Measuring Consumer Demand for Tires Made Without 6PPD

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Background

- Vehicle tires produced with additive known as 6PPD.
- 6PPD-Q, from ozone reaction, is highly lethal to coho salmon (Tian et al., 2020) and rainbow trout (Di et al., 2022).
- Coho salmon pre-spawning mortality (Scholz et al., 2011; Feist et al., 2017).
- Problem beyond the Pacific Northwest, e.g. Japan (Brinkmann et al., 2022; Hiki and Yamamoto, 2022).
- Tire reformulation is costly, but likely the most effective to remove 6PPD-Q.

Objectives

- Partnered with Salmon-Safe to investigate consumer demand for reformulated car tires without 6PPD
- Video vs. static text on preferences
- Forced deliberation on preferences

Literature

Stated preference method widely used in public good studies (Johnston et al. 2017).
→ Uncommon in private good.

Video vs. Text.

- Patients given video treatment comprehend information better than those given the text version (Lim et al., 2020).
- Information delivery via text and audio vs. text only (Agossadou and Nayga, 2023).
  → Unaware of similar tests in environmental quality.

Given exogenous time is too long: overnight and in-person studies

- Whittington et al. 1992, Cook et al. 2012, Tilley et al. 2016, Odihi et al. 2021.

→ Exogenously impose a 60-second delay for half of respondents.

Stated Preference Exercise

- Data collection period: Oct. 5th - 13th 2022
- 695 adults, car owners, residents of Washington, Oregon, and California.
- Participants compensated by Qualtrics.
- Reviewed by subject-matter experts.
- Two focus groups and a pilot study (n = 56).
- Two approaches to measure demand:
  - A single dichotomous choice.
  - 'Stoplight Exercise' (Whittington et al. 2009).

Stated Preference Core Scenario 1

A dichotomous-choice: conventional or Salmon Safe tire?

- Each respondent assigned: 1%, 10%, 25%, 50%
- Premium applied to the most recent purchase.
  - % premium and dollar amount.
  - "don't know" customers were given a baseline cost of $765.
- Minimize the possibility for hypothethical bias.
  - "cheap talk" and "oath" script (Carlsson et al., 2013).

Stated Preference Core Scenario 2

Multiple price list - "Stoplight" Exercise

- Red = completely sure not pay.
- Yellow = unsure to pay.
- Green = completely sure pay.
- Respondents given premia from 1% to 100% and saw the dollar amounts.
- Randomized display order: low-to-high or high-to-low.

Multivariate logit model results

	(1)		(2)		(3)		(4)	
premium	-3.59***	(-3.84)	-4.11***	(-3.94)	-4.31***	(-3.72)	-4.32***	(-3.87)
baseprice	< -0.00	(-0.19)	< 0.00	(0.32)	< 0.00	(0.23)	< 0.00	(0.36)
premium_dollars	< 0.00	(0.13)	< -0.00	(-0.15)	< -0.00	(-0.66)	< -0.00	(-0.00)
video	0.09	(0.52)	0.13	(0.65)	0.18	(0.82)	0.13	(0.64)
TTT	-0.07	(-0.39)	0.01	(0.05)	0.03	(0.12)	-0.06	(-0.27)
envi			0.16	(0.67)	0.33	(1.24)	0.20	(0.80)
water			0.60**	(2.49)	0.25	(0.87)	0.62**	(2.48)
endanger			0.83***	(3.44)	1.01***	(3.65)	0.81***	(3.20)
truth			2.95***	(3.61)	2.92***	(3.28)	2.88***	(3.48)
age35			-0.73***	(-2.75)	-0.46	(-1.45)	-0.64**	(-2.37)
age36_50			-0.55*	(-1.92)	-0.63**	(-1.98)	-0.52*	(-1.78)
age51_64			-0.14	(-0.46)	-0.11	(-0.34)	-0.02	(-0.08)
education level	No	-	Yes	-	Yes	-	Yes	-
race	No	-	No	-	Yes	-	No	-
political party	No	-	No	-	Yes	-	No	-
residence state	No	-	No	-	Yes	-	No	-
recreational fishing	No	-	No	-	Yes	-	No	-
fish consumption	No	-	No	-	Yes	-	No	-

T-statistics in parentheses. Model (4) drops respondents who were "somewhat unsure", "very unsure", or "neither sure nor unsure".

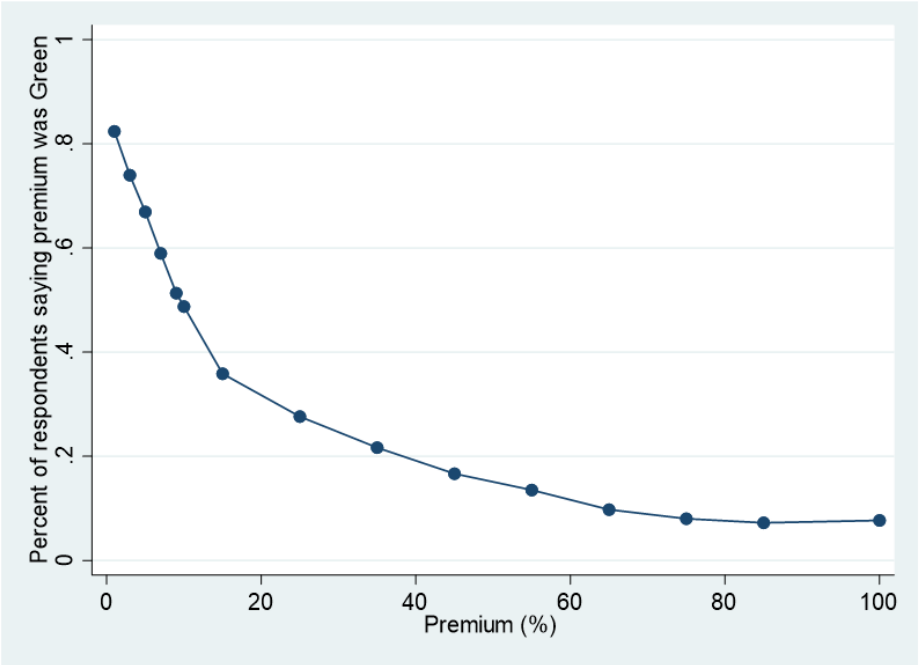
OLS Info Delivery | Binary Decision Summary

"Stoplight" exercise

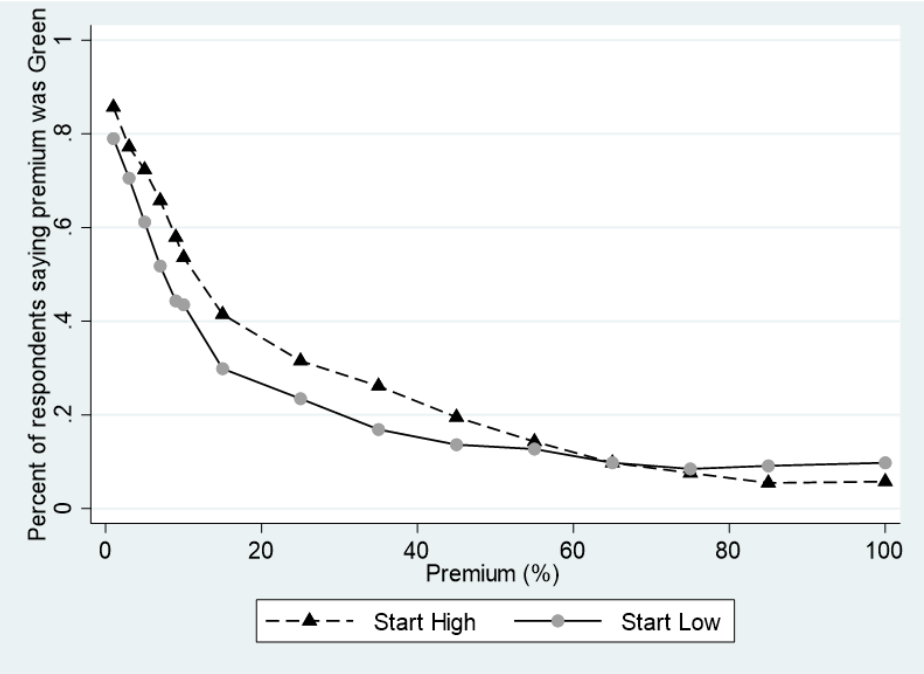
(a) 82% people were certain paying 1% premium.

(b) 28% people were certain paying 25% premium.

(c) The median response was willing to pay a 10% premium.



Does the order of premia matter?



Probability of choosing Salmon Safe tires by display ordering of premia.

- % of consumers who rated a premium as "green" decreases with increasing premiums.
- Low-to-high produces more conservative estimates of demand for most premia.
- Controlling for experimental treatments and socioeconomics, ordering is not statistically significant in OLS.

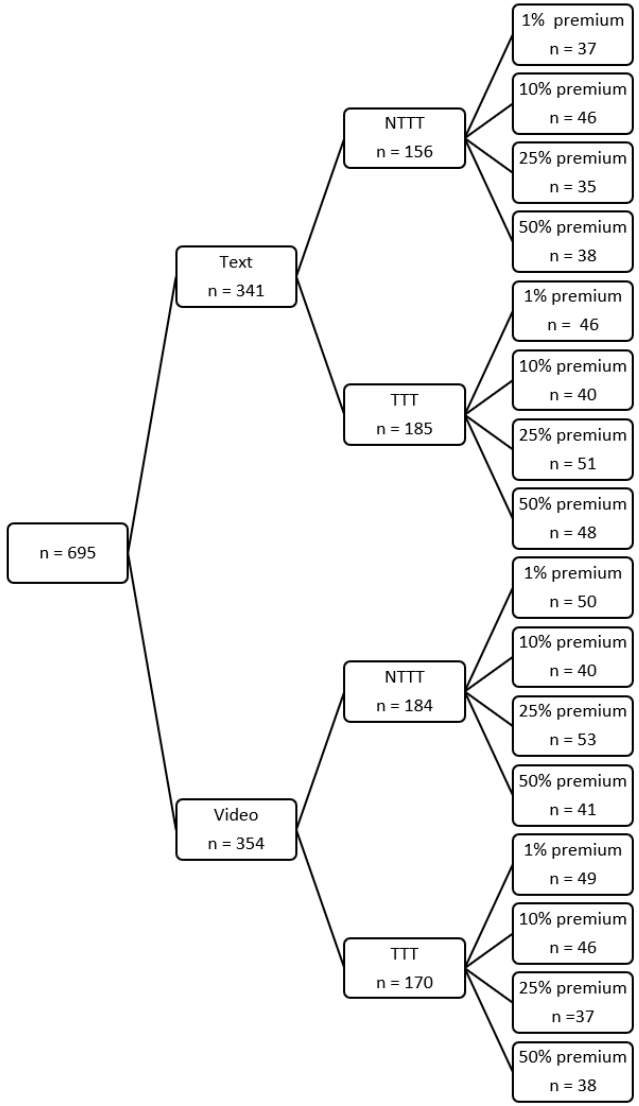
Video & TTT Demand Graph | PDF & CDF

Conclusions

- Median respondent willing to pay 10% more or $76 for a set of Salmon Safe tires (including installation fees).
- A segment of consumers may be willing to pay significantly higher premium (25% reported higher than $225).
- Information delivery has no impact on purchasing decision. Neither does forced deliberation.
- CA and PNW residents may have a higher demand for Salmon Safe tires.
- Our results do not quantify the total economic benefits.
- Considerations for tire producers, retailers, environmental groups, and regulators.

Survey Design and Development

- (a) Informed consent
- (b) Concerns on general issues
- (c) Recent tire purchase behavior
- (d) Scientific info: text vs. video
- (e) Quiz on the narrative
- (f) "Salmon Safe" scenario
- (g) Quiz on the scenario
- (h) Dichotomous-choice elicitation
- (i) Choice certainty and reasoning
- (j) "Stoplight" exercise
- (k) Fishing and fish consumption questions



Descriptive Statistics

Binary decision to purchase Salmon Safe tire

Percentage of respondents (n=695) choosing Salmon Safe tires by premium and treatment type.

	1%	10%	25%	50%
Total % choosing Salmon Safe tires	90.7%	78.5%	54.6%	55.2%
By Information Presentation				
Text	88.0%	74.4%	58.1%	54.7%
Video	92.9%	82.6%	51.1%	55.7%
By Time To Think (TTT)				
No TTT	92.0%	84.9%	52.3%	53.2%
TTT	89.5%	72.1%	56.8%	57.0%

Among the respondents who said they would not purchase a conventional tire at the assigned premium, 80% said they would purchase the Salmon Safe tire if it cost the same as the conventional tire.

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Descriptive Statistics of Respondents

Variable	Description	Mean (sd)
Location		
CA	= 1 if California resident.	0.69 (census: 0.77)
WA	= 1 if Washington resident.	0.19 (census: 0.15)
OR	= 1 if Oregon resident.	0.13 (census: 0.08)
Demographics		
age35	= 1 if younger than 35 years old.	0.30
age36_50	= 1 if between 36 and 50 years old.	0.22
age51_64	= 1 if between 51 and 64 years old.	0.19
age65	= 1 if 65 or older.	0.30
AAVOC	= 1 if post high school vocational training, completed some college, or associates degree.	0.40
BACH	= 1 if bachelors degree	0.22
MASPHD	= 1 if masters, professional, or doctoral degree.	0.18
Income	Total combined annual income ($, thousands) of all members in their household before taxes.	68.5 (49.8)
White	= 1 if respondent identifies as White.	0.67
Black	= 1 if respondent identifies as Black or African American.	0.04
Native	= 1 if respondent identifies as American Indian or Alaska Native.	0.01
Political party		
Repub	= 1 if Republican.	0.27
Democr	= 1 if Democrat.	0.40
Indep	= 1 if political independent.	0.23
NoParty	= 1 if respondent preferred not to answer about party affiliation.	0.10
Vehicle attributes		
baseprice	the most recent cost of a set of four tires, including installation, paid by each respondent.	$731 ($438).
car	= 1 if respondent owns a sedan or small car.	0.49
decmaker	= 1 if respondent makes the decision on which tires to purchase by themselves or jointly with another household member.	0.87
Fishing behavior and environmental attitudes		
freqfish	= 1 if reported "frequently" recreational fishing.	0.10
occafish	= 1 if reported "occasionally" recreational fishing.	0.31
eatfish	= 1 if reported eating fish or procssed fish at least one meal/week.	0.29
envi	= 1 if "very" or "extremely" concerned about environmental issues.	0.60
water	= 1 if "very" or "extremely" concerned about water pollution.	0.64
endanger	= 1 if "very" or "extremely" concerned about endanger species.	0.52

- 75% purchased tires within the past three years.
- 53% female.
- Median age was 50 years old.
- Median household income was $55,000 - $59,999.

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Information Delivery Mode on Information Comprehension

	(1)	T-statistics
video	0.03	(0.35)
envi	-0.08	(-0.75)
water	0.13	(1.21)
endanger	-0.11	(-1.03)
AAVOC	0.25**	(2.15)
BACH	0.32**	(2.37)
MASPHD	0.21	(1.43)
age35	-0.62***	(-5.34)
age36_50	-0.41***	(-3.35)
age50_64	-0.11	(0.86)
Constant	3.87***	(25.59)
Observations	695	
R^2	0.073	

$\longrightarrow$ Video treatment was not a statistically-significant predictor of the test score.

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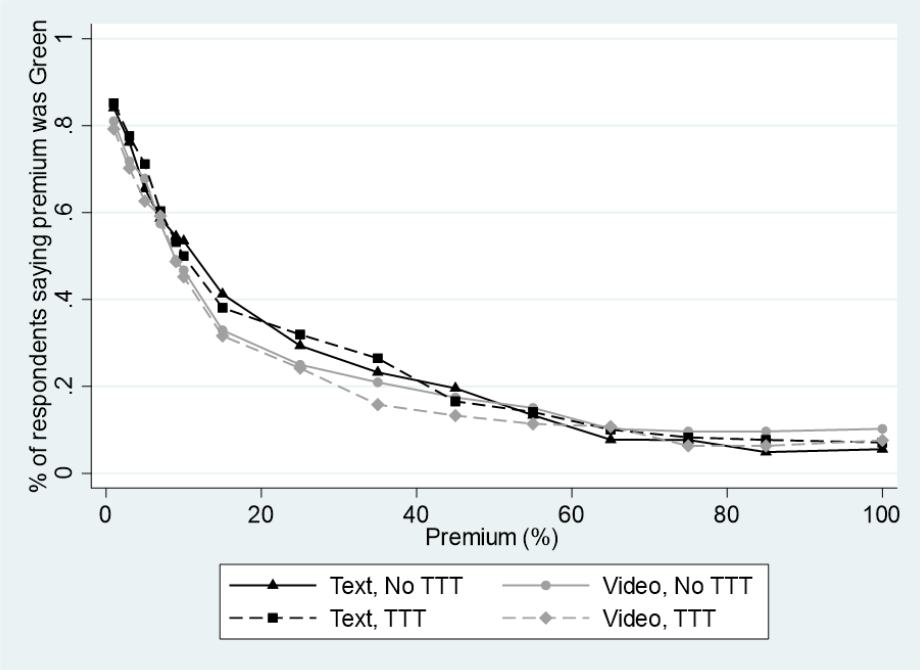
Does video or time-to-think treatment matter?



Probability of choosing Salmon Safe tires by video and time-to-think treatment.

- The video or time-to-think treatment did not affect the demand for Salmon Safe tires.
- Test statistic for a two-tailed test of differences in the average highest "green" premium:
  - by time-to-think treatment, t = 0.28.
  - by video vs. text, t = 0.208.

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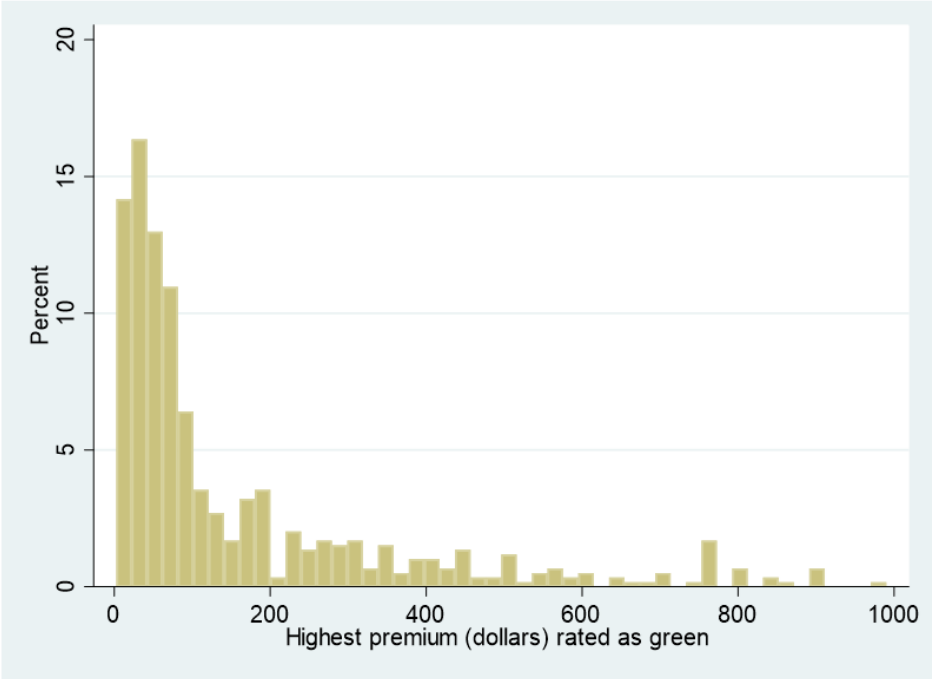
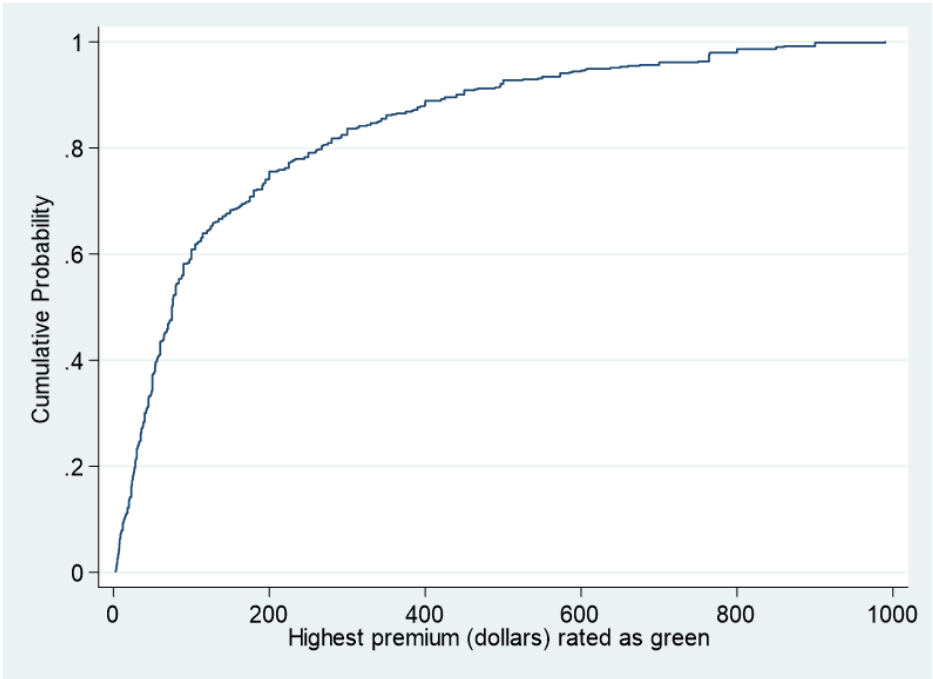
Distribution of the highest "green" premia



Excluding 12 outliers (over $1,000). The average highest "green" premium = $195.



The median highest "green" premium = $76. 25% of people were willing to pay a premium larger than $225.

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