

Are Eco-Labels Valuable?

Evidence from the Apparel Industry

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Abstract: Using U.S. apparel catalogue data, we estimate hedonic price functions to identify market valuation of environmental attributes of apparel goods. We identify a significant and robust premium for the organic fibers embodied in the apparel goods. We find an additional organic premium for baby items. However, we do not find evidence of a premium for environment-friendly dyes. We further investigate the pricing behavior of apparel suppliers for potential departure from competitive pricing of this environmental attribute and find no evidence different premium across firms, suggesting price-taking behavior in the environmental attribute space.

Keywords: Eco-labels, organic-cotton apparel, natural dye, hedonic price

JEL Classification: Q20, L81, L67

Introduction

Environmentally friendly labels, or eco-labels, have been appearing on a number of products in the United States and Europe. In Europe the White Swan is a common eco-label appearing on a myriad of products denoting that they have been certified as having minimized the negative effect on the environment. In the United States, “no animal testing” on cosmetics and “dolphin safe” on tuna cans are common eco-labels connoting non-use characteristics of the good. These labels are the manifestation of industries’ efforts to become or to be perceived as environment-friendly. A recent occurrence concerns eco-labels in the textile/apparel industry.

Although there is a great deal of anecdotal analysis, there has been minimal quantitative economic work (Teisl et al. is a notable exception). Our objective is twofold. First, we want to investigate the extent of market valuation, if any, for the environmental claims made by apparel manufacturers. Particularly, we want to estimate the price premium for the “organic-cotton apparel” and “environmentally friendly dyes” appellations, as well as the existence of a health component in addition to the non-use valuation of environmental characteristics of apparel goods.

Second, our disaggregated data set provides a unique opportunity to investigate pricing behavior by retail apparel suppliers. The green apparel market predominantly consists of a presumably competitive fringe of small mail-order firms, and of one large firm, Patagonia, which potentially yields some market power in the organic apparel industry. Patagonia’s nearly \$15 million (in 1995) sportswear division exclusively uses organic cotton (Imhoff, 1995)). This firm’s market power could raise the marginal price premium above its marginal cost. Market power by this single firm would complicate the interpretation of the results since the eventual premium would have two components, the marginal cost of supplying the environmental attribute and the

price markup resulting from the market power.

Our analysis is based on the hedonic price function framework. This approach is part of the traditional toolkit of environmental economists (see Freeman (1993), and Palmquist (1991)). The contributions of our paper, in reference to the existing literature, are first, to address the valuation associated with ecological claims embodied in the labels, and second, to investigate pricing behavior of suppliers within the hedonic approach.

Background on Eco-Labeling and the Organic Cotton Market

Eco-labels present some difficulties in the international context, because requirements to establish the label may serve as *de facto* trade barriers. Despite this shortcoming, voluntary labels bring an unusual consensus from many fronts, appealing to economists, ecological groups, and industry groups. In markets where consumers show preferences for “green” products, firms support eco-labels as they offer a way to differentiate their product from others in the same class. Ecological groups generally support eco-labeling initiatives as a way to encourage firms to reduce their products’ adverse environmental impacts.

Economists like the labels because they are voluntary and let the market reveal the potential valuation of environmental attributes, and because they move the market closer to full information, assuming that the labels contain accurate information. Labels provide a market-oriented instrument to achieve environmental goals, and thereby avoid the inefficiencies associated with government regulation, mandatory standards or bans.

The U.S. organic cotton market emerged a few years ago, and there has been an explosion in the acres devoted to its cultivation. In 1991 there were only 800 acres of organic cotton under cultivation but by 1994 there were 36,000 acres (Imhoff (1995)). Organic cotton is

cotton grown without the use of any synthetic insecticides, fungicides, or fertilizers. There is some contention on the exact nature of the benefits derived from using organic fibers in apparel.

Health concerns, especially for young children, is another potential source of benefits and demand for organic cotton apparel. There is little evidence that conventional cotton apparel contains levels of pesticide residues that cause any adverse health effects, but clothing catalogues included in our dataset, such as “The Natural Baby Catalogue”, nonetheless claim that organic cotton clothes are “healthy for babies because there are no pesticide or chemical residues to be absorbed through the skin.” They go as far as implying potential toxicity of conventional cotton and raising fears of contamination by dioxins resulting from the bleaching and dying processes. Similar fears have been insinuated by The Texas Organic Cotton Marketing Cooperative in its pamphlets (Imhoff et. al. (1996)).

Since these health claims have not been thoroughly debunked, consumers may believe in the existence of valuable health benefits, especially for the youngsters, from wearing organic-cotton apparel. If there are perceived health benefits then one would expect the price premium for organic apparel to contain an additional health component, beyond the environmental benefit associated with baby organic items and with the dyes. We try to shed some light on that question by investigating the existence of premia associated with organic apparel items made of natural dyes and for organic items for young children. Our conjecture is that if there were a health component in the organic premium, it would manifest itself most strongly in items for fragile babies of aging boomers with a new sense of vulnerability.

The Data

We collected price and characteristic data for apparel which we extracted from retail order

catalogues (mail catalogues and others). The data were collected between May and October of 1996. The search for the organic apparel firms combined many internet searches and was extensive if not exhaustive. We believe we nearly collected the whole population of the retail organic cotton apparel industry providing catalogues.¹ Besides the internet, sources included various apparel wholesalers and retailers, and organic cotton producer associations. The incentive structure faced by firms reinforces our belief in the extent of our search.

The data search for conventional cotton apparels proceeded in a similar fashion, but since the conventional market is so vast, an attempt was made to get a representative sample of firms. In total we have 27 apparel firms in our data set, fifteen of which are specialized in organic apparel. The data set has 794 observations in total with 364 observations for conventional-apparel observations and 430 observations for the organic-apparel ones.

The data then consist of prices of items, categorical dummies for items, catalogues, gender, age, the type of textile fiber used (organic cotton, conventional cotton), and types of dyes. From the National Cotton Council we have obtained the cotton weight included by item.

Empirical Estimation and Results

Rosen's basic hedonic framework is estimated for the apparel data using a semi-logarithmic functional form. The first goal of our empirical exercise is to identify the implicit price or premium associated with the organic cotton component of apparel. We present two sets of results. One uses a categorical and the other a quantitative definition of the organic attribute. The logarithm of the price of each piece of apparel, normalized by the pounds of cotton it contains, is regressed onto "core" attributes of the observation using the two following specifications:

$$\ln(\text{Price}/\text{fiber content}) = \beta + \alpha^T \text{items} + \gamma^T \text{catalogues} + \mu^T \text{gender} + \lambda^T (\text{age categories}) + \varphi^T (\text{dye types}) + \eta \text{ organic} \quad (\text{specification 1 in Table 1}), \text{ and}$$

$$\ln(\text{Price}/\text{fiber content}) = \beta + \alpha^T \text{items} + \gamma^T \text{catalogues} + \mu^T \text{gender} + \lambda^T (\text{age categories}) + \varphi^T (\text{dye types}) + \eta_1 \text{ percent organic} + \eta_2 \text{ percent synthetic} \quad (\text{specification 2 in table 1}),$$

where the various categories are expressed as dummy variables for items (socks, T-shirts, etc.), catalogues, gender (male, female, unisex), age (baby, youth, adult), dye type (low impact or no dyes), organic cotton categories (conventional cotton in the intercept), and shares of organic cotton and synthetic fibers in total fiber content. We postpone the inclusion of interaction terms including the organic dummy variable until the testing of the pricing behavior. We favor this uncluttered specification to let the η parameters reflect the effect of the organic attribute on price.

Table 1 reports results on the variables of interest for our investigation. As shown in column 1 of Table 1, the sign on organic is positive as expected and significant at the $\alpha = 0.0001$ level. The parameter estimate is 0.321879 and the Halvorsen-Palmquist-Kennedy formula implies an average premium of 37.7%. The second column reveals almost identical results using the quantitative definition of the organic attribute. The estimated premium is 35.7 percent using the latter definition. The premium has to be interpreted cautiously as many consumers do not buy organic apparel. Our estimated premium could not be readily used to infer welfare implications.

Many of the organic cotton clothes also employed environmentally friendly dyes. The two most common claims made were that the dyes used in the manufacturing process were low impact (LI) or that they used no dyes at all (ND). Our specification allows one to test if these claims add to the purchase price. The results shown in the first two columns of Table 1 indicate

¹ There are organic apparel retail shops which do not advertise by catalogue and we do not cover those outlets.

that a ND claim implies 3.3% and a LI claim a 6.0% premium but neither is significant. There are certainly cost issues here but clearly green dyes have a smaller role in price determination than does the organic characteristic.

In the third and fourth column of Table 1 we report results for two specifications which allow for the interaction of ecological attributes with the baby category. We find a strong positive interaction effect between the organic attribute and the baby attribute, while the “baby” fixed effect alone remains strongly negative. The additional organic premium for baby items is about 90 percent. This large number is due to the low price commanded by conventional baby items. Results on the interaction between the baby category and the dye types reveal no premium for the dye attributes in the baby items. We believe that the findings on the additional organic attribute for baby items, along with the nonresult on dyes, support our conjecture on a health motive being strong but limited to “baby organic” items.

We now report on the robustness of the organic premium result. The number of catalogues, especially of conventional apparel catalogues, included in the data set is not exhaustive. A legitimate question to address is whether the inclusion of any one particular catalogue is driving the results. Group-outlier analysis focusing on the organic coefficient shows that dropping one catalogue’s observations at a time can generate an estimated premium ranging from 32% to 46.1% while the model predicts 37.7% with the full data set.

While single catalogues have some effect on the premium, this range does not suggest that the inclusion of any single firm drives the results. A histogram of the estimated organic premia after having deleted one catalogue at the time, appears normal suggesting that the sample chosen is a representative one. The two lowest premium values occur with the deletion of two firms Patagonia and Seventh Generation, with the deletion of Seventh Generation inducing the

largest drop in the premium. Hence, the question then is, is the positive influence of Patagonia and Seventh Generation on the organic premium truly significant and does it reflect market power, presence of outliers, or a particular selection of items?

To analyze this issue further we compute DFBETAS (Besley, Kuh and Welsch (1980)) for both Patagonia and Seventh Generation individual observations.² Two Patagonia observations out of 54 are found influential with DFBETAS larger than 0.073 (the critical value). A larger but still moderate number of outliers is found for the Seventh Generation catalogue (13 out of 72 observations). In summary, we cannot find a systematic outlying pattern associated with these two catalogues. If they commanded a brand-related organic premium, it should be reflected in the majority of the observations, which is not the case.

The lower organic premium associated with the deletion of these two organic firms could come from the types of items included in their catalogues, which may command a higher apparel price and organic premium because of the item type rather than because of their brand name.

Next, we explore the sensitivity to the deletion of apparel items. A similar pattern emerges as in the catalogue deletion exercise. A histogram of the organic price premia obtained in 40 separate regressions, each deleting all the observations of one of the 40 items yields a bell shaped picture. The majority of the estimated values fall around the central value -- about 38 percent. One item group, leggings, exhibits strong influence. Its deletion induces a jump in the premium to 49 percent. At the opposite tail, deletion of overalls, and deletion of nightgowns and nightshirts (a combined item) induce the largest drop in premium to about 33 percent. Further investigation of the deletion of nightgowns and nightshirts reveals that 17 observations belong to

² DFBETAS measures the difference between a regression coefficient estimate obtained with the full data set and with a data set with one or more observations deleted. The difference in estimates is normalized by the estimated standard deviation of the coefficient estimates with the smaller data set. Besley et al. propose 2 as a critical value, but suggest to scale further for large data sets. They suggest $2/\sqrt{n}$ which we use.

Seventh Generation catalogue, and that 5 of these observations are outliers (based on the DFBETAS criterion) inflating the organic premium. Surprisingly, 3 of these outliers are for conventional nightshirts (Seventh Generation sells both organic and conventional goods), which apparently sold for a “low price” compared to the conventional-cotton nightshirts sold by other firms. The findings on these outlier patterns based on item categories seem to provide a partial explanation for the large organic premium associated with Seventh Generation, and it stresses the importance of accounting for item-specific premia when analyzing pricing behavior. We incorporate this information in our investigation of potential market power by some suppliers.

Potential multicollinearity concerns were raised because of the predominance of dichotomous variables among the regressors. Using the Besley, Kuh, and Welsch criterion, however, we find no evidence of degrading collinearity.

Testing Pricing Behavior

We present results based on both the categorical and quantitative definitions of the organic attribute. The test using the categorical definition is limited because we can only test the pricing behavior of four individual suppliers selling both conventional and organic apparel. If a firm sells only organic apparel items, then the organic dummy everywhere equals 1 and the interaction term (organic-catalogue) is perfectly collinear with the catalogue dummy. The test is interesting however, because Seventh Generation, the catalogue whose deletion creates the largest drop in the estimated premium in the outlier analysis, is one of the 4 individual suppliers being tested.

The second definition of the organic attribute allows us to test ten organic apparel suppliers who all use fiber blends, against the other organic catalogues offering only 100 percent

organic items. In this second approach we can test for both Patagonia and Seventh Generation, the two catalogues which were “outliers” in the investigation of the organic attribute premium. If all the organic-catalogue interaction terms are jointly equal to zero, then this is evidence that the organic markup is constant across the tested firms. In Table 2 we report representative results for a specification including (item*organic) interaction terms. Based on the first definition of the organic attribute, the joint F test for the restriction that the four interaction terms are jointly equal zero indicated that the restriction cannot be rejected, giving support for the competitive pricing hypothesis.

The second approach provides a more comprehensive test of the “organic” pricing by ten separate firms. As shown in Table 2, the F test indicates a rejection of the hypothesis that the ten firms price the organic attribute equally, although on an individual basis, none of the interaction terms is significantly different from zero. One catalogue, Eagle canyon, tends to under price its organic attribute (although not significantly, based on the individual test) and induces the rejection of the joint restrictions on the 10 catalogues. A F test on a joint restriction of equal pricing among the nine remaining catalogues, once Eagle canyon is excluded from the test, indicates the restriction cannot be rejected. Hence, we conclude that we found virtually no evidence of market power for Patagonia or Seventh Generation, or any other catalogue/supplier.

Table 2: F Tests for Firm by Organic Interactions

Organic Dummy Specification							
Allows a joint F test that 4 firm by organic interactions are jointly equal to zero.							
F-value	1.36						
P-value	0.246						
Percent Organic Specification							
Allows a joint F test that 10 firm by organic interactions are jointly equal to zero.							
<table> <thead> <tr> <th>Tests all 10 firms</th> <th>Tests 9 Firms</th> </tr> </thead> <tbody> <tr> <td>F-value</td> <td>0.6205</td> </tr> <tr> <td>P-value</td> <td>0.78</td> </tr> </tbody> </table>		Tests all 10 firms	Tests 9 Firms	F-value	0.6205	P-value	0.78
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Conclusions

Our results appear promising. We identify a robust organic premium which on average is about around 37 percent of the apparel price expressed in dollars per unit of fiber content. We also find a strong and positive additional baby-organic attribute. Nevertheless, we could not find any evidence of a premium associated with environmentally friendly dyes even for baby items. Hence, the health motive for an “environmentally friendly” premium seems to be limited to the additional organic attribute of baby items. Influential data points were found, but the results relative to the organic premium appear robust with most estimates of the premium locating around a central value of 37 percent.

Organic apparel suppliers do receive a premium for the organic attribute, but the premium appears competitive and we cannot identify differences in premia between the firms or groups of firms used to conduct the test. The distinct nature of organic apparel with respect to

conventional apparel does not constitute a real source of price setting behavior, despite attempts of organic firms, such as Patagonia, to distance themselves from the conventional apparel market. The absence of tangible restriction on entry in the organic market allows a competitive fringe to provide price discipline.

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Table 1

Variables of Interest	Specification 1 Core 1 Only		Specification 2 Core 2 Only		Specification 3 Core 1 and Health Variables		Specification 4 Core 2 and Health Variables	
	Estimated Premium	P-value	Estimated Premium	P-value	Estimated Premium	P-value	Estimated Premium	P-value
LI	6.0%	0.3257	7.8%	0.2291	4.9%	0.4345	6.8%	0.3039
ND	3.3%	0.5777	4.9%	0.4375	-2.5%	0.7228	-1.1%	0.8926
Baby	-17.1%	0.1346	-14.1%	0.272	-35.1%	0.0023	-33.1%	0.0094
Organic	37.7%	0.0001			29.4%	0.0001		
Perorganic			30.0%	0.0001			24.0%	0.0001
Org*Baby					90.2%	0.0531		
Porg*Baby							72.8%	0.0461
ND*Baby					-31.3%	0.3912	-31.9%	0.3669
LI*Baby					-33.4%	0.3254	-35.5%	0.2752

Other coefficients not reported include ones for items, catalogs, age, and gender. LI refers to low impact dyes, ND refers to the use of no dyes, Perorganic refers to the percent of organic fibers in each item, and Porg*Baby is the interaction between Perorganic and the Baby dummy.