Consumers' Willingness to Pay for Eco-Certified Wood Products

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We use Kriström's simple spike model to assess the factors influencing consumers' willingness to pay a premium for a variety of certified wood products. A survey of over 1,600 Pennsylvania and Tennessee residents found that approximately 35% were willing to pay some positive "premium" for environmentally certified wood products. For three types of wood products (a $28.80 shelf, a $199 chair, and a $799 table), we find the estimated market premiums to be $3.74, $15.94, and $45.07, respectively.

Key Words: eco-certification, eco-labeling, price premium, spike models

JEL Classifications: Q5, Q23

During the past several years, forest certification programs have attracted increased interest in the United States. Both the Forest Stewardship Council, an international nonprofit organization that accredits third party certifiers, and the American Forest & Paper Association (AF&PA), an industry organization, operate environmental certification programs. The primary purposes of these programs are to improve environmental quality and to promote sustainable forest management (Cabarle et al.). Major home improvement chains such as Home Depot and Lowe's have committed to

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these programs by giving preferences to certified wood products by purchasing specific proportions of their wood products from firms or organizations that have had their forest management and production practices monitored and certified.

Certification programs must be economically feasible for growers and manufacturers if they are to succeed. The production and marketing practices in certified growing, harvesting, manufacturing, and/or handling must either be cost competitive with uncertified methods or consumers must be willing to pay a price premium for the costlier certified products. The purpose of this study is to ascertain consumers' willingness to pay a premium for environmentally certified products. Although other researchers have examined this issue, this study differs from previous eco-labeled wood products studies in several ways. In particular, (1) our data are based on a representative sample of the population, (2) we follow the recommendations of Arrow et al. more closely in that a dichotomous choice referendum valuation question based on a statistically

efficient bid design is used, and (3) we incorporate recently proposed methods to mitigate hypothetical bias on the part of respondents.[1] Furthermore, the analysis uses a "spike" modeling approach that accounts for the preponderance of people who are not willing to pay a premium for certified wood products. The three products studied were an oak shelving board, an oak chair, and an oak table. Results from the study were obtained through a telephone survey of over 1,600 Pennsylvania and Tennessee residents.

Survey Data and Methods of Analysis

Survey Data

The survey consisted of two parts. First, a telephone survey was conducted to assess whether respondents would be willing to pay a premium for environmentally certified wood products, and thus participate in the market. For the second part of the survey, an information booklet regarding certification of hardwood products was sent to those who said they would be willing to participate in the market. A follow-up phone call was used to collect information from these respondents regarding their willingness to buy any of three certified wood products at a specified premium. All respondents were aged 18 or older. The caller requested that the person most responsible for the household's wood product purchases respond. Phone calls were placed until at least 800 completed surveys were obtained in each state. The University of Tennessee Human Dimensions Laboratory conducted the survey under the supervision of the project research-

ers, following the standard survey procedures recommended by Dillman.

Residents of six Pennsylvania and six Tennessee counties were randomly sampled from telephone lists. Both Tennessee and Pennsylvania are major hardwood producing states in the United States. In addition, Pennsylvania has the largest number of certified hardwood acres of any state in the United States (Jacobsen; Pennsylvania Hardwood Development Council). The counties were chosen on the basis of whether they had high (low) concentrations of hardwood removals and were rural (urban). In each case, the urban counties had population densities of greater than 500 people per square mile and hardwood removals of less than 2 million cubic feet per year. The rural counties had population densities of less than 75 persons per square mile (U.S. Census Bureau 1999) and hardwood removals of 10 million cubic feet per year or greater (USDA Forest Service). Urban counties with low hardwood output included Allegheny, Northampton, and Montgomery Counties in Pennsylvania, and Davidson, Hamilton, and Knox Counties in Tennessee. Rural counties with high hardwood output included Clearfield, Elk, and McKean Counties in Pennsylvania, and Hardeman, McNairy, and Wayne in Tennessee. The 1,614 residents surveyed were divided almost equally across states (811 and 803 Pennsylvania and Tennessee respondents, respectively) and county types (809 and 805 rural and urban counties, respectively).

Two versions of the survey were used. One version included a "full" scope of certification, whereas the other included a "partial" (growing and harvesting only) scope of certification. The text for the certification of the "Full" Program was as follows:

> Environmental certification means a product has passed a voluntary environmental screening process by an independent third party organization, not the wood products company, the wood products industry, or the government. All aspects of production, including timber growing and harvesting, product manufacturing, and handling methods, are monitored to ensure that practices are used that help sustain our environment

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[1] As such our study differs from much of the current literature. For example, Ozanne and Vlosky and Winterhalter and Cassens restrict their sample to only those households with relatively high incomes (greater than $30,000 and greater than $50,000, respectively). Forsyth, Hayley, and Kozak do not define any specific wood product, just the broad category of "wood products." Rametsteiner did not link willingness to purchase certified wood products to anything other than price. Spinazze and Kant presented respondents with a "percentage premium" instead of how a premium would be encountered by a market consumer, i.e., a higher price.

for current and future generations. A product label assuring certification appears on or nearby the product.

For the "Partial" Program, the text read:

Environmental certification means a product has passed a voluntary environmental screening process by an independent third party organization, not the wood products company, the wood products industry, or the government. Timber growing and harvesting methods are monitored to ensure that practices are used that help sustain our environment for current and future generations. Product manufacturing and handling would not be monitored or certified. A product label assuring certification appears on or nearby the product.

Each respondent was randomly assigned to the full or partial certification treatment. Some 816 respondents completed the full certification survey, and another 798 respondents completed the partial certification survey. Following Ozanne, Bigsby, and Vlosky, the certifying entity was an independent third party organization, not the wood products company, the wood products industry, or the government.

In the initial phone call, the caller read the certification text and respondents were asked to indicate which of the following three statements most closely reflected their opinions about environmental certification of hardwoods: (1) "I support environmental certification and would pay a higher price for hardwood products if they were certified"; (2) "I support environmental certification but not if it requires paying a higher price for hardwood products"; or (3) "I do not support environmental certification regardless of whether it costs me anything."

By allowing respondents to express support for environmental certification without being willing to pay higher prices, bias associated with "yea saying" may be minimized (Blamey, Bennett, and Morrison). In other words, pressure to provide a "socially responsible" response of support for the environment may be decreased, perhaps providing a more realistic estimate of consumers' behavior in the
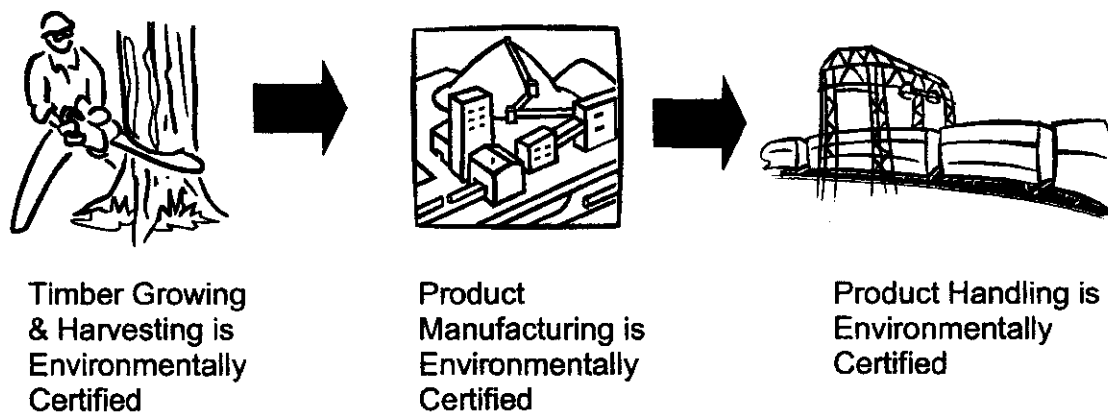
marketplace. Demographic data were also collected, as well as information regarding membership in environmental or conservation organizations and frequency of recreation in forests.

In identifying themselves with one of the above statements, respondents separated themselves into market participants (willing to pay a higher price) and nonparticipants (not willing to pay a higher price). Those who indicated willingness to pay a nonzero premium for eco-labeled hardwood products during the first phone call were asked to participate in a second round survey. Of the 1,614 original survey respondents, 516 (32%) were eligible for and agreed to participate in a second-round survey. These respondents were sent a survey booklet describing in detail the definition and scope of the certification process as well as pictures and product descriptions for each of three products. The three products were an oak shelving board, the uncertified version of which sold for $28.80; an oak chair, the uncertified version of which sold for $199; and an oak table, the uncertified version of which sold for $799.[2] Immediately adjacent to the picture and description of the uncertified wood product was a picture of an identical, yet certified, product. No price for the certified product was printed in the booklet; this price was stated at the time of the second telephone interview.
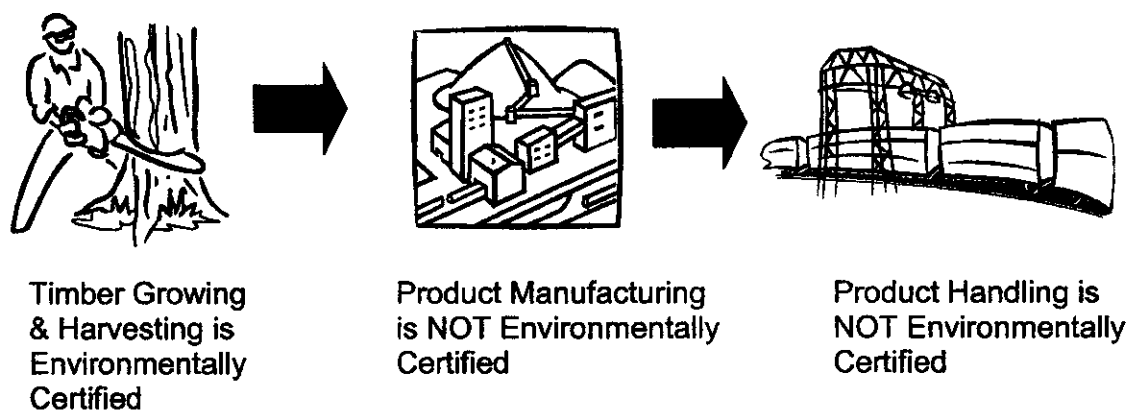
The booklet also defined environmental certification using both text and a graphic to depict the scope of the certification (Figure 1). For the full scope certification program, it was indicated that certification would occur at the timber growing and harvesting stage, product manufacturing stage, and the product handling stage. The partial scope certification program indicated that only the timber growing and harvesting stage would be certified.[3] An example of a certification label that would be displayed near eco-labeled products was also included (Figure 2). The certification label was

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[2] The pictures were taken of uncertified products offered at a major chain store in Knoxville, TN. Actual market prices were used for the uncertified products.

[3] Of course, the scope of certification described in the booklet and follow-up phone call matched that described in the initial phone contact.

Timber Growing
& Harvesting is
Environmentally
Certified

Product
Manufacturing is
Environmentally
Certified

Product Handling is
Environmentally
Certified

"Full" certification program

Timber Growing
& Harvesting is
Environmentally
Certified

Product Manufacturing
is NOT Environmentally
Certified

Product Handling is
NOT Environmentally
Certified

"Partial" certification program

Figure 1. Diagrams Depicting "Full" and "Partial" Certification Programs

placed adjacent to the picture of the certified product, whereas the picture of the uncertified product had no label. The certified and uncertified products were indicated as being identical in all characteristics except certification.

The respondents receiving the booklet also were asked to read a section on making hypothetical choices. A page of text reassured respondents that some people might be willing to pay more for environmentally certified products, whereas others might not. The text also described hypothetical bias and the prob-

lems it may cause when providing market information to the wood products industry. Respondents were asked to "carefully consider the choices" and think about "those for which you would truly be willing to buy and pay." The purpose of these statements was to mitigate the potential effects of hypothetical bias (Cummings and Taylor). Following Arrow et al., the text of the booklet contained a statement asking respondents to carefully consider their budget constraint. During the second phone call, the respondents were verbally re-
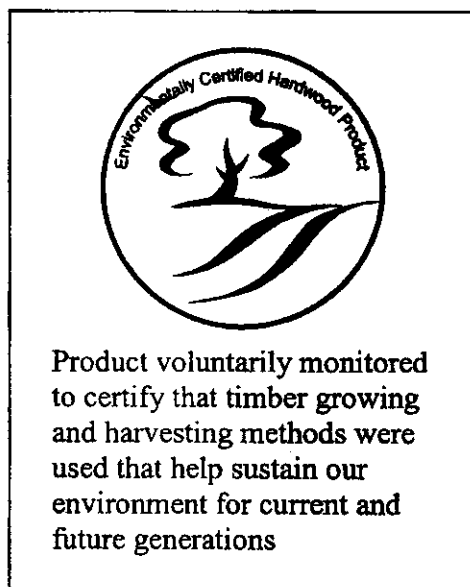
Figure 2. Sample Environmental Certification Label ("Partial" Certification Program)

minded to carefully consider their budget constraint and to make as realistic a choice as possible in a hypothetical situation (Kotchen and Reiling).

In the second phone call, the respondents were asked to refer to the product description, picture, and price contained in the booklet.[4] The price premium, or additional cost, for each product was selected randomly from a set of five levels.[5] Respondents were asked to indicate which product (certified, uncertified, or neither) they would be willing to purchase at the given attributes, including price. Respondents were requested to answer the questions

only if they were in the market for the products, either now or in the future. Respondents were also instructed to say they would buy neither product if they would never consider purchasing a product similar to that shown.[6]

Methods of Analysis

The simple spike model of Kriström is used to examine people's willingness to pay for eco-certified wood products. The model provides a spike in the willingness to pay (WTP) distribution at zero to account for "nonparticipants," where nonparticipants are those respondents stating that they did not support certification of wood products or that they did support certification but only if the additional cost was zero. "Participants" are those who, in principle, are willing to pay some nonzero premium for certified wood products. Further, the model does not allow for a negative willingness to pay. Given a price premium the respondent is willing to pay, say, P, the distribution of WTP is given by

$$(1) \quad F_{WTP}(P) = \begin{cases} 0 & \text{if } P < 0 \\ 1/[1 + \exp(\alpha X)] & \text{if } P = 0 \\ 1/[1 + \exp(\alpha X - \beta P)] & \text{if } P > 0, \end{cases}$$

where the parameters of $F_{WTP}(\cdot)$ are estimated via maximum likelihood. The vector X represents all factors other than price that are believed to influence WTP, and β is the coefficient on the premium faced by the respondent. The likelihood function consisted of three parts: those who are not willing to pay a positive premium (nonparticipants), those who are willing to pay a nonzero premium but the posted price is greater than their willingness to pay, and those who are willing to pay a nonzero premium and whose willingness to pay exceeds the posted price. Although this model is not a standard feature of "canned" econometric packages, the log-likelihood

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[4] The order in which the products were referenced by the interviewer was random, although respondents could peruse the booklet prior to the phone call and anticipate questions for three wood products.

[5] The price premiums for the certified shelving board were $1.50, $4, $5, $6, $10; for the certified chair the premiums were $10, $15, $20, $25, $40; and for the certified table the premiums were $25, $45, $50, $55, $60. Following Boyle et al., the responses regarding premiums were obtained through an open-ended pricing question for each product on the pretest survey. Pretest respondents were provided with product pictures and descriptions identical to those provided in the field survey. Responses to the pretest were used to generate statistically efficient bid values for use in the field survey.

[6] Those stating they would buy neither the certified or uncertified products were dropped from the econometric model for that product. Some 1.6% would not buy a product similar to the shelf, 3.5% would not buy a product similar to the chair, and 4% would not buy a product similar to the table.

Table 1. Variable Names and Definitions

Variable Names	Definitions	Mean
Age	Age, in years	48.9 years
Male	1 if male, 0 otherwise	55.4%
Urban	1 if urban area, 0 otherwise	50.2%
Environmental advocate	1 if contributed time or money to an environmental advocacy organization, 0 otherwise	39.1%
Hunting/fishing advocate	1 if contributed time or money to hunting or fishing organization, 0 otherwise	30.4%
Forest user	1 if use forests for recreation purposes at least once per month or more, 0 otherwise	43.2%
Bought eco-certified products in past	1 if yes, 0 otherwise	58.7%
TN resident	1 if a Tennessee resident, 0 otherwise	49.4%
Full	1 if "full" certification program, 0 otherwise	50.6%
Price	Premium faced by respondent for the eco-certified wood product	See footnote 5

function can be estimated in statistical software packages such as LIMDEP, as we have done, or any package that permits one to program a likelihood function.[7] Mean WTP is given by

$$(2) \quad \text{WTP} = \ln[1 + \exp(\alpha X)]/\beta,$$

where β is the price coefficient. The spike model requires $\beta > 0$; that is, a positive marginal utility of income.

The full certification program was hypothesized to have a positive influence on market participation relative to the partial certification program. This was anticipated because the potential positive environmental effects of the full certification would be throughout the market channel versus only at growing and harvesting. Based on findings from previous studies, those living in an urban area and women were hypothesized to be more likely to have a nonzero WTP relative to those who did not have these characteristics. Further, those who contribute to environmental advocacy organizations (e.g., Sierra Club, The Nature Conservancy) or hunting/fishing conservation organizations (e.g., Ducks Unlimited) and those who frequently recreate in forested areas were hypothesized to have nonzero WTP for certi-

fied wood products relative to those who did not share these characteristics, because these measures may reflect values the respondents place on the environment and forest resources. Those with previous experience in purchasing environmentally labeled products were believed to be more likely to pay a positive premium for eco-labeled wood products.

Results

Of the 1,614 respondents participating in the survey, 973 provided complete information needed for the study (Table 1).[8] Just under 31% supported certification and were willing to pay a nonzero premium for eco-certified wood products. Some 57% supported certification but were not willing to pay higher prices, and 12% did not support certification regardless of costs.[9]

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[7] LIMDEP code is available from the authors.

[8] The large drop in observations is due to the telephone-mail-telephone structure; it proved difficult to get an eligible respondent to complete a second-round interview.

[9] Some commonly cited reasons for not supporting certification were that the respondent did not believe certification would work to improve the environment, other causes were of higher priority, and companies should be regulated, rather than using voluntary certification. Some commonly cited reasons for not being willing to pay more were that the respondent could not afford to pay more, they did not believe it costs more, or that manufacturers should not charge higher prices even if it costs more.

Table 2. Spike Models for Three Certified Wood (Oak) Products

Variable	Shelf		Chair		Table	
	beta	*t*-ratio	beta	*t*-ratio	beta	*t*-ratio
Intercept	−2.775	−6.867	−3.092	−7.652	−3.000	−7.397
Environmental advocate	0.616	4.027	0.666	4.365	0.602	3.930
Forest user	0.854	5.230	0.892	5.392	0.846	5.111
Hunting/fishing advocate	−0.084	−0.480	−0.123	−0.695	−0.046	−0.259
TN resident	0.018	0.121	0.037	0.253	−0.012	−0.081
Male	−0.428	−2.841	−0.351	−2.320	−0.315	−2.085
Age	0.019	3.417	0.020	3.713	0.019	3.468
Urban	0.374	2.364	0.390	2.438	0.421	2.609
Bought eco-certified products in past	0.655	3.842	0.772	4.508	0.714	4.179
"Full" certification treatment	0.053	0.368	0.149	1.029	0.179	1.224
Price	0.090	9.551	0.021	9.087	0.007	7.996
Ln-L	−721.381		−701.781		−690.700	
WTP ($)	3.74 (0.42 SE)		15.94 (1.91 SE)		45.07 (5.92 SE)	
% Premium	13.0		8.0		5.6	
Observations	973		969		967	

The estimated spike models for each of the products are presented in Table 2.[10] The results were consistent across the various products with the same variables being significant in each of the models. Thus, the initial discussion with respect to hypotheses concerning any one variable applies to all products. Those who make donations to environmental organizations (*Environmental Advocate*) and who use national forests frequently (*Forest User*) are more likely to have a nonzero WTP relative to those who do not share these characteristics. Contrary to expectations, those who make donations to hunting or fishing organizations (*Hunting/Fishing Advocate*) are no more likely than others to have a positive WTP. Residents of Tennessee were not significantly different from residents of Pennsylvania in

willingness to pay a premium for environmentally certified wood products.

In terms of demographic factors, men were less likely than women to be willing to pay a nonzero premium for certified wood products, a result that is congruent with other studies. The likelihood a respondent was willing to pay a premium increased with age; residents living in urban counties were more willing to pay a nonzero premium relative to residents of rural counties. Those who had purchased environmentally certified products in the past (*Bought Eco-Certified Products in Past*) were more likely to pay a positive premium for certified wood products. With respect to "treatment" variables, the scope effect is not present. That is, respondents presented with the full certification scenario were no more willing to pay a premium than those respondents presented with the partial certification scenario, all else equal. Finally, as the price premium increased, respondents were less likely to pay the nonzero premium.[11]

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[10] Models including income were estimated but none of the income coefficients were significantly different from zero, implying that income effects were not present. We temper this conclusion because of a relatively high degree of item nonresponse to the income question. Models with income as a variable are available upon request.

[11] Recall the WTP distribution of Equation (1), in

The models presented in Table 2 were used to calculate unconditional estimates of WTP that can be applied to the population as a whole. Relative to the $28.80 uncertified oak shelving board, respondents were willing to spend, on average, an additional $3.74 for a certified board. This represents a 13.0% premium over an uncertified board. The 95% confidence interval for the premium is between $2.92 and $4.56.[12] Turning to the oak chair, respondents were willing to pay an additional $15.94 for a certified product, relative to a $199 uncertified chair. This corresponds to an 8.0% premium and a 95% confidence interval of $12.22–$19.66. Finally, respondents were willing to pay an additional $45.07 for the certified oak table relative to the $799 uncertified oak table, a 5.6% premium. The 95% confidence interval on the estimate was $33.53–$56.61. The declining premium as the product price increases is a feature found by more than one study.

Conclusions

As with the study by Grönroos and Bowyer, the results from this study show that the majority of consumers would not be willing to pay a premium for certified products. The data indicate that just under 31% of consumers would be market participants for certified hardwood products. This percentage is much lower than findings from studies by Ozanne and Vlosky and Winterhalter and Cassens, who report that 60%–80% of the sample would be willing to pay a premium, and very close to Stevens, Ahmad, and Rudell, whose survey of manufacturers reports a West Coast market of 28% of manufacturers' customer

base. One possible explanation for the lower participation in an eco-certified market in this study may be that respondents were allowed to express support for environmental certification without having to pay a premium, therefore "yea saying" bias may have been reduced. We also note that this finding satisfies one of Sedjo and Swallow's conditions for the emergence of separate certified and noncertified wood products markets. These authors show that a two-price market (i.e., a certified market at one price and a noncertified market at another price) requires "significant new demand" (p. 282). Our results suggest that the certified market, although smaller that that found in previous studies, is still substantial.[13]

The profile of those most likely to be willing to pay a premium includes women and older respondents, as well as those who contribute to environmental advocacy groups. Further, frequent forest users and those who have bought eco-certified products in the past were also more willing to pay a nonzero premium. This profile is similar to findings from previous studies.

The willingness to buy a certified product over an uncertified one is responsive to the premium level (price). Converted to percentages, the mean premium for the oak shelving board was 13.0%, the mean premium for the chair was 8.0% premium, and the mean premium for the table was 5.6%. This pattern of the percentage premium—declining as the base product price increases—is similar to the findings from previous studies that have examined wood products of similar cost.

Whereas a substantial segment of the wood products market is willing to pay a positive premium, the premium was insensitive to the scope of the certification. This result is somewhat surprising, because the complete supply-chain certification offered by the full certification program represents greater potential benefits to the environment; thus, it would be

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which the β coefficient is multiplied by −1. Thus, for WTP a premium varies inversely with the magnitude of the premium.

[12] The variance of the conditional willingness to pay estimates was calculated using the delta method (Greene):

$$\mathrm{Var(WTP)} = (\partial \mathrm{WTP}/\partial \Gamma')\mathrm{Var}(\Gamma)(\partial \mathrm{WTP}/\partial \Gamma)',$$

where WTP is given by Equation (2), the Γ parameters are estimated via maximum likelihood, and Var(Γ) is the variance-covariance matrix of the model.

[13] The other condition found by Sedjo and Swallow is that the cost of certification must be positive to all or most suppliers to this market. Stevens, Ahmad, and Ruddell indicate that certification costs are indeed positive, about a 5.4% increase in the cost of certified goods sold over the cost of noncertified products.

expected that consumers would place a greater value on the certified product. The finding points to several possibilities. First, it could reflect consumers' doubts about the ability of certification organizations to monitor environmental management practices throughout the market channel. Second, it could reflect that consumers place the greatest value on environmental management practices at the timber growing and harvesting level of the market channel. Finally, it could point to the importance of effective education programs regarding certification programs that will outline how monitoring is performed at each stage of the market channel and the potential benefits to the environment.

At this time, firms considering adoption of environmental certification of their products may wish to focus on certification of timber growing and harvesting, rather than focusing on certification at other stages of processing and handling. Perhaps if the market can be developed through educational programs regarding the potential benefits of certification throughout the market channel, then there may be economic benefits from further certification to firms. It should be noted that this study was done in only two states, Pennsylvania and Tennessee. Future research should likely address potential regional differences in market participation and WTP for certified products.

As with all contingent market studies, consumers' stated purchasing decisions may not be borne out in the marketplace. Although measures were taken in this study to help respondents make a realistic choice in a hypothetical situation, as the markets for environmentally certified products become more developed, the actual preferences of consumers may differ somewhat from the stated preferences examined in this study. This highlights the need for market studies as consumers become more aware of certified products and these products are more readily available on the market.

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