

# Color and Economic Choice

Nicole A. Kato  
Swarthmore College  
Experimental Economics  
April 28, 2010

## Abstract

---

Does color, specifically red and green, affect a person's certainty equivalent in a price list format? To test this question, I created a series of price list questions where people to choose their preferences, but had the background be in either red or green. People who were given the price list questions with a red background had a higher certainty equivalent than if they were given the questions in green. This suggests that people, who were given the red questions, subconsciously viewed the price list in a more risk averse manner and therefore tended to have a higher certainty equivalent than people who were given the questions in green, who tended to be more risk seeking.

## Introduction

---

For years, economists have been studying risk and uncertainty in predicting economic choices but currently there is very little published work on how perception can alter these choices. One of the most common ways to study risk behavior is using a price list format. A price list format is a list of questions that asks subjects to choose between two different amounts of items or money based on the probability in receiving a certain amount of the item or money. With this information one can find a subject's certainty equivalent. A certainty equivalent is the value that a subject is indifferent between accepting a certain and an uncertain amount. This value is one way economists determine how risky a subject is.

The earliest study in economics using a price list format to elicit a subject's certainty equivalent was done in 1980 by Binswanger in rural India (Binswanger, Hans). Binswanger gave people, mainly farmers, a list of two choices with 50/50 probability of either receiving a high or low pay off. The people choose which low pay off he or she would be willing to risk for the chance to receive the high pay off. He found that people leaned towards to side of being risk averse (Binswanger, Hans).

While there are some commonly studied factors that could affect one's risk assessment, such as age, there are other factors that have not been studied in an economic setting, such as color. The typical belief of economists is that money is the underlying factor to economic choices, but what if economic choice was truly based upon how something was perceived. In psychology, studies have shown that people will perform differently by simply changing the color of an exam (Elliot et al).

Over time, economists have been able to further enforce the idea that people tend to be naturally risk averse using the price list format, with slight alterations over the years. Holt and

Laury in 2002 gave people two choices that involved separate probabilities and rewards. Also Dohmen et al. gave people two choices that involved a certain payment and a 50/50 chance to win either a high or low payment.

In the world of psychology, there have been several studies on how color affects people's perceptions. The earliest article was written by Goldstein in 1942. He conceptualized warm hues such as yellow and red as being disagreeable and cool hues such green and blue as being agreeable (Elliot et al). The most recent study was done by Elliot et al. at the University of Rochester in 2007. They gave people one of three tests, either in red, green or white. People who took the red exam scored significantly lower on the exam than people with green or white exams. The people who took the red exam also tended to lean away from the exam as if it were something unfavorable (Elliot et al).

By introducing varying colors, specifically red and green, in a price list model we can see how color changes people's risk aversion. I hypothesize that people will subconsciously perceive the color red as a stop sign and therefore have a higher certainty equivalent and therefore be more risk averse than if they saw green as a go sign.

## Procedure

---

First, a subject was given a questionnaire that asked basic personal questions about his or herself, as seen in Appendix A. Then the subject was given instructions to the experiment as seen in Appendix B, in addition to one dark chocolate miniature Resses for participation. One of the two binders was given to the subject with questions one through 14 given on separate pages as seen below in figure 1.

Question	Choice A	Choice B
1	5 M&Ms	1/15 of 25 M&Ms or 14/15 of 0 M&Ms
2	5 M&Ms	2/15 of 25 M&Ms or 13/15 of 0 M&Ms
3	5 M&Ms	3/15 of 25 M&Ms or 12/15 of 0 M&Ms
4	5 M&Ms	4/15 of 25 M&Ms or 11/15 of 0 M&Ms
5	5 M&Ms	5/15 of 25 M&Ms or 10/15 of 0 M&Ms
6	5 M&Ms	6/15 of 25 M&Ms or 9/15 of 0 M&Ms
7	5 M&Ms	7/15 of 25 M&Ms or 8/15 of 0 M&Ms
8	5 M&Ms	8/15 of 25 M&Ms or 7/15 of 0 M&Ms
9	5 M&Ms	9/15 of 25 M&Ms or 6/15 of 0 M&Ms
10	5 M&Ms	10/15 of 25 M&Ms or 5/15 of 0 M&Ms
11	5 M&Ms	11/15 of 25 M&Ms or 4/15 of 0 M&Ms
12	5 M&Ms	12/15 of 25 M&Ms or 3/15 of 0 M&Ms
13	5 M&Ms	13/15 of 25 M&Ms or 2/15 of 0 M&Ms
14	5 M&Ms	14/15 of 25 M&Ms or 1/15 of 0 M&Ms

(Figure 1: Price List Format)

The subject chose whether to receive five M&Ms under choice A, or take a risk on a chance of winning either 25 or zero M&Ms under choice B. The only difference between the binders was that all of the backgrounds for each question were in either red or green as seen in appendix C. The questions where the subject changed from choice A to choice B was determined to be the person's certainty equivalent.

After the subject made a decision on all of the questions, a random number generator, the iPhone application, "RandInt," was used to create a random number between one and 14. This

number associated to the question that would be followed through. If the subject chose the five M&Ms during for that question, the subject would receive the five M&Ms. If the subject chose choice B another random number was created between one and 15 to determine if the subject got either zero or 25 M&Ms.

## Results & Discussion

---

The experiment was conducted with 31 college students in the three following locations, Parrish building, Hicks Hall, and the Science Center at Swarthmore College. While doing the experiment I sensed that people in Parrish were more concerned about getting to their final location on time over experiment. This was sensed because of Parrish's location on campus in addition to the frequent number of people looking at their watches and asking me how long the experiment would take in Parrish. For this reason I separated the results into two groups, Parrish\_ce (certainty equivalents for subjects at Parrish building) and SciHicks\_ce (certainty equivalents for subjects at Science Center and Hicks Hall). A Mann-Whitney test was performed regressing Parrish\_ce and SciHicks\_ce onto whether a person had the questions in red, as seen below in figure 2 and 3.

Two-sample wilcoxon rank-sum (Mann-whitney) test			
red	obs	rank sum	expected
0	7	56	52.5
1	7	49	52.5
combined	14	105	105
unadjusted variance		61.25	
adjustment for ties		-3.37	
adjusted variance		57.88	
Ho: parris~e(red==0) = parris~e(red==1)			
z =		0.460	
Prob >  z  =		0.6455	

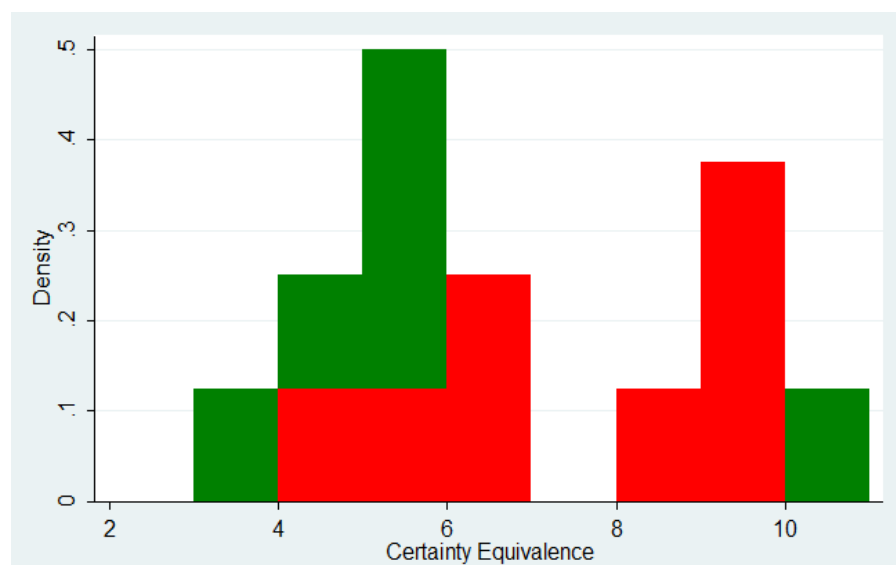
(Figure 2: Mann-Whitney Test for Parrish\_ce)

Two-sample wilcoxon rank-sum (Mann-whitney) test			
red	obs	rank sum	expected
0	8	51	68
1	8	85	68
combined	16	136	136
unadjusted variance		90.67	
adjustment for ties		-3.47	
adjusted variance		87.20	
Ho: scihic~e(red==0) = scihic~e(red==1)			
		z = -1.820	
		Prob >  z  = 0.0687	

(Figure 3: Mann-Whitney Test for SciHicks\_ce)

It can be seen that the p value for Parrish\_ce is not significant with 95% confidence, but SciHicks\_ce is almost significant with a p value of 0.0687. Therefore I focused whether my results were significant specifically significant with SciHicks\_ce.

Below in figure 4 is a histogram of the certainty equivalents found in the Science Center and Hicks Hall.



(Figure 4: Histogram for Certainty Equivalent in The Science Center and Hicks Hall)

Note: Red represents people given the questions in red and green represents people given questions in green.

Figure 4 suggests that when a subject was given the price list questions with a red background, the subject tended to have a higher certainty equivalent and therefore would be considered more risk adverse than if one was given the questions in green.

Below in figure 5 is a simple regression of the SciHicks\_ce onto the color background of the price list questions and other controlled variables that were found with the questionnaire as seen in appendix A.

Source	SS	df	MS			
Model	75.4345469	8	9.42931836	Number of obs = 16		
Residual	13.0029531	7	1.85756473	F( 8, 7) = 5.08		
				Prob > F = 0.0228		
				R-squared = 0.8530		
				Adj R-squared = 0.6849		
Total	88.4375	15	5.89583333	Root MSE = 1.3629		
scihicks_ce	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
red	4.965811	1.351222	3.68	0.008	1.770679	8.160942
age	2.807525	1.28853	2.18	0.066	-.2393634	5.854413
year	2.159358	.7285351	2.96	0.021	.4366468	3.88207
height	-.1358494	.1909034	-0.71	0.500	-.5872641	.3155654
female	-.1046858	1.962507	-0.05	0.959	-4.745278	4.535906
h	3.956663	2.926877	1.35	0.218	-2.964302	10.87763
ns	5.40058	2.758281	1.96	0.091	-1.121718	11.92288
northeast	1.62	1.329529	1.22	0.263	-1.523835	4.763836
_cons	-4392.544	1479.41	-2.97	0.021	-7890.793	-894.2942

(Figure 5: Simple Regression of SciHicks\_ce)

Red is a dummy variable that is equal to one if the subject was given the price list questions in red and zero if the subject was given the price list questions in green. Age is the age of the subject. Year is the year of graduation of the subject. Height is the height in inches of the subject. Female is a dummy variable that is equal to one if the subject is female and zero if the subject is male. H is one if the subject is a humanities major and zero if not. NS is one if the subject is a



natural science major and zero if not. Northeast is one if the subject's hometown is considered either a Mid Atlantic or East Coast state.

Considering 95% confidence, it was found that only the variables of red and year were statistically significant with each having a p values of 0.008 and 0.021 respectively. A significant robust red and year p value of 0.016 and 0.041 respectfully were also found using the same variables as seen in appendix D. This suggests that altering the background color of the price list questions to either red or green has a significant impact to one's certainty equivalent and therefore his or her level of risk aversion.

## Conclusion

---

With such a small sample size in addition to the high chance of there being omitted variable bias, it is quite surprising that changing the color background of the price list questions would have such a high statistical significance in both the OLS and robust regressing. This high significance suggests that with improvements on the constraints and the sample size the color would still produce statistically significant results.

With these results I am considering applying for a grant to continue this study, but with a few modifications. I would first get more background information on each subject in addition to having all of the subjects be tested in the same location. While doing this experiment I felt that some college students value candy almost as much as money however, further studies however would use money instead. I would also have the choices be reversed to see how that also affected choices. Finally, I would also like to test both green and red against a basic white background of the price list questions. In addition to creating a program using Ztree or some other economic computer program, to test the subjects on instead of pen and paper.

While perception has been a field in psychology for several years, it is a field that economists are hesitant to research, because it goes against the idea that people's decisions are based off of perfect information and money. Overall I feel that this experiment has had exceptional results given the underlying circumstances. Importantly, the experiment demonstrated that perception can confound actions that previously were interpreted to be strictly due to market forces.

## Appendix A: Questionnaire

---

**Age:** \_\_\_\_\_

**Year:** \_\_\_\_\_

**Height:** \_\_\_\_\_

**Gender:** \_\_\_\_\_

**Division of Major (check all that apply):**

Humanities ☐ Natural Science ☐ Social Science ☐

**Home State:** \_\_\_\_\_

## Appendix B: Description of experiment that will be given to subject before study

---

Please take the following price list experiment seriously because at the end of the experiment, one of the decisions you have made will be played out and you could possibly win candy!

The following is a description of the experiment:

You will be given two options (A or B). You must decide which option you prefer. Check the box on the additional page that corresponds to the option that you prefer. After you have checked the box, if the arrow says “Please go to next page,” go to the next page. If the arrow says, “End,” please tell me so that I can randomly select one of your choices, and either give you the 5 M&Ms if you selected option A, or else randomly determine if you get 0 or 25 M&Ms if you chose option B.

Note: I will use a die Iphone application to randomly select one of the choices.

Make sure every number on the additional page is answered.

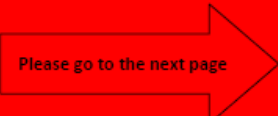
If you have any questions just ask me.

Thank you.

## Appendix C: Example of one of the questions in red and green

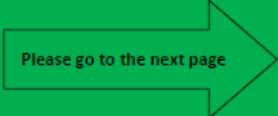
1

Choice A	Choice B
10 M&Ms	1/15 of 25 M&Ms or 14/15 of 0 M&Ms



1

Choice A	Choice B
5 M&Ms	1/15 of 25 M&Ms or 14/15 of 0 M&Ms



## Appendix D: Robust regression

Robust regression					Number of obs = 15	
					F( 7, 7) = 2.75	
					Prob > F = 0.1026	
scihicks_ce	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
red	5.080636	1.608038	3.16	0.016	1.27823	8.883041
age	2.857626	1.53343	1.86	0.105	-.7683605	6.483612
year	2.165007	.867002	2.50	0.041	.1148733	4.215141
height	-.140219	.2271869	-0.62	0.557	-.6774306	.3969926
female	-.0700316	2.335506	-0.03	0.977	-5.592625	5.452562
h	-1.568765	1.650144	-0.95	0.373	-5.470735	2.333205
ns	(omitted)					
northeast	1.526434	1.582222	0.96	0.367	-2.214925	5.267794
_cons	-69.14369	31.01926	-2.23	0.061	-142.4926	4.205213

## **Appendix E: List of Works Cited**

---

Binswanger, Hans. "Attitudes toward Risk: Experimental Measurement In Rural

India." American Journal of Agricultural Economics 1980, 395-407.

Dohmen et al. "Individual Risk Attitudes: Measurement, Determinants and Behavioral

Consequences." Journal of The European Economic Association -----.

Elliot et al. "Color and Psychological Functioning: The Effect of Red on Performance

Attainment." Journal of Experimental Psychology: General 2007, 154-168.