American University of Sharjah
الجـــامـعـة الأمـيـركـيـة فـي الـشـــارقـة
CENTER FOR ENTREPRENEURSHIP, INNOVATION AND SUSTAINABLE DEVELOPMENT
مركز ريادة الأعمال والابتكار والتنمية المستدامة

Working Paper Series

Working Paper No. 24-01

Organic Product Consumption and Environmental Awareness

Jay Squalli[a]
Soumya Gupta[a,b]

[a] CEISD, AUS
[b] Tata-Cornell Institute for Agriculture and Nutrition, Cornell University

Organic Product Consumption and Environmental Awareness

Abstract

This study explores the relationship between organic product consumption and environmental awareness in the United States. It tests the premise that demand for organic products reflects an alignment between individuals' consumption choices and environmental values. Using U.S. state-level data on household demographics, actual purchase of organic foods, the broader food environment and a set of eight indicators for environmental beliefs, this research yields several key findings. Environmental awareness variables are consistently associated with greater organic product purchases at the state level. At the same time, factors like education, population density, sex ratio and personal consumption expenditures also show a positive association with demand for organic products. These findings remain robust across various model specifications and after accounting for potentially influential observations. This study contributes policy-relevant recommendations into both demand-side and supply-side factors that can support increased purchases of organic products.

Keywords: Environmental awareness, organic product consumption, sustainable consumption, environmental attitudes, environmental concerns.

1. Introduction

Pro-environmental individuals often develop a "green identity" tied to their beliefs, attitudes, and potential actions toward environmental protection and sustainability. Individuals who identify as pro-environmental often engage in pro-environmental behavior (Whitmarsh and O'Neill, 2010). They also have a greater awareness of the environmental issues associated with conventional

farming practices and the environmental benefits of organic farming. As a result, such individuals may actively seek out opportunities to express their environmental values in various aspects of their lives, including their consumption choices. Organic food consumption can serve as a visible and tangible expression of this green identity. Individuals might choose organic foods as a means to align their consumption choices with their environmental values. Such individuals may also perceive organic food consumption as a way to align their behavior with the perceived social norm of environmentally responsible living, thereby reinforcing their green identity and maintaining a positive social identity within their environmental community.

In practice, however, not all who express pro-environmental beliefs end up purchasing organic foods. The higher cost of organic products can represent a significant financial deterrent for many individuals (Shepherd et al., 2005). In addition, organic foods may also be less accessible or available particularly in rural areas or places designated as food deserts. Some pro-environmental consumers might also prefer buying locally grown food as a means to support nearby farmers over organic alternatives that may have been transported over long distances.

There is a sizable literature that has analyzed the drivers of food choice particularly with respect to organic foods. However, an overwhelmingly large number of studies has concentrated on consumers' intentions to purchase rather than their actual behavior. Intent is usually measured by assessing individuals' willingness to buy or consume organic products if they become available or in the future. To the extent that intent serves as the precursor to actual behavior, it is assumed that it will be followed through by the action of actual purchase or consumption of organic foods. The link between intent and actual behavior is often described under the theory of planned behavior (TPB), which stipulates that intent often significantly predicts actual behavior (Ajzen, 1991). Empirical evidence, however, on such an eventual outcome is scant and varies depending on studies' scope, sample size, products, and methodology. For instance, a study focusing on Sweden provided mixed evidence linking en-

vironmental concern to both purchase intent and actual purchase, which varied across different products (Shepherd et al., 2005). On the other hand, a study focusing on Germany provided support for the TPB (Janssen, 2018), whereas a study focusing on India provided evidence supporting a positive association between environmental concern and intent to purchase organic food and no association between environmental concern and actual purchase of organic food (Tandon et al., 2020).

The lack of consensus on the TPB in previous research suggests there is room for further investigation, particularly concerning actual consumption rather than intent to consume organic food. The present study aims to contribute to the current literature by focusing on the tangible aspect of actual consumption and by being the first study that makes use of U.S. state-level data for 2016 from a sample of 100,000 households.

While this data is aggregated at the state level rather than the individual level used in previous research, the large sample used in this study provides significant advantages. First, research findings are likely to be more robust and reliable. With data from 100,000 households, the study can account for a wide variety of socio-economic, demographic, and regional differences, reducing the likelihood of biases that might affect smaller sample studies. Second, state-level data allows for the examination of broader regional trends and variations, which cannot be achieved by smaller and often local samples. Such insights are particularly meaningful to policymakers aiming to promote organic food consumption, as they can assist in crafting tailored strategies that consider regional contexts. To this end, this paper is organized as follows. Section 2 summarizes previous relevant research. Section 3 describes the data and methodology. Section 4 summarizes the estimation results. Section 5 discusses the results and concludes.

2. Previous Literature

Consumer attitudes toward organic food and their relationship with pro-environmental concerns have been the subject of extensive research. Previous studies can be categorized into three main strands: those examining consumer intent to purchase organic food, those investigating actual purchasing behavior, and those analyzing both consumer intent and actual consumption of organic food. The following represents a chronological review of the key findings from some relevant studies in all three strands. Table 1 summarizes some of the key details.

A study based on a sample of around 500 respondents in Sweden analyzed the drivers of attitudes and purchase frequency of organic foods (Shepherd et al., 2005). Using a multiple regression approach, the study found that environmentally friendly behavior held comparable importance to perceived health benefits in shaping consumers' positive attitudes toward purchasing various organic products, including milk, meat, potatoes, and bread. However, the study's analysis yielded mixed evidence concerning the impact of pro-environmental attitudes on the purchase frequency of organic milk, and it did not establish a significant link between these attitudes and the purchase frequency of organic meat.

Li et al. (2007) looked at drivers of organic food choice in a sample of 726 respondents from the University of Wisconsin's Study of Food Buying carried out in 2003 in the United States. Factors that were significant determinants of the decision to purchase organic foods included shopping venue, awareness of the organic USDA label, positive beliefs toward organic foods, a positive attitude toward cooking, and a lack of religious affiliation. Convenience, food safety and environmental concerns however were not significantly associated with organic food purchasing behavior. Their analysis was based on an endogenous switching regression model and they used two dependent variables, frequency of purchase of organic foods, and log of weekly per capita food expenditure in the household.

In a study focusing on the United Arab Emirates, Al-Taie et al. (2015) used a

sample of 266 respondents to assess the determinants of organic food consumption in the country. The study found that health and environmental awareness were the main factors contributing to the choice of consuming organic food. On the other hand, the study also found that factors such as cost, availability, shelf life, taste preferences, and a lack of knowledge represented barriers limiting the consumption of organic foods.

In a study conducted in Sri Lanka in 2015, Kapuge (2016) made use of data from 400 respondents and multiple regression analysis to investigate the factors influencing intent to purchase organic foods. The findings revealed that awareness and health benefits associated with organic foods significantly influenced consumer intent to purchase. However, factors such as concern for the environment showed no significant impact on intent to purchase.

In another study focusing on India, Yadav (2016) used a two-step structural equation model involving 304 consumers. Their research examined the role of concern for the environment in influencing consumer attitudes and intent to purchase organic foods. The study revealed that individuals tended to purchase organic foods primarily due to their perceived environmental benefits compared to traditional foods. Conversely, perceived health benefits, such as better nutritional value and greater food safety, were viewed as egoistic motivations since they primarily benefited the individual. The study concluded that both altruistic (environmental concern) and egoistic (health benefits) values played important roles in shaping attitudes toward the intent to purchase organic foods, but with egoistic motivations exerting a stronger influence.

Janssen (2018) analyzed the gap between attitudes towards organic foods and their actual purchase, for a panel of 9,470 households in Germany. In addition to environmental protection, they controlled for other characteristics associated with organic foods like "healthiness and naturalness", "quality and enjoyment", "price consciousness", "convenience orientation" and "local and domestic food" origin. The dependent variable was a measure of the share of a household's annual food budget spent on purchase of organic foods. The study found an attitude-behavior gap with regards to purchase of organic foods.

While over 20% of the respondents indicated an intent to purchase organic foods, less than 3% of the sample spent more than 20% of their food budget on organic foods. Despite this, structural equation models revealed that the same set of factors influenced both attitudes and purchases of organic foods, albeit to different degrees. Households had a greater share of organic foods in their food budget when they cared more about the environment, health, quality and local aspects.

Laureti and Benedetti (2018) relied on a two-stage multilevel random effects model to analyze the role of environmental concerns and attitudes on demand for organic foods. They utilized data from the 2014 round of the Aspect of Daily Life Survey in Italy that covered a sample of 50,000 individuals across 20,000 households in the country. Their study is unique in that it relied on self-reported frequency of purchase of organic foods (never, seldom, sometimes, always) in contrast to an intent to purchase. It also included controls for individual concerns about a range of environmental conditions along with pro-environmental behaviors and social behaviors. They found that consumer concern for environmental issues like animal welfare, deforestation and soil pollution, amongst others, were associated with a higher probability of purchase of organic foods.

In another study also focusing on urban India using a sample of 870 individuals and multiple regression analysis highlighted the role of environmental concerns as one of nine key determinants of purchase decisions related to organic foods (Basha and Lal, 2019). The study concluded that environmental concerns were one of the key factors associated with consumer purchase intentions. Furthermore, there was also a significant role played by other factors like health and lifestyle, product quality, price and subjective norms, amongst others.

Tandon et al. (2020) focused on the association of consumer motivations, attitudes and actual purchase behavior related to organic foods of 378 consumers from India. They accounted for the role of environmental factors in two ways. The first was by viewing individual preference for organic foods as being intrinsically motivated because of a concern for protecting the environment. Additionally, they accounted for the mediating role of environmental concerns

in the association of consumer motivations with purchase of organic foods. Results of a structural equation model suggested that while intrinsic motivation was associated with positive attitudes towards organic foods, it was not so with buying behavior. Such a gap was thought to be the result of context-specific factors like price sensitivity and availability of organic foods. Moreover, environmental concerns did not moderate the relationship between motivations and actual buying behavior. This was attributed to a low level of consumer awareness/knowledge about the environmental benefits associated with organic food consumption.

Kocer et al. (2023) evaluated the determinants of consumer decisions to purchase organic foods using data from 425 consumers in Turkey and structural equation model. The study found that environmental concerns were not a significant determinant of consumer attitudes towards organic foods. Rather it was concerns related to health, food safety, quality and price sensitivity that played a significant role.

In a study focusing on India and using a sample of 323 organic food consumers, Rashid and Lone (2023) found that purchase decisions for organic products were positively influenced by a combination of internal and external factors. Internal factors included individuals' attitudes toward organic products and their health consciousness, while external factors represented social pressures regarding the adoption of green products and concerns about the environment.

In sum, as reflected in Table 1, most studies indicate a positive association between environmental concerns and both the intent to purchase and the actual purchase of organic food. However, the relationship remains complex and not universally consistent. While many studies find that environmental concerns significantly influence consumer attitudes and purchasing decisions, others reveal additional elements. Factors such as health benefits, price sensitivity, and availability often play a significant role alongside or even overshadowing environmental motivations. Furthermore, a gap often exists between expressed intent and actual purchasing behavior, suggesting that despite pro-environmental attitudes, practical barriers and individual preferences significantly impact the

actual consumption of organic foods. Therefore, while environmental concerns are a key factor, they are part of a broader set of determinants influencing organic food purchases, and the extent to which they translate into actual behavior remains variable and worthy of further scrutiny.

3. Material and methods

3.1. Data

The data used in this study for the dependent variable are from the Organic Trade Association and represent the percentage of U.S. households purchasing organic products (*organic*). These data are available only for the year 2016 and are derived from Nielsen UPC scan data of 100,000 households. Consequently and for consistency, data for all explanatory variables are also limited to the year 2016.

Environmental awareness is measured using data from the Yale Program on Climate Change Communication, which are based on public opinion surveys of over 28,000 respondents. While the dataset includes 41 variables covering various dimensions of public opinion on environmental issues, this analysis focuses specifically on eight variables that reflect environmental awareness and likely commitment to environmental action. The eight variables we focus on in this analysis are as follows: 1) respondent has personally experienced global warming (*exp*), 2) respondent believes that global warming is happening (*happening*), 3) think that global warming can cause moderate/ great harm to the US people (*harmus*), 4) respondent believes that global warming is the result of human activity (*human*), 5) considers global warming to be a very/extremely important concern (*important*), 6) believe global warming can cause a moderate/great deal of personal harm (*personal*), 7) concerned about the adverse impact of global warming on the American people within the next ten years (*timing*), and 8) are somewhat/very worried about global warming (*worried*).

Table 2 lists all the variables and their descriptions. Descriptive statistics for all the variables are in Table 3. Data from the Bureau of Economic Analysis

includes a variable representing the proportion of personal consumption expenditures on food and beverages for off-premises consumption, such as groceries bought for home use (*consumption*). Data from the U.S. Census Bureau include:

1. Educational Attainment (*edu*): measured by the percentage of the population aged 25 years or older with a bachelor's degree or higher.
2. Population Density (*popdensity*): calculated using population and land area data.
3. Median Age (*medianage*): representing the age at which half the population is older and half is younger.
4. Sex Ratio (*sexratio*): the number of males per 100 females.

Other data also include the percentage of people with low access to a supermarket or large grocery store, known as food deserts (*fooddesert*), which is from the United States Department of Agriculture's Economic Research Service. This measure uses the population-weighted average of the share of the urban population living more than one mile from a supermarket and the share of the rural population living more than ten miles from a supermarket. Other data from the same source include data capturing the number of certified organic farms per million capita (*pcfarms*), which are calculated using population data from the U.S. Census Bureau and the number of certified organic farms from the Certified organic survey 2016 summary, National Agricultural Statistics Service, Table 1.

3.2. Methodology

This study aims to assess the connection between organic consumption and environmental awareness, primarily based on prior research to formulate the following model specification:

$$\begin{aligned} \text{organic}_i &= \alpha_0 + \alpha_1\ \text{consumption}_i + \alpha_2\ \text{edu}_i + \alpha_3\ \text{fooddesert}_i \\ &+ \alpha_4\ \ln \text{medianage}_i + \alpha_5\ \ln \text{pcfarms}_i + \alpha_6\ \ln \text{popdensity}_i \\ &+ \alpha_7\ \text{sexratio}_i + \alpha_8\ \text{ENV}_i + \epsilon_i \end{aligned} \tag{1}$$

where the variable *organic*, representing the percentage of U.S. households purchasing organic products, is estimated with respect to several factors: the proportion of personal consumption expenditures on food and beverages for off-premises consumption (*consumption*), the proportion of the population aged 25 years or older with a bachelor's degree or higher (*edu*), the percentage of people with low access to a supermarket or large grocery store (*fooddesert*), log median age (*medianage*), the log of the number of certified organic farms per million capita (*pcfarms*), the log of the population density (*popdensity*), the number of males per 100 females (*sexratio*), and a vector of eight environmental awareness variables (ENV). The model also includes ϵ_i as a state-specific error component.

In this study, we introduce three novel explanatory variables, namely *consumption*, *fooddesert*, and *pcfarms*, which help control for factors that have not been addressed in previous research. The first variable is *consumption*, which is used to assess the hypothesis that when a greater proportion of personal consumption expenditures is allocated to food and beverages for off-premises consumption, households may have more financial flexibility and may prioritize choosing higher-quality, healthier, and safer options, such as organic products.

The second novel variable is *fooddesert*, which controls for the likelihood that U.S. states with a higher prevalence of food deserts might see reduced consumption of organic foods. Several factors contribute to this hypothesized link. First, organic products are scarce in food deserts due to the absence or distant location of supermarkets and grocery stores that typically offer a diverse selection of organic options. Second, the higher cost of organic products compared to conventional foods poses a barrier to consumption, particularly for residents of food deserts who often have lower incomes and may turn to more budget-friendly, calorie-dense options such as fast food. Third, retailers in food deserts might not have the incentive to stock organic products due to perceived or actual low demand, thereby creating a self-reinforcing cycle where the lack of supply limits demand.

The third novel variable is *pcfarms*, which represents the number of certified organic farms per million capita. This assesses the hypothesis that a higher

number of certified organic farms can potentially lead to increased availability of organic products, thereby contributing to higher consumption of organic products.

The variable *edu* is included based on previous research, which suggests a positive correlation between education level and the likelihood of purchasing organic products (Singh and Verma, 2017; Janssen, 2018; Laureti and Benedetti, 2018). This obviates the need for a variable capturing income (or per capita GDP), given their high correlation within the dataset (0.6). It is worth noting that the *edu* variable is preferable for a number of reasons. First, education is a more reliable predictor than income in cross-sectional studies due to its stability over time compared to income, which can fluctuate due to economic conditions, job changes, and other factors. Second, unlike income, which does not necessarily translate into organic consumption, education is often associated with higher levels of knowledge and awareness about health, nutrition, and environmental issues. In fact, educational programs often include components that raise awareness about environmental issues, sustainability, and the benefits of organic products, thus directly influencing consumer attitudes and behaviors. Third, given the high correlation between *edu* and per capita GDP, excluding the latter would allay concerns about multicollinearity and the resulting model would focus on a variable that captures both the ability to purchase and the awareness that drives organic consumption.

The *medianage* variable is included to account for previous findings suggesting that younger demographics are more inclined to buy organic products (Singh and Verma, 2017; Janssen, 2018; Laureti and Benedetti, 2018). The variable *popdensity* is used to control for the contention that people living in small towns or rural areas are more likely to buy organic food products relative to those living in medium or large cities (Laureti and Benedetti, 2018). The variable *sexratio* is also accounted for, reflecting previous research indicating that males are less likely than females to purchase organic items Laureti and Benedetti (2018). Finally, the eight environmental awareness variables are introduced separately to explore whether states with greater environmental awareness exhibit higher

rates of organic product purchases by households.

When introducing novel explanatory variables, it is important to adopt an approach that balances complexity and explanatory power while minimizing the risk of overfitting and improving model interpretability. This can be accomplished through stepwise regression, which selects a parsimonious model with fewer variables. The process begins with stepwise forward selection, sequentially adding predictors based on their significant contribution to explaining the variation in organic product consumption. This is followed by systematic backward elimination, removing the least statistically significant predictors.

Estimations begin with a base model that includes only variables studied in the previous literature, namely *edu*, *medianage*, *popdensity*, and *sexratio*. Subsequently, novel variables are incrementally added. Variables demonstrating poor explanatory power are then excluded. Finally, a parsimonious model is identified, and environmental awareness variables are individually incorporated in separate estimations. Each estimation is performed using a Least Squares estimator with bootstrapped standard errors and 500 bootstrap replications. This approach addresses concerns about within-sample distortions and provides estimates of standard errors and confidence intervals based on the sample's underlying distribution, rather than relying on a priori distributional assumptions.

4. Estimation Results

Table 4 summarizes the estimation results from the stepwise model selection process. Column (1) presents the results for the base model, while columns (2) through (4) display the sequential addition of novel predictors. Column (5) shows the final selected model, based on the backward elimination of statistically insignificant variables. In the base model, only the coefficient estimates for *edu* and *sexratio* are positive and statistically significant ($p < 0.001$). When *consumption* is introduced in column (2), the coefficient estimate for *logpopdensity*, previously not significant, becomes positive and statistically significant ($p < 0.05$). The coefficient estimate for *consumption* is also positive and statis-

tically significant ($p < 0.001$). Adding *logfarmspc* and *fooddesert* in columns (3) and (4) does not affect the estimation results for the other variables, and their own coefficient estimates are not statistically significant.

This stepwise process reveals no evidence of a link between organic consumption and three variables: *logmedianage*, *logfarmspc*, and *fooddesert*. Only the variables *edu*, *logpopdensity*, *sexratio*, and *consumption* consistently maintain their statistical significance. While the positive and statistically significant coefficient estimate for *edu* is consistent with previous research and that for consumption is as expected, the implications regarding *logpopdensity* and *sexratio* diverge from previous research, suggesting that states with greater population density and a higher ratio of males to females were more likely to purchase organic products (Laureti and Benedetti, 2018).

The final model in column (5), which includes only these consistently significant variables, demonstrates the greatest explanatory power. Consequently, this specification is used as the base model for further analysis, namely the addition of environmental awareness variables.

Table 5 summarizes the bootstrap estimation results of the selected base model augmented with environmental awareness variables. Columns (1) through (8) present separate estimation results for the full specification after incorporating individual environmental awareness variables. Overall, the inclusion of these variables does not substantially alter the relationships between organic consumption and the variables from the base specification.

An important exception is the variable *edu*. Statistical significance for this variable is maintained in only two out of the eight estimations. This is not surprising given the high correlation between most of the environmental awareness variables and *edu*. Specifically, the correlations are 0.64 between *exp* and *edu*, 0.76 between *happening* and *edu*, 0.68 between *harmus* and *edu*, 0.71 between *human* and *edu*, 0.59 between *important* and *edu*, 0.52 between *personal* and *edu*, 0.61 between *timing* and *edu*, and 0.70 between *worried* and *edu*.

Despite the varying significance of *edu*, the estimation results consistently demonstrate a positive and statistically significant relationship between all en-

vironmental awareness variables and organic consumption. This persistent positive relationship highlights the associative and potentially influential role of environmental awareness in shaping consumer preferences for organic products.

4.1. Robustness of the Results

Given the cross-sectional nature of this study, data variability and the presence of outliers may represent an important concern, which can be effectively addressed using M-estimation with Huber weighting. M-estimation offers a robust method for estimating regression parameters, mitigating issues that might surface during the bootstrap resampling process. Although bootstrapping is a powerful technique for estimating the sampling distribution of regression coefficients, it can be sensitive to outliers. This sensitivity may result in biased or inefficient parameter estimates. M-estimation addresses this issue by assigning lower weights to potential outliers, thereby reducing their influence on the final estimates. Specifically, Huber weighting within M-estimation provides a balance between ordinary least squares (OLS) and more robust methods, minimizing the impact of outliers without completely disregarding them.

Table 6 reports Huber M-estimation results. The findings in columns (1) through (8) are largely consistent with those in Table 5, with one minor exception: the *edu* variable is statistically significant in only one out of the eight estimations. The statistical significance of *consumption*, *logpopdensity*, and *sexratio* remains largely unaffected by the introduction of the environmental awareness variables. Similar to the original estimations, the relationship between environmental awareness and organic consumption is consistently positive and statistically significant (at least $p < 0.01$) across all nine estimations.

To further assess the robustness of the results, all estimations were also completed using per capita GDP in lieu of education. This change had no impact on the parameter estimates for the environmental awareness variables and maintained the conclusions reached in the analysis. For brevity, these estimation results are not reported.

In sum, the consistency of the results indicates that even after addressing

the potential influence of outliers, the conclusions drawn from the bootstrap estimations remain robust. These results highlight the persistent and statistically significant link between environmental awareness and organic consumption, reinforcing the reliability of the initial findings.

5. Discussion and conclusions

The findings of this study reveal important insights into the factors associated with organic product consumption across U.S. states. The positive associations between organic consumption and both personal consumption expenditures on food and beverages for off-premises consumption and population density highlight the role of financial flexibility, the potential prioritization of higher-quality, healthier, and safer options, such as organic products, and more densely populated states in driving demand for organic products. This study also consistently demonstrates a positive relationship between environmental awareness and organic consumption, mirroring the connection to educational attainment. The robustness of this link is affirmed through alternative specifications addressing potential outliers via Huber M-estimation.

The positive association with population density can be attributed to several factors. Densely populated areas usually have a higher concentration of grocery stores, farmers' markets, and specialty food shops, which are more likely to stock a diverse range of products, including organic options. With greater population density comes greater demand for high-quality, diverse food options. Retailers and producers respond to this demand by offering a wider selection of organic products. The competitive market environment in such areas can drive prices down and make organic products more affordable and appealing to a broader audience.

The unexpected positive correlation with the sex ratio sets the stage for further research into gender dynamics and purchasing behaviors within different cultural and geographic contexts. In particular, this study diverges from prior research focused on Italy, which suggested a higher tendency among females to

purchase organic products. Instead, this study indicates a greater likelihood of organic product purchases in U.S. states with a higher ratio of males to females.

This disparity can be attributed to two primary factors. First, while both the United States and Italy boast rich culinary cultures, their culinary landscapes differ significantly. Italy's culinary traditions typically revolve around fresh, locally sourced ingredients and traditional recipes. In contrast, the U.S. culinary scene is more diverse and influenced by a multitude of cultural traditions. These differing cultural attitudes toward food may lead to variations in consumer behaviors regarding organic product purchases. Second, societal norms regarding gender roles and household responsibilities differ between the two countries. In the United States, gender roles have evolved over time, with a trend toward greater gender equality in household responsibilities. In contrast, Italian society tends to uphold more traditional gender roles, with women typically responsible for the bulk of grocery shopping and meal preparation duties. These disparities in gender roles and household dynamics can undoubtedly influence purchasing decisions and preferences for organic products.

Despite these important insights, the study has limitations. First, it relies on cross-sectional data, which captures a single point in time and may not account for changes in consumer behavior over time. Unfortunately, the choice of data for organic consumption limits access to panel data. Second, the study is based on state-level data, which may mask significant within-state variations in organic consumption patterns. Ideally, this analysis should be at the individual or household level. Nevertheless, this represents a first attempt at investigating the link between environmental awareness and organic consumption at the U.S. state level. Third, the study does not consider other potential confounding variables such as regional influences, availability of organic products, and marketing efforts.

Such limitations notwithstanding, findings from this study offer important recommendations for the design of policies aimed at enhancing both the demand for and supply of organic foods. The significance of educational attainment suggests that governments and educational institutions should enhance envi-

ronmental education programs to raise awareness about the benefits of organic products and sustainable consumption practices.

At the same time, the significance of predictors like personal consumption expenditure and population density points to the importance of ensuring that the increasing demand for organic foods is matched by a corresponding increase in the supply or availability of such foods. To this end, policymakers should work to improve access to organic products, particularly in underserved areas, by supporting local organic farmers and reducing barriers to market entry. They should also consider implementing financial incentives such as subsidies or tax breaks for organic products to make them more affordable and attractive to a broader range of consumers.

Furthermore, from the standpoint of businesses or producers, the consistently strong and significant relationship between the environmental variables and purchase of organic foods points to the value of incorportating concerns related to environmental sustainability in their production processes as they consider switching from conventional methods of food production to organic agriculture.

Future research can consider focusing on specific types of organic foods (eg. dairy, vegetables and so on) to generate evidence-based recommendations for specific food groups. It should also investigate variations in drivers of organic food consumption over time and across regions. Further research should also be conducted to understand the gender dynamics influencing organic consumption, which policymakers can use to tailor public awareness campaigns and initiatives that resonate with different demographic groups.

References

Ajzen, I., 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179–211.

Al-Taie, W.A., Rahal, M.K., AL-Sudani, A.S., AL-Farsi, K.A., 2015. Exploring the consumption of organic foods in the united arab emirates. Sage Open 5, 2158244015592001.

Basha, M.B., Lal, D., 2019. Indian consumers' attitudes towards purchasing organically produced foods: An empirical study. Journal of Cleaner Production 215, 99–111.

Janssen, M., 2018. Determinants of organic food purchases: Evidence from household panel data. Food Quality and Preference 68, 19–28.

Kapuge, K., 2016. Determinants of organic food buying behavior: special reference to organic food purchase intention of sri lankan customers. Procedia Food Science 6, 303–308.

Kocer, L.L., Ulucak, Z.S., Akca, T.D., 2023. The role of environmental concern in purchasing decision on organic food and the link to greenwashing. Environment, Development and Sustainability , 1–24.

Laureti, T., Benedetti, I., 2018. Exploring pro-environmental food purchasing behaviour: An empirical analysis of italian consumers. Journal of Cleaner Production 172, 3367–3378.

Li, J., Zepeda, L., Gould, B.W., 2007. The demand for organic food in the us: an empirical assessment. Journal of Food Distribution Research 38, 54–69.

Rashid, I., Lone, A.H., 2023. Organic food purchases: does green trust play a part? Asia-Pacific Journal of Business Administration , in press.

Shepherd, R., Magnusson, M., Sjödén, P.O., 2005. Determinants of consumer behavior related to organic foods. AMBIO: A Journal of the Human Environment 34, 352–359.

Singh, A., Verma, P., 2017. Factors influencing indian consumers' actual buying behaviour towards organic food products. Journal of Cleaner Production 167, 473–483.

Tandon, A., Dhir, A., Kaur, P., Kushwah, S., Salo, J., 2020. Why do people buy organic food? the moderating role of environmental concerns and trust. Journal of Retailing and Consumer Services 57, 102247.

Whitmarsh, L., O'Neill, S., 2010. Green identity, green living? the role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. Journal of Environmental Psychology 30, 305–314.

Yadav, R., 2016. Altruistic or egoistic: Which value promotes organic food consumption among young consumers? a study in the context of a developing nation. Journal of Retailing and Consumer services 33, 92–97.

Table 1: Selected previous relevant research

Contribution	Scope	Sample size	Organic food consumption	Statistical significance of environmental concern
Shepherd et al. (2005)	Sweden	around 500	Intent	Significant (+)
			Purchase	Mixed
Li et al. (2007)	USA	726	Purchase	Not significant
Al-Taie et al. (2015)	UAE	266	Purchase	Significant (+)
Kapuge (2016)	Sri Lanka	400	Intent	Not significant
Yadav (2016)	India	304	Intent	Significant (+)
Janssen (2018)	Germany	9,470	Intent	Significant (+)
			Purchase	Significant (+)
Laureti and Benedetti (2018)	Italy	50,000	Purchase	Significant (+)
Basha and Lal (2019)	India	870	Intent	Significant (+)
Tandon et al. (2020)	India	378	Intent	Significant (+)
			Purchase	Not significant
Kocer et al. (2023)	Turkey	425	Intent	Not significant
Rashid and Lone (2023)	India	323	Purchase	Significant (+)

Table 2: Description of variables

Variable	Description
organic	% of U.S. households purchasing organic products
consumption	% of personal consumption expenditures on food and beverages for off-premises consumption
desert	Food desert: the share of the urban population living more than one mile from a supermarket and the share of the rural population living more than ten miles from a supermarket
edu	% of the population 25 years or older with a bachelor's degree or higher
medianage	Median age in years
pop	Population density: population per square mile
sexratio	Number of males per 100 females
exp	% who somewhat/strongly agree that they have personally experienced the effects of global warming
happening	% who think that global warming is happening
harmus	% who think global warming will harm people in the US a moderate amount/a great deal
human	% who think that global warming is caused mostly by human activities
important	% who think global warming is very or extremely important
personal	% who think global warming will harm them personally a moderate amount/a great deal
timing	% who think global warming will start to harm people in the United now/within 10 years
worried	% who are somewhat/very worried about global warming

Table 3: Summary Statistics ($n = 48$)

Variable	Mean	Std. Dev	Min	Max
organic	81.25	6.40	69	92
consumption	7.94	0.76	6.39	9.75
edu	30.48	5.17	20.8	42.7
farmspc	73.23	137.52	2.09	873.74
fooddesert	54.16	8.99	38.93	78.83
medianage	38.42	2.36	30.7	44.5
popdensity	175.23	214.49	5.95	1045.49
sexratio	97.46	2.81	93.1	106.1
exp	34.95	6.25	22.80	49.28
happening	68.08	5.49	57.80	78.99
harmus	55.03	5.99	43.24	67.98
human	51.38	5.78	38.84	62.03
important	25.80	3.41	19.86	34.80
personal	37.93	4.74	28.33	49.28
timing	48.42	5.65	35.6	59.42
worried	55.50	6.22	41.76	68.36

Table 4: Bootstrap estimation results for model selection ($n = 48$)

Variables	(1)	(2)	(3)	(4)	(5)
edu	0.534***	0.639***	0.689***	0.685***	0.649***
	(0.138)	(0.135)	(0.169)	(0.167)	(0.138)
logmedianage	7.681	4.074	8.348	10.18	
	(11.17)	(9.124)	(10.98)	(11.49)	
logpopdensity	1.447	3.172*	2.924*	2.798*	3.150**
	(1.168)	(1.273)	(1.252)	(1.310)	(1.191)
sexratio	1.408***	1.866***	1.939***	1.975***	1.818***
	(0.374)	(0.411)	(0.434)	(0.462)	(0.377)
consumption		3.636***	3.678**	3.369**	3.671***
		(1.079)	(1.128)	(1.164)	(1.080)
logfarmspc			-0.507	-0.641	
			(0.773)	(0.819)	
fooddesert				-0.0736	
				(0.106)	
Intercept	-106.9	-178.2**	-200.0**	-202.5**	-159.1***
	(58.79)	(61.50)	(71.16)	(72.97)	(43.66)
Adj. R^2	0.408	0.518	0.513	0.511	0.528

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Bootstrap estimation results ($n = 48$)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
consumption	3.665***	3.869***	3.761***	3.806***	3.324***	3.864***	3.557***	3.834***
	(0.769)	(0.936)	(0.821)	(0.921)	(0.819)	(0.856)	(0.764)	(0.916)
edu	0.212	0.103	0.193	0.283	0.250*	0.363**	0.202	0.262
	(0.141)	(0.137)	(0.129)	(0.172)	(0.127)	(0.116)	(0.138)	(0.170)
logpopdensity	2.746**	2.866**	2.746**	2.824**	2.887**	2.658**	2.649**	2.946**
	(0.894)	(0.968)	(0.986)	(0.995)	(0.905)	(0.927)	(0.943)	(1.077)
sexratio	2.196***	2.091***	2.145***	2.074***	1.947***	2.150***	2.342***	2.144***
	(0.300)	(0.298)	(0.316)	(0.324)	(0.292)	(0.300)	(0.278)	(0.334)
exp	0.591***							
	(0.127)							
happening		0.703***						
		(0.154)						
harmus			0.606***					
			(0.125)					
human				0.500**				
				(0.180)				
important					0.960***			
					(0.201)			
personal						0.697***		
						(0.133)		
timing							0.711***	
							(0.150)	
worried								0.481**
								(0.154)
Intercept	-201.4***	-217.3***	-209.4***	-198.3***	-180.4***	-208.5***	-227.9***	-206.2***
	(34.22)	(36.82)	(35.86)	(38.15)	(34.80)	(35.56)	(33.23)	(38.71)
Adj. R^2	0.664	0.640	0.645	0.592	0.682	0.669	0.679	0.598

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Huber M-estimation results ($n = 48$)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
consumption	3.531**	3.698***	3.602***	3.656***	3.280**	3.775***	3.351***	3.665***
	(1.002)	(0.976)	(0.994)	(1.031)	(1.020)	(1.007)	(0.913)	(0.982)
edu	0.249	0.110	0.218	0.247	0.303	0.419*	0.219	0.222
	(0.184)	(0.205)	(0.190)	(0.201)	(0.177)	(0.163)	(0.166)	(0.193)
logpopdensity	2.438*	2.480*	2.474*	2.504*	2.644*	2.350*	2.337*	2.700*
	(1.067)	(1.036)	(1.058)	(1.098)	(1.079)	(1.074)	(0.974)	(1.041)
sexratio	2.110***	2.039***	2.090***	2.057***	1.903***	2.082***	2.242***	2.172***
	(0.409)	(0.393)	(0.404)	(0.419)	(0.404)	(0.407)	(0.380)	(0.404)
exp	0.571***							
	(0.150)							
happening		0.726***						
		(0.190)						
harmus			0.607***					
			(0.164)					
human				0.565**				
				(0.183)				
important					0.913***			
					(0.233)			
personal						0.666***		
						(0.175)		
timing							0.707***	
							(0.157)	
worried								0.553**
								(0.161)
Intercept	-191.0***	-210.8***	-202.2***	-196.0***	-175.1***	-200.3***	-215.3***	-209.1***
	(46.34)	(46.54)	(46.69)	(48.46)	(46.00)	(46.92)	(43.75)	(46.82)
Adj. R^2	0.618	0.632	0.622	0.589	0.622	0.625	0.665	0.623

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$