International Journal of Business and Social Research
Volume 06, Issue 07, 2016

Risk Preferences and Obesity: A Behavioral Economics Approach

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ABSTRACT

Risk aversion has been shown to have a negative effect on adverse health behaviors such as smoking and heavy alcohol consumption. However, the significance and sign of the effect of risk aversion on the tendency to be obese has not been established in previous research. Additionally, the knowledge of specific health risks arising from obesity has been shown to have a significant negative effect on obesity, although the interaction between health risk awareness and risk aversion has not been studied. This paper fills this gap in the literature by studying the relationship between risk preferences, health risk knowledge and the occurrence of obesity within. In this paper, data from a nationally representative survey of adults in the United States is used to determine the significance of measures for both risk aversion and health risk knowledge on the likelihood of obesity, while controlling for the usual variables shown by previous research to be predictors for obesity. Risk aversion is found to have a positive and significant effect on obesity within the general population; however, this effect loses its significance within sub-populations who exhibit awareness of the health risk from obesity, as measured by two different proxy variables.

Keywords: Behavioral economics, health risk knowledge, measures of risk preference, obesity, risk aversion.
JEL Codes: C21, D03, I12.
Available Online: 12-08-2016.

1.0 INTRODUCTION

The relationship between individual risk preferences, as exhibited in economic experiments, and the propensity to indulge in risky health behaviors has not been established in the economics literature. Cutler and Glaeser (2005) show that there is little correlation between 5 different forms of risky health behaviors (smoking, heavy alcohol use, being obese, not taking recommended medication and not undergoing medical tests), and concludes that individual characteristics such as genetics and behavioral-specific factors are likely to be important drivers of such health behaviors. Due to the conceptual importance of risk preferences in models of decision-making, individual risk preferences may be

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implicated as one of the individual characteristics that drive the propensity to engage in such behaviors. But the direction in which risk aversion might influence a specific type of health behavior remains unclear.

Dave and Saffer (2008) study risk preferences within a model of alcohol demand and find that risk aversion has a significant negative effect on alcohol consumption. Similarly, Barsky et al (1997) find that their experimental measure of risk aversion is significantly and negatively associated with behaviors such as smoking and failing to hold insurance. However, Picone et al (2004) find that risk-averse individuals are less likely to take needed medical tests, possibly because they do not want to discover they are at risk for a difficult or expensive procedure.

1.1 OBESITY AS A HEALTH BEHAVIOR

Obesity prevention, as a health behavior, may have more in common with preventative care than thrill-seeking behaviors such as smoking or heavy alcohol consumption. However, Anderson and Mellor (2008) study obesity/overweight as a health behavior, along with smoking, heavy drinking and seat-belt non-use, and find that risk aversion (as measured by an experimental lottery-based instrument) has a significant negative effect on all these health behaviors. While these results are consistent with other studies with regards to behaviors such as smoking and drinking, there are several reasons why the relationship between obesity and risk aversion found by Anderson and Mellor (2008) is worth investigating further. Firstly, the study includes both overweight and obese respondents under a single category, though it would be of interest to study the risk preferences of the narrower group of obese respondents. Secondly, as noted in the study, the sample of respondents exhibited much smaller rates of obesity/overweight than the national average. Thirdly, also as noted in the study, the sample of respondents were highly educated, with 30% holding a graduate degree, and it is possible that this introduces a bias into the relationship between risk aversion and obesity/overweight. The last point is especially relevant in the light of Davis et al (2010), who found previous results showing a significant relationship between obesity and risky decision-making in the Iowa Gambling Task (reported in Davis et al, 2004) became insignificant once education levels were added to the model. This study addresses these issues by using a nationally representative survey of the U.S population aged between 45 and 52 years, as well as focusing on the relationship between risk aversion and obesity, instead of the larger population of overweight respondents.

1.2 HEALTH RISK KNOWLEDGE

Any model of behavioral determinants of obesity will also need to take into account the levels of health risk knowledge exhibited by individuals. Unlike health behaviors such as smoking and alcohol consumption, which require a deliberate action to indulge in the unhealthy behavior, the tendency to become obese may not always manifest itself as deliberate action to become obese, e.g., by over-eating. Instead, obesity may be the result of not indulging in preventative behaviors, such as paying attention to the nutritional content of food and taking part in regular exercise. For example, Kan and Tsai (2004) show that the acquisition of health risk knowledge by itself can have a significant effect on obesity.

1.3 EXPERIMENTAL MEASURES FOR RISK PREFERENCE

As with any study on risk preferences, the fidelity of the survey instrument used to measure risk preference is an important aspect of the design of the study. The instrument used in this study to measure risk aversion is a version of the hypothetical gamble between two prospective sources of income described in Barsky et al (1997). An important issue with using this instrument is that there is no incentive provided, and therefore the response to the gamble may not capture true risk preferences. To mitigate this concern, this study uses the respondent's self-assessment of risk preference in combination with the experimentally determined value, in order to arrive at a robust measure of risk aversion. Previous studies, such as Dohmen et al (2011) have shown that self-assessment of risk preference is usually consistent with propensity to engage in real-life risky behaviors, and therefore the use of such an

assessment in combination with the experimental measure provides more confidence that the respondent's risk preference is being accurately measured.

1.4 RESEARCH QUESTIONS

To summarize, this paper advances the research on the relationship between obesity and risk preferences in the following ways:

- Construction of a measure of risk aversion that combines experimental results with the respondent's self-assessment of risk preferences.
- Investigation of the relationship between risk aversion measured in this fashion, and obesity in a diverse, nationally representative sample of adults aged between 45 and 52.
- Comparison of the results obtained for sub-populations who exhibit awareness of health risk.

2.0 DATA

The NLSY79 is an ongoing survey of a nationally representative sample of 12,686 men and women living in the United States. The respondents have been surveyed annually every year from 1979 to 19 94, and once every two years from 1994 to 2010. The NLSY79 respondents were aged 14 to 22 at the beginning of the survey, and this study uses data from the 2010 wave, when they were aged between 45 and 52. Due to attrition, the sample size of respondents who answered the relevant questions in the 2010 wave used in this study is 7,369.

2.1 RISK AVERSION

The NLSY79 provides a rich set of individual characteristics for each respondent, and the 2010 wave included questions on risk preference detailed below:

> **RISK 1:** Suppose that you are the only income earner in the family, and that you have to choose between two new jobs. The first job would guarantee your current total family income for life. The second job is possibly better paying, but the income is less certain. There is a 50-50 chance the second job would increase your total lifetime income by 20 percent and a 50-50 change that is would cut it by 10 percent. Which job would you take: the first job or the second job?

Respondents who chose the second job in response to question RISK1 were asked the following question:

> **RISK 2:** Suppose the chances were 50-50 that the second job would increase your total lifetime income by 20 percent, and 50-50 that it would cut it by 15 percent. Would you take the first job or the second job?

Respondents who chose the first job in response to question RISK1 were asked the following question:

> **RISK 3:** Suppose the chances were 50-50 that the second job would increase your total lifetime income by 20 percent, and 50-50 that it would cut it by five percent. Would you take the first job or the second job?

Also, all respondents were asked to self-rate their attitude towards the question below.

> **RISK 4:** Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Rate yourself from 0 to 10, where 0 means "unwilling to take any risks" and 10 means "fully prepared to take risks."

For this study, we denote all respondents who chose the first job in response to questions RISK1 and RISK3 in addition to self-rating their risk preference between 0 and 4, as being "risk averse." As described earlier, this combination of the experimentally-determined risk preference and self-rated score should prove more accurate than risk preferences determined purely through hypothetical gambles.

2.2 HEALTH RISK KNOWLEDGE

Three questions from the 2010 wave of the NLSY79 are used to control for the awareness of the respondent of health risks posed by obesity.

HEALTH 1: When you buy a food item for the first time, how often would you say you read the nutritional information sometimes listed on the label - would you say always, often, sometimes, rarely or never?

HEALTH 2: Are you now trying to lose weight, gain weight, stay about the same, or are you not trying to do anything about your weight?

HEALTH 3: How often do you do light or moderate activities for at least 10 minutes that cause only light sweating or slight to moderate increase in breathing or heart rate?

Respondents who answer that they read the nutritional information always or often in response to HEALTH 1 are coded with the value 1 for a created variable called "Read Nutritional Information". Similarly binary variables are created for respondents who answer that they are trying to lose weight in response to Health 2 (called "Trying to Lose Weight") and for respondents who answer that they never (or are unable to) exercise in response to question HEALTH 3 (called "Never Engages in Exercise).

2.3 BODY MASS INDEX (BMI) & OBESITY

The Body Mass Index (BMI) was calculated for each participant based on their height and weight in 2010. Per the usual guidelines, respondents were coded as obese if their BMI is greater than or equal to 30. Where overweight is shown as a variable in the analysis, the definition of overweight used is that the BMI is greater than or equal to 25 and less than 30.

3.0 ANALYSIS

3.1 SUMMARY STATISTICS

Summary statistics for the key variables used in this study are shown in Table 1. These statistics are in line with previous research, showing a risk aversion rate of 38.6% which is slightly lower than previous estimates such as Dave and Saffer (2008), who estimated it at 42.9% for this age-group – but within reasonable limits of consistency, given that this study is using a two-pronged method to confirm risk aversion. The percentage of obese respondents, 37.4, is also consistent with previous studies on the US population.

Table 1: Summary statistics key variables

Variable	Mean	Standard Deviation
Risk Aversion (1=Averse)	0.386	0.487
Overweight (1=Overweight)	0.752	0.432
Obese (1=Obese)	0.374	0.484
Read Nutrition Information (1=Yes)	0.497	0.500
Never Engages in Exercise (1=Never)	0.262	0.439
Currently Trying To Lose Weight (1=Trying)	0.465	0.499
BMI	29.166	6.200

To explore the distribution of BMI further, Tables 2-4 show the percent quantiles for the distribution of BMI within the risk-averse respondents and the not risk-averse respondents for three populations: Table 2 shows the distribution for the full sample, Table 3 for the sub-sample of respondents who were coded as reading nutritional information while shopping for food, and Table 4 for the sub-sample of respondents who were coded as trying to lose weight.

Table 2: BMI quintiles for full sample population

Percent	Not Risk Averse	Risk Averse
1	18.5979	19.1284
5	20.9803	21.2547
10	22.4263	22.5941
25	24.9637	25.0647
50	27.9865	28.3396
75	32.075	32.7305
90	36.4879	37.7855
95	39.7973	41.5976

Table 3: BMI quantiles for sub-sample who read nutritional information

Percent	Not Risk Averse	Risk Averse
1	18.5595	19.2027
5	20.7988	21.1599
10	22.3125	22.4327
25	24.8865	24.9586
50	27.8913	28.1639
75	32.0946	32.6099
90	36.5765	37.5852
95	39.6211	41.5976

Table 4: BMI quantiles for sub-sample trying to lose weight.

Percent	Not Risk Averse	Risk Averse
1	21.2846	21.4806
5	23.4908	23.1702
10	24.9586	24.5247
25	27.1219	27.4324
50	30.3411	30.7276
75	34.3852	35.3002
90	39.0556	40.4133
95	42.717	43.754

Each of these tables shows that the risk-averse population has a higher BMI threshold in every quantile of the BMI distribution. For the full sample, the 90 percent quantile is a full point of BMI higher for the risk-averse population when compared with everyone else. The sub-sample of respondents who read nutritional information have a lower BMI, and the sub-sample of those trying to lose weight have a higher BMI, at every quantile when compared to the overall population. This can be explained by the higher likelihood that respondents who are trying to lose weight are motivated to do so due to being overweight or obese, compared to either the general population or respondents who regularly read nutritional information. Interestingly, the risk averse population in both sub-samples show a higher BMI threshold in every quantile, similar to the overall population. Thus, the summary statistics provide early support for the idea that risk aversion, and not risk-taking, may be associated with higher BMI.

3.2 ESTIMATION RESULTS

Next, the following model specification is estimated:

$$Logit[Prob(O_i = 1)] = \beta_0 + \beta_1 X_i + \beta_2 R_i + \beta_3 H_i \quad \textbf{Equation (1)}$$

where O_i is a dichotomous variable which indicates whether the respondent is obese at the time of the survey; X_i represents a set of individual characteristics such as age, gender, educational level and household income & net-worth that have been shown to influence the tendency to become obese; R_i is a dichotomous variable that codes the risk aversion of the respondent as described in Section 2; H_i represents the 3 different methods to capture health risk knowledge of the respondent which are described in Section 2.

Estimation results are shown as Odds Ratio Estimates in Table 5 for readability. Many of the variables shown as having significant effects on obesity in Table 5 are well-established predictors of obesity, thus giving confidence to the study methodology and survey measures used. The strongest significant negative effect observed in Table 2 is that when the respondent is trying to lose weight, followed by race and whether the respondent reads nutritional information on food labels. These are all expected results; but the interesting finding for the purpose of this study is that risk aversion has a significant, positive effect on the likelihood of being obese. In fact, the positive effect of risk aversion is large enough to offset the negative effect of the variable that captures whether the respondent reads nutritional labels.

Table 5: Odds ratio estimates for determinants of obesity

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Race (1=Not Hispanic or Black)	**0.706***	0.63	0.791
Regular Exercise (1=No Exercise)	1.025	0.913	1.151
Years of Schooling	**0.964***	0.94	0.989
Household Net Worth	**0.938***	0.919	0.961
Reads Nutritional Labels (1=Yes)	**0.869***	0.782	0.966
Age	1.008	0.986	1.031
Married (1=Yes)	**0.943***	0.904	0.984
Risk Averse (1=Yes)	**1.196***	1.079	1.325
Trying to Lose Weight (1=Yes)	**0.619***	0.594	0.645
Gender (1=Female)	0.913	0.822	1.015
(* indicates significance at 5% Level).			

Tables 6 and 7 further explore the idea of health risk information and its effect on the relationship between risk preference and obesity. Table 6 shows Equation 1 re-estimated with a sub-sample of the survey population who read nutritional information on food labels, and Table 7 shows the re-estimation with the sub-sample who are trying to lose weight.

Table 6: Determinants of obesity (sub-sample of respondents who read nutritional info).

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Race (1=Not Hispanic or Black)	**0.731***	0.62	0.863
Regular Exercise (1=No Exercise)	1.038	0.868	1.241
Years of Schooling	0.966	0.932	1.001
Household Net Worth	**0.927***	0.908	0.95
Age	1.031	0.998	1.065
Married (1=Yes)	**0.887***	0.832	0.945
Risk Averse (1=Yes)	1.08	0.929	1.255
Gender (1=Female)	**0.807***	0.692	0.942
Trying to Lose Weight (1=Yes)	**0.555***	0.52	0.592
(* indicates significance at 5% Level).			

Demographic and economic variables such as race, marital status and net worth continue to be significant determinants of obesity in the sub-population of respondents who reporting reading nutritional labels. In addition, gender shows a significant effect, with women being significantly less likely to be overweight and education loses significance at the 5% level, though it continues to be associated with a slightly lowered chance of obesity at the 10% level of significance.

Table 7: Determinants of obesity (sub-sample of respondents trying to lose weight).

Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Race (1=Not Hispanic or Black)	**0.581***	0.495	0.682
Regular Exercise (1=No Exercise)	0.973	0.821	1.154
Years of Schooling	0.969	0.937	1.003
Household Net Worth	**0.933***	0.914	0.967
Age	1.003	0.972	1.035
Married (1=Yes)	**0.928***	0.875	0.984
Risk Averse (1=Yes)	1.061	0.918	1.227
Gender (1=Female)	**0.637***	0.547	0.741
Reads Nutritional Labels (1=Yes)	1.009	0.871	1.169
(* indicates significance at 5% Level).			

The sub-population of respondents who are trying to lose weight show similar characteristics to those who read nutritional label s, with the demographic variables representing gender and race both having much stronger effects while retaining significance. Remarkably, neither of these two subsamples show significant effect of risk aversion on the likelihood of being obese though the effect of the demographic variables remains similar.

4.0 DISCUSSION

This study uses an experimentally-obtained of risk preference, which is further validated by a self-assessment, to show that risk aversion is significantly associated with higher levels of obesity in a representative sample of the US population. Further, when knowledge of health risk is taken into account, using proxy measures for nutritional awareness and motivation to lose weight, the significance of risk aversion with regard to obesity disappears, and demographic factors are found to have both stronger and wider-ranging effects on the likelihood a respondent being obese.

The results also show that many demographic and socioeconomic determinants of obesity, such as race, income levels, years of schooling and marital status, are significant determinants of obesity in the overall population. This is consistent with the research literature on obesity risk, and increases the confidence that the relationship shown between risk preference and obesity is indeed a new finding, which is not correlated with the well-known socioeconomic factors. Further, the fact that gender emerges as a significant determinant of obesity risk in the sub-samples of respondents who have greater health risk knowledge provides an independent verification of Kan and Tsai (2004), who similarly found gender-specific effects of the health risk knowledge on obesity.

This difference in the significance of risk aversion in the two sub-samples provides us with a valuable clue as to the nature of the mechanism that may be linking risk aversion and obesity in the full population. Since risk-averse individuals have been shown to be less likely to avail themselves of health risk information and tests, the same effect might make them averse to discovering facts (such as nutritional information) that can reveal unwelcome facts about their current diets. Such an effect would, obviously, disappear when looking at risk-averse individuals in sub-populations who have already made the decision to avail themselves of health risk information. Thus the results consistently support the hypothesis that risk-averse behavior is significantly associated with greater obesity risk.

5.0 CONCLUSIONS AND POLICY IMPLICATIONS

This study advances the strand of research that seeks to determine whether the classification of obesity as a risky health behavior in much of the prior research is valid, and whether obesity might be better characterized by a failure to engage in healthy, preventative behaviors. The correct characterization of the behavioral profile of people who are likely to become obese is an important policy consideration, given the economic impacts of increasing obesity in the US population. In particular, as Mullahy & Sindelar (1994) demonstrate, policy that does not take risk preferences into account may seriously underestimate the cost of health interventions, and undermine economic models of healthcare. Therefore, if a set of risk preferences were seen to be significantly associated with obesity, the set of policy tools being used for economic modeling of obesity and related health issues can be calibrated to better fit individual heterogeneity in decision-making.

The need for incorporating behavioral economics into the design of incentives for healthy behavior have been well-studied in the research literature. In particular, as Volpp et al (2009) show, there is enormous potential for improving health outcomes if incentives are designed with the biases that inform decision-making are taken into account. While behavioral patterns such as time discounting have been researched for their effect on health, this study indicates that policies that are targeted towards risk averse populations might provide enhanced health outcomes, since the findings indicate that such populations are at heightened obesity risk, even after accounting for the usual socioeconomic and demographic factors. As previous research in health policy shows, the same bias that causes poor health-related decisions can be used to make incentives more effective once the bias is understood. In this case, if risk-averse populations are at greater obesity risk, structuring incentives as penalties will be expected to generate better outcomes than structuring them as benefits. And regardless of the actual design, policies that do not take into account the risk preferences of the population will have sub-optimal outcomes compared to policies that do take this important factor into account.

Future research can look at the complete question of the propensity to seek health risk information, and how it interacts with risk preferences, given that risk preferences do not appear to be significantly associated with obesity risk in individuals with better health awareness. Longitudinal studies that measure changes in risk preference, and investigate the relationship between such changes and health behaviors will also provide insight into the design of optimal health policies. Given the importance of obesity risk to public health and related economic issues in the United States, the results shown here indicate that the structuring of incentives to specifically appeal to risk-averse individuals is an area of research that needs urgent and sustained focus from policy-makers.

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