Consumer preferences and willingness to pay for character-marked cabinets from Alaska birch

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Abstract

Alaska birch lumber has a higher occurrence of defects (knots, bark pockets, flecks, spalting, etc.) when compared to competing hardwoods. These defects are a disadvantage when birch lumber is graded under standard National Hardwood Lumber Association (NHLA) grading rules. This paper examines whether defects and other character markings found in birch lumber may be an advantage for certain applications. Contingent valuation techniques are used to determine the willingness of consumers to pay a price premium for kitchen cabinet doors made from Alaska birch lumber containing a variety of character features. Results show that consumers prefer cabinet doors with knots and color variation, and that in general, doors with more character marks are preferred to those with less. In addition, consumers were willing to pay price premiums of between $13 and $43 for their favorite door. Further, results indicated that women tend to prefer cabinet doors with fewer or no character marks, while men prefer doors with higher levels of these features.

A frequent concern among birch lumber producers and retailers in Alaska is the relatively large proportion of knots, natural discolorations, and other defects found relative to competing hardwoods. Throughout this paper, all birch species growing in Alaska, including *Betula papyrifera* (paper birch) and *Betula kenacia* (Kenai birch), will be referred to as Alaska birch. Within Alaska, birch forests predominate in the interior and south-central regions of the state, covering tens of millions of acres. The total volume of standing sawtimber for all commercial species in interior Alaska is estimated to be 31 billion board feet (BBF) (Wheeler200l), and Alaska birch accounts for about 8 percent of this total (approximately 2.5 BBF). Despite this abundance, it is estimated that only 19 sawmills, many of which operate part time, process even small amounts of birch (Parrent 2000). Almost all the birch lumber produced in Alaska is used within the state.

The presence of knots, bark pockets, and other character mark features in Alaska birch is a disadvantage when selling lumber under standard National Hardwood Lumber Association (NHLA) lumber grades (NHLA 1998). However, several studies have shown that consumers may be willing to accept character-marked hardwood lumber for certain applications, and that inclusion of knots can lead to yield improvements and costs savings (Wiedenbeck and Buehlmann 1995, Buehlmann et a1. 1998).

Bumgardner et a1. (2001a) evaluated consumer preferences for oak furniture containing three classes of character marks. Preference scores were found to be inversely related to knot size. However, this study found that knot size accounted for only 35 percent of the importance in buying decisions, and that there are opportunities for manufacturers to increase their use of lumber containing small character marks,

Jahn et a1. (200]) studied consumer preferences for character-marked hardwood cabinet doors. This study found that the presence of character features was unimportant to 73 percent of those sampled. For the remaining 27 percent of the sample, character marks were the most important attribute influencing their choice of cabinet door. This char-

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actor-sensitive segment of the sample had a higher proportion of female and younger respondents, suggesting that these groups would be less receptive to the presence of character marks. In addition, it was found that light levels of character were generally preferred to heavy levels.

Bumgardner et a1. (200lb) found that large furniture manufacturers could successfully market character-marked products at upper and middle price points. However, gaps in product knowledge between manufacturers, retailers, and consumers made it difficult for producers of character-marked products to accurately gauge consumer preferences. A potentially useful strategy for using character-marked wood is to include, character-marked products in the earliest stages of product development, especially when formulating new product ideas.

An implicit assumption common to most studies of character-marked lumber is that character marks are a negative, or at best neutral, attribute of hardwood lumber. Consequently, researchers have concentrated on ways of mitigating the impact of character marks. In contrast, in this study we examine whether consumers may regard character marks, as a positive feature of hardwood lumber. We estimate consumer willingness to pay (WTP) for different types of character-marked Alaska birch kitchen cabinet doors using contingent valuation methodology (CVM).

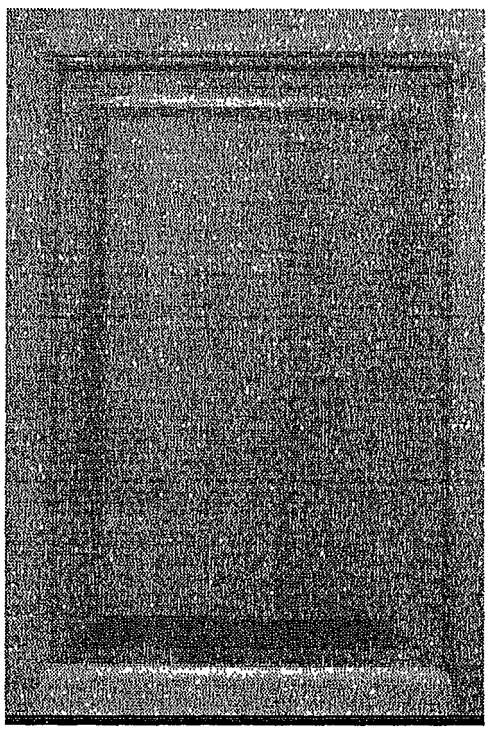

Figure 1. - *Birch cabinet door A - clear; cabinet group I.*

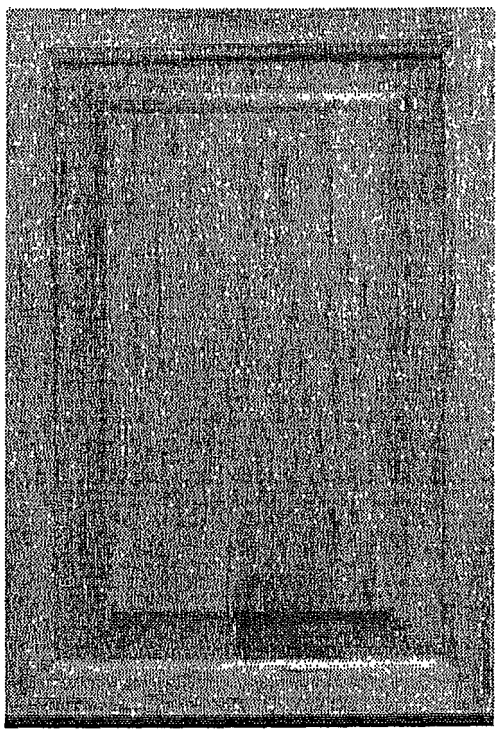

Figure 2. - *Birch cabinet door B - fleck pattern; cabinet group I.*

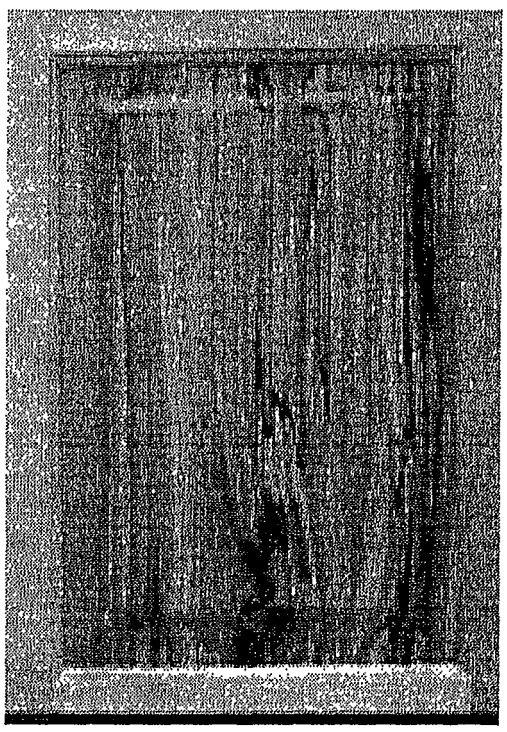

Figure 3. - *Bitch cabinet door* C *spalted; cabinet group I.*

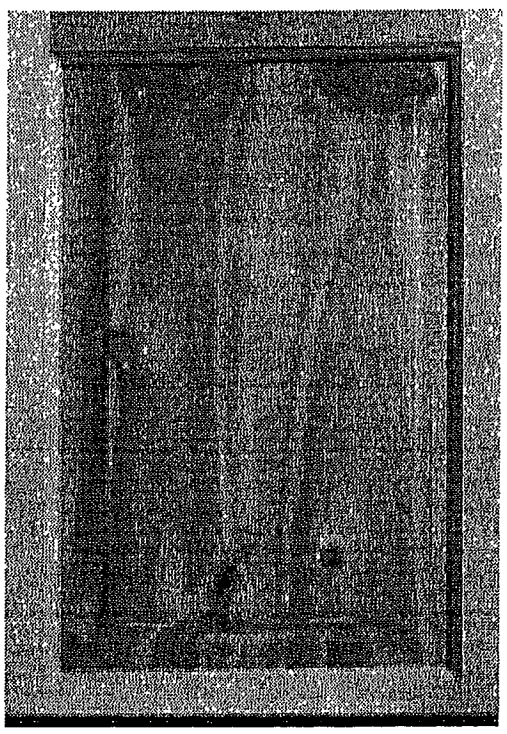

Figure 4. - *Birch cabinet door D - grain variation/knotted; cabinet group I.*

We found no evidence in the wood products literature of the use of CVM to quantify consumer preferences for character-marked wood. However, CVM has been used to estimate consumer WTP a price premium for environmentally certified wood products, and to quantify the importance of place of manufacture. Ozanne and Vlosky (1997) found that consumers were willing to pay a price premium of between 4.4 and 18.7 percent for environmentally certified wood products, depending on the type product. However, they found that 37 percent of the sample was not willing to pay a price premium for any type of environmentally certified wood product.

New homebuyers in Minneapolis/St. Paul and Chicago were surveyed (Gronroos and Bowyer 1999) to determine their WTP for environmentally certified wood products. Results showed that while some new homebuyers were willing to pay a price premium for environmentally certified wood, for most in the sample it was not a top priority.

Donovan and Nicholls (2002) used CVM to quantify a made-in-Alaska price premium for secondary wood products. Results showed that consumers were willing to pay an $82 price premium for a made-in-Alaska coffee table compared to an identical table made in China.

Methods

Sampling procedures

Consumer preference data were collected at home shows in Anchorage, Fairbanks, and Sitka during March and April 2002. In addition, demographic information on age, income, gender, state residency, and the kitchen remodeling plans of respondents was collected. Respondents were asked to rank a set of four Alaska birch kitchen cabinet doors, A through D, in order of preference, for use in their current kitchen. Door A was made from clear birch lumber, while doors B through D were made from flecked, spalted, and grain variation/knotted birch, respectively (Figs. 1 through 4). The lumber used to construct doors B through D was selected to represent three distinct types of character markings found in Alaska birch. Respondents were then asked to repeat this

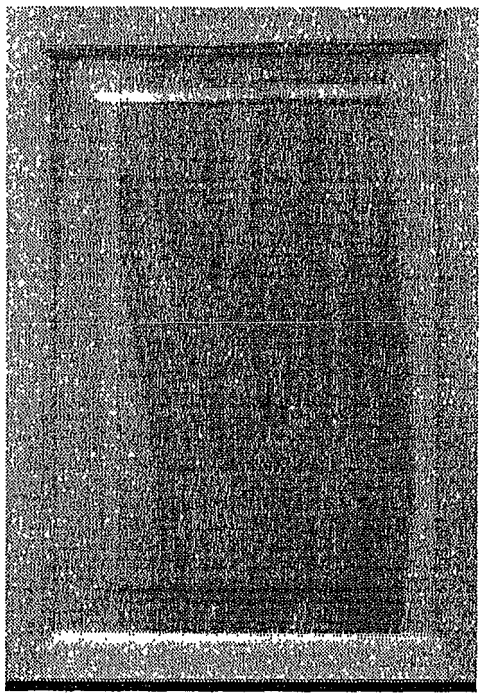

Figure 5. - Birch cabinet door E - low level of character; cabinet group II.

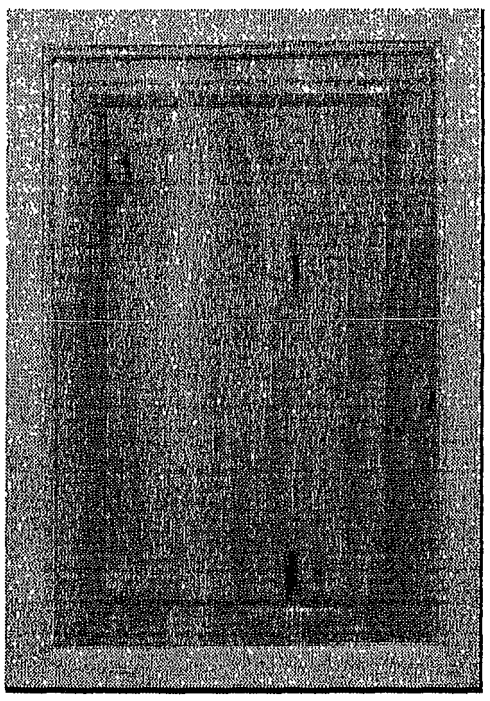

Figure 6. - Birch cabinet door F - intermediate level of character; cabinet group II.

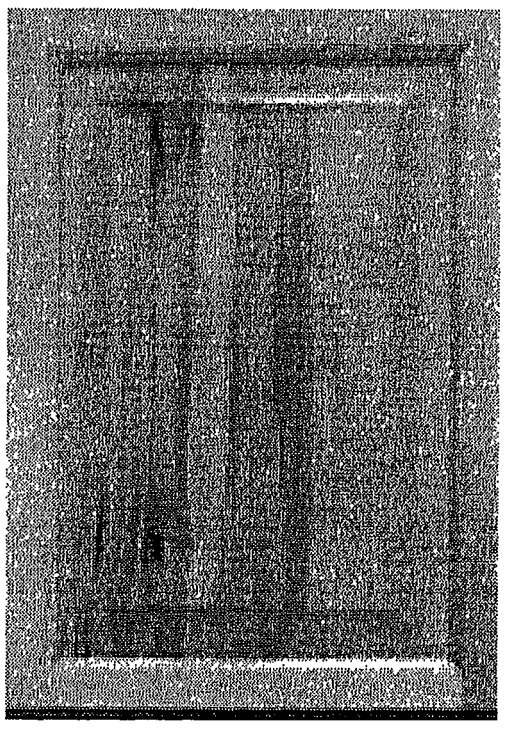

Figure 7. -Birch cabinet door G - intermediate level of character;' cabinet group II.

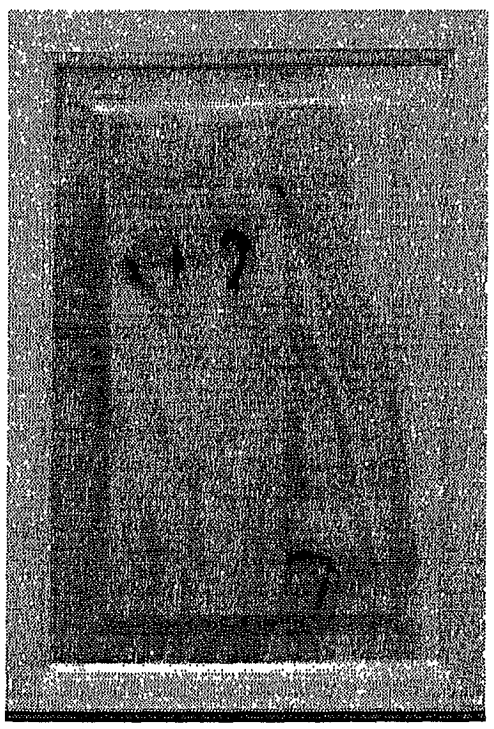

Figure 8. - Birch cabinet door H - high level of character; cabinet group II.

ranking process for another set of four doors, E through H. The doors in this set each had the same type of character (primarily bark pockets and color variations) with the prevalence (size and frequency) of the character features increasing from door E through H (Figs. 5 through 8). Thus, two sets of cabinet doors were used to obtain consumer preference data on: 1) different types of character; and 2) different levels (or gradations) of a single character type.

CVM methodology

Having ranked both sets of doors in order of preference, respondents were asked to choose between their favorite and second favorite doors, in each set of four, at different prices. The price of the second favorite door was always $40, while the price of the favorite door varied between $41 and $90.

Several studies in the CVM literature (Cooper 1993, Judez et a1. 2000) have recognized the importance of determining optimal bid amounts, and the distribution of the sample among these bids, We follow Boyle et a1. (1988) in using the "method of complementary random numbers" as a sampling strategy. This method involves four stages. First, given a sample size of N (number of respondents), N/2 random numbers are generated on the interval (0,1). These random numbers serve as probabilities. Second, each number from the original sample is subtracted from one. The result is a total of N probabilities. Third, a cumulative distribution function, derived from pretest data, is used to convert the probabilities to dollar bid amounts. In the pretest, respondents were asked the open ended question, "How much more would you be willing to pay for door X over door Y?" Fourth, these individual bid amounts are randomly assigned to surveys.

It was necessary to modify the method somewhat as we did not know the number of respondents in advance. Therefore, we calculated the optimal sampling strategy for a sample size of 100 and scaled up as necessary. The bid distributions for the final sample sizes of 630 responses for doors A through D and 625 responses for doors E through H are contained in **Tables 1** and 2.

We followed Hanemann (1984) in using a utility difference model as the basis for calculating maximum WI1) estimates from dichotomous choice data. We assumed that a respondent derives indirect utility from two sources: 1) income; and 2) whether the cabinet door they select is their favorite or second favorite.

Formally: $V(y, Cab_i)$ [1]

where:

i = 1 or 2

y = income

Cab_1 denotes selection of the favorite door, while Cab_2 denotes selection of the second favorite door. The favorite door will be selected if the difference in indirect utility from selecting the favorite door over the second favorite is positive. Formally:

$$dV = [V_1(y\ 0\ p_1, Cab_1) + \eta_1]\ 0\ [V_2(y\ 0\ p_2, Cab_2) + \eta_2] > 0 \quad [2]$$

The prices of the favorite and second favorite door are denoted by p1 and p2, respectively. The indirect utility functions contain unobservable stochastic element." denoted by η1 and η2. There have been several functional forms suggested for dV, a linear one is used here for two reasons. First, a linear form is consistent with the utility difference model outlined above. Second, a linear form yields a closed ended expression for mean WTP.

Table **1**. - *Bid distributions for doors A through D.*

Bid amount ($)	Door A	B	C	D
2	12	1	2	12
3	2	0	0	3
4	4	1	0	2
5	9	1	1	6
6	6	2	2	7
7	19	2	9	21
8	19	5	12	13
9	18	5	9	18
10	25	7	19	35
15	29	8	22	50
20	25	8	18	47
30	11	1	7	21
40	12	4	10	14
50	6	5	7	16
Total[a]	197	50	118	265

a Number of times chosen as favorite within cabinet door group.

Table 2. - *Bid distributions for doors E through H.*

Bid amount ($)	Door E	F	G	H
1	8	1	2	1
2	23	3	5	7
4	8	2	4	4
5	13	5	5	4
7	26	9	9	16
9	24	8	8	13
10	33	8	22	40
11	46	20	9	43
12	35	10	9	29
15	14	6	9	10
20	14	4	6	16
25	9	5	3	17
Total"	253	81	91	200

a Number of times chosen as favorite within cabinet door group.

Table 3. - *Demographic information for State of Alaska and for respondents to cabinet door survey at selected home shows in Alaska.*

Demographic	Cabinet door sample	State of Alaska
Median age	45 to 55	32.4
Median household income	$60,000 to 80,000	$47,177
Gender distribution	Male 52.2%	Male 51.7%
Home ownership	90.3%	62.5%

Consequently, we estimated the following equation (other demographic factors are excluded for clarity):

$$Pay = B_0 + B_1 \times Bid \qquad [3]$$

where:

Pay = respondent's yes/no response to the WTP question

Bid = price premium respondent s are asked to pay for their favorite door

Two additional assumptions were made. First, the probability of selecting the favorite door was specified as a cumulative distribution function of a standard logistic variate. Second, it was assumed that no one in the sample would select their second favorite door over their favorite door, if they were available at the same price. Given these assumptions, the mean WTP price premium for a respondent's favorite door may be expressed as (Hanemann (1989):

$$\text{MeanWTP}) = (1/B_1) \partial \ln(1 + e^{BO}) \qquad [4]$$

Where B_1 is the absolute value of the estimated coefficient on the bid amount $X, and B_0 is either the estimated constant, if there are no additional independent variables, or the sum of the estimated constant plus the product of all other independent variables multiplied by their means.

Confidence intervals around estimates of mean WTP cannot be calculated conventionally, as mean WTP is a nonlinear function of estimated regression coefficients, which are themselves random variables. Therefore, we followed the simulation approach developed by Park et al. (1991). A bivariate normal distribution was generated using the means and variance covariance matrix of the bid coefficient and intercept term. There were 1,000 draws made from this distribution, allowing 1,000 WTP estimates to be calculated. This distribution of WTP estimates was used to calculate confidence intervals.

Results and discussion

Since survey responses were obtained from attendees at three home shows, they were not a random sample of Alaska residents. Respondents were older, wealthier, and more likely to own their own home than the general population of the state **(Table** 3).

Although the sample is not representative of the state as a whole, it may be representative of the subset of the state population interested in buying kitchen cabinet doors, since making the effort to attend a home show implies an active interest in home improvement. **Tables** 4 and 5 show the proportion of respondents who favored each door for each set of cabinets. The grain variation/knotted door D was the favorite among doors A through D, followed by the clear door A **(Table** 4). The more heavily character-marked doors B (flecked) and C (spalted) were considerably less popu-

lar, and combined they were only favored by a quarter of the respondents. However, many respondents who wouldn't select B or C for a whole kitchen indicated through general comments (but not through the formal survey) that smaller items such as coffee tables or picture frames made from spalted or flecked lumber would be appealing.

To determine if demographic factors influenced the choice of favorite door, analysis of variance was used to compare the proportion of the sample that chose each door as favorite. Gender was found to be the only demographic factor that significantly influenced consumer choice (95% significance level), with women tending to prefer cabinet doors made from wood containing only minimal character, while men tended to prefer doors with heavier character marking (particularly the spalted door and the high-character door).

Table 4. - Preferences for cabinet doors A through D in cabinet group I (cabinet styles); percent of time selected as favorite within group.

Door	Description	Percent of times selected as favorite within group (%)
A	Clear	31
B	Fleck pattern	8
C	Spalted	19
D	Grain variation/knotted	42

Table 5. - Preferences for cabinet doors E through H in cabinet group II *(cabinet styles); percent of time selected* as *favorite within group.*

Door	Description	Percent of times selected as favorite within group (%
E	Low character	40
F	Intermediate character	13
G	Intermediate character	15
H	High character	32

Table 6. - *Estimated regression coetticients"*

Door	No.of respondents	Bid coefficient	Intercept	Mcfadden r^2
A	197	-0.0673** (-4.54)	2.38** (7.43)	0.109
B	50	Not sig.		
C	118	-0.0894** (-4.64)	2.81 ** (6.04)	0.202
D	265	-0.0538** (-4.72)	2.21** (7.94)	0.0809
E	253	-0.115** (-4.14)	1.51** (4.83)	0.0578
F	81	Not sig,		
G	91	-0.0899* (-1.96)	Not sig,	
H	200	Not sig.		

a Mcfadden r^2 is an analog of the r^2 reported in linear regression models; ** = significant at. the 99 percent. level; *=significant at the 95 percent level.

Table 7. - Willingness to pay (WTP) price premium estimates and confidence intervals for Alaska birch cabinet doors.

Door	WTP	95% upper bound	95% lower bound
A	$36.70	$50.00	$23.40
B	NS*	NS	NS
C	$32.10	$40.70	$23.50
D	$43.00	$56.60	$29.40
E	$14.80	$19.40	$10.20
F	NS	NS	NS
G	NS	NS	NS
H	NS	NS	NS

a NS = not significant.

CVM results

Eq, [3] was estimated for each of the eight cabinet doors (none of the demographic variables were significant). Regression coefficients are shown in Table 6.

The coefficient on bid was significant in five of the eight equations, while the intercept term was significant in four. The finding that bid was insignificant for three of the doors is consistent with relatively low r^2 values (Table 6), indicating that bid amount is a relatively minor factor in explaining the probability of a bid being accepted or not. This was borne out by our experiences collecting the data. Once respondents had selected their favorite door they were often adamant that they wouldn't switch preferences, even when faced with significant price premiums.

WTP estimates are presented for the four doors with significant intercepts and bid coefficients (Table 7).

(Respondents were willing to pay significantly more for their favorite door drawn from the first set of doors (A through D) representing four distinct types of character marking, compared to the second set of doors (E through G), which contained gradations of the same type of character markings. Willingness to pay for favorite cabinet doors ranged from $14.80 for door E (low level of character) to $43 for Door D (grain variation).

Summary and conclusions

This study examined consumer preferences for different types of character marks commonly found in Alaska birch. Previous studies have focused on the willingness of consumers to accept character markings. The implicit assumption of these studies is that consumers prefer clear wood. We found that the majority of our sample of respondents preferred cabinet doors with some degree of character marking and were willing to pay a substantial price premium for their preferred choice.

In particular, cabinet doors with high levels of grain variation and those with high levels of character marking were appealing to consumers, while doors containing moderate amounts of charac-

ter were preferred less often. Doors containing fleck patterns, spatted material, and intermediate levels of character were also generally less well received. WTP price premium amounts as high as $43 (above a base amount of $40) were observed. Gender was the only demographic factor that influenced a respondent's choice of door, with women more likely to prefer clear wood. The reference to "in your current kitchen" in the WTP) question may have influenced survey responses because respondents may have tried to match the sample doors with their current kitchen decor. In a future study it would be useful to examine the effect of wording on consumer responses.

Respondents were reluctant to change their choice of favorite door, even when faced with a substantial price premium. The magnitude of the price premium consumers were willing to pay was dependent on the choices offered. Consumers were willing to pay a price premium for a character-marked door to the extent that the door is differentiated from other doors available. However, while distinctive character-marked doors may command a price premium, they may appeal to a smaller proportion of the population than would less distinctive doors. This points to the importance of market research.

Our findings show that the high occurrence of character marks in Alaska birch lumber is not necessarily a disadvantage, and could represent an opportunity to capture a price premium in the manufacture of such secondary products as flooring, paneling, furniture, and craft items.

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