

Breaking niche sustainable products into the mainstream: Organic milk and free-range eggs

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Abstract

We contribute to the existing literature on factors influencing sustainable product consumption behavior by (a) employing actual supermarket sales data from over 300 outlets in England covering up to 18 million customers, and by (b) examining two products that can both be labeled as sustainable but have very different market positions: organic milk as a typical niche product, and free-range eggs which (based on market share) can be seen as a mainstream product. Our study has looked into the influence of factors such as deprivation and race, which have not previously been looked into. The results partially confirm previous research, which is mostly based on self-reported behavior, identifying both price and deprived catchment areas as barriers but green attitudes as a facilitator while more affluent people purchase organic milk. What is new from our work is that convenience stores have a negative influence and for organic milk, older families and those aged 25–44 years have a positive influence. Crucially, we identify clear differences between purchasing behaviors regarding niche and mainstream products in our analysis: while purchases of organic milk can be predicted by a wide range of sociodemographic factors, this is not the case for free-range eggs. Here, besides price and green attitudes, there are no other influences on behavior. The results of our study can therefore provide fresh insight into the debate around recent attempts to mainstream sustainable product consumption.

KEYWORDS

free-range eggs, organic milk, purchase, retail, sustainable products

1 | INTRODUCTION

Interest in so-called sustainable products is growing in line with increasing concerns on the damage to the environment and health caused by less sustainable products (ECRA, 2015). We use the term “sustainable products” for products that have an eco-label from an organization that is independent from the company selling the product. This is a rough rule of thumb but is how consumers identify more sustainable products in purchase decisions (Young, Hwang, McDonald, & Oates, 2010). Increased interest in sustainable products, however, does not necessarily convert into more sustainable purchasing behaviors, as the proportion of sustainable product sales are well below the

claims made by consumers. One phenomenon often cited in the literature is the attitude–behavior gap, i.e., that between attitudes to consumption and actual consumption of sustainable products (O'Rourke & Ringer, 2016). This gap can largely be attributed to the attempts to measure consumption as a reflection of attitudes (Aschmann-Witzel & Niebuhr Aagaard, 2014). In addition to attitudes there is a range of socio demographic factors that could influence behavior. A clear understanding of the role of attitudes and other factors in the consumption of sustainable products is useful for practitioners and policy-makers in their endeavors to develop business policies to encourage more sustainable production, and to design interventions to educate and influence consumers towards greater consumption of

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sustainable products. However, it is not yet clear what the driver and barrier factors are for the consumption of sustainable products and whether their influence is the same across products. Some progress has been made toward understanding the role of ethics and attitudes as well as demographics within sustainable product consumption. However, previous research in this context has been based largely on individual level self-reported attitudes as well as purchasing behavior (Defra, 2011; Eurobarometer, 2005), and mostly around a single product (Sanitthangkul, Ratsamewongjan, Charoenwongmitr, & Wongkantarakorn, 2012). As a result, it is unclear how the attitude–behavior gap may have biased earlier findings in this field. Furthermore, the single-product or generic focus of earlier studies would appear to build on the assumption that no notable differences exist in relation to the purchasing behavior of different sustainable product types.

Contrary to a large majority of earlier studies that used self-reported data (see Background), this research uses behavioral data sets (actual sales) of two different products—free-range eggs and organic milk—recorded at several stores across England and linking them to relevant (green and ethical attitudes and demographics such as age, gender and ethnicity) data sets from alternative sources to understand the role of ethics and attitudes, and demographics, in shaping the consumption of sustainable products. It is important to note that sales data are collected from a major conventional UK retailer and thus focus on the mainstream market rather than the sustainable niche. Major retailers attract a consumer base that is very different from their smaller competitors (Kolk, 2012) and are typically not positioned at the forefront of innovation for sustainability; however, market share makes them an important target from a sustainability viewpoint (Illge & Preuss, 2012). In recent years, a multitude of drivers ranging from recent food safety scandals, to increasing customer awareness or increased regulatory pressures (Chkanikova & Mont, 2015) have led mainstream supermarkets to become increasingly engaged in corporate sustainability.

Selection of the products for this study was based on the criterion that the consumers have an option to buy conventional counterparts yet purchase sustainable products. In other words, consumers could actively make a choice between a conventional product and its more sustainable counterpart. Otherwise, it would be difficult to measure whether the purchase decision reflects a consumer's intention-driven decision or through retailer "choice editing" product selection to have more sustainable products (Morgan, 2015). Both product types (milk and eggs) are bought frequently by consumers so they are familiar with them but spend less time thinking about these purchases when compared to large one-off purchases (Young et al., 2010). "Free-range" and "organic" are also terms backed up by European regulations in which these purchases are governed (EC, 2007; EC, 2008). By comparing two eco-labeled products which—judged by market share—can be characterized as niche (organic milk) and mainstream (free-range eggs), we are able to inform the ongoing debate on the mainstreaming of sustainable products.

The remainder of this paper is structured as follows. In the next section, we briefly introduce the market for sustainable food products as the subject of our study, and review the literature on determinants of sustainable product purchasing behavior—with an emphasis on studies investigating organic produce and free-range eggs—as well as recent attempts to mainstream sustainable consumption. We then

describe and justify the research methods applied in this study. Subsequently, we present the results of a General Linear Modeling (GLM) approach to a wide range of (attitudinal and sociodemographic) factors in shaping sustainable purchasing behavior. We illustrate the interplay of these various factors taking the example of North London, UK. We conclude by discussing our findings in light of previous studies in this field and by developing implications for practitioners, with particular emphasis on recent attempts to mainstream sustainable purchasing behavior.

2 | BACKGROUND

This section introduces the market for sustainable products as the context of our study. It then discusses some of the literature around the influence of consumer attitudes and demographic characteristics on sustainable product consumption. Finally, we examine recent attempts to make sustainable products more accessible and attractive to mainstream supermarket consumers, and present the research questions that guide our analysis.

2.1 | The market for sustainable products

Today's society has led consumers to become concerned for the environment and they express these concerns through their purchasing behavior, increasingly buying sustainable products (Fisher, Bashyal, & Bachman, 2012; Vermeir & Verbeke, 2006). These products provide assurance of a level of social and/or environmental standards (Fisher et al., 2012) which other products may not possess. This type of consumer, the ethical consumer, has grown increasingly over the past 20 years as consumers perceive a more direct link between what they consume or purchase and any social or environmental issue associated with it (ECRA, 2015; Vermeir & Verbeke, 2006).

Any attempt to examine the market for sustainable products inevitably is confronted with a range of different labels such as "sustainable," "green," "environmentally friendly" or "organic," which are often used interchangeably and can carry different meanings in different contexts. Taking the example of organic products, the term "organic" has been defined in various ways. The definition itself remains quite vague for mainstream consumers, which is perhaps the reason why they struggle with understanding the meaning behind organic labels, logos and certifications (Vukasovič, 2016). According to the US Department of Agriculture's National Organic Standards Board (USDA, 1995) the definition of organic agriculture is "an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity." By contrast, the European Commission defines organic production as "an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes" (EC, 2007). The latter definition includes animal welfare and consumer preferences.

Irrespective of these definitional debates, the global organic food market has grown steadily over the last decade to reach a current value

of US\$84,281 million (MarketLine, 2015). Total growth of organic sales is actually outpacing total growth of conventional food sales, increasing by 10.2 and 3.7% respectively (Schroeder, Chassy, Tribe, Brookes, & Kershen, 2014). The United States comprises 42.6% of the international organic food market value while Europe accounts for 41.3%. In Europe, the countries with the largest organic markets are Germany and France while the highest per-capita consumption is found in Switzerland, Denmark and Luxemburg (Buder, Feldmann, & Hamm, 2014). In the UK, organic food and drink sales have grown by nearly 300% since 2000 (ECRA, 2015). However, the economic recession in 2009 greatly impacted demand for organic food and drink, leading to a fall in sales between 2010 and 2012 and a slight increase in 2014 (ECRA, 2015; Falguera, Aliguer, & Falguera, 2012). The market share of organic food and drink is still less than 2% of the UK consumer expenditure (ECRA, 2015).

By contrast, free-range eggs are one of only few examples where products have moved beyond the green niche and firmly entered the mainstream market. In 2015, the overall market share of free-range eggs in the UK was 48% (BEIC, 2016). The mainstreaming of free-range eggs has been attributed to several factors. In the UK, one important aspect might be that the promotion of free-range eggs was part of the early-age green consumer and ethical consumerism movement in the 1980s and 1990s, and thus was before most other organic food stuffs (Harper & Makatouni, 2002). In addition, a range of different factors have been argued to drive consumption of free-range eggs with all research in this area being by self-reported data. While concerns about animal welfare certainly are among the most important drivers (Harper & Makatouni, 2002; Midmore, Francois, & Ness, 2011), quality considerations have also been argued to be relevant, with consumers experiencing taste differences between battery eggs and free-range eggs (Midmore et al., 2011). "Feeling good about yourself" has also been argued as one of the major factors driving consumption of free-range eggs (Defra, 2011).

Furthermore, health considerations also play an important role (Harper & Makatouni, 2002). Free-range eggs have commonly been seen to be a safer alternative than battery eggs in light of several salmonella outbreaks (Smith, 2003). Likewise, the BSE (bovine spongiform encephalopathy or, more commonly, "mad cow disease") scandal—even though not directly related to eggs—has been argued to have resulted in a higher market share of free-range eggs (Midmore et al., 2011). Another crucial factor might have been extensive media coverage on the issue, with several TV programs uncovering the conditions under which chickens are held in large-scale batteries, and celebrity chefs such as Jamie Oliver championing consumption of free-range eggs (Lewis & Huber, 2015).

Crucially, and likely to have been influenced by the above factors, some major UK supermarkets decided to phase out battery eggs, starting with Marks and Spencer as early as 1997 (Miele, Murdoch, & Roe, 2005). Competitors such as Sainsbury's and Morrison's soon followed suit, as well as major restaurant chains such as Little Chef and Starbuck's, in turn dramatically increasing the market penetration of free-range eggs.

Finally, from a supply side, free-range eggs have generally been seen as an attractive market opportunity. This is due to a premium that more than compensates for a slight increase in the cost of production.

In addition, a high degree of protection from foreign competitors is a result of the so-called Lion assurance standard that has been signed by all major UK retailers (BEIC, 2016).

A potential flip side of the attractiveness of free-range eggs in terms of both supply and demand, moving further and further away from a niche market, has been that new actors have entered the market that have been accused of applying less stringent standards that can at times can no longer be considered free-range (Lewis & Huber, 2015). While this also increases the reach and market share of free-range eggs, there is a substantial risk of watering down production standards and thus damaging the reputation of the free-range segment more generally.

In summary, the market for sustainable products is heterogeneous and characterized by confusion regarding different understandings of what sustainable products are in the first place. Within this market segment, organic produce and free-range eggs reflect the extreme ends of a spectrum in relation to both market penetration and rigor of associated labels, and thus illustrate the diversity of sustainable products.

2.2 | Determinants of sustainable product consumption

Sustainable consumption or purchasing behavior is a decision-making process that takes into account any social or environmental issues directly linked (or perceived to be linked) to the product. If one can agree that the ultimate goal is to make sustainable consumption more accessible and attractive to mainstream consumers, then it will be crucial to understand the determinants of sustainable purchasing behavior. As can be seen in Table 1, a range of studies have examined the purchasing behavior of sustainable products more generally; yet other studies have specifically focused on organic produce or free-range eggs. A common denominator across these studies is that a clear majority have focused on self-reported measures—rather than actual purchasing behavior—to generate their findings.

Dekhili and Achabou (2013) use self-reported data to show that consumers purchasing sustainable products tend to focus on distribution networks (local products) and communications (no greenwashing campaign). They state that consumers often accept a higher price for ecological products because of the perceived superior value they have for such items (Dekhili & Achabou, 2013). They also find that consumers' perceived benefits of sustainable product purchases included individual benefits (such as premium quality and health benefits) as well as environmental and social benefits (such as the hope to protect nature and improve social conditions).

A number of studies using self-reported data report mixed results in relation to the impact of sociodemographic factors on behavior. For example, gender is typically seen as a key influence of sustainable behavior (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003; Schröck, 2012) but Fisher et al. (2012) found it has little impact other than on using sustainable products and recyclable bags. Furthermore, they found age, education level and even number of children in the household did not have any significant relationship with any proenvironmental behavior. However, with regards to purchasing sustainable products, they found this action does depend on the level of income.

TABLE 1 Research evidence based on self-reported compared to purchase data

Characteristic	Self-reported			Sales data		
	General sustainable purchasing	Organic food and milk	Free-range eggs	General sustainable purchasing	Organic food and milk	Free-range eggs
Higher price	Positive (Dekhili & Achabou, 2013) Negative (Aschemann-Witzel & Niebuhr Aagaard, 2014)	Negative (Buder et al., 2014)	Positive (Pettersson, Weeks, Wilson, & Nicol, 2016)		Negative (Marian, Chrysochou, Krystallis, & Thøgersen, 2014; Ngobo, 2011)	
Indicator of high quality	Positive (Dekhili & Achabou, 2013)	Negative (Buder et al., 2014)	Positive (Harper & Makatouni, 2002; Midmore et al., 2011; Pettersson et al., 2016)			
Health benefits	Positive (Dekhili & Achabou, 2013)		Positive (Harper & Makatouni, 2002)			
Females more likely to purchase	No association (Fisher et al., 2012) Positive (Diamantopoulos et al., 2003; Jones, Reilly, Cox, & Cole, 2017)	Positive (Schröck, 2012)				
Age	No influence (Diamantopoulos et al., 2003; Fisher et al., 2012)	Positive for Younger consumers (Vukasovič, 2016). 35-55-year-olds are more engaged (Tilikidou, 2007).	Significant for Middle-aged consumers (Pettersson et al., 2016).	Positive for Middle-aged (Wier et al., 2008). Positive for % Housewives older than 65 years (Van Herpen et al., 2012).		
Higher levels of education	No influence (Diamantopoulos et al., 2003; Fisher et al., 2012)	Positive (Choi, Wohlgenant, & Zheng, 2013; Vukasovič, 2016)			Positive (Ngobo, 2011; Van Herpen et al., 2012; Wier et al., 2008)	
Children in household	No influence (Diamantopoulos et al., 2003; Fisher et al., 2012)	Positive for one young child (Schröck, 2012)			Positive to children under 15 years and negative for those over 15 years (Wier et al., 2008) Positive for older children (Ngobo, 2011)	
Marital status	No influence (Diamantopoulos et al., 2003; Fisher et al., 2012)					
Poor availability	Positive (Aschemann-Witzel & Niebuhr Aagaard, 2014; Dekhili & Achabou, 2013; Diamantopoulos et al., 2003; Vermeir & Verbeke, 2006)	Positive (Buder et al., 2014)				
Living in urbanized areas		Positive (Schröck, 2012)			Positive (Smith, Huang, & Lin, 2009; Wier et al., 2008)	
Higher income	Positive (Fisher et al., 2012). Nonlinear relationship (Park, Choi, & Kim, 2012)				Positive (Ngobo, 2011)	

Diamantopoulos et al. (2003) investigated the impact of demographic variables on all components of environmental consciousness including knowledge, attitude and behavior to determine if sociodemographics have a role to play in profiling green consumers.

The results of their study were again mixed, as demographic characteristics were found to explain attitude but not environmental knowledge, and were found to be limited for explaining behavior. Women were more likely to have greener shopping habits and skilled

TABLE 2 Collapsed Green and Ethical categories

New category	Original G&E categories	New name	% Representation
1	1	Rich	17
2	2, 3, 4, 5	Eco-friendly	24
3	7	Green drivers	36
4	8, 9, 10	Not easy	10
5	11, 12, 13	Other priorities	13

TABLE 3 Descriptive statistics

Parameter	Level	Mean	SD	Min.	Max.
Green and ethical	Rich	0.17	0.37	0	1
	Ecofriendly	0.24	0.43	0	1
	Green drivers	0.36	0.48	0	1
	Not easy	0.10	0.30	0	1
	Other priorities	0.13	0.34	0	1
Deprivation	Index of multiple deprivation	32.37	18.21	2.81	80.58
Age (years)	<11	234.33	84.24	76	559
	11–17	138.74	48.16	29	559
	18–24	178.10	112.62	59	1,188
	25–34	269.22	124.51	61	995
	35–44	240.13	67.20	103	653
	45–54	220.57	46.35	96	393
	>55	414.70	132.37	136	934
Gender	Female	864.50	154.97	521	1456
	Male	846.01	166.47	506	1525
Ethnicity	White	1,436.94	377.55	16	2,554
	Mixed	38.84	35.26	1	253
	Asian	161.57	279.35	1	2197
	Black	59.85	123.04	0	929
	Other	17.45	31.93	0	209
Store type	Convenience store	0.40	0.49	0	1
	Superstore	0.60	0.49	0	1
Price	Milk	91.95	1.71	87.40	93.59
	Egg	18.95	1.25	16.73	21
Share	Milk	0.01	0.01	4.46×10^{-5}	0.088
	Egg	0.56	0.11	0.19	0.99

manual workers (C2 social class) participated less in green purchasing activities. They attribute the weakness in explanatory power to widespread acceptance of environmental responsibility within Western culture, creating a situation where the environment is no longer a marginal issue that is reflected in only certain sectors of the consumer base.

2.3 | Mainstreaming sustainable product purchasing

One important element of any successful attempt to achieve more sustainable consumption patterns will be to make sustainable products more accessible and attractive to mainstream consumers. Unfortunately, despite an increase in awareness and concern for environmental issues, there is a lack of translating this concern into behavior. Therefore, the literature discusses the so-called “attitude–behaviour gap” present in many consumer behavior studies. This gap is created by favorable attitudes toward sustainable behavior but a lack of behavioral intention to act sustainably (Vermeir & Verbeke, 2006). In

other words, consumers express positive attitudes toward a product or buying a product but their actual behavior falls short due to several factors (Aschemann-Witzel & Niebuhr Aagaard, 2014). For example, studies demonstrate how 30–70% of consumers claim they want to purchase in a greener, healthier and more socially responsible way but only 1–5% actually do so (O'Rourke & Ringer, 2016).

The most salient factors in studies based on self-reported data are motivation to buy the product, actual behavioral control, self-efficacy and the situational context that creates a barrier in enacting the behavior (Aschemann-Witzel & Niebuhr Aagaard, 2014). One factor that is consistently highlighted as a barrier to enacting behavior is price, particularly around premium and green products. Aschemann-Witzel and Niebuhr Aagaard (2014) cite price and availability as the major barrier to organic purchases as well. They also illustrated how young consumers, in particular, have positive attitudes toward organic products but state they will postpone their organic purchases to a later stage in life when they can afford the higher price of items (Aschemann-Witzel & Niebuhr Aagaard, 2014). Similarly, Dekhili and Achabou

TABLE 4 GLM estimation results for organic milk data

Parameter	Level	Coefficient	p-value	t-value
Green and ethical	Rich	0.3024	0.00	3.49
	Ecofriendly	0.1778	0.01	2.66
	Green drivers	Base		
	Not easy	0.0011	0.99	0.01
	Other priorities	0.0455	0.72	0.35
Deprivation	Index of multiple deprivation	-0.0157	0.00	7.78
Age (years)	<11	-0.0032	0.00	4.37
	11-17	0.0013	0.03	2.23
	18-24	0.0003	0.23	1.21
	25-34	0.0013	0.00	2.90
	35-44	0.0020	0.06	1.88
	45-54	0.0007	0.45	0.75
	>55	Base		
Gender	Female	0.0035	0.00	4.25
	Male	Base		
Ethnicity	White	-0.0023	0.00	4.04
	Asian	-0.0019	0.00	3.44
	Black	-0.0013	0.07	1.85
	Other	0.0016	0.24	1.19
Store type	Mixed	Base		
	ConvenienceStore	-1.1712	0.00	15.88
	Superstore	Base		
Price	Price	-0.0070	0.00	3.86
No. of observations		9,667		
BIC		-88,506.86		

(2013) explored the gap between pricing policies and consumers' price expectations around green products and found consumers were willing to pay more for such products but only to a certain extent. Consumers indicate an "acceptability interval and psychological threshold" in which they are not willing to pay above a certain level of price difference compared to conventional products.

2.4 | Research question

Previous research has generated mixed results with regard to explaining sustainable purchasing behavior. However, previous studies typically used self-reported behavior as a dependent variable, and typically had a one-product focus and thus implicitly assumed the market for sustainable products to be homogeneous, with no notable differences between different sustainable products. In this study, we use actual sales data as a more reliable measure of purchasing behavior, and extend the analysis to two sustainable products with very different market characteristics, that is, organic milk and free-range eggs. Our research is guided by two complementary research questions: (1) How do sociodemographic and attitudinal factors shape the sustainable purchasing behavior of retail customers? (2) Do the observed relationships vary between niche and mainstream sustainable products?

3 | METHOD

3.1 | Setting and study design

This study is an ecological study of cross-sectional design, using supermarket sales data from over 300 outlets in England covering 18 million customers a week. By combining multiple datasets acquired from

consumer data partners and open data it is possible to gain insight into the characteristics of those purchasing sustainable or ethical products, namely organic milk and free-range eggs. No other study, to our knowledge, had either a dataset of this size or coverage of such vast geography.

3.2 | Data

The data for the research comprise four data sets collected from as many different sources.

1. Retail sales data of two sustainable products. The first data set is from one of the major retailers in the UK and from all its stores across England. The data consist of weekly aggregated sales records of two food products (Milk and Eggs) that have both sustainable and conventional variants. The data also consist of information such as location of the store and type of store (convenience store or superstore). Milk sales data are for a period of 2 years between December 2012 and December 2014 and egg sales data are over a period of just over 1 year between June 2014 and July 2015.
2. Green and ethical segmentation data. The second data set, from Callcredit Information Group (CallCredit, 2014), consists of green and ethical (G&E) segmentation of individuals depending on attitudes to green and ethical issues. The Callcredit Information group, among other things, generates a series of geodemographic classifications. A geodemographic classification is generated through identification of clusters in demographic characteristics, associated with a geographic location. The G&E classification

TABLE 5 GLM estimation results for free-range eggs data

Parameter	Level	Coefficient	p-value	t-value
Green and ethical	Rich	0.0862	0.15	1.42
	Ecofriendly	0.1909	0.00	3.91
	Green drivers	Base		
	Not easy	-0.0006	0.99	0.01
	Other priorities	-0.0660	0.22	1.22
Deprivation	Index of multiple deprivation	-0.0093	0.00	8.25
Age (years)	<11	-0.0004	0.43	0.79
	11-17	0.0004	0.46	0.74
	18-24	0.0000	0.96	0.05
	25-34	-0.0001	0.65	0.45
	35-44	0.0004	0.54	0.61
	45-54	-0.0004	0.59	0.53
	>55	Base		
Gender	Female	0.0001	0.86	0.17
	Male	Base		
Ethnicity	White	0.0000	0.98	0.03
	Asian	-0.0002	0.51	0.66
	Black	-0.0004	0.36	0.92
	Other	0.0002	0.80	0.25
Store type	Mixed	Base		
	ConvenienceStore	-0.1546	0.00	3.88
Price	Superstore	Base		
	Price	-0.0327	0.00	9.73
No. of observations		5,339		
BIC		-45,455.28		

combines attitudes against green and ethical characteristics such as green knowledge and attitudes, green living, and green and ethical shopping. The classification assigns individuals to one of 13 G&E segments. For this study we use the dominant G&E classification for the geographic unit of Lower Super Output Area (LSOA). This is a small geographic area which contains between 1,000 and 3,000 individuals.

- Office of National Statistics data. The third data set is a combination of files from the Office of National Statistics (ONS, 2015) consisting of sociodemographic characteristics. ONS publishes aggregate count statistics reported in the 2011 National Census for England and Wales. This census takes place every 10 years collecting a range of information on the nation's characteristics from over 56 million individuals. The data are predominantly used to underpin public service provisions. We used count data on: age, gender and ethnicity aggregated to LSOA geography, so that it matches in spatial scale to the G&E classification. Before this study, ethnicity has not been investigated in relation to sustainable product consumption, although it has repeatedly been found to influence, for example, consumption of fruit and vegetables in a U.S. context (Lowry, Wechsler, Galuska, Fulton, & Kann, 2002; Reynolds et al., 1999).
- Index of multiple deprivation. The fourth data set contains deprivation scores from the 2015 Index of Multiple Deprivation (IMD, 2015). This is a widely used index that has primarily been used in the context of health (Payne & Abel, 2012) and nutrition (Cummins, McKay, & MacIntyre, 2005), and which allows neighborhoods to be classified according to their level of deprivation.

The index is a continuous score variable which is created using information such as: income, employment, education, health, crime, housing and living environment. IMD is also presented for LSOA geographies.

3.3 | Data preparation

- Using the retail sales data, the proportion of sustainable product sales has been calculated for each store. This is then used as the primary response variable (dependent variable) in the subsequent modeling. A new variable is introduced to represent the store type with 1 representing convenience store and 0 representing superstore. Price is the average price of a unit of the product. The unit is a liter in the case of milk and one egg in the case of eggs.
- As described above, the G&E classification has 13 segments and the dominant segment is assigned to each LSOA. We used the LSOA in which each retail store is located in our modeling. Some G&E segments were poorly represented (0-4%) while others are well represented (16-35%) in our areas. To make the representation more even, we combined some G&E segments by collapsing the classification into five new categories (Table 2). Category 6 has no representation in the data so is excluded from the analysis. "Green Divers" is considered as the base category in our modeling. The other categories are dummy coded (1—presence, 0—absence).
- Sociodemographic data such as age, gender and ethnicity are drawn from the ONS data for each LSOA. The count data were downloaded for each individual characteristic and merged into our master dataset using LSOA.

- IMD is merged into the data again using LSOA.
- The LSOA for each store was determined through geography lookup tables, matching via the store postcode. ArcGIS 10.1 was used for matching the store data to that of the wider surrounding area to produce map visualizations of the results.

3.4 | Model specification

Regression models are used to measure the influence of factors derived from the data sets (described in the previous section), on the purchasing/consumption behavior of sustainable products. The analysis assumes that people living in an LSOA shop more frequently at the local store(s).

As explained in Section 3.3, the response variable in the analysis is the market share of sustainable product and the value of the response variable lies between 0 and 1. Papke and Wooldridge (1996) suggested that the most suitable model when the response variable lies between bounds is the GLM as it has the ability to restrict the predictions within the bounds. Therefore, to analyze the data, we fit GLMs to the data set. We used binomial as family, logit as link function and cluster to take into account the panel nature of the data. Stata 12.0 was used to analyze the data. The model takes the form:

$$\begin{aligned}
 Y = \exp(\beta_0 + \beta_1 * Rich + \beta_2 * EcoFriendly + \beta_3 * NotEasy \\
 + \beta_4 * OtherPriorities + \beta_5 * IMD + \beta_6 * Age11 + \beta_7 * Age17 \\
 + \beta_8 * Age24 + \beta_9 * Age34 + \beta_{10} * Age44 + \beta_{11} * Age54 \\
 + \beta_{12} * Female + \beta_{13} * White + \beta_{14} * Asian + \beta_{15} * Black \\
 + \beta_{16} * Other + \beta_{17} * Storetype \\
 + \beta_{18} * Price)
 \end{aligned} \quad (1)$$

where β_0 is constant, β_1 to β_4 are dummy coefficients for green and ethical attitudes, β_5 is a coefficient for IMD, β_{6-11} are coefficients for age group, β_{13} to β_{16} are coefficients for ethnicity, β_{17} is a dummy coefficient for store type, β_{18} is a coefficient for price, IMD is the of multiple deprivation, Age11 to Age44 represent population in age groups "under11," "11-17," "18-24," "25-34," "35-44" and "45-54," and Storetype is a dummy variable (1 for convenience store, 0 otherwise).

3.5 | Visualization of the results

To visualize the results effectively a diverse area in the UK was selected—North London—and the proportion of milk and eggs sales were presented on a map displaying the variation in characteristics which influence purchasing behavior. These maps were generated in ArcGIS. For gender, IMD and age, LSOA boundary data were downloaded from Edina borders, which is a census support service (ONS, 2011). IMD was displayed as recognized quintiles of deprivation. Gender was displayed as the proportion of females in that area. For G&E, to display the richest quality of data, the map was generated using G&E at postcode level. These were matched to easting and northing references for the postcode point data downloaded from the Ordnance Survey. To convert these to polygons, Thiessen polygons were drawn around the points. Store longitude and latitude locations were generated using an online tool (GPS, 2015) and plotted on the map.

4 | RESULTS

Descriptive statistics of the data are presented in Table 3.

The results of the GLM estimates for organic milk and free-range egg data sets are presented in Tables 4 and 5.

4.1 | GLM for milk data

The results of the model fit on organic milk indicate that G&E Rich and G&E Eco-Friendly are statistically significant and have a positive influence on organic milk sales compared to the category "Green drivers." Similarly, demographic characteristics such as age 11-17, age 25-34 and age 35-44 compared to age above 55 and being female compared to male are statistically significant and have a positive influence on the purchase of organic milk. By contrast, IMD, age under 11 compared to age above 55, White and Asian ethnicities compared to Mixed, convenience store compared to superstore and price are statistically significant but have a negative influence on the purchase/consumption of organic milk. One interpretation is that the dominant presence of a rich and eco-friendly population, the presence of population in age groups 11-17, 25-34 and 35-44 and the presence of females increases the likelihood of organic milk purchase, while a higher IMD, dominant presence of under 11 age population, and White and Asian ethnic population decreases the likelihood of organic milk purchase. Convenience stores, which are smaller and understandably unlikely to have large varieties of products, decrease the likelihood of purchase of sustainable products. Price, as expected, has a negative effect on the purchase of organic milk.

4.2 | GLM model for egg data

The results indicate that G&E Eco-Friendly, IMD and convenience store are the only parameters that are statistically significant and have an influence on the purchase of free-range eggs. While G&E Eco-Friendly has a positive influence, IMD and convenience store have a negative influence. These results suggest that the dominant presence of an eco-friendly population increases the likelihood of free-range egg purchases while a higher IMD decreases the likelihood of free-range egg purchases.

The nature of the influence of the significant parameters on free-range eggs purchases is similar to that of the influence on organic milk. However, interestingly a majority of the factors that have a significant influence (either positive or negative) on the purchase of organic milk fail to show any significant influence on the purchase of free-range eggs.

Convenience stores decrease the likelihood of consumption of sustainable products. Price has a negative effect on the purchase of free-range eggs.

4.3 | Visualizations

The results demonstrate clearly that the factors influencing purchasing behavior for two ethical products, free-range eggs and organic milk, differ. For the purposes of visualization we display the sales from five stores in the North London area of England, UK (Figure 1).

Organic milk represents a higher proportion of sales in areas which have the highest proportion of White purchasers but also in areas

North London



FIGURE 1 Study area for visualization [Colour figure can be viewed at wileyonlinelibrary.com]

where the proportion of White purchasers is lowest (Figure 2). For free-range eggs, the pattern is unclear, with free-range eggs comprising a higher proportion of egg sales with the highest proportion and the lowest proportion of sales being in ethnically diverse areas comprising between 30 and 60% whites.

Deprivation appears to influence organic milk sales, with stores selling the highest proportion of organic milk sales being located in close proximity to the least deprived areas in North London (Figure 3). The association with free-range egg purchases is again not clear with the two stores with the highest proportion of free-range egg sales located in the most affluent and the most deprived areas. This suggests that financial situation has a weaker influence on purchasing of free-range eggs.

5 | DISCUSSION

Our research has examined how the demographics and environmental attitudes of retail customers influence their purchasing behavior of niche and mainstream products with sustainable labels and whether the influence varies by products. Our analysis, which is based on a

large sample comprising actual sales data of sustainable products (organic milk and free-range eggs) over a period of time (organic milk, 24 months; free-range eggs, 12 months) across many stores (over 300) linked with the sociodemographic and green and ethical attitudinal characteristics of the population in the service area of the stores, provides valid and reliable insights into the drivers and barriers of the consumption of sustainable products.

Our research only partially supports earlier studies using self-reported measures (Dekhili & Achabou, 2013; Van Herpen, Van Nierop, & Sloot, 2012; Vermeir & Verbeke, 2006). Across the two sustainable products, richer green and ethical attitudes have a positive impact on consumption. Deprivation in the store service area has a strong negative effect on the consumption of sustainable products. Price does have a negative effect but differs in impact for the two products. Convenience stores, which are smaller and understandably unlikely to stock large varieties of products, decrease the likelihood of consumption of sustainable products. There are influences of other characteristics such as gender, age and ethnicity, but these vary by product. More generally, beyond these commonalities mentioned above, markedly different profiles have emerged for the two different products included in our study.

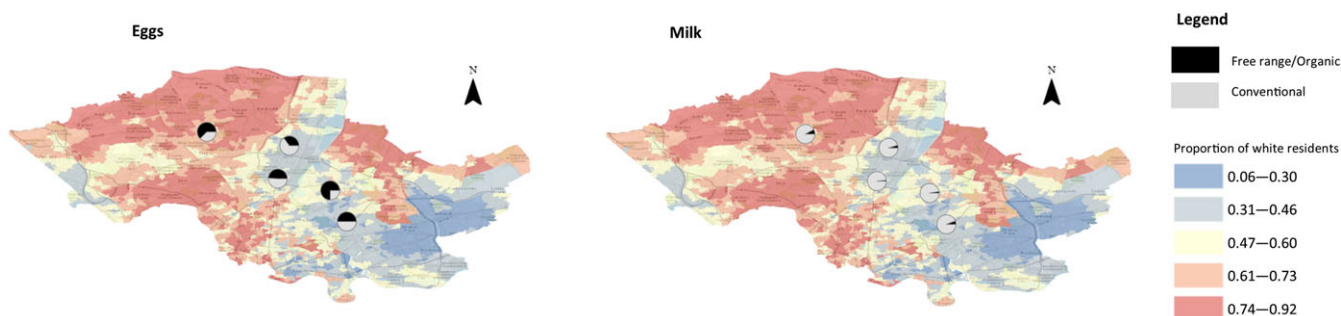


FIGURE 2 Egg and milk sales by store displayed over a background indicating the proportion of White residents [Colour figure can be viewed at wileyonlinelibrary.com]

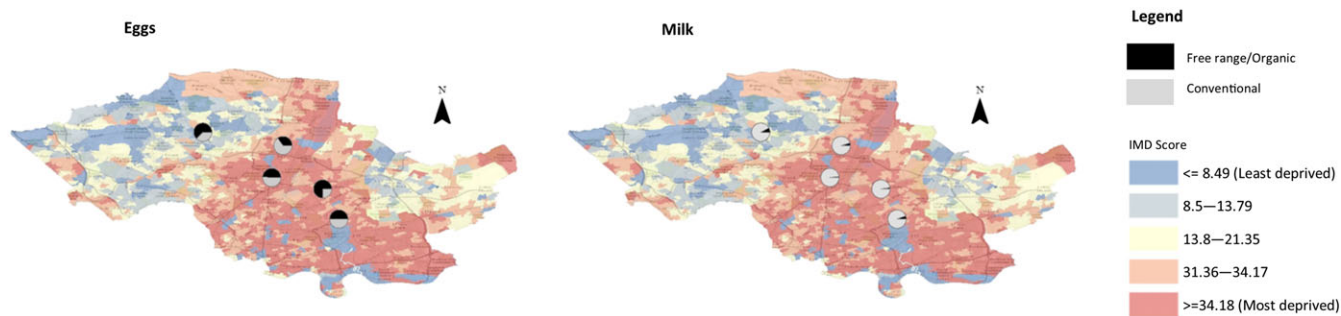


FIGURE 3 Egg and milk sales by store displayed over a background indicating area deprivation. The association with the condensed version of G&E can be seen in Figure 4. [Colour figure can be viewed at wileyonlinelibrary.com]

Starting with organic milk, more affluent consumers with green and ethical attitudes emerge as main consumers, thereby confirming previous studies (Schröck, 2012; Vukasovič, 2016). Consumers who have positive green and ethical attitudes but have lower disposable incomes do not consume organic milk, which supports the literature that price is a barrier (Aschemann-Witzel & Niebuhr Aagaard, 2014; Buder et al., 2014). The presence of children aged under 11 years has a negative effect on the consumption of organic milk, which goes against the conclusions made by Wier, O'Doherty Jensen, Andersen, and Millock (2008) and Schröck (2012) that young families are higher purchasers of organic milk. By contrast, the presence of children aged between 11 and 17 years has a positive effect on the consumption of organic milk, supporting the conclusions of Ngobo (2011). Consumers aged between 25 and 44 years are consuming organic milk, supporting the research of Wier et al. (2008), and hence help to clarify previous contradictory results (Aschemann-Witzel & Niebuhr Aagaard, 2014; Van Herpen et al., 2012; Vukasovič, 2016). Female consumers are more likely to purchase organic milk than their male counterparts, which helps to clarify previously inconclusive results (Diamantopoulos et al., 2003; Fisher et al., 2012). Consumers living in areas of higher deprivation have a lower demand for organic milk, which is linked to affordability as shown above. Ethnicity seems to show some influence on the consumption of organic milk. Compared to mixed ethnicities, White and Asian ethnicities have a negative influence on the consumption of organic milk. This is a new contribution to the literature (Schröck, 2012; Vukasovič, 2016).

A notably different picture has emerged with regard to free-range eggs as the second product included in our study. Here, eco-friendly green and ethical attitudes, IMD and convenience store are

the only parameters that have an influence on the purchase of free-range eggs. While G&E Eco-Friendly has a positive influence, IMD has a negative influence, and these two factors are generally supported by the literature (Dekhili & Achabou, 2013; Van Herpen et al., 2012; Vermeir & Verbeke, 2006). Based on the patterns identified in our study, it is clear that sustainable products represent a highly heterogeneous market segment. This may also explain the inconclusive results of previous studies when looking at purchasing of sustainable products in general (Fisher et al., 2012) without distinguishing between different product categories. For retailers, this means that rather than treating all sustainable products in the same way, they will need to develop product-specific marketing strategies, considering the particular characteristics of a given product. Models such as the one presented in this study can help retailers to predict sales and market share of sustainable products at specific geographic locations to streamline and more effectively market their supply.

Equally importantly, when comparing our two different products, the impact of sociodemographic factors on purchasing behavior appears to be fading with increasing market penetration. The two products included in our study arguably reflect the two extremes on a spectrum from niche to mainstream sustainable products. It is reasonable to assume that they therefore reflect at least one possible pathway to a sustainable transition in food production and consumption. Logically, there could be two viable mainstreaming strategies (or a combination of the two): (a) attempts to grow the sustainable niche and thus to attract a greater number of green and ethical customers; or (b) attempts to make sustainable products more accessible to mainstream customers beyond the sustainable niche.

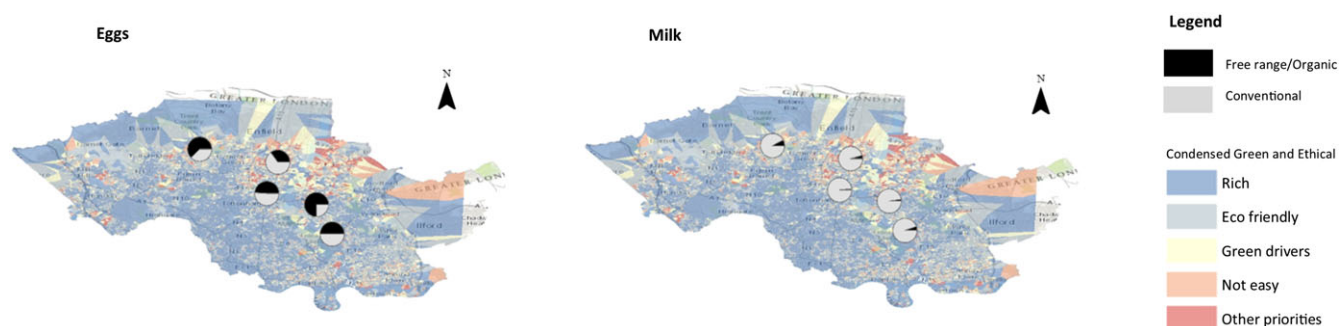


FIGURE 4 Egg and milk sales by store displayed over a background indicating G&E attitudes. There is no clear visual association between gender and purchases of free-range eggs or organic milk. [Colour figure can be viewed at wileyonlinelibrary.com]

Current attempts of UK retailers to mainstream sustainable products arguably reflect the former of these two strategies, that is, aiming to appeal to green and ethical consumers and to continue to grow the sustainable niche.

However, recent studies of the market share of sustainable products show that despite a substantial increase in proenvironmental attitudes in recent years, this has not triggered an equivalent increase in proenvironmental purchasing behavior (Aschemann-Witzel & Niebuhr Aagaard, 2014; O'Rourke & Ringer, 2016). Following the above argument, "conventional" sustainable marketing strategies that are centered around a price premium that customers are expected to pay for more sustainable products are unlikely to be successful. Instead, price sensitivity represents a key barrier in the context of mainstreaming. In other words, sustainable products such as organic milk are at risk of being locked into the sustainable niche.

This leads us to conclude that retailers, suppliers and sustainability practitioners involved in the production, marketing, sales and setting of product standards should change their strategy for selling sustainable products. For sustainable products that are able to achieve the availability and supply levels required for mainstream supermarkets, marketing and communication should be focused on the quality, safety and health of their production (Ottman, Stafford, & Hartman, 2006; Sheth, Sethia, & Srinivas, 2011). These more mainstream aspects seem to be a bridge between mainstream consumers' purchasing values and their green values leading to the purchase of sustainable products. This supports other research that advocates making sustainable products more "normal" and not "different" to appeal to mainstream consumers (Rettie, Burchell, & Barnham, 2014). The shift to a bridging communication strategy will connect those mainstream consumers using a mainstream retailer without the loss of niche consumers who will probably shop at more niche green retailers to purchase sustainable products.

A parallel supporting strategy should come from the retailers themselves as part of their sustainable business strategy (Youn et al., 2017). This would guide mainstream consumers on buying sustainable products through choice editing (Gunn & Mont, 2014; Morgan, 2015), as is widely the case for coffee, tea and chocolate products and sustainability awareness campaigns. Regarding the latter, emerging evidence shows that mainstream consumers will change their behavior on sustainability issues after awareness campaigns from brands they trust using mainstream consumer values (Butt et al., 2017; Perrini, Castaldo, Misani, & Tencati, 2010; Young, Russell, Robinson, & Chintakayala, 2018).

Our study is subject to several limitations. The results are based only on two products, only on data from England and only from a single national retailer. Therefore, generalization of the findings across products or regions is cautioned. In addition, we do not have data on price promotions over time, which might have affected the market shares of the products that we considered in the analysis. We use data from a retailer that mainstream consumers are more likely to use than niche ethical consumers who will be more likely to shop at small independent retailers.

Further research needs to be done around the marketing methods retailers have used for sustainable labeled products. Are they using methods that just appeal to niche green consumers who may not be

buying their products from a mainstream retailer anyway? Are these marketing methods putting off mainstream consumers who may buy organic milk but need better marketing that appeals to their mainstream consumer values? This is key as mainstream consumers are used to buying sustainable labeled products, but retailers need to change their marketing of these products to mainstream consumers. Crucially, future research may need to examine additional sustainable products with differing degrees of market penetration to test whether the patterns identified here also hold for products beyond organic milk and free-range eggs. More specifically, we would expect increasing market penetration to coincide with a decreasing impact of socio-demographic variables on purchasing behavior.

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