AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Got green milk? Field Experimental Trail of Consumer Demand for a Climate Label

Elina Matsdotter[2], Katarina Elofsson2[2] and Johan Arntyr[3]

[1] Swedish University of Agricultural Sciences, Department of Economics, elina.matsdotter@slu.se

[2] Swedish University of Agricultural Sciences, Department of Economics, katarina.elofsson@slu.se

[3] Ramböll Sverige AB, johan.arntyr@ramboll.se

Paper prepared for presentation at the EAAE 2014 Congress
'Agri-Food and Rural Innovations for Healthier Societies'

August 26 to 29, 2014
Ljubljana, Slovenia

Copyright 2014 by Elina Matsdotter, Katarina Elofsson and Johan Arntyr. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

GOT GREEN MILK? FIELD EXPERIMENTAL TRIAL OF CONSUMER DEMAND FOR A CLIMATE LABEL

Abstract

A majority of consumers claim to prefer climate labelled food over non-labelled alternatives. However, there is limited empirical evidence that such labels actually influence consumer behaviour when shopping. In a randomized field experiment, conducted in 17 retrial stores in Sweden, the short run effects of a voluntary climate labelling scheme on milk demand were measured. Results suggest that climate labelling increased demand by approximately 7%. The response is significantly smaller than suggested by consumer surveys, but larger than observed in earlier studies of actual purchasing behavior where quantitative information on climate impact is provided.

Keywords: *Climate labelling, milk, voluntary policy instruments, randomized controlled trial, consumer demand.*

1. Introduction

Food consumption accounts for a large proportion of the global greenhouse gas (GHG) emissions (Steinfeld *et al*, 2006). Within Europe, it is estimated that approximately 30% of the GHG emissions originate from food consumption (Tukker *et al*., 2006). Current trends in food consumption patterns point toward increased demand for foods with a large environmental impact, but if consumption patterns of food are altered, the GHG emissions can be lowered substantially (Carlsson-Kanyama and Lindén, 2001; Duchin, 2005; Weber and Matthews, 2008; Carlsson-Kanyama and González, 2009).

Climate labelling is one method by which food consumptions patterns could be changed on a voluntary basis (see e.g. Dietz *et al.*, 2009; Vandenbergh *et al.*, 2011). The first climate label, the so called Carbon Reduction Label (CRL), appeared in 2007 in the UK. This initiative was launched with the aim of providing an opportunity for companies to demonstrate their commitment to decreasing the GHG emissions from their products and altering consumer demand towards lower amounts of carbon consumption (Carbon Trust, 2006). Since then, several other countries have followed the UK example. However, there is limited evidence regarding the effectiveness of climate labelling in shifting consumer demand towards more environmentally friendly consumption.

In market surveys, consumers often maintain a high demand for climate labels. For example, a majority of Swedes claim they would buy climate labelled food (YouGov, 2012). Also, approximately 50% of Swedish consumers claim that they are willing to pay a 10-45% price-premium for climate labelled milk (YouGov, 2012). Studies from the UK show similar results (e.g. Gadema and Oglethorpe, 2011). Despite the stated consumer demand, the market share for climate labelled milk in Sweden is only about 1.5%[1]. Even when climate labeled milk is readily available, consumers are not backing expressed preferences with actual consumption. Prices, habits, limited trust in labelling schemes, perceived low environmental impact of the own individual purchases, and lack of information and marketing have been suggested as possible reasons for the discrepancy between consumers' stated preferences for climate certified food and

[1] According to statistics from the Swedish Dairy Association.

observed consumption (Leire and Thidell, 2005; Grankvist and Biel, 2007; Röös and Tjärnemo, 2011).

Further knowledge on the impact of climate labelling on consumer demand is warranted for a number of reasons. First, producers are less likely to voluntarily spend efforts on improving environmental standards in production if they are uncertain as to whether consumers will prefer the more environmentally friendly product to other product alternatives. Second, environmental organizations and governmental bodies are uncertain whether devoting resources to environmental certification schemes is an effective strategy, when knowledge about demand responses to labelling is limited. Third, policy makers are likely interested in whether voluntary initiatives can provide significant environmental improvements. Successful voluntary schemes could, at least hypothetically, relieve the pressure on governments to introduce more stringent policy instruments, such as environmental regulation and taxation, which could meet substantial resistance from different interest groups due to the associated costs.

The purpose of this paper is to investigate if an in-store information sign on a voluntary climate labelling scheme has potential to alter consumer demand of climate labelled milk in the short run. A randomized controlled field trial (RCT) is carried out in 17 grocery stores in the Uppsala region of Sweden. The trial isolates the effect of information on consumption, holding all other conditions the same – thereby measuring the impact of climate labelling on consumer demand for milk. Causal parameter estimates suggest that in-store information has the potential of alter demand for climate labelled milk. The results suggest that climate labelling increased sales by about 7%. This result implicates that information to consumers on a climate labelling scheme does not substantially close the gap between consumers' expressed preferences for climate labelled milk and observed behaviour.

This study is, to our knowledge, the first application of an RCT performed in retail stores to estimate the impact on demand of climate labels on food. One of the few previous studies, successful in estimating the empirical impact of a certified food label on consumer demand, is Hainmueller *et al*. (2011) who perform an RCT across 26 stores of a major US grocery chain, to derive the impact of a Fair Trade label on demand for coffee. Results show that sales of the two most popular bulk coffees rose by 10% when they were labelled as Fair Trade. Also, Vanclay *et al.* (2011) use an empirical experiment to determine the effectiveness of a climate label placed on the shelf in a single grocery store in Australia. They labelled 37 products, in five product lines of high-volume sale items, to indicate embodied GHG emission by using a traffic light coloured system. Results show that labelling increased sales by 4% of the least carbon intensive products, while there was a negative impact on sales of the most carbon intensive products. Several studies are based on observational market data. For example, Teisl *et al.* (2002) find that consumers are responding positively to the Dolphin-safe label, and Bjørner *et al.* (2004) obtain an increase in demand from the Nordic Swan label. Kortelainen *et al.* (2013) apply a difference-in-differences approach to test whether there is a price premium for climate labelled detergents, but their results do not confirm the existence of such result.

We thus add to the earlier literature, which has mainly relied upon observational data of product sales, consumer surveys and focus groups (for a review, see e.g. Cohen and Vandenberg, 2012). Compared with studies based on experiments in a single store, such as Vanclay *et al.* (2011), the randomized approach facilitates the isolation of the effects of labelling from potential time-varying or product specific confounding factors, thereby increasing the ability to extrapolate the findings to a broader context. When compared with studies that make use of a single time series of scanner data (e.g., Kortelainen *et al.*, 2013; Teisl *et al*., 2002; Bjorner *et al.*, 2004) the cross sectional variation in this study, in combination with the use of a control group, implies that

we avoid the confusion of the effect of the environmental label with effects that could be due to unobserved market factors (see for instance Hainmueller *et al*., 2011). Limitations to this study include the measurement of only the short term impact of climate labelling, and limited knowledge about consumers' pre-experiment perceptions about the labelled products climate characteristics.

The remainder of the paper is structured as follows: Section 2 presents the experimental design, and Section 3 shows the results of the empirical analysis. Finally, results are summarized and discussed in Section 4.

2. Experimental Setting

To measure the impact of climate labelling on consumer demand of milk, an RCT was conducted in 17 grocery stores. The sample of grocery stores is the full population of Coop stores[2] which sell the climate labelled product. These stores vary significantly in size and turnover, as supermarkets, mid-size shops as well as convenience stores are included. The stores are spread out over a relatively large region, including rural, suburban and metropolitan areas throughout Uppsala and Stockholm Counties. Therefore, consumers can be expected to have varying socioeconomic backgrounds. The distribution of the sample across stores of various sizes in different types of location, and the associated average milk sales and prices, is shown in Table 1.

Table 1. Descriptive statistics of sample.

Region	Share of sample (%)	Sales of all milk (litre)	Sales of climate milk (litre)	Sales of organic milk (litre)	Sales of conventional milk (litre)
Rural	35.3	1,795	161	52	1,583
		(770.6)	(67.7)	(39.2)	(774.3)
Sub-urban	29.4	6,026	794	277	4,955
		(4374.5)	(649.3)	(205.6)	(3825.3)
Metropolitan	35.3	2,475	341	146	1,988
		(1050.1)	(154.3)	(109.5)	(1819.8)
Store size					
Convenient store	23.5	1,196	308	84	804
		(194.6)	(108.3)	(56.4)	(87.0)
Mid-size store	53.0	1,906	256	90	1,560
		(704.9)	(174.3)	(66.6)	(666.7)
Supermarket	23.5	8,453	861	357	7,235
		(2,597,5)	(716.7)	(196.3)	(2,046.2)
Average price per litre milk			12.82	10.34	7.53
			(0.10)	(1.09)	(0.72)

Note: The unit of the sales of milk containers (either 1 or 1.5 litre) is presented as averages per week during the 4 week experimental period. Standard deviations in parenthesis.

The consumer good that is the focus of this study is fluid unflavoured climate labelled milk from the brand Sju Gårdar ("Seven Farms"), which is a local economic association for milk producers. The milk from Sju Gårdar was labelled according to the Swedish standards for Climate Certification of Food (CCF) in 2010, and is the only climate labelled milk product

[2] Coop is a grocery retail group accounting for approximately 20% of the Swedish grocery retail market.

offered in the market area of the study. Prior to the trial, minor marketing efforts were made to market the climate labelled milk. The choice of product is thus motivated by the availability of a food product which is climate labelled, and where this is hardly communicated to consumers before our experiment. In earlier studies, it is also recognized that fluid unflavoured milk is a suitable choice of commodity, when studying demand effects of environmental labelling (Kiesel and Villas-Boas, 2007). This is because it is a relatively standardized commodity with no significant flavour and quality differences between various brands. Milk is also a staple good that consumers purchase in significant volumes. This permits us to assume that the distribution of sales volumes is approximately normal, facilitating identification of a treatment effect.

The CCF is a voluntary labelling scheme which requires that certified food producers strive towards a significant reduction of GHG emissions (CCF, 2012). Reductions are made by focusing on production choices with the largest climate impact, such as the use of soy protein-based feed, fossil fuels, and chemical fertilizer. A requirement for accreditation to a climate label is that the producer already has another quality certification. This requirement is motivated by the climate impact being only one out of several sustainability issues that need to be addressed by farmers, implying that a narrow focus on the climate impact alone can lead to sub-optimal decisions (CCF, 2012). The milk from Sju Gårdar fulfils this requirement as it is also organically certified.

2.1 Treatment Design and Randomization of Treatments

Treatment design requires consideration of the type of information that is to be presented to consumers in the treatment and control groups respectively. Most existing climate labelling schemes provide consumers with quantitative information about the amount of GHG emitted during the product's life-cycle, such as the CRL (see e.g. Vandenbergh *et al.*, 2011). Some schemes, however, only provide consumers with a logo that states that the product is certified, thereby indicating that producers are committed to make a particular effort to reduce GHG emissions from production (Czarnezki, 2011). The Swedish CCF label applies the latter approach. Thus, the treatment design builds on this specific labelling scheme. This is motivated by our aim to investigate the potential impact of voluntary labelling schemes. It also seems unlikely that any government would propose the introduction of a general carbon-labelling scheme for all food products, given the large transaction costs such a system would entail. Furthermore, Korteleinen *et al*. (2013) also highlight the importance of investigating climate labels that only convey qualitative information, due to the cognitive difficulties for consumers to process the quantitative information.

For the intervention, we use two different signs, in the format of 18x13 cm, attached to the shelf in close proximity to Sju Gårdar's medium-fat milk. This placing of the signs is motivated by the medium-fat milk having the highest sales rates *a priori.* One of the signs explains that Sju Gårdar's milk is climate certified (treatment), and the other is a placebo sign with similar design but without climate related information (control). The use of placebo-signs facilitates the isolation of consumers' response to the environmental information from the marketing effect of the sign itself, which can arise when diverting consumers' attention to a product (Carpenter *et al.*, 1994). The treatment sign builds on the design of the placebo sign, but adds the information that the milk from Sju Gårdar is climate certified and that the producer thereby is committed to reduce their climate impact. Since trust as well as third party monitoring of a climate labelling scheme is important for a climate label to be trustworthy, the provision of an URL address, which supplies the consumer with information about the CCF standards, validates the claim of certification and reduces the risk of mistrust.

Treatments were introduced on a weekly basis following a randomly assigned scheme, running over a four-week period. Treatments were normally distributed to consider the difference between stores with regard to size and demographics. The random assignment procedure of this trial resulted in comparable treatment and control groups, with similar background characteristics and covariate balance in expectation[3].

2.2 The Data

Scanner data is used to estimate the effect on demand. Altogether, 23 different fluid unflavoured milk products (either low, medium and standard-fat content) with associated purchases and prices are included in the final panel dataset. The quality and reliability of the data is high since the risk of measurement errors is minimal. Potentially other factors could affect the quality of the dataset, e.g. non-compliance to the treatment protocol. To minimize the risk of non-compliance, all store managers and responsible employees were personally visited and informed about the trial. A detailed scheme with instructions on when signs were to be changed was provided. At every instance when signs were to be changed, stores were directly contacted by telephone to confirm that the sign had been correctly put up. In addition, unannounced visits were made to all stores to verify compliance with assigned treatments. Overall, the compliance was high, and only one instance of deviation from the treatment protocol was detected for the 68 observations.

Only products that have actually been purchased are registered in the cash register and consequently missing values may represent either that the product is out of stock, or that no purchases were made even though the good was available in the store. The conditions for using intention-to-treat (ITT) estimation (Gerber and Green, 2012) are satisfied as the assignment to treatment is highly correlated with actual treatment received and not correlated with the error term. Observations are analysed as if treatments were received according to the initial assignment of treatments following the ITT-logic (Newell, 1992), and all missing values in the dataset are therefore replaced with zeroes. Consequently, all following reported estimates are based on the ITT method.

3. Results

The trial is designed to investigate if an in-store information sign on a voluntary climate labelling scheme has the potential to alter consumer demand of climate labelled milk in the short run. The hypothesis to be tested is whether consumption of milk changes when information about a climate label is present, compared with when it is not. Average sales in the presence of climate impact information will be compared to average sales without that information – hereafter referred to as the average treatment effect (ATE). Our quantities of interest are the effects of the information on sales of climate labelled milk, and sales of the main alternative milk products; organically produced milk without climate certification, and conventional milk.

If demand for the climate certified milk is more elastic than the demand for the alternatives, or if the treatment design does not fully account for marketing spill over effects, the total sales of

[3] The randomization procedure is tested through a regression of a binary treatment variable, indicating the assignment to either the treatment or control groups, on the full set of covariates. The result from this test support that the randomization procedure was successful in creating comparable treatment and control groups, and suggests that the randomization successfully orthogonalized the assignment with respect to confounding factors.

milk could potentially increase due to the climate information (cf., e.g., Krishna and Rajan, 2009).
To identify if such an increase has followed, we start the analysis by estimating the effect of climate information on the aggregate sales of *all* milk products in the dataset. The analysis of total sales is followed by estimation of the ATE on *(i)* aggregate milk demand for the three different product types, and *(ii)* demand for medium fat milk for the three different product types. The latter is motivated by the medium fat milk being the product with the largest sales volume, and by the sign being placed in close proximity to that particular type of milk, implying that consumers may perceive that the information primarily pertains to the medium fat milk.

3.1 Effects on Aggregate Sales

The estimation of the ATE on aggregate milk sales will also help us to judge whether it is more relevant to analyse changes in sales volumes or market shares for different milk products in the subsequent analysis. Market share is a suitable measure if aggregate demand is unaffected by the trial, but less informative if aggregate demand is influenced by the treatment. We conduct this estimation by using first the aggregate sales of all milk, then the ratio of aggregate sales of all milk to total turnover in the store, as the dependent variable. This is convenient since most of the explanatory power stems from store size, where total turnover can be viewed as a suitable complement. We estimate the following regression equations:

$$\log S_{ALL,it} = \alpha + \beta_1 T_{it} + \beta_2 \log Turnover_{it} + \beta_3 \log \bar{P}_{ALL,it} + \gamma_i + \delta_t + u_{it} \quad (1)$$

$$\log S_{ALL,it} - \log Turnover_{it} = \alpha + \beta_1 T_{it} + \beta_2 \log \bar{P}_{ALL,it} + \gamma_i + \delta_t + u_{it} \quad (2)$$

where $S_{ALL,it}$ represents the aggregate sales of all the 23 milk products over the experimental period of $t = 1, 2, 3, 4$ weeks in $i = 1, 2, \dots, 17$ grocery stores. Thus, there are a total of $i \times t = 17 \times 4 = 68$ observations. T_{it} is a binary variable for treatment. The coefficient β_1 represents the estimated magnitude of the ATE on the total sales of all milk products. To increase the precision in the estimated ATE two covariates, store turnover and the mean milk price[4] in the store, are also included controlled for. Finally, γ_i captures store-specific effects, δ_t controls for week-specific effects and u_{it} represents the idiosyncratic error-term that may change across *t* and *i*. By including γ_i and δ_t, we control for the unobserved heterogeneity within the stores and over weeks (Angrist and Pischke, 2008). The unobserved heterogeneity in store-specific effects could, e.g., be due to demographic differences between stores' customers, or to local competition with nearby stores, while the week-specific effects could be explained by, e.g., fluctuations in demand over time that affect all shops equally, such as paydays or certain holidays. Maximum precision is achieved by estimating the store-specific random effects with GLS and by including unobserved heterogeneity over time[5]. We estimate all regressions with robust standard errors, and use a

[4] The construction of the price variables has been made considering that all of the 17 stores do not carry all the 23 milk products and that milk is provided in both 1 and 1.5 liter packages. An average price per product category per store has been calculated according to the following formula: $\bar{P}_{it} = \left(\sum P_j + \frac{\sum P_i}{1.5}\right) / \left(\sum n_j + \sum n_i\right)$, where *j* = 1 liter milk containers, *i* = 1.5 liter milk containers.

[5] A Hausman test showed that random effects are more suitable (Prob>chi2 = 0.518). Performing a Breusch-Pagan Lagrange multiplier test resulted in the same conclusion (Prob>chi2 = 0.000). Using random effects will in this case yield a higher precision, and since the random effects are orthogonal to the regressor (treatment dummy) using random effects for the analysis would be justified (Gerber and Green, 2012).

logarithmic transformation for the dependent variable because of the considerable variation in store size, and for the ease of interpretation, given that coefficients can then be interpreted as percentage changes.

The results from the estimation of equations (1) and (2) are presented in Table 2, and referred to in the table as models 1 and 2, respectively. The estimates suggest that climate information has no significant effect on the total volume of milk sales. As we cannot exclude a positive impact of climate information on the whole product group, we also cannot exclude the possibility that milk purchases increase in total at the expense of other product groups. In the following, we will therefore estimate changes in both sales and market shares of the different product types.

3.2 The effect on climate certified milk and product substitutes

We continue the analysis by estimating the ATE on the sales of climate labelled milk, and on the sales of the main alternatives. The three main product categories investigated are: *(i)* climate labelled milk; *(ii)* certified labelled organic milk; and *(iii)* conventional milk. All the 23 fluid unflavoured milk products in the dataset are allocated to one of these three product categories. The aggregated sales of each milk product category are used as the outcome variable in the following regression framework. Analogously to equation (1), we estimate the following regression:

$$\log S_{jit} = \alpha + \beta_1 T_{jit} + \beta_2 \log Turnover + \beta_3 \log \frac{\bar{P}_{jit}}{\bar{P}_{kit}} + \gamma_i + \delta_t + u_{it} \qquad (3)$$

where the outcome variable of interest, S_{jit}, is litres of milk sold in product category $j = 1, 2, 3$. In this setting, β_1 represents the estimated magnitude of ATE on each of the milk product categories when treatment is presented to consumers. We control for the impact of prices on milk demand by including a price ratio between the product categories as an explanatory variable. A price ratio is convenient, given the small variation in prices in the dataset. Furthermore, the impact of climate information on milk demand is also estimated using the market share of milk product category j as the response variable, see equations (4).

$$\log S_{jit} - \log S_{ALL\,it} = \alpha + \beta_1 T_{jit} + \beta_2 \log Turnover + \beta_3 \log \frac{\bar{P}_{jit}}{\bar{P}_{kit}} + \gamma_i + \delta_t + u_{it} \qquad (4)$$

Results indicate that information on the climate label has a positive effect on total sales of the labelled product. In Table 2, model 3-4, the estimates suggest that the presence of climate information increased aggregate sales of the climate labelled milk compared to sales in the control group. However, the outcome is not significant at standard levels, wherefore we cannot rule out the hypothesis that the average effect of the climate label information is zero. To be able to verify a positive impact, a larger sample would arguably be needed. As expected, turnover is significant in equations (3) and the coefficient has the expected sign.

Results in Table 2, model 5-6, suggest that treatment leads to a decline in the aggregate sales of organically produced milk compared with the control, however, the outcome is not significant at standard levels. Furthermore, in Table 2 model 7-8, results suggest that the impact of climate information on the aggregate sales of conventionally produced milk is not significant, albeit the estimated coefficient is positive.

The treatment sign was displayed in close relation to the climate certified medium-fat milk. Moreover, the green colouring of the sign coincides with the colour used on the package for

medium-fat milk of all brands. It is therefore possible that consumer primarily associate the information on the signs with the medium-fat milk. Furthermore, some of the low- and standard-fat milk products were not offered to consumers in all stores, implying that it can be less suitable to use aggregate milk sales in each product category as the dependent variable, compared with using the sales of the medium-fat milk. This motivates an investigation of the specific impact on the medium-fat milk products.

We estimate model (3) in a similar manner as above, but now only considering sales of medium-fat milk in the three different product categories. The results from these estimations, which can be found in Table 2, model 9-11, gives a coefficient of the same sign as in model 3-4, but the impact of the presence of climate information on the climate certified milk is both larger and statistically significant. These estimates show that climate information increased sales of the medium-fat climate labelled milk by about 7% on average compared with the control. The results from this sub-sample analysis also indicate that increased climate information might have a positive impact of on conventionally produced milk, combined with a reduction of the sales of organically produced milk, albeit the estimates are not statistically significant.

Taken together, our results suggest that consumers react to the climate information provided through the experiment by increasing their demand for climate labelled milk. Results confirm a significant but low impact of in-store information on sales. In particular, consumers increased their purchases of the climate certified milk placed most close to, and with a similar colour as the treatment sign.

Table 2. Effect of climate information

Model No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Variables (log)	All milk	All milk / Turnover	Climate milk	Clim. milk/ All	Organic milk	Organ. /All milk	Conv. milk	Conv. milk/ All	Climate medium milk	Organic medium milk	Conv. Medium milk
Climate information	0.003	0.004	0.029	0.027	-0.047	-0.054	0.006	0.003	0.071**	-0.078	-0.001
	(0.007)	(0.007)	(0.027)	(0.03)	(0.060)	(0.06)	(0.010)	(0.005)	(0.036)	(0.083)	(0.013)
Turnover	0.9***		0.78***	-0.08	0.92***	-0.07	0.96***	0.054	0.92***	0.63***	0.85***
	(0.049)		(0.142)	(0.16)	(0.24)	(0.29)	(0.084)	(0.044)	(0.212)	(0.232)	(0.073)
$P_{All\ milk}$	-0.825	0.469									
	(2.100)	(1.956)									
$P_1/P_{2,3}$			-0.578	-0.664							
			(2.912)	(3.24)							
$P_2/P_{1,3}$					1.764	1.564					
					(2.321)	(2.66)					
$P_3/P_{1,2}$							0.401	0.376			
							(0.547)	(0.252)			
$P_{1\ med}/\ P_{2,3\ med.}$									-5.825**		
									(2.467)		
$P_{2\ med}/\ P_{1,3\ med.}$										-6.279*	
										(3.363)	
$P_{3\ med}/\ P_{1,2\ med.}$											-3.8***
											(0.839)
Constant	-0.371	-4.409	-2.642*	-0.885	-5.60**	-2.385	-2.9***	-0.667	-3.010	-3.135	-3.7***
	(5.033)	(4.699)	(1.533)	(1.89)	(2.608)	(3.22)	(1.038)	(0.487)	(1.858)	(2.588)	(0.618)
Observations	68	68	68	68	63	63	68	68	68	63	68
Rho	0.974	0.968	0.984	0.988	0.864	0.885	0.983	0.982	0.960	0.663	0.953

Note: The dependent variable is represented by the heading to each column. All variables are logged. Robust standard errors in parentheses. Store random effects and week fixed effects are included in all regressions. P_1 represents the average price for climate labelled milk; P_2 represents the average price for certified labelled organic milk; and P_3 represents the average price for of conventional milk. * Significant at 10 % level. ** Significant at 5 % level. *** Significant at 1 % level.

4. Concluding Remarks

The purpose of this study is to investigate whether in-store information about a voluntary climate labelling scheme affects demand of milk in the short run. The study contributes to the literature on environmental labelling through applied empirical analysis of the impact of climate information on milk demand. By conducting a randomized controlled field trial, we measure the average response of demand of milk to the introduction of a certified climate label in 17 stores. The trial is carried out across a variety of geographical locations, hence capturing a wide consumer group, which strengthens the general validity of the results. The climate information is manipulated experimentally through an in-store information sign placed in close proximity to the climate friendlier milk. Findings suggest that an information signs on the shelf have the potential of increasing the demand for climate certified milk by approximately 7%.

This result suggests that in-store information on a climate labelling scheme does not significantly close the discrepancy between consumers' expressed preferences for climate certified milk and observed behaviour, highlighting the weaknesses of market survey methodologies where respondents are being asked to state openly whether they support efforts to provide a public good in a context in which voicing support is costless (Vermeir and Verbeke, 2006; Murphy, Allen, Stevens, and Weatherhead, 2005; List and Gallet, 2001). The preferences consumers reveal in a real market setting, when they are actually spending their money, may thus differ substantially from the preferences they declare in surveys.

The estimated magnitude of the increase in sales of the climate labelled milk can be compared with results from previous in-store experimental studies on demand effects of environmental labelling where, for example, Hainmueller *et al*. (2011) find that the sales of coffee rose by 10% when consumers received information on a Fair Trade certification. Also, Vanclay *et al*. (2011) find that a "green light" carbon label increased sales by 4%. It can be noted that our estimated impact is larger than that in Vanclay *et al*. (2011), even though the labelling in both cases indicates impacts on the same public good, namely the impact on the climate. In contrast, the Fair Trade label analysed in Hainmueller *et al*. (2011) is more likely to be associated with differences in consumption quality, e.g. taste differences, which might explain the higher impact in that study.

The trial also reveal potential indications that the increased sales of climate certified milk are associated with a decrease in the sales of organic milk, hence suggesting that changes in demand could result from "green" consumers shifting between different environmental labels. Such substitution effects imply that it is not evident that the net environmental impact will decrease as a consequence of the introduction of voluntary climate labelling, given that milk production affects not only the emissions of GHG, but also has other environmental consequences on e.g. biodiversity and nutrient losses. This indication warrants for further investigations in this regard.

Evidently, if climate certified products are simultaneously associated with a higher price compared with other substitutes, this is likely to reduce the impact of climate labels on demand for the labelled product, as suggested by Vanclay *et al*. (2011). It might be that, in order to change the behaviour of the majority of consumers, the price premium on climate certified products would have to be smaller than what is privately optimal to the producer or retailer. Failing trust in labelling schemes and perceived low environmental impact of purchases can also affect consumers' willingness to purchase climate labelled food (Cason and Gangadharan, 2002; Upham, Dendler and Bleda, 2011; Röös and Tjärnemo, 2011). If consumers do not trust labelling schemes, behavioural changes cannot be expected to occur.

The risk for distrust in labelling or falsely perceived low environmental impact of food choices could potentially be higher with a qualitative labelling scheme. On the other hand, quantitative information on climate impact can have other disadvantages, e.g. due to the cognitive difficulties for the consumers to process advanced and abundant information on such a climate label. Even though more detailed information on the label can provide consumers with more adequate information on the environmental impact, there are difficulties for consumers to notice, understand and compare quantitative carbon emission information. This can imply that the effect of additional information can be counterproductive, such as indicated in the study by Kortelainen *et al.* (2013).

It is possible that the issues of trust and perceived environmental impact also affect the outcome of our experiment given the limited use of, hence limited knowledge about, the Swedish climate label. Consequently, the results from our study may underestimate households' actual valuation of the climate impact from milk production. Related to this, we only capture the short term impact of a climate label on milk demand. The long-term impact may well differ from this, as the level of trust and perceived environmental impact might increase. Furthermore, studying short term impacts alone will not reveal how increased public exposure to climate related information in stores will help to foster the conditions in which more substantive demand shift can take place.

References

Angrist, J. D. and Pischke, J. S. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press, USA: Princeton.

Bjørner, T. B., Hansen, L. G., and Russell, C. S. (2004). Environmental labelling and consumers' choice—an empirical analysis of the effect of the Nordic Swan. *Journal of Environmental Economics and Management* 47(3): 411-434.

Carbon Trust (2006). *Carbon footprints in the supply chain: the next step for business*. Carbon Trust: London. Available at: www.carbontrust.com/media/84932/ctc616-carbon-footprints-in-the-supply-chain.pdf (accessed at January 2014).

Carpenter, G., Rashi G. and Kent N. (1994). Meaningful Brands from Meaningless Differentiation. *Journal of Marketing Research* 31(3): 339-350.

Carlsson-Kanyama, A. and Linden, A. L. (2001). Trends in food production and consumption: Swedish experiences from environmental and cultural impacts. *International Journal of Sustainable Development* 4(4): 392-406.

Carlsson-Kanyama, A. and González, A. D. (2009). Potential contributions of food consumption patterns to climate change. *The American Journal of Clinical Nutrition* 89(5): 1704-1709.

Cason, T. N. and Gangadharan, L. (2002). Environmental labelling and incomplete consumer information in laboratory markets. *Journal of Environmental Economics and Management* 43(1): 113-134.

CCF (2010*). Criteria for Mitigation of Climate Impact from Food Production and Distribution.* Climate Certification for Food, Stockholm. Available at: www.klimatmarkningen.se/wp-content/uploads/2009/02/Climate-Certification-of-Food-2010-3.pdf (accessed at 14 September 2013).

Cohen, M. A. and Vandenbergh, M. P. (2012). The potential role of carbon labelling in a green economy. *Energy Economics* 34(1): 53-63.

Czarnezki, J. J. (2011). Future of Food Eco-Labelling: Organic, Carbon Footprint, and Environmental Life-Cycle Analysis. *The Stanford Environmental Law Journal* 30(3): 3-50.

Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., and Vandenbergh, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences* 106(44): 18452-18456.

Duchin, F. (2005). Sustainable consumption of food: a framework for analyzing scenarios about changes in diets. *Journal of Industrial Ecology* 9(1-2): 99-114.

Gerber, A. S. and Green, D. P. (1st Ed.) (2012). *Field experiments: design, analysis, and interpretation*. W.W. Norton & Company Inc, USA: New York.

Grankvist, G. and Biel, A. (2007). Predictors of purchase of eco-labelled food products: A panel study. *Food Quality and Preference* 18(4): 701–708.

Gadema, Z. and Oglethorpe, D. (2011). The use and usefulness of carbon labelling food: a policy perspective from a survey of UK supermarket shoppers. *Food policy* 36(6): 815-822.

Hainmueller, J., Hiscox, M., and Sequeira, S. (2011). *Consumer demand for the Fair Trade Label: Evidence from a field experiment*. Research Paper no. 2011-9B, MIT Political Science Department. Available at: papers.ssrn.com/sol3/papers.cfm?abstract_id=1801942 (Accessed at 9 September 2013).

Kiesel, K. and Villas-Boas, S. B. (2007). Got organic milk? Consumer valuations of milk labels after the implementation of the USDA organic seal. *Journal of Agricultural and Food Industrial Organization* 5(1): 1-38.

Kortelainen, M., Raychaudhuri, J. and Roussillon, B. (2013). *Effects of Carbon Reduction Labels: Evidence From Scanner Data.* Economics Discussion Paper Series 1309, University of Manchester.

Krishna, A. and Rajan, U. (2009). Cause marketing: spillover effects of cause-related products in a product portfolio. *Management Science* 55(9): 1469–1485.

Leire, C. and Thidell, Å. (2005). Product-related environmental information to guide consumer purchases – a review and analysis of research on perceptions, understanding and use among Nordic consumers. *Journal of Cleaner Production* 13(10): 1061-1070.

List, J. A. and Gallet, C. A. (2001). What Experimental Protocol Influence Disparities Between Actual and Hypothetical Stated Values? *Environmental and Resource Economics* 20(3): 241–254.

Murphy, J. J., Allen, P. G., Stevens, T. H. and Weatherhead, D. (2005). A Meta-analysis of Hypothetical Bias in Stated Preference Valuation. *Environmental and Resource Economics* 30(3): 313–325.

Newell, D. J. (1992). Intention-to-treat analysis: implications for quantitative and qualitative research. *International Journal of Epidemiology* 21(5): 837-841.

Röös, E. and Tjärnemo, H. (2011). Challenges of carbon labeling of food products: a consumer research perspective. *British Food Journal* 113(8): 982-996.

Steinfeld, H., Gerber, P., Wassenaar, T. D., Castel, V. and De Haan, C. (2006). Livestock's long shadow: environmental issues and options. Food and Agriculture Organissation (FAO).

Teisl, M. F., Roe, B. and Hicks, R. L. (2002). Can eco-labels tune a market? Evidence from dolphin-safe labeling. *Journal of Environmental Economics and Management* 43(3): 339-359.

Tukker, A., Huppes, G., Guinée, J. B., Heijungs, R., Koning, A. D., Oers, L. V. and Nielsen, P. (2006). Environmental Impact of Products (EIPRO). Analysis of the life cycle environmental impacts related to the final consumption of the EU-25. European Commission: Technical Report EUR 22284 EN.

Upham, P., Dendler, L. and Bleda, M. (2011). Carbon labelling of grocery products: public perceptions and potential emissions reductions. *Journal of Cleaner Production* 19(4): 348-355.

Vanclay, J. K., Shortiss, J., Aulsebrook, S., Gillespie, A. M., Howell, B. C., Johanni, R. and Yates, J. (2011). Customer response to carbon labeling of groceries. *Journal of Consumer Policy* 34(1): 153-160.

Vandenbergh, M.P., Dietz, T. and Stern, P.C. (2011). Time to try Carbon Labeling. *Nature Climate Change* 1(1): 4-6.

Vermeir, I. and Verbeke, W. (2006). Sustainable food consumption: Exploring the consumer "attitude–behavioral intention" gap. *Journal of Agricultural and Environmental Ethics* 19(2): 169-194.

Weber, C. L. and Matthews, H. S. (2008). Food-miles and the relative climate impacts of food choices in the United States. *Environmental Science and Technology* 42(10): 3508-3513.

YouGov (2012). *Så tycker konsumenterna – Projektet Klimatcertifiering för mat* (So do consumers' think – The Climate certification for food). Available at: www.klimatmarkningen.se/wp-content/uploads/2009/11/Konsumentundersokning-maj-2012.pdf (Accessed 10 January 2014).