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CULTURE, CARBON, AND CLIMATE CHANGE: A CLASS ANALYSIS OF CLIMATE CHANGE BELIEF, LIFESTYLE LOCK-IN, AND PERSONAL CARBON FOOTPRINT

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Abstract

Global climate change is arguably the defining issue of the present age, and high carbon emissions are the major cause of this change. Prior research has shown that carbon emissions are strongly positively associated with household incomes – both in a given nation and between nations. Scholars explain that one of the root causes of this "income-carbon" relationship is lifestyle lock-in: the inability of individuals to change their consumption habits – due to institutionalized structures, contexts, and norms. Using a United States nationally representative dataset (N=2107), I test whether climate change beliefs moderate the income-carbon relationship (emissions were only examined for personal mobility and dietary carbon footprints). I found a significant positive correlation between climate change beliefs and personal carbon footprints only among one segment of the public – those who are most concerned about climate change (18% of the sample). I also reaffirm the significant positive correlation between household income and carbon emissions – income was the most dominant predictor variable in my analyses. I call for taxes and limits on both income and carbon emissions.

Keywords: *personal carbon footprint, environmentally significant behavior, attitude-behavior gap, lifestyle lock-in, climate change belief*

1. INTRODUCTION

Climate scientists warn that human activities – primarily in the area of carbon emissions and the burning of fossil fuels – have tipped the planetary climate "off balance". There are also reports of impending environmental catastrophes and extreme costs if the current climate imbalance is not remedied. In this study, I examine the income-carbon relationship – the established significant association between personal income, personal consumption behaviors, and resultant carbon emissions (i.e. the way humans consume in relation to their income) – and I test whether climate change belief can moderate this relationship. My country of research is the United States and I use a broad, nationally representative, climate change belief construct to test possible moderating effects. As informed by the literature, I hypothesize that, due to normative and structural constraints, climate change belief would not moderate the income carbon relationship.

In my results, I reject the null hypothesis as survey respondents with the strongest climate change beliefs did slightly moderate the income-carbon relationship. Though this moderation affect does exist, it is only slight, while income – as elaborated in the literature – is the most dominant independent variable in my analyses. In this paper, I review the pertinent literature, present my data and research methodology, discuss my findings and conclude with recommendations.

This study is based on a cultural approach; my interest is in how individual attitudes and actions might assist in efforts to mitigate global climate change. However, like other scholars, I believe a more structural institutional level approach – as opposed to cultural / individual – is most effective for reducing carbon emissions related to human activities.

2. REVIEW OF THE LITERATURE

In light of the looming crisis of climate change (IPCC, 2014a; Melillo et al., 2014; Zalasiewicz et al., 2015), there is a wave of scholarship directed at trying to understand and change human-environmental attitudes and behaviors, especially carbon-emissions related behaviors (Brulle, 2010; Dietz et al., 2009; Maibach et al., 2008; McCright, 2009; McKenzie-Mohr, 2011).[1] However, with respect to carbon emissions, they are not emitted equally by all persons (Hertwich and Peters, 2009): a great majority originates from people with higher levels of income and more industrialized nations (Chichilnisky and Heal, 1994; IPCC, 2014b; Munasinghe, 2010; World Bank, 2015).[2, 3]

A number of studies have analyzed the distribution of greenhouse gas emissions (GHGEs) within industrialized nations and found they are positively correlated with personal income (Dey, 2010; Druckman and Jackson, 2009; Ummel, 2014; Wilson et al., 2013).[4] Thus, as income is known to be distributed unequally, there are also carbon emission inequalities (Chancel, 2014; Ummel, 2014). In the U.S., K. Ummel (2014) observed that "the top 20% of polluters account for 40% of all GHG pollution…

1 The terms GHGs, carbon, carbon footprint, CO_2 and CO_2e are used synonymously: they refer to the emitted greenhouse gases and carbon dioxide / CO_2 equivalents emitted during any part of the human extraction, processing, production, distribution, consumption, or dumping of a product / good.

2 Though there is a global shift toward lower income countries as the dominant source points of greenhouse gases (embodied in products, consumption, and international trade), consumers in industrialized countries remain the primary end users of this embodied carbon (Caldeira and Davis, 2011; Davis and Caldeira, 2010; Peters et al., 2011).

3 Analyses of the environmental impacts of affluent versus poorer countries are not new (Ehrlich and Holdren, 1971).

4 Income-carbon correlations have been found in the United States (Jones and Kammen, 2014; Ummel, 2014), the United Kingdom (Druckman and Jackson, 2008, 2009), Australia (Dey, 2010; Lenzen and Murray, 2001), Canada (Wilson, Tyedmers, and Spinney, 2013), and The Netherlands (Gatersleben et al., 2002).

[while] the lowest-emitting 40% of the population (largely individuals in lower income groups) are responsible for just 20%" (2014:12).[5]

When attempting to explain the causes of these economically stratified and geospatially dispersed GHGEs, scholars tend toward two explanations: consumer lifestyle and "lock-in". *Lifestyle* is a term which identifies and classifies group behaviors, expenditures, and energy use patterns (Bin and Dowlatabadi, 2005; Schipper et al., 1989; Weber and Perrels, 2000).[6] Some scholars explain lifestyle as the outcome of individuals just trying to meet their needs and wants (Druckman and Jackson, 2009), and high emissions associated with higher income groups reflect desires for more goods, services, luxuries, and comforts (Zhang et al., 2015:6). Observing this income / lifestyle / energy-use relationship, Gatersleben et al. posit that "as soon as people have the financial ability to perform the behavior, they are tempted to do so" (2002:354). Sanne (2002:280) presents a similar view with what he calls the "ratchet effect": the more money people have, the more they buy, and the more they buy, the more money they need to support themselves.

"Lock-in", the other predominant explanation for the stratification of GHGEs – not to be considered separate from *lifestyle* as much as part of it – is best defined as cultural and structural constraint. These constraints are generally explained as institutionalized structures, contexts, and norms (Chancel, 2014; Guagnano et al., 1995; Jackson, 2005; Sanne, 2002; Thogersen, 2005).[7] Druckman and Jackson (2009) assert that it is difficult to change both individual and institutional norms and, by extension, it is the affluent who should be targeted with new policies. Druckman and Jackson (2009) also allude to more than one type of lock-in: one which is more institutional / structural and the other more normative / cultural.[8]

This dichotomizing of strategies (cultures versus structures and individuals versus institutions) to assuage the planetary impacts of human behavior is supported by others; although structural / institutional level changes are seen as the most effective approach to climate change mitigation (IPCC, 2014a; Princen et al., 2002; Szasz, 2011), lifestyle and personal behaviors are also a key area for research and intervention (Dietz et al., 2009; Nagel et al., 2010; Tucker, 1978). Moreover, at this critical historical juncture, it appears that what can be done, should be done.

5 Studies have also found that geospatial distribution (urban, suburban, rural) and population densities are also important determinants of GHGEs (Jones and Kammen, 2014; Ummel, 2014). Zhang et al. (2015), Lyons et al. (2012), and Fahmy et al. (2011) report similar findings in China, Ireland, and the United Kingdom respectively.

6 Additionally, lifestyle can also include residence location, family size, age cohort, and size of house or apartment (Chancel, 2014).

7 Sanne (2002) asserts that people are not happy to be constrained by their circumstances, but feel locked-in.

8 The phenomenon of a finite planet itself presents a third type of lock-in, a biophysical one. Therefore, a possible "collision of lock-ins" can be theorized.

2.1. Probing Climate Change, Lifestyles, and Cultural Lock-In

In light of this global climate urgency, I attempt to dig deeper into human behavioral norms, the issue of lock-in, and consumption lifestyles by researching at the individual level with a cultural perspective. I also intend to ground my approach sociologically and in a *class* cultural perspective (Bourdieu, [1979]1984). This means that lifestyles are not considered benign, arbitrary phenomena, but are inculcated from childhood, as an individual habitus – an unconscious system of predispositions – in relation to certain socio-economic fields with respect to one's specific class fraction and conditions of existence. Practically, then, individuals from distinct classes will be inclined to remain culturally "stationary" – i.e. locked-in – with respect to their inculcated predispositions which match them to certain positions in social space. This theoretical approach, then, suggests that not only might there be an income-carbon relationship, but also a relationship between class culture and carbon emissions, as might be deduced from Bourdieusian theory ([1979]1984).

Concerning attitudes about climate change, as a minority of people in the United States believe that climate change is both occurring *and* human-caused (Guber, 2013; Leiserowitz et al., 2012; Nisbet and Myers, 2007). I am interested in how awareness of climate change may affect behavior; specifically, the relationship between an individual's climate change belief and GHGEs.[9] I am also interested in examining, while controlling for income, any changes in *environmentally significant behavior* – via estimations of GHGEs – with respect to one's belief in anthropogenic (human-caused) climate change (ACC).[10]

It must be noted that there is an important methodological distinction upon which I am building: *pro-environmental behavior* versus *environmentally significant behavior*.[11] In response to much research on pro-environmental behavior, of which findings are dominated by survey data and self-reports (Capstick et al., 2015; Diamantopoulos et al., 2003), *environmentally significant behavior* has emerged.[12] In this new development,

9 In 2012, Leiserowitz et al. reported that only 38% of their sample agreed that global warming was *both* happening and mostly human-caused; with such a split in the U.S. between "believers" and "non-believers", this is an opportune time to explore these phenomena.

10 The term belief – and other terms related to it – such as *non-belief*, *disbelief*, *believers* or *deniers* – may be seen to invoke a type of religious discourse or dynamic in a debate over climate science. However, use of the term *belief* in this study refers to the affirmative response of survey participants to a question such as, "Do you think that global warming [or climate change] is happening? Yes, No, or I don't know". In response, there are people who *think* climate change is happening, those who *think* it is not, and those who "do not know".

11 Over the years, different scholars have used different synonyms for pro-environmental behavior: environmentally responsible (Fransson and Gärling, 1999; Hines et al., 1987), friendly (Gärling et al., 2009; Haustein and Hunecke, 2007), or sustainable behavior (Griskevicius et al., 2012; Kurz, 2002; McKenzie-Mohr, 2011), and also conservation (Kaiser et al., 2005; Schultz et al., 2005), or ecologically conscious behavior (Ellen et al., 1991; Roberts and Bacon, 1997).

12 Besides critiquing the dominance of polling data in the literature, Capstick et al. (2015) also identify a lack of consistency in the construction of belief measures and call for an increase in qualitative research.

scholars have focused on identifying and quantifying *actual environmental impacts* as distinct from self-reported environmental behaviors (Clements et al., 2015; Martiskainen, 2007; Stern, 2000b). It is not so much that research on environmentally significant behavior foregoes all self-reported behavior as much as it focuses on the actual material / environmental impacts of such reports.[13] In this present study, my interest is in environmentally significant behavior, but first I will review the research on climate change belief.

2.2. Climate Change Belief

There is actually not a lot of research on the relationship between climate change attitudes and environmentally significant behavior.[14] When strictly analyzing attitudes on climate change, though, some scholars have identified a debate embedded in oppositionally poised cultural worldviews – hierarchical individualists versus egalitarian communitarians: attitudes that preexist in respondents (Kahan et al., 2012). These worldviews undergird much of the debate on ACC and are found to be the strongest predictors of perceptions of climate change risk (Kahan et al., 2012). Thus, these scholars assert that it is preexisting worldviews – not a lack of information, scientific understanding, or even political orientation – that most strongly determine climate change attitudes.[15] Other studies have also found survey responses oppositionally polarized, but over political ideology and party lines (Dunlap and McCright, 2008; Guber, 2013; Leiserowitz et al., 2011, 2012; Perkowiz et al., 2014). Additionally, Leiserowitz et al. (2009) identified six respondent groups / segments: *Alarmed, Concerned, Cautious, Disengaged, Doubtful,* and *Dismissive.* Figure 1 below displays these segments for the fall of 2008, with their respective population distributions represented by the size of each sphere.[16] The questioning schemes that determine these different segments range from belief about global warming to risk perceptions, degree of worry, reported energy use behaviors, and preferences with respect to possible societal responses (Maibach et al., 2011). Though there

13 For a review of this literature, see Osbaldiston and Schott (2012).

14 Most of the existing literature examines self-assessed respondent behaviors, but aside from climate change, scholars have long studied consumption patterns and have tried to understand their relationship to demographic indicators, ecological attitudes, and environmental concern (Balderjahn, 1988; Jones and Dunlap, 1992; Kassarjian, 1971; Shove, 2003; Stern, 2000a). However, the relationship between environmental and climate attitudes is still being explored, i.e. although ACC alarm has grown (Melillo et al., 2014) with some fluctuations, attitudes and environmental concern – both nationally and internationally – have remained stable (Franzen and Vogl, 2013; Jones and Dunlap, 1992).

15 Kahan et al. (2012:733) define this dynamic as *cultural cognition*: "the conforming of beliefs to the ones that predominate within one's group". Thus, when they were expecting one's scientific literacy to increase perceived risk, they instead found a polarized split in accordance with one's groups' individualist or communitarian worldview.

16 Though there are more recent and up-to-date findings on climate change belief segmentation in the US, data from 2008 is presented because this is the year that the (carbon calculable) behavioral questions I analyze were asked.

is some variation demographically, the six segments are not very different: the strongest predictor variable of segmentation is political orientation, e.g., whether a respondent is more liberal, conservative, Republican, Democrat, Independent or other. Liberals are more inclined to the population segments to the left (of Figure 1) and conservatives more to the right. Thus, the literature posits that asking someone their beliefs about climate change will reveal more than just beliefs; it is akin to asking, "What is your ideological tribe?" Additionally, these beliefs and these "tribes" invoke grander institutional narratives and culturo-politico-economic tensions between groups with different views on nature and fairness (Douglas et al., 1998; Rayner and Malone, 1998). In the words of Rayner and Malone (1998:24), the "…debate about climate change is often a surrogate for a broader, so-far intractable political discourse about population, lifestyles, and international development".

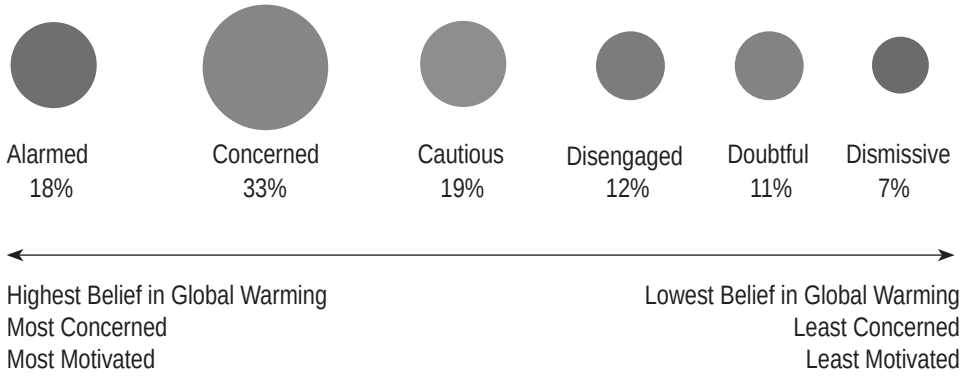

Figure 1. *Six Americas adult population segmentation (Leiserowitz et al., 2009:3)*

There are also other studies that suggest a socioeconomic connection to ACC belief. During the recession of 2008, economic concerns prevailed with studies detecting a decline in ACC belief (Newport, 2010; Pew, 2009; Saad, 2009). Postmaterialist / prosperity arguments posit that there exists a well-educated, left-leaning middle-class with the time and ability to be concerned about ecological issues (Franzen and Meyer, 2010; Inglehart, 1990).[17] There are mixed findings on such a thesis, with some scholars finding evidence of a somewhat stable cultural field of ecological views and practices expanding across class boundaries (Carfagna et al., 2014; Laidley, 2013) – what Carfagna et al. (2014) call an *eco-habitus* – while other scholars find little or no "prosperity" tendencies:

17 Seemingly confirming this argument, at the international level there is evidence of greater environmental concern in wealthier countries (Franzen and Vogl, 2013), but when using different measures, there is evidence that finds relations between wealth and environmental concern inconclusive (Dunlap and York, 2008).

(i) in countries with higher levels of income inequality (Dolenec et al., 2014), or (ii) when respondents consider the trade-offs between economic growth and environmental protection (Domazet et al., 2014). Furthermore, other scholars find that those of higher classes *are* more politically engaged on climate issues (Dietz et al., 2007; Leiserowitz et al., 2012; McCright, 2009). Nevertheless, these studies are primarily attitudinally focused and do not assess actual respondent behaviors or their ecological impacts. Therefore, it might be assumed that an increase in environmental concern does reduce environmental impacts, but this specific relationship – at least in these studies – was not measured.

2.3. Attitude-Behavior Gap

Although scholars have long examined the environmental attitude / behavior relationship (Diamantopoulos et al., 2003; Osbaldiston and Schott, 2012), when it comes to assessing *environmentally significant behavior*, the literature shows that the effects of an individual's concern for the environment are annulled by the effects of their income (Csutora, 2012; Gatersleben et al., 2002; Wilson et al., 2013).[18] Therefore, scholars assert that even if the affluent have high levels of environmental concern, they still use more energy and emit more GHGs than their lower income counterparts. Furthermore, when compared to those similarly situated socioeconomically, there is no comparable difference in ecological impact between those with high or low levels of environmental concern. This is the attitude-behavior gap (A-B gap): the general inability, all along the socio-economic hierarchy, of ecological consciousness to significantly reduce human impacts on the environment.[19] In other words, the A-B gap is present when self-reported behaviors do not align with self-reported attitudes (Blake, 1999; Hoggett, 2013; Kollmuss and Agyeman, 2002; Whitmarsh et al., 2011).[20]

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18 These particular studies, though, were not conducted in the U.S. – Csutora (2012) in Hungary, Gatersleben et al. (2002) in the Netherlands, and Wilson et al. (2013) in Nova Scotia, Canada – nor did they specifically focus on climate change attitudes; this is the underdeveloped area of research that I plan to explore.

19 Csutora (2012) found that there is less variance in the ecological footprint for individuals of lower income. This may be reflective of Bourdieu's ([1979]1984) concept of proximity to necessity and limited lifestyle options. Relatedly, Whitmarsh (2009:13) observed that "those who take action to conserve energy generally do so for reasons unconnected to the environment (e.g., to save money)".

20 Verplanken (2011) asserts that in light of the A-B gap researchers should strictly focus on changing behaviors and disregard changing attitudes. Lertzman (2013) questions the whole existence of a gap, arguing that it is an outcome of shortcomings in measures and the oft contradictory and illusive nature of the human subject itself. Others add that measures of environmental attitudes are often inflated as they are rarely ranked alongside other personal and social concerns (Guber, 2013), i.e. relative to one's economic priorities or a "pool of worry" (Linville and Fischer, 1991). Some assert – in accord with cultural lock-in – that social norms obstruct an individual's ability to behave in accord with their attitudes (Newhouse, 1990). To be clear, the idea that there is a gap between *self-reported* and *actual* behavior is not new (LaPiere, 1934; Schuman and Johnson, 1976; Wicker, 1969). Additionally, the A-B gap is reminiscent of a number of adages: the spirit is willing but the flesh is weak; actions speak louder than words; walk the talk; put your money where your mouth is, etc.

3. RESEARCH DESIGN

In light of this literature, I conducted this study in the United States and used ACC belief as an indicator of environmental awareness. I tested ACC belief against GHGEs calculations for mobility / transportation and dietary behaviors / carbon-footprints.[21] This specific combination of factors is unique in literature.[22] Additionally, in light of the phenomena of lock-in, the A-B gap, and my hypothesis, moving forward – reflective of the literature that attitudes on climate change will not moderate the effects of income on carbon emissions, I decided: (i) to use the strongest form of climate change belief available – that survey respondents perceive climate change as human-caused (anthropogenic) and dangerous (they are deeply concerned about it and report that they have changed some of their behaviors because of it), and (ii) since Jones and Kammen (2011) report that changes in mobility and dietary footprint behaviors have the highest potential to abate carbon emissions (comparatively low upfront "costs" versus the subsequent GHGE reductions), that I will only analyze respondent mobility and dietary footprints. Thus, to be clear, my research question is, "Does ACC belief play a moderating role in the income-carbon relationship?" and my hypothesis – in accordance with the literature – is that it does not.

4. METHODS

For the U.S. research, I used the weighted, nationally representative dataset *Climate Change in the American Mind* survey (CCAMS; N=2107).[23] The 2008 CCAMS has specific carbon calculator inputs from car ownership (year, make, model, and usage), air travel, and dietary type.[24] These carbon calculations were analyzed both separately and

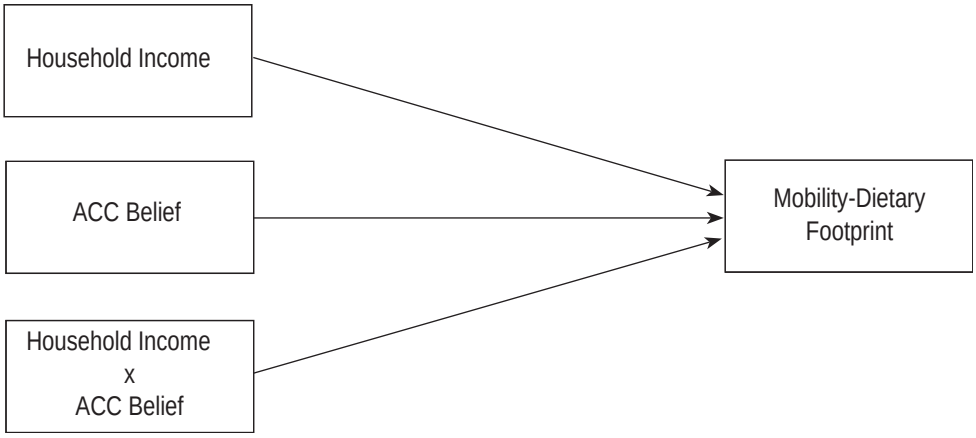
21 The terms *mobility* and *transportation* are used synonymously.

22 Even though studies have examined the socio-economic distribution of carbon emissions in the U.S. (Jones and Kammen, 2014; Ummel, 2014) and third party carbon calculators that are publicly available (Lynas, 2007; Padgett et al., 2008), as well as numerous studies (in the US) on the public distribution of climate change belief and risk perceptions (Guber, 2013; Howe et al., 2015; Leiserowitz et al., 2012, 2014; Leiserowitz and Feinberg, 2005), a combined analysis of carbon calculations in relation to climate change belief is not present in the literature.

23 This ongoing nationally representative survey has been the source of various research and reports – see the Yale (2015) website. Amongst other things, this survey tracks and examines public understanding of climate change in the U.S.: its causes, how risks are perceived, and possible consequences. For more detail, see Maibach et al. (2011:7-8).

24 Air travel calculations were based on four questions which queried (1) how many short distance (up to 300 miles), (2) medium distance (between 300 and 1,000 miles), (3) long distance (between 1,000 and 3,000 miles), or (4) overseas flights a respondent "usually takes each year". Dietary carbon calculations were based on respondent dietary type, i.e. plant-based (vegetarian, vegan) or meat-based (i.e. omnivore). This data was used in conjunction with different recommended dietary guidelines by respondent age and gender (USDA, 2010; USDA-ERS, 2014).

added into one *mobility-dietary footprint* – a total yearly rate of GHGEs per person (kg-CO_2e/adult-yr) – the primary dependent variable in my analyses. Lifestyles were operationalized as personal GHGEs, i.e. carbon lifestyles, but in a reduced mobility-dietary version. In operationalizing ACC belief, I utilized the Six Americas belief segmentation as provided by the CCAMS (Maibach et al., 2011), and these ACC beliefs are segmented into six types: *Alarmed, Concerned, Cautious, Disengaged, Doubtful,* and *Dismissive.*[25] The concept of lock-in – a main theme of this research – was examined relationally as the correspondence between household income and the mobility-dietary footprint – see Figure 2 below.[26] This relationship was tested to examine the degree to which it is moderated by ACC belief.[27] Finally, I also introduced the "standard fare" of demographic variables: gender, age, race, ethnicity, education, political ideology, and household size. As census tract locations were available for the CCAMS respondents, I introduced census tract data from the American Community Survey (US Census Bureau, 2015) specifically: population density, educational attainment, and median income levels for respondent census tracts.[28] Thus, with census tract data I was able to test for "neighborhood effects".[29]



Source: *Author's adaption from Baron and Kenny (1986).*

Figure 2. *Anthropogenic climate change belief moderating income-footprint path model*

25 The signifiers *ACC belief* and *CCAMS segmentation* are used synonymously.
26 The terms *household income* and *income* are used synonymously, and always mean household income.
27 *Moderation* as defined by Baron and Kenny (1986) includes a test for interaction effects as seen in Figure 2: household income multiplied by ACC belief.
28 The ACS years 2006-2010 consist of a five-year estimate of census data and are considered the most appropriate for the 2008 CCAMS dataset.
29 The CCAMS also had a dichotomous metropolitan statistical area (MSA) measure – MSA / non-MSA – and this measure was also utilized in my analyses.

5. FINDINGS

These findings were derived from four different ordinary least squares regression analyses, in which I tested the effects of ACC belief on the income-carbon relationship. The different analyses consisted of a combined total and three dimensions of that total: (1) the individual motor vehicle carbon footprint, (2) the air travel carbon footprint, (3) the dietary footprint, and (4) a combined total mobility and dietary carbon footprint.[30] Each of these analyses was conducted on the same set of independent variables. The total mobility and dietary footprint is the summation of the two mobility footprints – vehicle and air – and the dietary footprint.

Descriptive statistics detailing the summations of the total mobility-dietary footprint – all sample respondent footprints (N=2107) added together – can be seen in Table 1. Approximately 56% of this sum total is due to motor vehicle use, 24% to dietary habits, and 13% to air travel – see Figure 3. Though all sample respondents (100%) are represented in the dietary footprint, only 88% (N=1859) and 37% (N=784) of respondents contribute to vehicle and air travel footprints, respectively. In other words, about 12% of the sample did not report motor vehicle use and 63% did not usually fly each year.[31] Also, in Table 1, dietary GHGEs appear to be the most normal with mean, median, and mode values relatively close to each other; this is not the case for vehicle or flight GHGEs.

Table 1. *Descriptive statistics of total carbon emissions.*

	Vehicle GHGEs (tCO_2/yr)	Air Travel GHGEs (tCO_2/yr)	DietaryGHGEs (tCO_2/yr)	TotalGHGEs (tCO_2/yr)
Mean	6.312	2.218	2.695	11.224
Median	3.512	0.00	2.674	7.452
Mode	0.00	0.00	2.188	2.431
Sum	13296.5	4671.7	5676.9	23645.1
Totals	56.2% N=1859	19.8% N=784	24.0% N=2107	100.0% N=2107
Representation	(88.2%)	(37.2%)	(100.0%)	

30 These dependent variables have units of measure in tons of CO_2 over a one year period of time (tCO_2/yr).

31 Note: the median value for air travel is zero.

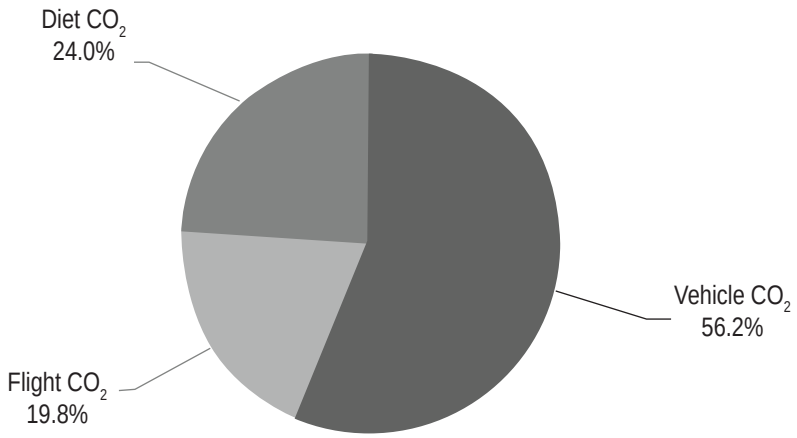


Figure 3. *Composition of total mobility-dietary footprint.*

5.1. Stratified Emissions and the Income-Carbon Relationship

Before detailing the multi-variate regression analyses, I review a number of bivariate figures which visually illustrate the stratification of the mobility-dietary footprint. Figure 4 depicts the sum totals of respondent GHGEs by population quintiles.

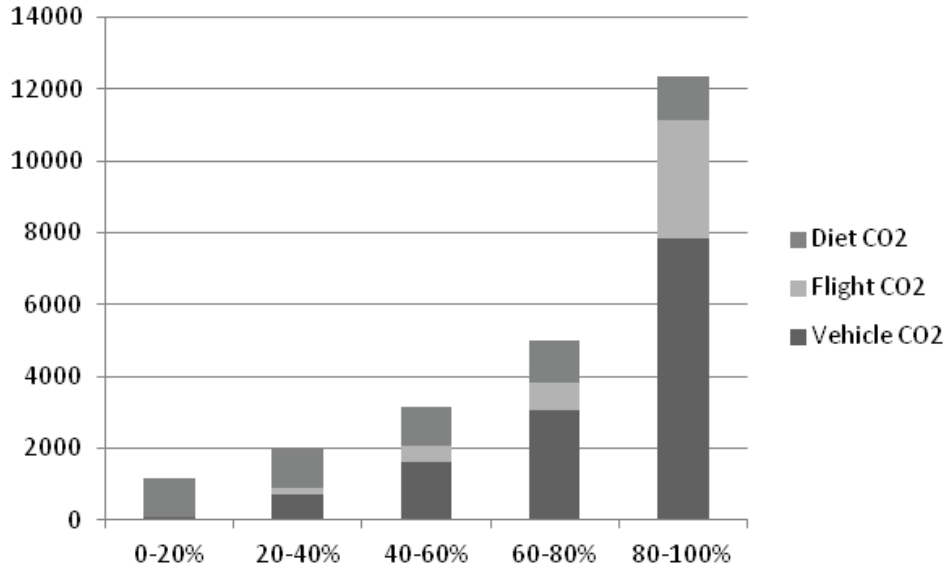


Figure 4. *Carbon emissions by population quintiles.*

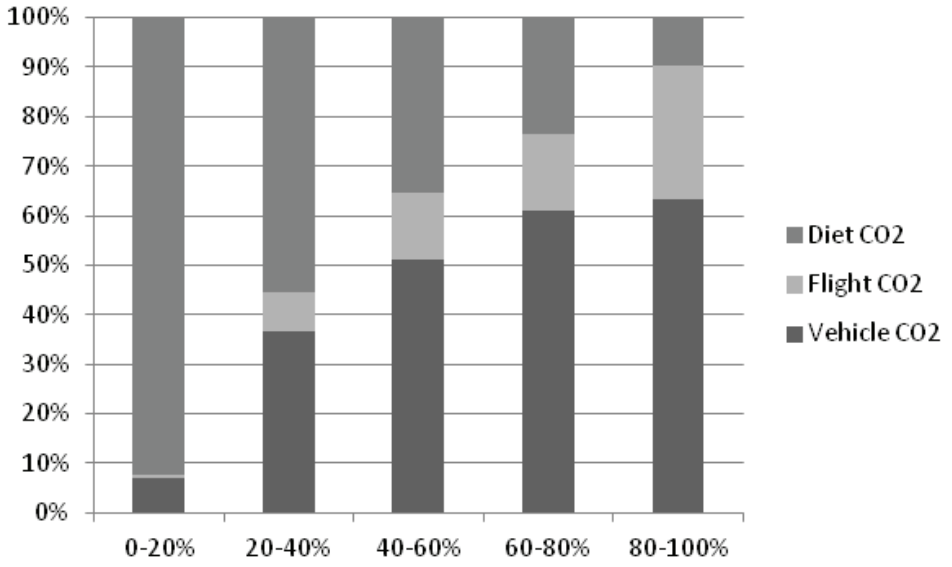


Figure 5. *Carbon quintiles – relative proportions.*

When moving from left to right, from the lowest emitter quintile group to the highest, a near exponential increase can be seen.

Similar to other studies (Chancel, 2014; Ummel, 2014), Figure 4 illustrates the level of emissions inequality: the top 20% of the sample emits more mobility-dietary carbon than the combined total of the bottom 80%. The separate footprints which comprise the total carbon footprint can also be observed. Though dietary GHGEs remain near constant, there are – when moving left to right – near exponential increases in flight and vehicle footprint. In the lowest quintile, dietary carbon dominates emissions, while in the top quintile, it occupies a smaller fraction. Figure 5 depicts the very same data but as relative quintile proportions. Again, stark variances across the quintiles can be seen.

5.2. Linear Regression Analyses

Table 2 below displays the standardized models of the four regression analyses.[32] Along the left side of Table 2 are the independent variables: demographics, political ideology, neighborhood effects, household income, and ACC belief – I dichotomized ACC belief

32 Prior to the dichotomization of the CCAMS belief variable into Alarmed and Non-Alarmed respondents, I ran two analyses which examined a reduced catchment of respondent attitudes: (i) the degree of certainty of one's global warming beliefs, (ii) the affirmation that it is human caused, and (iii) a broader catchment of attitudes – the individual segments of the CCAMS belief construct. Aside from some air travel, I found no association between belief and emissions from these early analyses and this finding informed my decision to dichotomize the CCAMS belief variable which was an integral factor to the construction of Table 2.

into *Alarmed* and *Non-Alarmed* respondents.[33] The bottom rows contain values for the adjusted R^2, F ratio, and number of observations. Column 1 displays the final regression output for vehicle carbon footprint per year (tCO_2/yr); column 2, the dietary regression; column 3, the flight footprint; and column 4 the total mobility-dietary footprint. The dietary footprint model has the greatest predictive capacity with an R^2 value of .813 and an F ratio of 416.424 ($p<.01$); the most powerful predictors are gender and age with significant negative correlations for female at b=-.798 ($p<.01$) and age at b=-.350 ($p<.01$).[34] The total mobility-dietary footprint is the next model in terms of explanatory capacity with an R^2 of .119 and an F ratio of 13.903 ($p<.01$). The strength of this model may be a partial "carry over" of the dietary footprint – with a significant negative correlation for female at b=-.106 ($p<.01$); however, household income is the greatest predictor in this model with a significant positive correlation at b=.320 ($p<.01$). Household size also has notable predictive capacity in this model with a significant negative correlation at b=-.128 ($p<.01$).

When looking across the rows: age, household size, household income, the *Income* Alarmed* interactions are consistently significant. Age tends toward a significant negative correlation suggesting that people are emitting less carbon as they get older. Household size is more mixed, with a significant *positive* correlation for dietary footprint (b=.045; $p<.01$), but a significant *negative* correlation for vehicle footprint (b=-.112; $p<.01$) and total footprint (b=-.128; $p<.01$). These correlations suggest that individuals who live in larger households eat more of a meat-based diet, but they also have more passengers in their cars (reducing one's vehicle footprint) and fly less.

Except for dietary footprint, household income is a consistently significant positive predictor across all the regression analyses.[35] It is most highly correlated with the total mobility-dietary footprint at b=.320 ($p<.01$). Dietary footprint aside, the *Income*Alarmed* interaction in the climate change belief category is also a consistent, significantly negative factor in these models, with its strongest predictive capacity in the total footprint at b=-.161 ($p<.01$).For those who are more highly educated (bachelor's degree and above), there are significant *positive* correlations for flight footprint and total footprint. Also, in the political ideology category, those who identify as liberal have significant *negative* correlations for dietary footprint but significant *positive* correlations for flight foot-

33 Besides including respondents who are more female, educated, liberal, and from more highly educated census tracts – the Alarmed demographic is not that different from the Non-Alarmed. For more detail, see Table 3 of the Appendix.

34 The sheer explanatory power of this model – nearly implausible – must be attributed to the calculation of the dietary footprint which was heavily based on respondent age and gender (see footnote 24).

35 The CCAMS household income is a variable with nineteen intervals: (1) Less than $5,000; (2) $5,000 to $7,499; (3) $7,500 to $9,999; (4) $10,000 to $12,499; (5) $12,500 to $14,999; (6) $15,000 to $19,999; (7) $20,000 to $24,999; (8) $25,000 to $29,999; (9) $30,000 to $34,999; (10) $35,000 to $39,999; (11) $40,000 to $49,999; (12) $50,000 to $59,999; (13) $60,000 to $74,999; (14) $75,000 to $84,999; (15) $85,000 to $99,999; (16) $100,000 to $124,999; (17) $125,000 to $149,999; (18) $150,000 to $174,999; (19) $175,000 or more.

print; perhaps these correlations cancel each other out as they are not seen in the total footprint. There are also significant positive correlations between those who identify as somewhat conservative and the vehicle footprint (b=.060; p<.05) and the total footprint (b=.055; p<.05). Finally, there are significant negative correlations between census tract population density and the vehicle footprint (b=-.075; p<.01) and the total footprint (b=-.051; p<.05). I will discuss these findings in more depth below.

Figure 6 below was constructed with values from the total mobility-dietary footprint and illustrates the interaction of income and climate change beliefs.[36] The vertical axis represents tons of CO_2 per year and the horizontal axis is the CCAMS household income intervals.[37] When compared to the slope of the Alarmed (gray line), it can be seen that with respect to income the total footprint of the Non-Alarmed (black line) rises more sharply. Also, around income interval 6 – household income of $20,000/year, there is something of an income tipping point where the effect of ACC belief (being Alarmed) begins to have a greater impact on respondent carbon footprint. Figure 6, then, illustrates that the greatest effect of being Alarmed occurs in the highest income brackets, which is also where carbon emissions are the largest and where there is both a greater need and capacity for emission reductions.

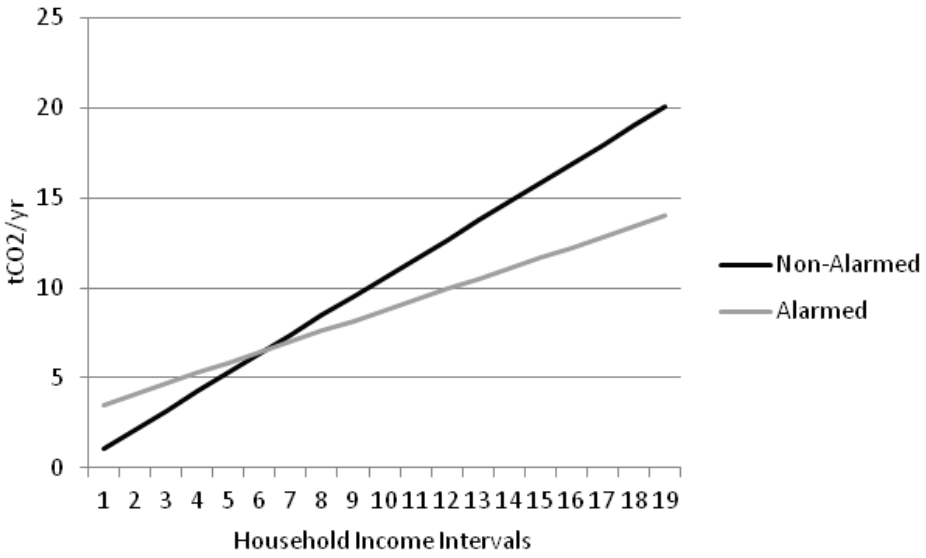


Figure 6. *Interaction of household income and climate change belief on total mobility-dietary footprint*

36 These are unstandardized emissions values.
37 See footnote 35 for detail on these intervals.

Table 2. *The primary carbon models regressed on demographics, political ideology, neighborhood effects, household income, and climate change beliefs interaction.*

	1 Vehicle-Footprint$_{tt}CO_2$/year	2 Dietary-Footprint$_{tt}CO_2$/year	3 Flight-Footprint$_{tt}CO_2$/year	4 Total-Footprint$_{tt}CO_2$/year
(Constant)	- ***	- ***	.**	- ***
Age	-0.050**	-0.350***	-0.047*	-0.080***
Male	.--	.--	.--	.--
Female	-0.103***	-0.798***	0.004	-0.106***
High school or less	.--	.--	.--	.--
Some college/Assoc.	0.010	0.006	-0.027	-0.008
Bachelor's degree	0.019	0.016	0.042	0.041*
Master's or more	-0.001	0.000	0.082***	0.049**
White	.--	.--	.--	.--
Black	0.027	0.005	0.056**	0.056**
Other (Non-Hispanic)	-0.034	-0.009	0.065***	0.013
Hispanic	0.029	-0.039***	0.037	0.044**
Two or more races	0.020	0.002	0.002	0.017
Household size	-0.112***	0.045***	-0.066***	-0.128***
Moderate	.--	.--	.--	.--
Very liberal	-0.025	-0.039***	0.063***	0.017
Somewhat liberal	-0.026	-0.022**	0.066***	0.019
Somewhat conservative	0.060**	0.013	0.011	0.055**
Very conservative	0.007	0.005	-0.032	-0.014
Item non-response	-0.024	0.000	-0.005	-0.022
CT Median income	0.002	0.004	-0.001	0.001
CT % BA degree	-0.070**	0.001	0.016	-0.046
MSA status	0.016	0.000	0.027	0.029
CT Pop. density	-0.075***	0.015	0.013	-0.051**
Household income	0.233***	-0.020*	0.222***	0.320***
Non-Alarmed	.--	.--	.--	.--
Alarmed	0.045	-0.062***	0.078	0.081
*Income * Alarmed*	-0.099*	0.002	-0.134**	-0.161***
Adjusted R2	0.073	0.813	0.075	0.119
F value	8.586***	416.424***	8.725***	13.903***
Number of Observations	2107	2107	2107	2107

Source: *Climate Change in the American Mind Survey (2008); US Census Bureau (2015); Abbreviations: CT = Census Tract; MSA = Metropolitan Statistical Area; .-- indicates reference category, * $p < .10$, ** $p < .05$, *** $p < .01$*

6. DISCUSSION AND CONCLUSION

In this discussion I focus on the object of this research: the moderating capacities of ACC belief on the income-carbon relationship. I also concentrate more on the total mobility-dietary carbon footprint, rather than the individual regression models. Additionally, it is perhaps good to recall that this data is from 2008 and the scope of this research only includes reported mobility-dietary behaviors and their related GHGEs – in other words, there are other carbon emissive behaviors related to human behavior.
Starting with the demographic variables, there are significant negative correlations with age. This dynamic may be due to "life roles" attributable to age, i.e. life course and / or workforce characteristics, or generational age cohort characteristics. It may well be due to people becoming more settled and comparatively consuming, flying and driving less as they get older. Setting air travel aside, the significant negative correlations for *female* may be related to the traditional – though changing – gender separation of labor, with men out of the house and driving more than women. Interestingly, this "travel-for-work dynamic" was not evident with the flight footprint.[38]
Educational attainment offers something of a mixed effect. Higher education – bachelor's degree and above – positively contributed, on average, to air travel carbon emissions, and this was reflected in the total footprint. This may have to do with the demands, apart from income, of one's occupation. These effects of education, independent of income, may be due to cultural characteristics which align well with Bourdieu's ([1979]1984) insights into education and class culture – where cultural drivers to maintain social status and symbolic capital may outpace economic drivers.
When considering the total mobility-dietary footprint, there are significant positive correlations to be seen with Black and Hispanic (compared to White). There is perhaps a cultural attribute beneath these correlations; the Black correlation appears to be a direct carry-over from the flight footprint: Are Blacks flying relatively more for some reason? Might this be a consequence of migration and respondent visits to countries of origin? This requires further research. The positive Hispanic correlation, however, seems to result from a sum of parts, as it is not present in the other models – though it is present, negatively, in dietary carbon. The race / ethnicity category of *other (non-Hispanic)* had a significant *positive* correlation for air travel footprint. However, this correlation did not carry over to the total mobility-dietary footprint.
When considering household size, it perhaps helps to consider how more people in one's home – both through social norms and sheer consumptive needs – affects behavior. Firstly, there is probably an association between household size and the number of passengers usually in someone's vehicle – *number of passengers* was a denominator in the respondent vehicle footprint calculations. Accordingly, there are significant *negative* correlations with vehicle and total carbon footprint. There is also, though, a significant *negative* correlation with flight footprint: might flying be too expensive for large

38 Again, some of these age and gender correlations may be attributable to the dietary footprint calculation.

families or do they have trouble "getting away"? Concerning dietary GHGEs, there is a significant positive correlation with household size. Perhaps it is difficult for people from larger homes to moderate their dietary choices (i.e. "go vegetarian"); however, this requires further research.

When considering political ideology in the total mobility-dietary footprint, there is a significant positive correlation for only one political response: *somewhat conservative*. This particular correlation appears to be attributable to, and a "carry-over" from, the vehicle footprint. Interestingly, *somewhat conservative* is the second largest ideological population (23%) and it may be representative, as far as car use, of a commuter culture. There is also a significant negative correlation between vehicle GHGEs and population density, which seems to align with a "commuter culture" frame and Bourdieu's ([1979]1984, [1993]1999) views on lifestyles and site effects. However, this requires more research. Concerning those with more liberal ideological tendencies and their significant negative correlations with dietary footprint and, conversely, significant positive correlations with flying: perhaps these contrary tendencies resolve themselves as there are no significant correlations related to liberal responses in the total mobility-dietary footprint.

Neighborhood effects were primarily found relative to the motor vehicle. Concerning the significant negative correlation between census tract population density and both vehicle and total GHGEs (i.e. the more dense a census tract, the less car usage), there is evidence in the literature for this relationship: those in more urban areas "share" more resources, have greater access to public transportation, and drive less (Dargay, 2002; Heinonen et al., 2013; Jones and Kammen, 2014).[39] There is also a significant negative correlation between census tract percentage of bachelor degrees (or above) and vehicle footprint; apparently census tracts with higher levels of education are producing relatively lower driving impacts. This particular relationship, though, did not carry over into the total mobility-dietary footprint.

6.1. Household Income and Climate Change Belief

Confirming the literature, household income – dietary carbon aside – had the largest significant impact of any independent variable. This finding reaffirms the established "income-carbon" relationship, the "inequalities" of carbon emissions, and lifestyle lock-in.[40] When examining the total footprint for a finding concerning the main question animating this research: *Does ACC belief moderate the income-carbon relationship?*, the finding is mixed and depends on what is meant by "belief". For *strong* "believers" like the CCAMS composite construct *Alarmed*, the answer is *yes*: ACC belief does moderate the income-carbon relationship. However, for those who are *not* strong believers, like the CCAMS *Concerned* or *Cautious*, the answer is *no*: this belief is not strong enough.

39 However, Heinonen et al. (2013) also argue that some overlooked behaviors may offset the "urban advantage" of proximity.

40 Rather than thinking of income as a medium for buying and disposing of products, energy and emissions, it could be thought of as a proxy for a set of normative, socially positioned behaviors – an *income lifestyle*, a *class culture*.

Thus, since the strongest ACC believer – the Alarmed – has demonstrated the potential to bridge the A-B gap; I reject my original null hypothesis.

This is not the first time scholars report that strong attitudes can overcome certain contexts (Guagnano et al., 1995) and with this finding I argue against the proponents of an A-B gap (Blake, 1999; Csutora, 2012; Gatersleben et al., 2002; Hoggett, 2013; Kollmuss and Agyeman, 2002; Whitmarsh et al., 2011; Wilson et al., 2013). Additionally, I align myself with scholars who argue that, essentially, the A-B gap is a measurement problem (Guber, 2013; Lertzman, 2013; Newhouse, 1990). In other words, there is no gap when a larger catchment of human concerns – like the multifaceted CCAMS belief construct – is considered in aggregate.[41]

In conclusion, I must reiterate that the income-carbon moderating capacity of the strong ACC attitude is slight and that – dietary emissions aside – income remains the most dominant predictive variable of GHGEs. This means that though an A-B gap may have been bridged, it may not make a great environmental difference. Thus, in light of this finding – that regardless of climate change belief those with the lowest incomes generally emit the lowest amounts of CO_2, I recommend policy tools – such as greater taxes and limits on both income and carbon emissions – that more directly constrain personal carbon emissive behaviors. Similar to the arguments of others, it appears that the most effective place to create environmentally significant behavioral change is at the structural, governmental, and institutional level (IPCC, 2014a; Princen et al., 2002; Szasz, 2011). However, I do not suggest this because I think culture and behavior are not powerful areas for creating change, but because I think it is difficult to *intentionally* generate change in these areas.

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41 There may be a gap between *environmental* attitudes and *environmental* behaviors, but human beings are not unidimensional.

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Appendix

Table 3. *Average and frequency information for the Alarmed including demographics, political ideology, neighborhood effects, household income, and climate beliefs.*

	Average or Frequency of Variable		Significance of Difference
	Alarmed	Non-Alarmed	
Median Age	50 yrs	45 yrs	t = -.886 (p=.376)
Gender			
% Male	38.5%	50.3%	χ^2 = 17.7 (p=.000)
% Female	61.5%	49.7%	
Education			
% High school or less	33.5%	46.8%	χ^2 = 38.3 (p=.000)
% Some college/Assoc.	28.2%	27.8%	
% Bachelor's degree	22.7%	17.8%	
% Master's/above professional, or doctoral	15.7%	7.6%	
Race/Ethnicity			
% White (Non-Hispanic)	66.3%	70.1%	χ^2 = 3.6 (p=.460)
% Black (Non-Hispanic)	10.9%	11.2%	
% Other (Non-Hispanic)	6.1%	5.2%	
% Hispanic	15%	12.4%	
% Two or more races (Non-Hispanic)	1.7%	1.0%	
Household			
Household size	2.47 persons	2.55 persons	t = .975 (p=.330)
Household income	$50,000 - $59,999 (median cat selection)	$50,000 - $59,999 (median cat.selection)	t = -.217 (p=.828)
Political ideology			
Very liberal	15.7%	4.0%	χ^2 = 149.5 (p=.000)
Somewhat liberal	32.1%	18.7%	
Moderate	38.4%	39.7%	
Somewhat conservative	10.9%	26.1%	
Very conservative	2.8%	10.6%	
Item non-response	0.1%	0.9%	
Neighborhood effects			
CT median income	$55,278	$53,820	t = -1.04 (p=.297)
CT % BA degree	30.79%	27.13%	t = -3.38 (p=.001)
MSA status	86.7%	83.0%	χ^2 = 2.95 (p=.086)
CT Pop. density	6119.03 pers/mile^2	4612.46 pers/mile^2	t = -1.80 (p=.072)
CCAMS belief segmentation			
Alarmed	18.0%		
Non-Alarmed		82.0%	
All Totals / Sample Size	100.0% / 380	100.0% / 1727	

Source: *Climate Change in the American Mind Survey (2008); US Census Bureau, American Community Survey 5-year Estimate, 2006-2010 (US Census Bureau, 2015).*

KULTURA, UGLJIČNI DIOKSID I KLIMATSKE PROMJENE: KLASNA ANALIZA VJEROVANJA U KLIMATSKE PROMJENE, INERTNOSTI ŽIVOTNOG STILA I OSOBNOG UGLJIČNOG OTISKA

Jean Léon Boucher

Sažetak

Globalne klimatske promjene jedno su od najvažnijih pitanja današnjice a emisije ugljičnog dioksida među glavnih krivcima za postojeće stanje. Ranija su istraživanja pokazala da su emisije ugljičnog dioksida usko povezane s visinom prihoda kućanstava – kako unutar određene države tako i usporedbom između država. Jedan od temeljnih razloga navedene veze između prihoda i emisija ugljičnog dioksida istraživači pronalaze u inertnosti životnog stila: nesposobnosti pojedinaca da izmijene svoje potrošačke navike zbog institucionaliziranih struktura, konteksta u kojima žive i vladajućih normi. Na reprezentativnom uzorku Sjedinjenih Američkih Država (N=2107) provjerili smo korelaciju između vjerovanja u klimatske promjene i odnosa između prihoda i emisija ugljičnog dioksida (emisije se odnose na ugljični otisak izmjeren isključivo za osobnu mobilnost i način prehrane). Pronašli smo statistički značajne pozitivne korelacije između vjerovanja u klimatske promjene i osobnog ugljičnog otiska kod samo jednog dijela populacije – onih koji su najzabrinutiji oko klimatskih promjena (18% uzorka). Dodatno, potvrdili smo statistički značajnu pozitivnu korelaciju između prihoda kućanstva i emisija ugljičnog dioksida – prihodi su se pokazali najjačim prediktorom. U radu predlažemo oporezivanje i ograničavanje kako prihoda tako i emisija ugljičnog dioksida.

Ključne riječi: *osobni ugljični otisak, ekološko ponašanje, ekološki stavovi, inertnost životnog stila, vjerovanje u klimatske promjene*

KULTUR, KOHLENSTOFFDIOXID UND KLIMAWANDEL: KLASSENANALYSE DES GLAUBENS AN DEN KLIMAWANDEL, TRÄGHEIT DES LEBENSSTILS UND PERSÖNLICHER CO2-FUßABDRUCK

Jean Léon Boucher

Zusammenfassung

Der globale Klimawandel ist eine der wichtigsten Fragen der Gegenwart und die Kohlenwasserstoffemission eine der Hauptursachen dieses Zustands. Vorherige Forschungen haben gezeigt, dass die Kohlenwasserstoffemission eng verbunden ist mit der Einkommenshöhe der Haushalte, sowohl innerhalb eines Staates als auch im Vergleich unter Staaten. Einen der Hauptgründe der genannten Verbindung zwischen Einkommen und Kohlenwasserstoffemission sehen die Forscher in Trägheit des Lebensstils: der Unfähigkeit des Einzelnen nämlich, seine Verbrauchergewohnheiten zu ändern infolge der institutionalisierten Strukturen, des Lebenskontextes und der vorherrschenden Normen.

An einem repräsentativen Muster der USA (N=2107) haben wir die Korrelierung zwischen dem Glauben an die Klimaänderung und dem Verhältnis des Einkommens und der Kohlenwasserstoffemission geprüft (Emissionen beziehen sich ausschließlich auf den CO2-Fußabdruck für persönliche Mobilität und Ernährungsweise). Wir haben statistisch bedeutende positive Korrelierungen gefunden zwischen dem Glauben an den Klimawandel und dem persönlichen CO2-Fußabdruck bei nur einem Teil der Population – bei denjenigen nämlich, die sich wegen des Klimawandels am meisten Sorgen machen (18% des Musters). Außerdem haben wir statistisch bedeutende positive Korrelierungen zwischen dem Haushaltseinkommen und den CO2-Emissionen bestätigt – die Einkünfte haben sich als der stärkste Prädiktor gezeigt. Deshalb schlagen wir Besteuerung und Begrenzung sowohl von Einkünften als auch von CO2-Emissionen vor.

Schlüsselwörter: *persönlicher CO2-Fußabdruck, ökologisches Verhalten, Stellungnahmen zum Umweltschutz, Trägheit des Lebensstils, Glauben an den Klimawandel*