummy variable. Either a (1) or (0) is assigned to every zip-code in which co2 data is available. (1) is assigned to zip-codes which reside in counties that Barack Obama won in the 2012 presidential election. (0) is assigned to zip-codes in counties that Mitt Romney won.

## VII. Results

<u>PARAMETER ESTIMATES</u>					
<u>VARIABLE</u>	<u>DF</u>	<u>Parameter Estimate</u>	<u>Standard Error</u>	<u>t Value</u>	<u>Pr &gt;  t </u>
INTERCEPT	1	34.02070	0.17883	190.24	<.0001
_POPDEN	1	-0.00070543	0.00001588	-44.41	<.0001
_POPSENSQ	1	5.289207E-9	2.06172E-10	25.65	<.0001
INCRD	1	0.48617	0.00693	70.12	<.0001
INCRESQ	1	-0.00096438	0.00005880	-16.40	<.0001
VOTE	1	-2.26640	0.08706	-26.03	<.0001

The results for my regression were pretty clean and straightforward. Population density and income had effects which aligned with my theoretical model. Their respective signs conformed with my expectations. Each variable is statistically significant, however, not every variable had a significant impact on the intercept. Even better, my dummy variable, vote, had a substantial negative impact on the co2 emissions. This is good, because I expected zip-codes in Democrat counties to have lower emissions. However, I did not expect the difference to be so substantial. I found that zip-codes in counties which Obama won emitted, on average, almost 2.3 less metric tons on emissions per year. Considering, the results are zip-code level, this impact would be quite large when scaled up.

## VIII. Conclusion

As previously mentioned, my results are pretty straightforward. They don't raise too many questions aside from possible limitations with the study overall. Since, my theoretical model was confirmed there is one main takeaway from the study. For independent and moderate voters who prioritize environmental issues, my results may be useful. There is always some doubt that campaign promises won't be kept, or that policies won't have the desired affect. Therefore, people who desire improved air quality should be excited to learn that their vote might actually make a difference. However, as previously mentioned, there are some limitations in my study. For one, a time-series model would have been much more accurate in identifying causality, opposed to correlation. This way, I would have been able to examine change in emissions over time, after changes in governing party. In addition, I could have identified changes in industry which might have an effect on emissions. For example, are emissions lower in Democrat counties because policies caused manufacturers to change emissions standards, or did manufacturers just change locations. There is also a strong chance that people who vote democrat make more environmentally efficient purchases. This could account for the difference in emissions, opposed to policy change. That being said, my results are still interesting, given the magnitude of the difference. If climate change continues, pro-environment polices will have to be implemented, even if certain politicians disagree.

<b>Data Table</b>		
<b>Data</b>	<b>Description</b>	<b>Source</b>
C02 Emissions (tC02e/yr)	C02 emission per year in a given zip code. Total, and industries specific totals for each zip-code -Metric Tons	Cool Climate Network – UC Berkeley
Popden	Population Density for each zip-code  -Per square mile	Cool Climate Network – UC Berkeley
IncomePerHoushold	Average income per household for each zip-code	Cool Climate Network – UC Berkeley
Vote	Results from the 2008 presidential election by county	Data.gov – US geological survey, Department of the Interior

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