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Ecolabeled paper towels: Consumer valuation and expenditure analysis

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Abstract

Ecolabeled paper towels are manufactured using post-consumer recycled material and sold in markets using a recycle logo. Environmentally conscious consumers purchase these paper towels and thereby contribute to improving environmental quality. In this paper, we estimate the implicit value placed by consumers on ecolabeled paper towels using a hedonic price function and conduct an expenditure analysis using Heckman's selection model. Using the data set from the Internet-based grocery stores called as Peapod we find that some consumers recognize ecolabels on paper towels and place a substantial, positive price premium on them. The expenditure analysis indicates that for the preferred functional form, the demand for ecolabeled paper towels is inelastic for environmentally conscious consumers. The simulated results from the selection model indicate that a small subsidy for ecolabeled paper towels will not substantially change consumers' purchase decisions.

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1. Introduction

Markets for environmentally safe products started to emerge during the early 1980s. Initially “dolphin safe” claims appeared on tuna and since then claims have appeared on goods ranging from electronics to certified wood and organic food. Recent studies by Levin (1999), Cason and Gangadharan (2000), Nimon and Beghin (1999), and Blend and van Ravenswaay (1999) reported that consumers have expressed their willingness to purchase products that are “safe” for the environment. Environmental claims on paper towels started to appear during the early 1990s when producers began manufacturing paper towels using post-consumer recycled material. These paper towels are marketed using ecolabels. Ecolabels identify products that are perceived to be less harmful to the environment when compared to other products in the same category.

The market for paper products, specifically for paper towels and tissue paper, has been growing at an average annual rate of 4% for the past 25 years and is projected to continue at the same

rate (Harrison, 1999). As the paper products are single use and are recyclable, they have drawn considerable attention from ecolabeling programs worldwide as they offer potential for environmental benefits through the use of post-consumer recycled material as an input in production. The potential for resource and energy conservation has been achieved to some extent by the increase in the utilization percentage of recovered paper, from 24.6% in 1986 to 48.3% in 2001 at United States paper and paperboard mills (American Forest and Paper Products Association, 2001). The recovered paper is used to make a variety of products including copier paper, corrugated boxes, paper towels and napkins, and hydraulic mulch. Nearly 4% of recovered paper was used in manufacturing paper towels and napkins in 2000 (American Forest and Paper Products Association, 2001). Several brands of paper towels now in the market are manufactured with post-consumer recycled material. Environmentally conscious consumers have an opportunity to purchase these brands of paper towels. Consumers purchasing these paper towels presumably place some value on the environmental characteristic in addition to other product characteristics.

Several studies in the past have estimated the price premium on ecolabeled products. Nimon and Beghin (1999)

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estimated a price premium of 33.8% for the organic cotton apparel over the conventional apparels. Similarly Maguire et al. (2001) estimated a premium of \$0.13 per jar for organic baby food purchased by parents who presumably perceive that organic food could reduce the risk of cancer for their infants. Gumpfer (1998) reported a price premium of \$0.76 per ecolabeled notebook in his exploratory study of consumer responses to notebooks containing recycled paper. As no studies have been done in the past to estimate the price premium on ecolabeled paper towels, our study will contribute an estimate. In the first part of this paper, we will begin by examining whether consumers recognize ecolabels on paper towels, and then we will estimate the implicit value placed by consumers on ecolabels using a revealed preference hedonic model developed by Rosen (1974).

None of the studies mentioned above have examined the consumer expenditure on ecolabeled products. Some studies have, however, examined the relationship between consumer characteristics and preference to purchase ecolabeled products. Wessells et al. (1999) assessed the consumer preference for ecolabeled seafood using a contingent choice survey. They found that consumers who were members of environmental organizations were more likely to choose the certified seafood compared to other consumers. Blend and van Ravenswaay (1999), using a stated preference model, analyzed consumers' intentions to purchase ecolabeled apples and found an inverse relationship between the probability of purchasing ecolabeled apples and the price premium. Also, both Johnston et al. (2001) and Moon et al. (2002) find a positive relationship between environmentally conscious consumers and ecolabeled products. As none of the studies have analyzed the expenditure on ecolabeled products, in the second part of this paper we conduct an expenditure analysis on ecolabeled paper towels using a two step Heckman's selection model. In the first step, we analyze the consumers' intention to purchase ecolabeled paper towels and, in the second step, we estimate the actual expenditure on ecolabeled paper towels by correcting for sample selection bias. The analysis is conducted using consumer expenditure data on ecolabeled paper towels obtained from the Internet-based grocery stores called as Peapod.

The rest of the paper is organized as follows: Section 2 describes the model's framework and estimation; Section 3 describes the data set and variables used in the analysis, followed by a discussion of results and policy implications in Section 5.

2. Model

To estimate the implicit value placed by consumers on different characteristics of a product hedonic framework is used. Rosen (1974) and Freeman (2003) make detailed presentation of this hedonic framework used in this analysis. According to hedonic theory, consumers do not buy characteristics separately, but rather buy a bundle, and pay only one price for the entire bundle. The prices that consumers pay are a function of the characteristics and the implicit value placed on each characteristic. The prices are implicit in the sense that they

are not observable directly, but are determined by the interaction of demand and supply in the market for the good. The hedonic price function is an appropriate approach to estimate the implicit prices of the attributes of the goods, including their environmental characteristics. Assuming that the markets are in equilibrium, the estimated coefficient on each characteristic of a differentiated product is the implicit value placed by the consumers.

The empirical specification of the hedonic price function is analyzed in the following form:

$$P_{ic} = \alpha_0 + \alpha X_i + \beta Y_i + \gamma Z_c + \varepsilon_i \quad (1)$$

where P_{ic} = price paid per pack of paper towels for brand 'i' in city 'c'; X_i = characteristics of a brand of paper towel; Y_i = dummy variables ($i = 1, \dots, 14$) for the brand of paper towel; Z_c = dummy variables ($c = 1, \dots, 8$) for the cities where the paper towel was purchased; where α_0 is a constant and ε_i is the error term.

The definitions for these variables, along with their respective means and standard deviations are presented in Table 1. Quantitative characteristics of the paper towels recorded by visual observation and lab experiments include number of rolls per pack, number of cuts (sheets) per roll, number of square feet of paper towel in a packet, strength and absorbency. Qualitative characteristics of the paper towel are color, design or pattern, and, for our purpose, the most important variable, presence or absence of ecolabels. A dummy variable for ecolabels is used because of the unavailability of information on the percentage of post-consumer recycled content in the paper towels. A brand of paper towel is given a value 1 if it has a recycle logo on the package else 0. The other unobservable characteristics of the paper towels were controlled using a brand dummy variable for each of the 14 brands.

Modeling of consumer expenditure can be separated into two elements of choices. The first choice or decision involves whether or not to purchase the ecolabeled brand of paper

Table 1
Definition of variables and summary statistics in hedonic analysis ($n = 34,100$)

Variable	Definition	Mean	Standard deviation
Price	Price per pack of paper towels in 1997 U.S. dollars (1997 \$)	2.25	1.98
Ecolabels	Ecolabel indicating post-consumer recycle content in the paper towel. Dummy variable takes a value 1 if the brand has an ecolabel, else 0	0.04	0.19
Sheets	Number of sheets per roll	90.86	35.38
Rolls	Number of rolls per pack	2.26	2.33
Square feet	Number of square feet of paper in each pack	157.52	140.48
Absorbency	Grams of water absorbed by a square foot of paper towel	36.04	11.96
Strength	Grams of weight a paper towel could hold	98.33	71.12
Color	Color of the paper towel – dummy variable takes a value 1 if it is white, else 0	0.83	0.38
Design	Design on the paper towel – dummy variable takes a value 1 if it has design, else 0	0.42	0.49

Source: Author's calculations using the Peapod data set.

towels. The second deals with the quantity of ecolabeled paper towels purchased. Both of these choices or decisions do not necessarily coincide, and zero purchases may be due to the following instances: (1) the price or income constraint results in a corner solution or (2) the individual consumer has no preference for ecolabeled paper towels. The resulting effect of these responses is a limited dependent variable that is partly qualitative and partly quantitative. The possibility of zero expenditure presents an empirical difficulty of censored response bias. In such cases, the appropriate procedure is to use a Heckman's (1976) selection model that uses the zero observations. The model assumes that individuals with zero consumption do not impose restrictions on the parameters. The level of consumption is estimated on the truncated sample of positive values.

Expenditure on ecolabeled paper towels is analyzed using Heckman's selection model which involves two choices or decisions. The decision to purchase an ecolabeled brand of paper towels is analyzed using a probit model while the amount spent on these towels is analyzed in the second step. In this model, to overcome the misspecification or selection bias, a corrected term, the 'inverse Mill's ratio' (λ), will be included as one of the regressors in the second step. The 'inverse Mill's ratio' is the error from the probit equation explaining the selection bias (Vella, 1998). The sign on the selection bias depends on the correlation between the error terms in the expenditure and the selection equation, and the correlation between λ_i and the variables in the expenditure equation.

The empirical specifications for Heckman's selection model are as follows:

Selection specification:

$$Y_{it}(1/0) = \alpha + \beta P_{opti} + \gamma PS_{ebr} + \nu PS_{nebr} + \delta X_i + \varepsilon_i \quad (2)$$

Expenditure specification:

$$Y_{ebit} = \alpha' + \beta' P_{opti} + \gamma' PS_{ebr} + \nu' PS_{nebr} + \delta' X_i + \varphi' \lambda_i + \varepsilon'_i \quad (3)$$

where $Y_{it}(1/0)$ = a dummy variable indicating whether an ecolabeled brand of paper towels was purchased by consumer 'i' during time 't'. Y takes a value of 1 if a purchase was made, else 0. Y_{ebit} = expenditure on the ecolabeled brand of paper towels by consumer 'i' during time 't'; P_{opti} = own price of paper towels during time 't'; PS_{ebr} = price of a substitute: ecolabeled brand of paper towels during time 't'; PS_{nebr} = price of a substitute: non-ecolabeled brand of paper towels during time 't'; X_i = socioeconomic characteristics of consumer 'i'; λ_i = error correction variable (inverse Mill's ratio).

The definitions for these variables, along with their respective means and standard deviations are presented in Table 2.

3. Data

The data set¹ used in this paper is from an Internet-based grocery store called as Peapod.com. It was serving eight cities between January 1997 and May 1998 in the continental United

Table 2
Definition of variables and summary statistics used in the expenditure analysis (n = 9883)

Variable name	Definition of the variable	Mean	Standard deviation
Age	Age of the consumers in the dataset in years	40.57	8.86
Income	Income of the households expressed in dollars per year (1997 dollars)	71.32	45.73
Household size	Size of a household	3.63	0.91
Education*			
Own price	Price of a particular brand of paper towel (1997 dollars)	2.25	2.00
Price of substitute: ecolabeled	Substitute price of ecolabeled brand of paper towel during that particular day and city (1997 dollars)	1.01	0.57
Price of substitute: non ecolabeled	Substitute price of non-ecolabeled brand of paper towel during that particular day and city (1997 dollars)	2.08	0.68
Expenditure: ecolabeled brand of paper products	Expenditure on the ecolabeled brand of paper towels by the household (1997 dollars)	1.95	1.56

Note: * please see Table 3 for categories.

States. The city names were not released due to confidentiality. Each consumer uses a customer identification number to access their website and make a purchase. The data set includes date of purchase, name of the brand, price paid per pack, quantity purchased during each visit, and city and frequency of purchase from this store during the above mentioned time period. The prices paid for their purchases are all indexed to the January 1997 price using the consumer price index for non-durable goods. For the hedonic analysis, price paid per pack is the unit of observation and 34,100 observations were used to estimate the price premium on ecolabeled paper towels.

The expenditure on ecolabeled paper towels was generated by multiplying price and quantity of ecolabeled paper towels purchased by a consumer in a given day and city during each transaction. In addition to the own price of a particular brand of paper towels, substitute prices for both ecolabeled and non-ecolabeled brands of paper towels were calculated using the purchase data for a given day and city. They are the weighted averages of the price per pack of any given brand of paper towels for a particular day in a given city. The weight used in the analysis was the quantity of a particular brand of paper towels purchased during each visit to Peapod in a given day and city. If there were more than one transaction for a particular day in a given city, the weighted average price per pack of paper towels was calculated and was used as a substitute price for all the transactions during that day. There were instances where no transactions were recorded for ecolabeled brand of paper towels. In such instances, the price of a substitute for ecolabeled brand of paper towels was obtained by looking at the average price of such paper towels in the same city on the previous day. If the price was not found on the previous day, then we looked for the price two days earlier and continued the process of looking for the prices back to the beginning of that particular week. This process was repeated

¹ We would like to thank Professor Andrew Cohen of University of Virginia, Charlottesville, VA for providing the data for the analysis.

for all the missing substitute prices for the ecolabeled brands of paper towels. We did not look back beyond a week for the missing substitute price as it seems too much time would have passed since the last transaction and also prices do change every week.

The socioeconomic characteristics of consumers such as age, education, income and household size were identified using customer identification numbers. The total number of consumers who bought paper towels from the online grocery store Peapod was 3435 from January 1997 through May 1998. Among these 3435 consumers, 184 consumers (5.35%) purchased ecolabeled paper towels during this period.

4. Results

The summary statistics in Table 1 indicate that the average price per pack of paper towels was \$2.25. There were 2.26 rolls per pack with 90.86 sheets per roll. The absorbency and strength of a square foot of paper towel were 36.04 and 98.33 g, respectively. There were 14 brands of paper towels purchased during this period, including three ecolabeled brands viz., Kroger, Marcal and Green Forest. These three brands of paper towels accounted for 4% of all 34,100 transactions.

In Table 2, price and demographic data of consumers are presented. The mean age of the consumers in the data set was 40.57 years and household size was 3.63. The average level of income was \$71,320 per year. The own price (price paid for any brand of paper towels) by consumers on average was \$2.25 per pack. The average price of the substitute for ecolabeled brand and non-ecolabeled brands of paper towels was \$1.01 and \$2.08 per pack, respectively. The number of rolls in ecolabeled brands of paper towels ranged between one and three rolls per pack, while it was between one and 12 for non-ecolabeled. Therefore, there is a noticeable difference in the average price per pack of paper towels. The demographic characteristics of the consumers who bought ecolabeled paper towels are compared with the sample percentage and the national average for 1997 in Table 3. More than half of the consumers (60.56%) who purchased ecolabeled paper towels were in the 35–49 year age group and 36.41% of consumers were college educated. Similarly 57.61% of consumers were in the \$50,000–\$100,000 income group, followed by 32.48% in the \$25,000–\$50,000 group.

Although there is no general consensus on a preferred “best” functional form, the semi-log form is a widely used specification in the hedonic literature (Palmquist, 1992; Nimon and Beghin, 1999; Cropper et al., 1993). We also use a semi-log specification² for estimation of implicit values and results from this specification are presented in Table 4. The hedonic specification is analyzed using the weighted least

² Other functional forms levels, log–log, and Box–Cox specifications were attempted. We choose a semi-log specification based on log likelihood ratio. The LR ratio for semi-log specification was –15,568.64, whereas for levels and log–log specifications it was –15,725.04 and –31,548.61, respectively. The dependent variable is in natural logarithm in the chosen model.

Table 3

Summary statistics of socioeconomic characteristics of all consumers, the national percentage for 1997, and consumers with ecolabeled purchase

Variable name	Sample total	Sample percentage	National percentage (1997) ^c	Ecolabeled purchase, percentage with category ^d
<i>Consumers</i>	3435	—	—	5.35
<i>Age groups (years)</i>				
18–24	58	1.69	9.56	3.80
25–34	1051	30.60	15.16	31.27
35–49	1948	56.71	23.07	60.56
50–65	321	9.34	13.79	4.37
65 and above	57	1.66	12.62	0.00
<i>Education</i>				
High school and less	256	7.45	52.12 ^a	6.52
Some college	897	26.11	25.33	28.80
College graduate	1390	40.47	15.40	36.41
Advanced graduate	892	25.97	7.07	28.26
<i>Income (dollars)</i>				
Not reported	287	8.36	—	7.61
25,000–50,000	881	25.65	29.15	32.48
50,000–100,000	2040	59.39	27.03	57.61
100,000–150,000	97	2.82	9.42 ^b	1.63
150,000–200,000	130	3.78	—	1.09
<i>Household size (members)</i>				
1	232	6.75	—	9.24
2	733	21.34	42.72	22.83
3	716	20.84	22.90	17.93
4	1023	29.78	20.64	29.35
5	513	14.93	9.24	16.85
6	152	4.43	2.88	3.26
7	44	1.28	1.59 ^c	0.54
More than 8	22	0.64	—	0.00

^a Age adjusted percentage — people who are 18 years or above.

^b Percentage of households with more than \$100,000 income. The total in this column for income adds up to 65.60%. Other 34.60% includes households with less than \$25,000 income per annum.

^c Percentage of households with more than seven members.

^d The percentage of consumers in the Peapod sample who purchased ecolabeled paper towels is 5.35. For the age, education, income, and household size variables, the percentage distribution across categories is shown. The percentages for each variable sum to 100.

^e Source: Author's calculations using data from the United States Bureau of Census (1998a,b,c).

squares method, wherein each observation in the data set is weighted with the quantity of the particular brand of paper towels purchased at a given price, day, and city. The estimated coefficient on the presence of an ecolabel, 0.532, is significant and positive, indicating that some consumers recognize ecolabels on paper towels. The Halvorsen and Palmquist (1980) formula³ indicated a price premium of 69.9% on ecolabeled paper towels. This means that, if a brand of paper towel is labeled to indicate that it is manufactured using post-consumer recycled material, some consumers are willing to pay 69.9% more compared to a non-ecolabeled brand of paper towel. The positive price premium on ecolabels is consistent with

³ The Halvorsen and Palmquist formula is: $g = 100 \times (\exp[c] - 1)$, where g = premium and c = estimated coefficient.

Table 4
Weighted least square regression results of hedonic analysis in the semi-log specification with price per pack of paper towel as a dependent variable ($n = 34,100$)

Independent variables	Coefficient	Robust standard error	T-Statistics
<i>Product characteristics</i>			
Ecolabels	0.532	0.099	33.73*
Rolls	0.083	0.006	14.67**
Square feet	0.003	0.000	31.82*
Sheets	-0.001	0.000	-10.02*
Absorbency	0.028	0.006	10.41*
Strength	0.001	0.000	13.43*
Design	-0.097	0.003	26.14*
White	0.189	0.006	33.43*
Brand names ⁺	Yes		
City dummies ⁺⁺	Yes		
Constant	-1.449	0.165	-8.78*
R^2	0.885		
$F(27, 34,072)$	5522.84		

Note: *significant at 1%; **significant at 10%; ⁺Chow test on city dummies was significant with $Prob > F = 0.000$; ⁺⁺Chow test on brand names was significant with $Prob > F = 0.000$. Weights are quantity of paper towels purchased at a given price, city, and day.

the results from studies conducted by [Nimon and Beghin \(1999\)](#) and [Maguire et al. \(2001\)](#) who also estimate a positive price premium on organic cloths and organic baby food, respectively.

The coefficients of other quantitative characteristics of paper towels such as number of sheets, rolls, and square feet are significant and have the expected signs as do the coefficients of quality characteristics such as design and color. An F -test on estimated coefficients on brand names and city dummies revealed a significant difference in the price paid by consumers for paper towels purchased in different cities.

Expenditure on ecolabeled paper towels was analyzed using Heckman's maximum likelihood method.⁴ The selection and expenditure equations are analyzed by clustering using customer identification numbers and the results are presented in [Table 5](#). Results in the first column are from the selection specification (i.e., the decision whether or not to purchase ecolabeled paper towels). They indicate that the estimated coefficient on own price, -1.212, is significant. This implies that the probability of purchasing an ecolabeled brand of paper towels decreases with an increase in the own price of paper towels. The estimated coefficients on the price of a substitute for ecolabeled brand of paper towels, 0.519, and on the substitute for non-ecolabeled brand of paper towels, 0.483, were significant. The positive signs on both these variables indicate that, with the increase in the price of substitutes, the probability of purchasing the own brand of paper towels increases.

⁴ The expenditure specification was analyzed using levels, semi-log and log-log models. The log-log is preferred functional form because it had the maximum likelihood value of -2009.01, while semi-log and levels had maximum likelihood values of -2072.334 and -2603.878, respectively. The reported results are in the log-log specification.

Table 5
Regression results from Heckman's maximum likelihood procedure for expenditure on ecolabeled paper towels in log-log specification form ($n = 9883$)

Independent variables	Purchased ecolabel: yes/no	Expenditure on ecolabel
Own price ^a	-1.212 (10.09)**	0.699 (6.40)**
Price of substitute: ecolabel	0.519 (6.88)**	-0.038 (0.043)
Price of substitute: non-ecolabel	0.483 (2.76)**	-0.080 (0.76)
Income	-0.159 (2.06)**	0.001 (0.63)
Missing income	-0.571 (1.14)	-0.013 (0.07)
Some college	-0.137 (0.59)	0.119 (1.25)
College graduate	-0.165 (0.70)	0.062 (0.66)
Advance graduate	0.071 (0.29)	0.101 (0.95)
Age	-0.458 (2.26)**	0.045 (0.27)
Household size	-0.085 (0.85)	0.042 (0.07)
Constant	0.916 (1.26)	0.442 (0.78)
Inverse Mill's ratio ^b		-0.125 (0.088)

Note: *significant at 5%; **significant at 1%. Figures in parenthesis are absolute value of 'z' statistic for other variables.

^a A positive coefficient on own price in the expenditure equations implies that demand is inelastic.

^b Figures in parenthesis are standard errors for inverse Mill's ratio.

The socioeconomic characteristics of consumers that significantly influenced purchase decision are age and income. As the age of consumers increases, the probability of purchasing ecolabeled paper towels decreases. This result is also evident in earlier studies by [Moon et al. \(2002\)](#) and [Balderjahn \(1988\)](#), who found that older consumers are less willing to pay a premium for a product's environmental attribute. The elasticity on income indicates that, as the income of consumers' increases, the probability of purchasing an ecolabeled brand of paper towels also decreases. This result seems to contradict the idea that environmental quality is a normal good and that the demand for a normal good should increase with income. [Grossman and Krueger \(1995\)](#) report that consumers living in countries with higher income and wealth, demand higher/better environmental quality. However, in our data set, consumers tend to exhibit higher incomes, the average being \$71,300. Consequently, the negative relationship between income and purchase decision cannot be compared easily with other studies. But, within this high-income group, people with higher incomes have a lower probability of purchasing ecolabeled paper towels. Education of the consumers has a negative influence on the purchase decision but is not significant. All these results suggest that consumers do not perceive ecolabeled paper towels as having the same environmental impact as other products which do significantly improve environmental quality. As a result, more highly educated consumers do not shift their consumption patterns towards purchasing ecolabeled paper towels.

Results from the second step of Heckman's model, expenditure specification⁵ are presented in the second column of [Table 5](#). The elasticity on own price, 0.699, is significant and has an

⁵ A hypothesis test was conducted to test whether the elasticity of expenditure function is equal to 1. Chow test results indicate that elasticity of expenditure function is not equal to 1 with a Chi-square $Prob < 0.01$.

influence on expenditures. The positive expenditure elasticity of 0.699⁶ on own price indicates that the demand is inelastic. Inelastic demand is plausible because there are niche groups of consumers who pledge their support for environmental concerns and are willing to spend more on environmentally safe products (Levin, 1999; Cason and Gangadharan, 2000). The estimated coefficients on substitute prices for both ecolabeled and non-ecolabeled paper towels are negative, but not significant. Socioeconomic characteristics of consumers did not have any significant influence on the expenditure for ecolabeled paper towels. The inverse Mill's ratio was also not significant, indicating that there is no selection bias in the sample.

The probability of purchasing ecolabeled paper towels is estimated at the means using selection specification is presented in Table 6. The estimated probability of purchasing ecolabeled paper towels at the mean is 0.010. Several simulations were conducted to estimate the probability of purchase by decreasing own price during each simulation and holding substitute prices and household characteristics at their respective means. The predicted probability of purchasing ecolabeled paper towels indicates that consumers are not especially sensitive to changes in own prices. Ten percent of consumers would purchase ecolabeled paper towels when the price per pack is a dollar. This might suggest that consumers' perception of improvement in environmental quality by using ecolabeled paper towels is different from their perception of the environmental benefits from consuming ecolabeled food products. As paper towels are a small household budget item, and due to the public good nature of environmental quality, consumers may choose to contribute to the betterment of the environment through charitable donations to environmental movements or organizations rather than by purchasing ecolabeled paper towels. Hence, for policy purposes, this result suggests that any amount of subsidy to producers by the government will not result in a significant increase in consumer purchases of ecolabeled paper towel.

5. Conclusion

Concern for environmental degradation has prompted some consumers beginning in the 1990s to alter their consumption by purchasing the products that are more environmentally compatible. Producers have responded to this change by offering products ranging from environmentally safe wood to food by informing consumers of the environmental attribute of these products using ecolabels. In this paper, we investigate the consumer preference for ecolabeled paper towels (paper towels manufactured using post-consumer recycled material). Our results from hedonic analysis indicate that some consumers recognize ecolabels on paper towels and place a positive price premium on them. The

⁶ While a Chow test indicates that this expenditure elasticity is different from one at the 1% level, the expenditure elasticity is somewhat sensitive to functional form. In the log–log and levels specification the elasticity is 0.669 and 0.7606, respectively, but in the semi-log form it is 1.18, which is elastic.

Table 6

Estimated probability of purchase of ecolabeled paper towels using the probit equation

Own price	Price of substitute: ecolabeled	Price of substitute: non-ecolabeled	Predicted probabilities
2.32*	1.01	2.08	0.010
2.25	1.01	2.08	0.012
2.00	1.01	2.08	0.019
1.90	1.01	2.08	0.023
1.80	1.01	2.08	0.028
1.70	1.01	2.08	0.033
1.60	1.01	2.08	0.039
1.50	1.01	2.08	0.046
1.40	1.01	2.08	0.054
1.30	1.01	2.08	0.062
1.20	1.01	2.08	0.072
1.10	1.01	2.08	0.084
1.00	1.01	2.08	0.096
0.90	1.01	2.08	0.110
0.80	1.01	2.08	0.125
0.70	1.01	2.08	0.141
0.60	1.01	2.08	0.159
0.50	1.01	2.08	0.178
0.40	1.01	2.08	0.199

Note: *the first iteration is estimated at sample mean for all variables. In the following iterations, own price is changed, socioeconomic characters and substitute prices were held constant at their respective means.

premium estimated using the Halvorson and Palmquist formula turns out to be 69.9%. Additionally, our expenditure analysis using Heckman's selection model indicates that the probability of consumers purchasing ecolabeled paper towels decreases with an increase in the own price, and that older consumers have a lower probability of purchasing ecolabeled paper towels. We also find that environmentally conscious consumers are relatively insensitive to price changes. The elasticity estimated for the own price at the mean implies that these environmentally friendly consumers spend an additional \$0.699 on ecolabeled paper towels for every one dollar increase in their price. Finally, our simulated results indicate that even if ecolabeled paper towels are priced as low as \$0.40 a roll (this price is below the observed price in this data set), 20% of consumers would purchase them. As a policy prescription therefore modest subsidization to producers of ecolabeled paper towels would not result in any significant increase in consumption of such towels.

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