

# Consumers' (not so) Green Purchase Behavior

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## Abstract

The discrepancy between consumers' progressive environmental attitudes in polls, and their actual purchase behavior, has led to research on the behavioral and socio-economic drivers of sustainable purchase behavior. The results of this body of research are, unfortunately, inconsistent. This paper complements the existing research using two unique datasets. The first is based on 'interception' of consumers at the shopping aisle at the point of choice. The second is an aggregate data set including the socio-economic characteristic of consumers in the catchment areas of hundreds of retail outlets.

A structural equations model of the first data set indicate that subjective norms dominate purchase intentions. Purchase intention, in turn, was found to be a significant determinant of actual purchase behavior, although the overall impact on the likelihood of choosing a sustainable product is limited. Using the second data set, the sales shares of sustainable products for each of 408 retail stores was correlated with the socio-demographic population profiles of the store's catchment area. Higher income and higher education in the population as well as larger store size and higher number of customers were found to be positively associated with higher sales of 'green' products.

In further analysis of the consumer interview data, price was found, not surprisingly, to be the main purchase barrier for sustainable household goods, followed by lack of information and lack of familiarity. The findings indicate that even positively inclined customers do not change their purchase behavior owing mainly to economic barriers.

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# 1 Sustainable Consumption

The rapid loss of biodiversity, increasing resource scarcity and intensifying climate change are threatening the life-support systems of the earth (IPBES, 2019). A United Nations report highlighted consumption patterns of an ever-growing world population as one of the key reasons for these global challenges (UN, 2015). The main policy priority of the environmental movement has been an education campaign aimed at shifting consumer preference towards more sustainable resource use. As the UN Sustainable Development Goals states, consumers can work towards the goal of sustainable consumption by “reducing [their] waste[,] being thoughtful about what [they] buy and choosing a sustainable option whenever possible” (UN, 2016). Indeed numerous polls report that consumers not only prefer sustainable products but are willing to pay more for them, including 73 percent of millennials (Curtin, 2018), “most” beer drinkers (Cohen, 2018), and 66 percent of global respondents (Nielsen, 2015). Similar numbers are reported in many other surveys. Yet, these stated response to pollsters hardly translate to actual buying behavior. As overall consumption keeps increasing, the market share of sustainable products remain negligible (Terlau & Hirsch, 2015).

The gap between stated and actual purchase behavior regarding sustainable goods attracted researchers trying to explain the gap by, for example, using socio-demographic drivers to analyze barriers to sustainable consumption (Peattie & Charter, 2003). Yet, the results were often inconclusive and contradicting, often depending on the methodology and data input (M. J. Carrington, Zwick, & Neville, 2016). This paper addresses three main questions:

1. How can the ‘say-do’ gap be characterized? We model the discrepancy between stated and actual purchase behavior of consumers for environmentally friendly household goods. The underlying behavioral model is the ‘Theory of Planned Behavior’ (TBP) and the empirical data was gathered through in-store observations of purchase behavior with subsequent customer interviews in three supermarkets around Boston, Massachusetts.
2. What are the socio-demographic drivers of sustainable consumption? We correlate the market share of sustainable products in over 400 retail outlets in New England with the socio-economic census data for the stores’ catchment areas and two store characteristics.
3. What are common purchase barriers for sustainable goods? After purchase behavior was observed in store, shoppers were asked, at the point of purchase, about obstacles for buying green products.

## 2 The 'Say-Do' Gap

A large body of research use psychological models and theories to understand sustainable consumer behavior (Ertz, Karakas, & Sarigöllü, 2016). The growing awareness of environmental destruction and the exploitation of humans in production processes were expected to become the determining factor for consumption choices in the Western world (Schaefer & Crane, 2005; Shaw, Shiu, & Clarke, 2000). Moreover, there was an expectation that consumers would seek to demonstrate their social credentials and appear 'green' through their consumption (Hansen & Schrader, 1997; Miniero, Codini, Bonera, Corvi, & Bertoli, 2014). The deluge of scientific and media reports was thought to shape consumers' personal values and beliefs so that they will use sustainability as a buying criterion in addition to price, brand or quality (Caruana, 2007; Caruana, Carrington, & Chatzidakis, 2016). It was also believed that consumers will perceive sustainable products as having higher quality and better value (Biswas & Roy, 2015; De-Magistris & Gracia, 2016; Forbes, Cohen, Cullen, Wratten, & Fountain, 2009).

The reality, however, has been that consumers typically do not live up to their own set of expressed expectations (Carrigan & Attalla, 2001; Michal J. Carrington, Neville, & Whitwell, 2010, 2014; Roberts, 1996; Schäufele & Hamm, 2018; Titus & Bradford, 1996; Vantomme, Geuens, De Houwer, & De Pelsmacker, 2005). This widespread gap between 'say' and 'do'; between professed concerns about the environment and social justice on the one hand and actual buying behavior on the other, has led to an expanding body of academic research that aims to understand the underlying factors (Carrigan & Attalla, 2001; Michal J. Carrington et al., 2014; Chatzidakis, Hibbert, & Smith, 2007).

In trying to understand consumer behavior and find levers to influence this behavior, researchers have investigated norms and beliefs, socio-demographic profiles, sustainability labels, and knowledge of environmental problems (De-Magistris & Gracia, 2016; Dembkowski & Hanmer-Lloyd, 1994; Hartikainen, Roininen, Katajajuuri, & Pulkkinen, 2014; Vermeir & Verbeke, 2006). The most frequently used model for sustainable consumption is the Theory of Planned Behavior (Ertz et al., 2016; Grimmer & Miles, 2017). The framework consists of the interplay between attitude, subjective norm, perceived behavioral control, intention, and behavior (Ajzen, 1991). The attitude consists of the expected outcome of the behavior and an associated evaluation of the outcome. Subjective norm is the perceived social pressure to engage or not to engage in the respective behavior. Perceived behavioral control refers to an individual's perception of their ability to perform a given behavior. The attitude towards the behavior, the subjective norms, and the perceived behavioral control, all frame the intention for the behavior. The intention is an indication of a person's readiness to perform a given behavior and is considered to be the immediate antecedent of behavior (Ajzen, 1985, 1991).

A significant portion of this body of research has focused on the discrepancy between attitude and behavior, the gap between attitudes and intentions, or the gap between intentions and actual behavior (Michal J. Carrington et al., 2010). Investigations of the effect of positive attitude towards environmentally friendly behavior on the behavior yielded mixed results. Moser (2015) found no significant relationship between pro-environmental attitude and green purchase behavior, and Hughner (2007) showed that positive environmental attitudes towards organic products does not translate into purchases of organic products. On the other hand, Lee (2014) found a positive influence of pro-environmental attitude on green purchase behavior.

Another stream of research focused the effect of attitude on intention and found contradictory results. For example, Shaw et al. (2007) found no direct impact of attitude on intention, whereas Kumar et al. (2017) concluded a positive and significant effect of attitude to intention, a result supported by Bartels & Onwezen (2014).

More recent research has taken the conversion of intention to actual behavior into consideration as explanation of the gap (Michal J. Carrington et al., 2010, 2014). Once again the results are varied, as Gollwitzer & Sheeran (2006) review intention as a good predictor for behavior, while for example Auger & Devinney (2007) and Carrigan & Attalla (2001) conclude the opposite.

This paper follows the call for research on the extent of translation of purchase intention to purchase behavior using real product choice data (Auger & Devinney, 2007; Michal J. Carrington et al., 2010; Hassan, Shiu, & Shaw, 2016; H. J. Lee & Goudeau, 2014; Miniero et al., 2014; Moser, 2015). The data was collected by the authors, as described below, and analyzed using structural equation modeling (SEM).

### 3 The Consumer and Choice Data

We observed consumer choices at the purchase decision point during what Procter and Gamble calls “the first moment of truth.” It is the 3-7 seconds after a shopper first encounters a product on a store shelf. It is in these precious few seconds, P&G contends, that marketers have the best chance of converting a browser into a buyer by appealing to their senses, values and emotions. In our data collection we used stores where the distinction between sustainable and regular products was supported by a conspicuous green enclosure around the shelf section holding the green products in each aisle. These enclosures were set right next to the placement of the regular products, making both categories easily recognizable for the customers (and researchers).

The consumer’s choice observation was followed by an immediate interview. The items included in our study draw on Young et al. (2010), defining sustainable products as ‘environmentally friendly’, ‘ethical’ or ‘green’. The products included in this study were environmentally friendly household goods. This decision was motivated by the need to distinguish between consumers choosing sustainable products and consumers choosing organic or ‘natural’ products where the motivation may be health-related rather than environmental (Magnusson, Arvola, Hursti, Åberg, & Sjöden, 2003; Moser, 2016).

The observation and survey data were collected in three supermarkets from two chains around Boston, Massachusetts, both of which belong to one large retail conglomerate. The study focused on laundry detergents, dishwashing liquids, household cleaners and paper products. The distinction between a regular and a sustainable household product is adopted from the partner supermarket’s internal classification system, which ranks products as ‘regular’ or ‘sustainable’ (with the latter placed in the green-framed part of aisle).

The data were collected directly in the aisles in two steps. First, observing and documenting a consumer’s picking up one of the household products under study. Second, interviewing the consumer once they reached the end of the aisle and were moving on towards the next shopping aisle. Picking the product out of the shelf, placing it in the carriage, and moving on from the aisle was used as the indication of a purchase (no change of product choice has been observed following the interview). A random selection approach ensured that all potential consumers had an equal chance of being interviewed, the only restriction was that customers needed to be 18 years or older in order to participate.

Before approaching a customer for the survey, the interviewer documented the product selected (laundry detergent, household cleaner, dishwashing liquid, paper products) and the version chosen (‘regular’ or ‘sustainable’). The result of this observation was then aggregated to the dichotomous behavior variable ‘Sustainable product choice’. When agreeing to take part in the survey, customers received an introductory statement with a definition and clarification of the term ‘sustainable products’ and ‘sustainable version’ following Hughner et al. (2007). Participants received a \$5 shopping gift card upon successful completion.

The four latent dimensions attitude, perceived behavioral control, subjective norm and intention were derived using multiple indicator questions (Bollen, 1989). Each indicator question was measured with a 7-point bipolar Likert scale, which is commonly used in assessing TPB (Hassan et al., 2016). On this scale, 7 indicates a positive view (Strongly Agree) and 1 represents a negative view (Strongly Disagree). In addition, interviewees were asked for their socio-demographic profile, adopted from Buder, Feldmann & Hamm (2014).

Table 1: Questionnaire items and the respective sources of adoption

Dimension	Indicator Variable	Measuring items	Median:	Mean:	Sources of adoption
Attitude (ATT)	ATT_1	Purchasing sustainable products helps protect the environment	6.000	6.005	Lee (2011), Moser (2015)
	ATT_2	Specifically buying environmentally friendly products is a good way to lower pollution	6.000	5.901	
	ATT_3	Climate Change needs to be addressed quickly	7.000	6.177	
Subjective Norm (SN)	SN_1	Most of my family members think I should use sustainable products	4.000	4.621	Minton & Rose (1997), Moser (2015)
	SN_2	I feel a personal obligation to buy sustainable products	5.000	4.981	
	SN_3	I prefer buying products that are produced in a sustainable way	6.000	5.595	
	SN_4	I prefer buying "green" household products	5.000	5.257	
Perceived Behavioral Control (PBC)	PBC_1	If I wanted to, I could easily buy environmentally friendly household products	6.000	5.493	Sheeran, Trafimow & Armitage (2003), Han, Hsu, & Sheu (2010)
	PBC_2	If I choose to, I can afford to buy sustainable products	6.000	5.495	
	PBC_3	I feel that sustainable products are available to me	6.000	5.407	
Intention (INT)	INT_1	I intend to buy environmentally friendly products	6.000	5.505	Lee (2011), Yadav & Pathak (2016)
	INT_2	I intend to buy products that are produced in a sustainable way	6.000	5.548	
	INT_3	I intend to buy "green" products whenever possible	6.000	5.385	
	INT_4	I am willing to put more effort into buying environmentally friendly products	6.000	5.555	

presents the questionnaire items and their literature sources of adoption, as well as the median and means for each indicator variable.

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A total of 223 Interviews were conducted between November 2018 and March 2019. Before running the analysis, the data was screened as suggested in Bollen (1989), to identify the significance of each observation as it relates to the dimensions of the structural equation model described below. Three obviously flawed observations were taken out leaving 220 observations.

Table 2 presents the socio-demographic profile of the sample as well as a comparison with the Massachusetts population (ACS, 2018). The majority of the interviewed customers were women (69 %) which is consistent with the still existing gender bias in grocery shopping (Mortimer & Clarke, 2011). The largest group of customers was between 25 and 34 years old and the average age was 45 years. The large majority of the respondents were white (70 %), which matches the general population in Massachusetts and New England. The sample shows a disproportionately large percentage of people with higher education, as two-thirds of the respondents had a college degree or higher, compared to only 40 % in the general Massachusetts population. Most households had an income in the '\$125,000 or more' bracket, which matches the state-level data. Household with an income less than \$25,000 were underrepresented (17 % in Massachusetts population vs. 4 % in sample). In our case, 14 percent of the customers chose the sustainable version of a product, which is significantly higher than the average market share of green household products in the US of below 5 % (Packaged Facts, 2015).

The background of the sustainable customers was skewed towards higher levels of income and education and therefore confirms the stereotype of green consumers as higher income academics (Finisterra do Paço & Raposo, 2010).

Table 2: Socio-demographic profile of the sample compared to the Massachusetts population

Socio-Economic Characteristic	Massachusetts (%)	Sample (%)
Gender		
Female	51%	69%
Male	49%	31%
Age		
18-24	9%	8%
25-34	18%	23%
35-44	16%	17%
45-54	19%	20%
55-64	17%	20%
65+	20%	12%
Race & Ethnicity		
White	73%	70%
Black or African American	7%	9%
Asian or Asian American	6%	10%
Latino/a	11%	7%
Multiple	2%	3%
None of the above / other	1%	1%
Highest level of education		
Less than high school diploma	10%	1%
High school diploma or equivalent (e.g., GED)	25%	11%
Some college or Associate's degree	26%	20%
College degree (e.g., B.A., B.Sc.)	22%	38%
Graduate school degree (e.g., M.Sc., PhD)	16%	29%
Annual household income		
Less than \$15,000	10%	1%
\$15,000 to \$24,999	7%	3%
\$25,000 to \$34,999	7%	9%
\$35,000 to \$49,999	10%	8%
\$50,000 to \$74,999	14%	21%
\$75,000 to \$99,999	12%	12%
\$100,000 to \$124,999	10%	10%
\$125,000 or more	29%	22%
Prefer not to answer	n/a	14%



## 4 Data Analysis – The Model

A structural equation model was estimated in order to evaluate the impact of attitudes, subjective norms, perceived behavioral control, the intention to buy, and the product choice. Following the theory of planned behavior, the model was set up as shown in Figure 1. The first three factors determine the intention, which determines, in turn, the product choice (sustainable or not).

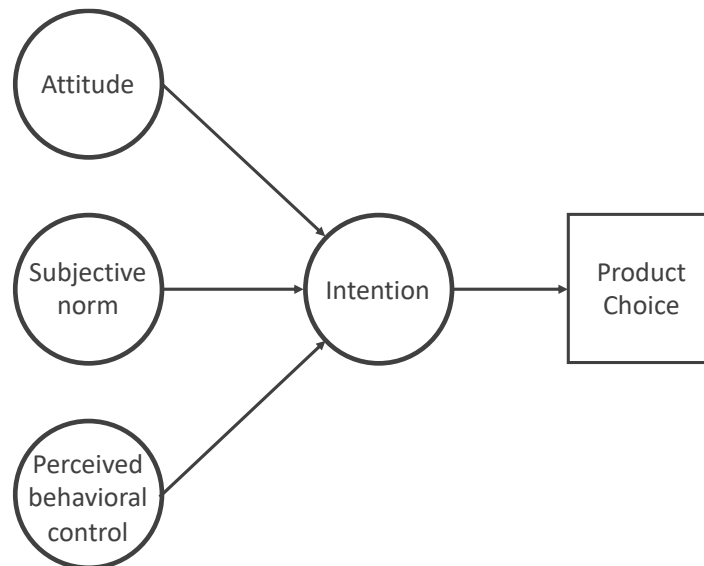


Figure 1: Investigated Model adapted from the Theory of planned behavior model

The SEM was analyzed in R using the software packages Lavaan (Version 0.6-3), Sem (Version 3.1-9). The association between the intention variable and the dichotomous behavior variable was modelled with a Probit link. The estimator for the SEM is a weighted least squares (WLS) estimator instead of the more common maximum likelihood because the exogenous variable is categorical. In particular, the estimator used is a robust diagonally weighted least squares (DWLS), since the endogenous variables are continuous but non-normally distributed and therefore require a robust estimator. Furthermore, DWLS is a simpler form of WLS estimation and is more suitable for small sample sizes (Bollen, 1989). Missing data were treated with multiple imputation through the R packages SemTools (Version 0.5-1.) and Mice (Version 3.5.0). First, the 14 indicator variables were subject to factor analysis to evaluate their relationship to the latent variables (see Table 3).

All of the loadings were above 0.5 and thus significant (K. Lee, 2011). Table 3 presents the loadings of the manifest variables on the latent variables. All four latent variables show a sufficient reliability, as their Cronbach's alpha, the most common measure of internal reliability, are above 0.6 (Kline, 2011). These results were the basis of the SEM whose path diagram is shown in **Error! Reference source not found.**

Table 3: Factor loadings and reliability measures

Latent constructs and manifest variables	Variable	Factor Loading	Cronbach's Alpha
Attitude			0.66
Purchasing sustainable products helps protect the environment	ATT_1	0.71	
Specifically buying environmentally friendly products is a good way to lower pollution	ATT_2	0.67	
Climate Change needs to be addressed quickly	ATT_3	0.56	
Subjective Norm			0.82
Most of my family members think I should use sustainable products	SN_1	0.59	
I feel a personal obligation to buy sustainable products	SN_2	0.80	
I prefer buying products that are produced in a sustainable way	SN_3	0.77	
I prefer buying "green" household products	SN_4	0.75	
Perceived Behavioral Control			0.79
If I wanted to, I could easily buy environmentally friendly household products	PBC_1	0.81	
If I choose to, I can afford to buy sustainable products	PBC_2	0.72	
I feel that sustainable products are available to me	PBC_3	0.69	
Intention			0.90
I intend to buy environmentally friendly products	INT_1	0.82	
I intend to buy products that are produced in a sustainable way	INT_2	0.86	
I intend to buy "green" products whenever possible	INT_3	0.85	
I am willing to put more effort into buying environmentally friendly products	INT_4	0.82	

The results of the structural equation model are displayed in Table 4. Five different measures were used to evaluate the model: Chi-Square ( $\chi^2$ ), degrees of freedom (df), root mean square error of approximation (RMSEA), comparative fitment index (CFI) and Tucker-Lewis-index (TLI) as these are the standard measures to interpret the SEM fit (Hair, Black, Babin, & Anderson, 2010). The model fit results are mixed:  $\chi^2 = 208.239$  (p-value < 0.001), df = 84, RMSEA = 0.08, CFI = 0.83 and TLI = 0.79. The ratio of Chi-Square to degrees of freedom is 2.48, which is smaller than the recommended bound of 3 (Kline, 2011). In addition, the RMSEA, does not exceed 0.08, which indicates an 'ok' fit, a better fit would have an RMSEA of 0.05 (Bollen, 1989). CFI and TLI, however, are smaller than the ideal lower threshold of 0.9. No measurement error was observed since the covariances between latent measures are moderate and do not exceed 0.8, which would have been seen as an indication of two latent variables measuring the same construct (Kline, 2011).

Table 4: Results of the structural equation model

Relationships	Path loadings and levels of significance
Attitude → Intention	0.13*
Subjective Norm → Intention	0.82**
Perceived Behavioral Control → Intention	0.03 (n.s.)
Intention → Behavior	0.61**

Relationships	Covariances and levels of significance
Attitude – Subjective Norm	0.64**
Attitude – Perceived Behavioral Control	0.39**
Subjective Norm – Perceived Behavioral Control	0.44**

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n.s. = non-significant  
\* p < 0.05  
\*\* p < 0.001

The results from the model are as follows:

- The attitudes towards sustainable purchases have a significant, but very low positive effect (0.13) on the intention to buy sustainable products.
- Meanwhile, subjective norms strongly impact a customer's intent to purchase sustainable goods (0.82).
- Contrary to the theoretical hypothesis, the association between perceived behavioral control and intention was minute and statistically insignificant.

The results indicate that attitude towards sustainable consumption only marginally impacts the formation of purchase intentions and therefore demonstrate the existence of an attitude-intention gap. This highlights the common observation that concern for environmental challenges and positive attitudes towards green purchases do not translate into both behavior intentions and actual behavior, and are overrated in trying to explain or predict consumers' behavior. This is of particular importance as 81% of consumers say to purchase fewer products to preserve natural resources and 71 % of consumers state to be willing to pay more for an environmentally responsible product and thus positive environmental attitudes have already become the norm (Cone Communications & Ebiquity, 2015).

Additionally, these findings suggest the important role of social norms and preferences for developing green shopping habits in consumers. An increased moralization and judgement of consumption might influence behavioral preferences, as also a nascent example from Sweden shows, where a small number of people say to no longer use the plane out of flygskam, or "flight-shaming" in the face of the climate crisis (Thornill, 2019).

Furthermore, perceived behavioral control was not found to be significant in forming sustainable purchase intentions. This is not surprising, as consumers should in general feel capable of buying the sustainable version of a product given the abundance and availability of purchasing options in modern supermarkets.

As shown in Table 4, the effect of intention on behavior was significant and positive. However, since the association between intention and behavior is modelled using a Probit regression, it has to be interpreted with care. The 0.6 intention coefficient indicates that an increase of intention by one

standard deviation increases the z-score of the probability to purchase the sustainable product by 0.6. Thus, for example:

- The intercept of the sustainable product choice is -1.076, meaning that a customer with average sustainable purchasing intentions has a 14.1 % probability of actually choosing a sustainable product (pnorm of the z-value:  $\Phi(-1.076) = 14.1\%$ ).
- A customer with above average intentions (+1 standard deviation in intention) has a 32 % probability of selecting a sustainable item ( $\Phi(-1.076 + 0.61) = 32\%$ ) with a 95% confidence interval of 24% to 40%.
- In addition, a customer an intention far above average (+2 standard deviations in intention) has, on average, a 56% probability of picking the sustainable products ( $\Phi(-1.076 + 2*0.61) = 56\%$ ); the confidence interval of choosing the sustainable product ranges from 47% to 64%.

These results indicate, that customers with strong intentions to buy a sustainable product are also more likely to select a sustainable product than customers without. However, the overall effect of intention on behavior was moderate, as even customers with very high intentions, had no better likelihood of purchasing a sustainable product than a coin toss landing on heads. This suggests that consumers choose their products based on the price and quality, instead of their own ethical compass, similar to the finding of Carrington et al. (2016). Furthermore, consumers' response to poll-takers may be skewed by the social desirability bias, as consumers try to give answers that make them appear more sophisticated or trying to give the answer they think the poll taker wants to hear (Milfont, 2009).

## 5 Socio-demographic drivers of sustainable consumption

In addition to investigating purchase behavior through psychological models, many researchers and marketers have also tried to find ways to classify and cluster green consumers based on socio-demographic criteria such as gender, age, income and education. However, the results were often inconclusive and the findings in some studies could not be confirmed in others (Wagner, 1997).

For example, Shuai, Ding & Zhang (2014) found age and education as being influential for the willingness to pay for low carbon products, while for Finisterra do Paço & Raposo (2010), gender, income, and education were significant in differentiating between green and other consumer groups. The main socio-economic driver for choosing organic products was gender according to Lockie et al. (2004), while Zelezny, Chua & Aldrich (2000) found gender to be a determining factor respect to broader environmental attitudes and behavior. Vecchio (2013) and Pomarici & Vecchio (2014) found age and gender being significant for buying sustainable wine, while Abeliotis, Koniari & Sardianou (2010) concluded that age and income were positively related with green consumption. In addition to these varying findings, Evans et al. (2011), Roberts & Straughan (1999) and Bartels & Onwezen (2014) all reported no significant influence of any socio-demographic factor. These latter findings match the outcomes of meta-analyses from Schlegelmilch, Bohlen & Diamantopoulos (1996), Peattie & Charter (2003) and Diamantopoulos et al. (2003) that conclude that It is very difficult to relate green values and behaviors to socio-demographic profiles and that academic findings are inconsistent and thus not reliable.

Our analysis of a second type of data set was aimed at identifying socio-demographic indicators for sustainable consumption in the population, by associating aggregated sales data at the store level with the socio-demographic profile of the store's catchment area. One supermarket brand provided the sales share of sustainable products on each of its 408 stores in New England. The dataset included the sustainable sales shares from September 2017 to August 2018 for each store, in addition to the store's size (ft<sup>2</sup>) and average number of monthly customers. In general, the share of sustainable products is moderate and ranges in the low single-digit-percentages of total sales. The average sustainable sales share per store is 3.14%, with a minimum of 0.5% and a maximum of 6.8%. The data provided are aggregated sales share data which represent the sales share over the whole product portfolio, including products that do not have sustainable options. Consequently, results may be only valid directionally.

The socio-demographic profiles of the catchment area of each store were created with data from the 2013 – 2017 American Community Survey (ACS) - a 5-Year estimate based on the U.S. Census. The profile of the catchment area for each store included the distributions of age, highest level of education, annual household income and the total population within two different types of radii around each store.

Two different socio-demographic profiles were created for each store with varying catchment area sizes: 1-mile and 3-miles network buffers. A network buffer comprises the area around a store within which the store can be reached by driving maximum *r* miles. The profiles were created with ArcMap, Version 10.6.1 and the socio-demographic data were accessed on the 14<sup>th</sup> of December 2018 on the web page of the US. Census Bureau. After creating the profile for each store, the categories for the socio-demographic dimensions of age, income and education were aggregated to five categories each to reduce the number of predictors in the regression and each category is expressed as a percentage of the total population within the respective catchment area.

Owing to the high multi-collinearity among the subgroups of the percentage distributions for age, education and income, a two-step regression analysis was performed. First, we used Lasso (least absolute shrinkage and selection operator) for variable selection. Then we performed OLS (ordinary

least squares) regression with the prior selected variables. For this two-stage analysis, we split the dataset twice. First, we used 75% of the observations for the Lasso variable selection, and left the remaining 25% of observations for the OLS regression. Then, we separated the Lasso dataset into a training and test dataset set following a ratio of 20/80. Lasso regression is based on the linear model but adds a penalty term to the cost function equivalent to the sum of the absolute values of the coefficients times a penalty parameter,  $\lambda$ . To balance the penalty term, Lasso sets some coefficients to zero and reduces the model's predictor variables. The parameter  $\lambda$  with the smallest cross-validation error was chosen by k-fold cross validation from an array of 100 possible values, using  $k = 10$  folds.

After running the Lasso model with the correct  $\lambda$ , we performed OLS with the selected variables. The two regression steps (Lasso & OLS) were applied for each of the two store profiles in turn. For the 1-mile network buffer, six variables were set to zero through Lasso, while for the 3-miles network buffer eight variables were omitted. Additionally, nine categories were selected as relevant variables for both profiles: total store area size, average number of customers per month, age categories <18 and 18-24, college degree and graduate degree for highest level of education, household income > \$125,000, and the catchment area's population size. Detailed results are shown in Table 5. Overall, these results also held when using a circular buffer instead of a network buffer to create the socio-demographic profiles.

Table 5: Regression results

Predictor	1-mile network buffer			3-miles network buffer		
	$\beta_L$	$B_{OLS}$	$SE_{OLS}$	$\beta_L$	$B_{OLS}$	$SE_{OLS}$
Store area size(ft <sup>2</sup> )	0.112	0.133*	0.067	0.044	0.089	0.066
No. customers per month	0.11	0.082	0.064	0.155	0.191	0.067
Age						
<18	-1.539	-1.463*	0.631	-0.547	-0.242	0.774
18-24	-0.694	-0.824	0.551	-0.587	-0.815	0.682
25-44	0.000	n/a	n/a	0.000	n/a	n/a
45-64	0.000	n/a	n/a	0.000	n/a	n/a
>65	0.079	-0.031	0.269	0.000	n/a	n/a
Education						
9th grade	-0.712	-0.473	0.54	0.000	n/a	n/a
high school degree	0.000	n/a	n/a	0.000	n/a	n/a
some college	-0.975	-0.801	0.562	-0.189	1.259	0.79
college degree	0.841	0.887*	0.378	0.687	0.441	0.434
graduate degree	0.931	0.88*	0.317	1.019	1.057**	0.382
Income						
< \$30,000	0.000	n/a	n/a	-0.512	-0.394	0.386
\$30,000-\$49,999	-0.122	0.366	0.475	0.000	n/a	n/a
\$50,000-\$74,999	0.000	n/a	n/a	0.000	n/a	n/a
\$75,000-\$124,999	0.000	n/a	n/a	0.000	n/a	n/a
> \$125,000	0.544	0.77*	0.249	0.619	0.618	0.353
Population size	-0.104	-0.108**	0.016	-0.134	-0.17***	0.019
Intercept	n/a	-5.088***	0.756	n/a	-4.559***	0.726

\* p &lt; 0.05

\*\* p &lt; 0.01

\*\*\* p &lt; 0.001

 $\beta_L$ :Lasso coefficient,  $B_{OLS}$ :OLS coefficient,  $SE_{OLS}$ : Standard error OLS

In both Lasso and OLS, the store's characteristics, both average number of customers per month and store area size were consistently positively associated with the sales share of sustainable products. The results indicate that bigger stores have higher share of sales of sustainable products. This may owe to the fact that the product portfolio of a store is dependent in the store's ft<sup>2</sup>. While smaller stores need to prioritize their products more strictly by sales, larger stores can afford to present a broader range of products. These niche products often tend to be green alternative products that complement the existing regular products. Interestingly, population size in the catchment area was negatively correlated with green purchases. This is likely owing to the fact the higher density areas may be lower income areas. Alternatively, it is possible that higher populated areas offer more green niche shops, where customers can buy their green products.

In the OLS, the younger age categories demonstrated consistently a negative correlation with sustainable sales shares while overall, age was found to be a minor factor for sales of sustainable products. These results are in contrast to many who argued that younger people are more inclined to choose sustainable products and even to pay more for them (Nielsen, 2015). This could be because the age effect was swamped by the income effect in this aggregate data set – young people have less income and lower income consumers are less likely to buy sustainable products. As shown in Table 5, income had a significant positive correlation with sustainable purchase, as did education level.

In particular, low income and lower education averages were negatively correlated with the sustainable sales, whereas high income and high education had a strong and positive correlation with sustainable sales. This may be because of the importance of higher education on creating awareness about sustainability (Cortese, 2003), or because higher educated consumers tend to have higher income and can afford sustainable products. Lower income groups (< \$30,000 and \$30,000-\$49,999) were negatively associated with the share of sustainable purchase in the Lasso variable selection. At the same time, the highest income group (> \$125,000) was consistently positively associated with sustainable sales.

Using these insights, we estimate the market potential for sustainable household goods in Massachusetts and the US by comparing the sample's profiles of sustainable and regular customers from the in-store data collection and applying these ratios on the census data for Massachusetts and the whole US (United States Census Bureau, 2019). Based on the regression results, we use the education distribution as determining factor for being a green customer and we assume the answer category 'Prefer not to answer' to be equally distributed over all education groups in our sample. By expanding the ratios of the sample data to the general Massachusetts population, we find over 570,000 adults being potential sustainable consumers based on their level of education, which represents a share of 10.7% in the Massachusetts population. In addition, we compute a share of 9.6% sustainable shoppers for the whole United States based on the education distribution in the population, which corresponds to around 24 million adults. Although these estimations are based on a small sample (especially at the lower income and lower education brackets), these numbers give a general idea of the market size for sustainable household products in Massachusetts and the whole US.

## 6 Product-specific purchase barriers

As a final step we explored product-specific purchase barriers and thus addressed a granularity that has not received sufficient coverage in the literature (Buder et al., 2014; Michal J. Carrington et al., 2010). As part of the consumer interviews at the point of purchase, consumers were asked to report their usual product choice for household goods. For each of the four household products included in the study (and regardless of their choice), consumers were asked if they typically buy it in the sustainable or the regular version.

For consumers who usually bought a regular product (which was the majority), we asked for specific purchase barriers for buying the sustainable variety. The list of purchase barriers was created through the preliminary in-depth interviews and complemented with purchase barriers and deterrents from Buder et al. (2014), Hughner et al. (2007) and Vantomme et al. (2005) (see Appendix 2 for the detailed list).

Across all product groups, price was by far the most frequently mentioned purchase barrier (see Table 6). Despite the growing portfolio and availability of sustainable alternatives, price premiums on sustainable products serve the dominant obstacle, especially for low-income customers. This is consistent with prior research that states people who have positive attitudes towards green products and who claim to be willing to pay a premium still do not translate their intentions into action because prices for sustainable alternatives remain too high (Hughner et al., 2007). This is also in line with the finding of the last section, where income was positively associated with green purchases. Price, however, was not the only factor.

For each of the products investigated, more than a quarter of the responses indicated lack of familiarity and lack of information as major hurdles. These two barriers relate to each other, as people who have not tried a sustainable product are unlikely to know much about it and vice versa. This is particularly important, because convenience and shopping habits were stated as purchase hindrances by more than a fifth of the customers in every product category. This highlights the value of educating customers about sustainable alternatives and incentivizing them to try sustainable versions. In addition, quality was reported as a significant purchase impediment, especially for laundry detergents and household cleaners. This may be due to the fact that customers perceive environmentally friendly products as gentle to the environment but ineffective as laundry detergent or household cleaner (Luchs, Naylor, & Irwin, 2010).

Contrary to prior research that claims consumer distrust of environmental claims is a primary impediment for buying green products (Kaufmann, Panni, & Orphanidou, 2012), lack of trust was not named frequently in these surveys. Lastly, availability and display in the supermarkets did not appear to be pervasive obstacles for buying environmentally friendly products in our sample – probably because of the large portfolio of green products in the test supermarkets and the elevated attention given to the sustainable items display in the aisles.



Table 6: Product-specific purchase barriers for sustainable household products and frequency of mentioning

Laundry Detergent		Household Cleaner		Paper Products		Dishwashing Liquids	
Price	50%	Price	42%	Price	46%	Price	45%
Quality	32%	Quality	29%	Familiarity	41%	Familiarity	32%
Familiarity	31%	Familiarity	26%	Information	30%	Information	25%
Information	28%	Information	25%	Convenience	25%	Quality	24%
Convenience	24%	Convenience	22%	Quality	23%	Convenience	21%
Preference	16%	Preference	17%	Availability	18%	Availability	17%
Trust	13%	Availability	15%	Preference	18%	Preference	14%
Availability	13%	Trust	12%	Trust	12%	Trust	12%
Display	6%	Display	7%	Display	5%	Display	9%
Interest	4%	Interest	5%	Other	2%	Interest	3%
Other	4%	Other	1%	Interest	1%	Other	2%
n = 135		n = 146		n = 101		n = 127	

## 7 Discussion & Conclusion

This paper aimed to make three contributions to the expanding literature on sustainable consumer behavior. Investigating the discrepancy between stated and actual purchase behavior for sustainable household goods, the data indicates that positive attitudes towards sustainable consumption hardly impact the purchase intentions for sustainable products. This is particularly important, as we live in times of ever more positive reported mindsets towards environmental and climate protection. Thus, the focus on beliefs seems too narrow and trivial, and attitude should therefore be discarded as meaningful explanatory variable for both intentions and actual behavior.

The positive and significant effect of subjective norms on purchase intentions indicate the strong role of the social environment on behavior. This could offer an avenue of incentivizing sustainable purchases through peer influence, possibly through social media (Pookulangara & Koesler, 2011).

The effect of intention on actual behavior is significant in our model and contradicts the hypothesis of an intention-behavior gap. However, the results in our model show that even customers with extremely high intentions are only about as likely to buy the sustainable version as they are to buy the regular version. This finding highlights the observation that consciously stated intentions still have a limited impact on the actual purchase behavior (Carrigan & Attalla, 2001; Caruana et al., 2016).

In light of these findings, the utility of questionnaires and stated attitudes and intentions in behavioral research regarding sustainability remains debatable, even when featured with real product choice data. This means that managers should not be swayed by verbal expressions on attitude, concerns and intentions, but rather work on the economics, efficacy, and promotions of sustainable alternatives.

Socio-economic drivers for sustainable consumption were investigated by comparing real sales data with customer profiles that included age, income and education distributions, as well as the total population size of the store's catchment area. The positive association of income and education with sustainable consumption is in line with prior research on socio-demographic drivers (Panzone, Hilton, Sale, & Cohen, 2016). In our study, education was found to be the single strongest predictor. While income and education were highly correlated, education had more explanatory power. This underscores the niche character of sustainable products which appeal to predominantly higher educated and wealthy consumers (Adalja, Hanson, Towe, & Tselepidakis, 2015; Reynolds, Murray, Kolodinsky, & Howell, 2015). For lower income consumers sustainable products seem to be luxury goods.

In addition, the size of a store was positively associated with the sales share of sustainable products, which may suggest that larger sustainable product variety in stores could encourage consumers to choose that alternative. For example, one store manager commented anecdotally that it seems that the relative number of green choices for a particular product relative to normal products is an important determinant of buying behavior.

Notably, the price of sustainable household products was the most frequently stated purchase barrier. Despite the increasing awareness of sustainability challenges and the negative effects of current-state private consumption, people's purchase decisions are largely determined by economics. The difference between "say" and "pay" may be due to "free riders" who may believe in the need for sustainability but hope others will act responsibly while they act in line with their own economic interests. Another way to look at this is to see it as a "tragedy of the commons." While individuals keep consuming resources in accordance with their own self interest, the common is depleted. Current product development has not managed to offer affordable green products, which can change the consumption choices of the majority

Other hurdles to sustainable purchase include lack of both information and familiarity. These factors can possibly be overcome with more advertisement, free test samples, and other marketing initiatives. Furthermore, consumers hesitate to buy the sustainable version of household goods because of perceived quality and efficiency, which has long been an obstacle for consumers, as reported by Ottmann (1998)

This study is one of few to combine real product choice data with interview data from the same individual customers in a real world setting at the point of product choice. Despite the novel data collection methodology the survey answers may have artificially high values for the TPB measures as customers might have given socially desirable answers (Andorfer & Liebe, 2012; Hassan et al., 2016). The sample may have also depicted skewed results owing to the small number of low income and low education levels in the sample. Nevertheless, future research may also use interception-style research interviews on the product choices in the aisles to gather new insights about consumers' motivation to select (or not to select) sustainable products. Such effort may combine directly with measures of green product breadth and other hypothesized reasons for (or lack of) green choice.

Furthermore, although the number of observations for the structural equation model surpassed the suggested minimum of 200 observations, the model's fit indices are not optimal (Kline, 2011). In addition, it should be noted, that the results of this SEM study have sampling and selection effects based on the limited number of stores and times of data collection available (MacCallum & Austin, 2000; Raykov, Tomer, & Nesselroade, 1991). Therefore, the generalizability of these results beyond the sample is limited. Likewise, the findings of the regression analysis for sales shares of sustainable products need to be treated with care, as the data was derived from one supermarket chain and included only limited information about the presentation at the various stores. Future research may integrate both population demographics and store characteristics into a single study.

The results of this study indicate that positive attitudes towards sustainable consumption are poor predictors for intention and that even people with high intentions to purchase sustainable products frequently do not translate this into consistent actions. Furthermore, sales of sustainable products are low, in single digit percentages for most consumer categories, and are only higher in areas with higher educated and higher income population. In light of these findings, it seems that consumers would not bring the necessary change on their own. The study was carried out in Massachusetts, one of the most progressive states in the US, and even there, the results were not encouraging. Price, quality and convenience continue to be the most important determinants of product purchase.

Effective policy variables that may affect choices will invariably have to use economic factors. Thus, a carbon tax which will increase the costs of non-sustainable products, or subsidies for sustainable products can change the economic incentives. Of course, as the Yellow Vests movement in France (Carattini, Kallbekken, & Orlov, 2019), the 2013 Australian elections (Rootes, 2014), the failure of a carbon tax proposal in Washington State in 2018 (Anzilotti, 2018), the lack of attainment of the Paris accord commitments by most nations, and many other indicators, all illustrate that none of this is easy or even feasible in the near future.

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**APPENDIX**

Table A-1: Aggregation of socio-demographic dimensions for regression analysis

Age	Highest level of education	Annual household income
Under 5 years	No schooling completed	Less than \$10,000
5 to 9 years	Nursery to 4th grade	\$10,000 to \$14,999
10 to 14 years	5th and 6th grade	\$15,000 to \$19,999
15 to 17 years	7th and 8th grade	\$20,000 to \$24,999
18 and 19 years	9th grade	\$25,000 to \$29,999
20 years	10th grade	\$30,000 to \$34,999
21 years	11th grade	\$35,000 to \$39,999
22 to 24 years	12th grade, no diploma	\$40,000 to \$44,999
25 to 29 years	High school graduate	\$45,000 to \$49,999
30 to 34 years	Some college, <1 year	\$50,000 to \$59,999
35 to 39 years	Some college, >1 year, no degree	\$60,000 to \$74,999
40 to 44 years	Associate's degree	\$75,000 to \$99,999
45 to 49 years	Bachelor's degree	\$100,000 to \$124,999
50 to 54 years	Master's degree	\$125,000 to \$149,999
55 to 59 years	Professional school degree	\$150,000 to \$199,999
60 and 61 years	Doctorate degree	\$200,000 or more
62 to 64 years		
65 and 66 years		
67 to 69 years		
70 to 74 years		
75 to 79 years		
80 to 84 years		
85 years and older		

Table A-2: Purchase barriers for sustainable household products

Purchase barrier	Description
Price & Value	Prices for sustainable household products are higher than the regular products and thus too expensive for many customers. The added value of the sustainable product may not justify the price premium. As one interviewed customer mentioned, 'To be honest, if you have kids, price is the driving factor'.
Availability	Depending on the supermarket, there may be a lack of sustainable product alternatives, removing the possibility to choose for many customers. One customer consternated that '[Sustainable] products are hard to find!'.
Quality & Performance	Sustainable products are often thought to be less effective, as they lack some of the harsher chemicals used to clean clothes, dishes or surfaces. Customers might simply refuse to buy the sustainable alternative because they do not want to sacrifice product performance.
Convenience & Purchase habits	Grocery shopping can cause individuals to feel stress and/or time pressure. Customers often do not want to put additional effort into trying new products when they can easily stick to what they know, minimizing time and thought. As one customer from the exploratory interviews put it: 'I think we humans are very convenient and only buy what we know'.

Preference for regular products	Many customers have a favorite brand and will stick to it. This preference may be due to price, quality or familiarity. To some extent, it may even be based on the packaging or size of a product. One customer said that she prefers regular paper products, because these come in large 48 packs, while the recycled paper products are only offered in small quantities.
Positioning & Display in the store	In addition to a potential lack of alternative products in the store, it is possible the sustainable products are simply poorly displayed and thus easy to overlook. For example, not all supermarkets have green boxes to indicate sustainable product choices, which would make it harder for customers to find these.
Trust in sustainable brand or product	Due to the surging use of product classifications like 'sustainable', 'green' & 'environmentally friendly', customers are increasingly skeptical about whether a product is actually less harmful for the environment. Customers do not want to get sold cheap, so they may refuse to buy the sustainable product as a matter of principle.
Lack of information about sustainable alternative	Some customers might not know that each household product has an equivalent environmentally friendly alternative. In addition, many customers are missing information on why the sustainable alternative is actually better or more environmentally friendly than the regular product.
Lack of familiarity with sustainable alternatives	Another deterrent for buying sustainable products is the person's lack of knowledge or experience that comes from trying a sustainable alternative.
No interest in sustainable alternatives	There are consumers who simply not care about sustainable products, and therefore, will not buy them.