TESTING FOR THE ENDOWMENT EFFECT IN CHILDREN

by

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A THESIS

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Consistent experimental evidence has shown that, contrary to theory, their is a persistent gap in an individual's willingness to pay and to accept compensation. One of the explanations for this anomaly is the endowment effect. The endowment effect is the notion that an individual will value a good more highly when considering decisions that involving disposing of the good versus decisions that involve the acquisition of an equal good. The result of this asymmetry is that indifference maps have to be drawn with reference to unique endowments of goods, with discrete segments representing acquisition and disposal decisions. The result is that indifference curves are "kinked", and therefore produce a significant willingness to pay and willingness to accept gap.

While current experiments are supportive of the endowment effect, there has been no experiments run that test for the endowment effect in children. As a result, economists can only speculate on whether the endowment effect is an acquired characteristic or an innate trait. My experiment tested for the endowment effect on a mixed class of fourth and fifth graders, using the BDM procedure to illicit bids for goods in three round of a simulated market. My results are robustly supportive of the endowment effect in children.

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I. INTRODUCTION

One of the underlying assumptions of consumer theory is that the measures of the maximum amounts people will pay to avoid a loss and the minimum compensation necessary for them to accept it are approximately equal.[1] Many economists have therefore become disheartened by the consistent empirical evidence which suggests that consumers demand a higher level of compensation to give up a good than they are willing to pay to acquire it.[2] This anomaly is commonly referred to as the willingness to pay (WTP) willingness to accept (WTA) disparity. Economists have offered several suggestions for this anomaly and many believe that consumer theory needs to be adjusted to account for these discrepancies. The rationale that I examine in this thesis is the endowment effect, a term popularized by Richard Thaler in 1980. In order to better facilitate a discussion of the endowment effect, it is worthwhile to first go over the key elements of consumer theory.

The Basics of Consumer Theory

One of the main tools of consumer theory is indifference curves. Indifference curves are simply graphical representations of all the different bundles of consumer goods that yield some utility level. Utility is the units by which economists measure individual's well-being. It is important also to note that by assumption, higher levels of

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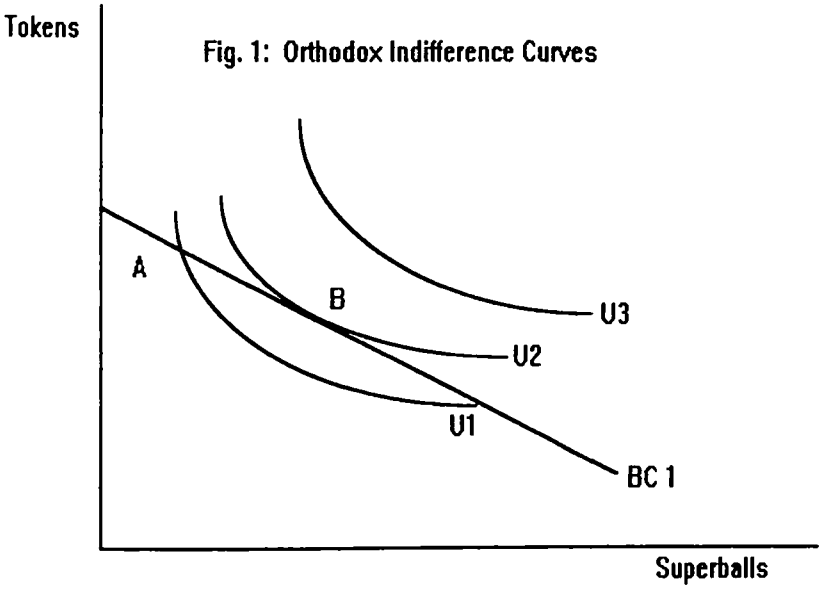
[1]Willig (1976)

[2]For experimental evidence see Coursey, Hovis, and Schulze (1987); Kahnman, Knetsch, and Thaler (1990); and Knetsch and Sniden (1984)

utility are always preferred and consumers will make decisions such that they maximize their utility. Hence, people are considered utility maximizers. Suppose there are two goods, tokens and superballs. A consumer will purchase various quantities of tokens and superballs limited by income and the price of the goods such that the consumer's utility is maximized. This utility maximizing bundle of goods occurs where the indifference curve is tangent to the budget constraint (BC), or the ratio of the marginal utilities of the goods are equal to the ratio of the good's prices. An example of this type of utility maximizing behavior is illustrated in Figure one.



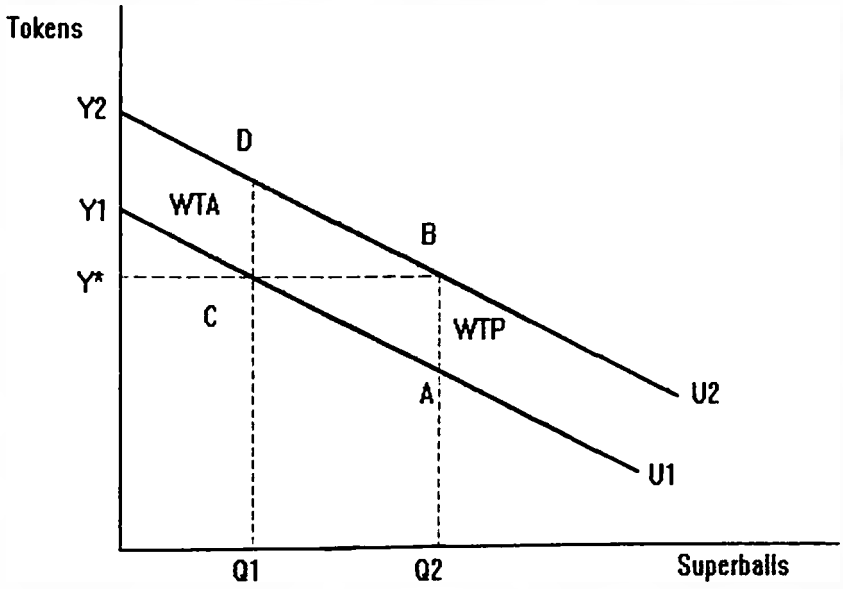
For example, suppose Jane starts with some initial endowment of tokens and superballs, point A. At point A, Jane receives some level of utility, represented by the indifference curve U1. However, Jane can maximize her utility by giving up beer and buying more pizza, moving down her budget line (BC1) until she is tangent to indifference curve U2 at point B. Given her budget constraint, indifference curve U3 is not accessible.

II. WTP AND WTA: ORTHODOX THEORY AND EXPERIMENTAL RESULTS

The Substitution Effect

Armed with this bit of economic know-how, we can now tackle consumer theory's claim that consumers willingness to pay should be roughly equivalent to their willingness to accept compensation. Economics acknowledges two effects that determine the size of the WTP-WTA gap: the substitution and income effect. The relative scarcity or substitutability of a good will determine the shape of the indifference curves. For example, a good with perfect substitutes will have flat indifference curves and as a result, will yield no WTP-WTA gap. Consider the indifference curves in figure 2.

Fig. 2: Indifference Curves for Perfectly Substitutable Goods



Suppose I was to reduce an affected individual's holdings of superballs from Q2 to Q1, while holding their amount of Tokens at Y*. The effect of this action will be to bump the person from point B and the corresponding level of utility U2, to point C and the corresponding level of utility U1. Now consider the same individual, holding Q2 of superballs and constrained by the smaller budget constraint. In order to achieve the indifference curve U2, the consumer would have to pay AB, this is the amount the consumer is theoretically willing to pay (WTP) for an increase in utility. However, it is also possible that I would be willing to compensate affected consumers for their utility loss, in exchange for the consumer's willingness to give me their superballs. The amount of compensation that the affected consumers would demand is equal to CD, the amount necessary to return the consumer to their previous utility level. The distance CD is referred to as the consumer's willingness to accept compensation (WTA). Notice that AB and CD are both equal to Y1Y2, hence WTP and WTA for goods with perfect substitutes should be relatively equal.[3]

However, there is also the case where goods do not have perfect substitutes. In this situation the indifference curves will be have a traditional curve shape which will produce a small WTP-WTA gap. Figure three illustrates this small gap.

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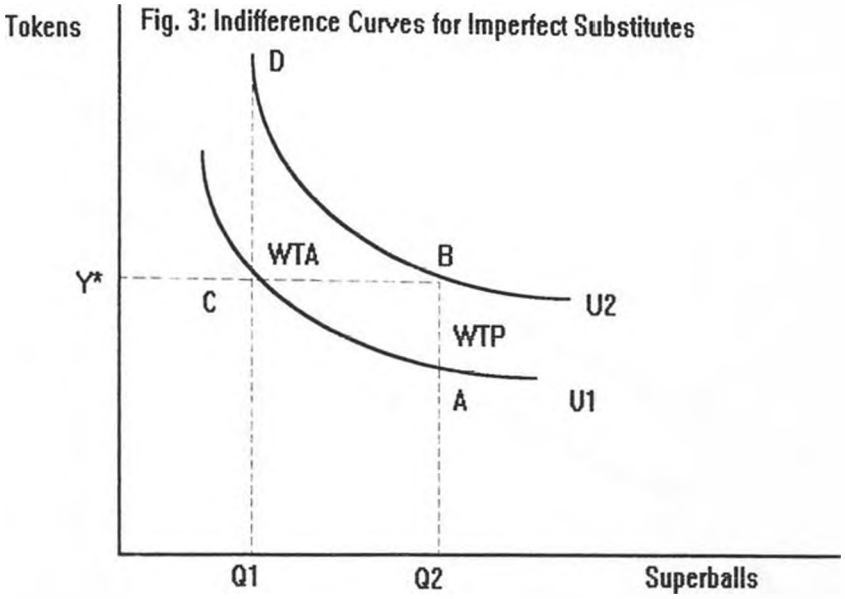
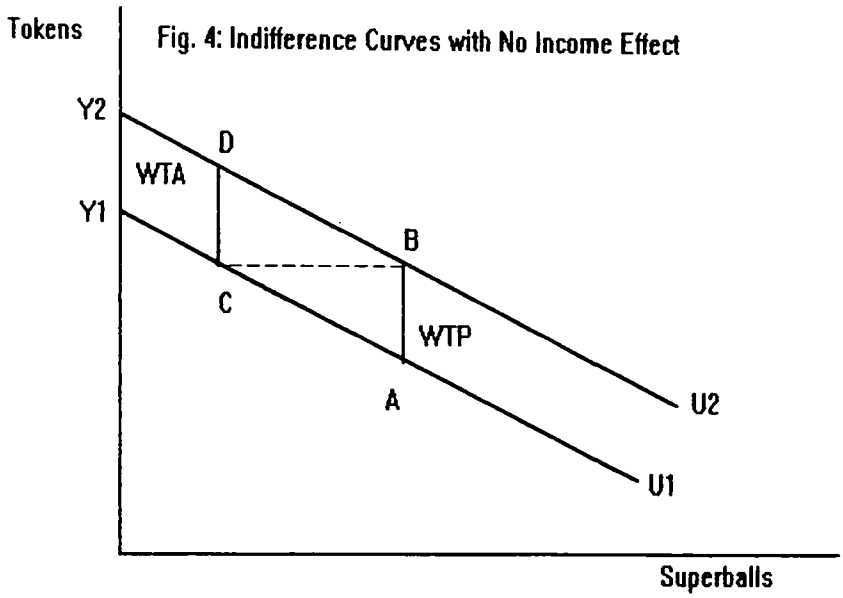
[3]Randall and Stoll (1980)



Willingness to pay is again AB, while willingness to accept is CD. Notice that because of the curvature of the indifference maps, willingness to accept is slightly larger than willingness to pay.

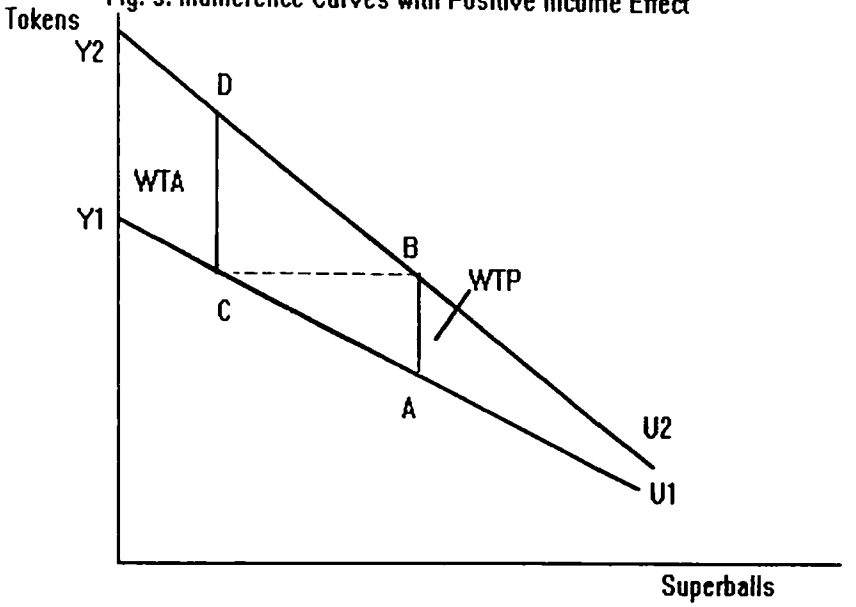
The Income Effect

The income effect is another occurrence that can produce a WTP-WTA gap. Consider a good with perfect substitutes whose consumption does not vary with income. In this circumstance, an increase of income will have no effect on consumption patterns and will result in a WTP-WTA equality. Figure four illustrates this example.



In figure four, a change in income (tokens), will not affect the relative quantity of superballs consumed. As a result, any willingness to pay and willingness to accept measurements will be equal. However, this circumstance is a bit unusual. Most goods are considered normal goods. That means the consumption of them is positively related with income. A normal good produces an income effect, a change in consumption based on a change in income. The implication being that the measurements of willingness to pay and willingness to accept will be different. Figure five provides a graphical example.

Fig. 5: Indifference Curves with Positive Income Effect



The slope of U2 is steeper, illustrating the increased demand for superballs due to an increase in tokens. As a result, willingness to accept measurements are greater than willingness to pay measurements.

While the income and the substitution effects are able to produce WTP-WTA gaps, the magnitude of the effects are not robust enough to explain the gaps produced in experimental studies. Empirical evidence suggests that willingness to accept is generally much greater than willingness to pay. In this case figure six, which features "kinked" indifference curves, U1 and U2, may be a more appropriate representation of the "costs" for transactions that involve giving up a good. A scenario such as figure six would suggest the presence of "separate indifference maps to illustrate acquisition and disposal decisions.[4]

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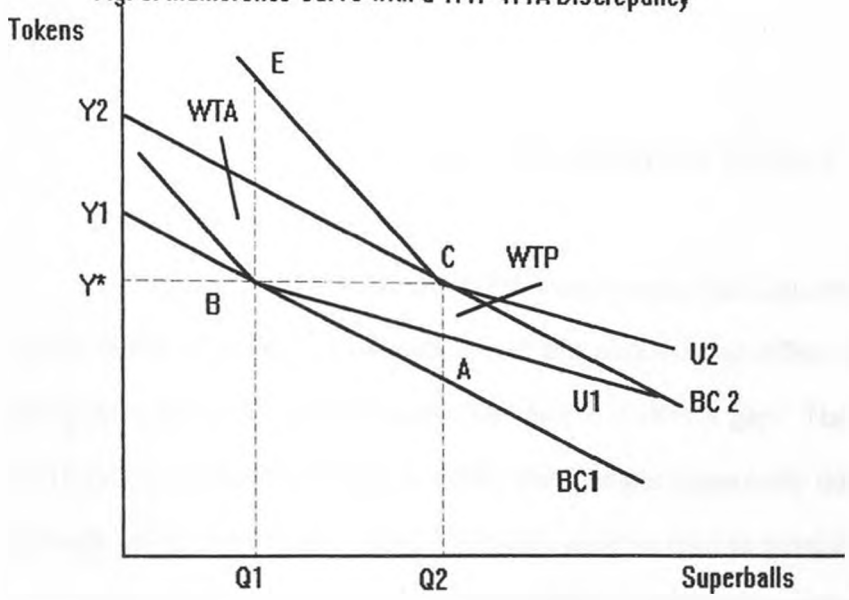
[4]Knetch and Sniden (1990) p.519

Fig. 6: Indifference Curve with a WTP-WTA Discrepancy



III. THE ENDOWMENT EFFECT

The presence of separate indifference maps for acquisition and disposal decisions is one of the theoretical implications of the endowment effect, which is the focus of my thesis and one of the explanations for the WTP-WTA gap. The endowment effect is a term used to describe the extra utility that people apparently derive from a good merely through possession of the good. The old adage: a bird in hand is worth two in the bush, is an apt summation of the rational behind the high value placed on endowed goods. In one of the seminal papers on the subject, Kahneman, Knetch, and Thaler describe the endowment effect as a manifestation of prospect theory, the principle that losses are weighted substantially more than equal sized gains in the evaluation of prospects and trades.[5] The implication of this is that if a good is coded as a loss when it is sold and as a gain when it is acquired, on average, the price demanded by sellers will exceed the reservation price of the buyer. An interesting graphical implication of the endowment effect is that it puts a "kink" into the standard indifference curve depending upon an individual's initial endowment of goods and produces angular indifference maps such as those in figure six.

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[5]Kahneman, Knetsch, and Thaler (1990)

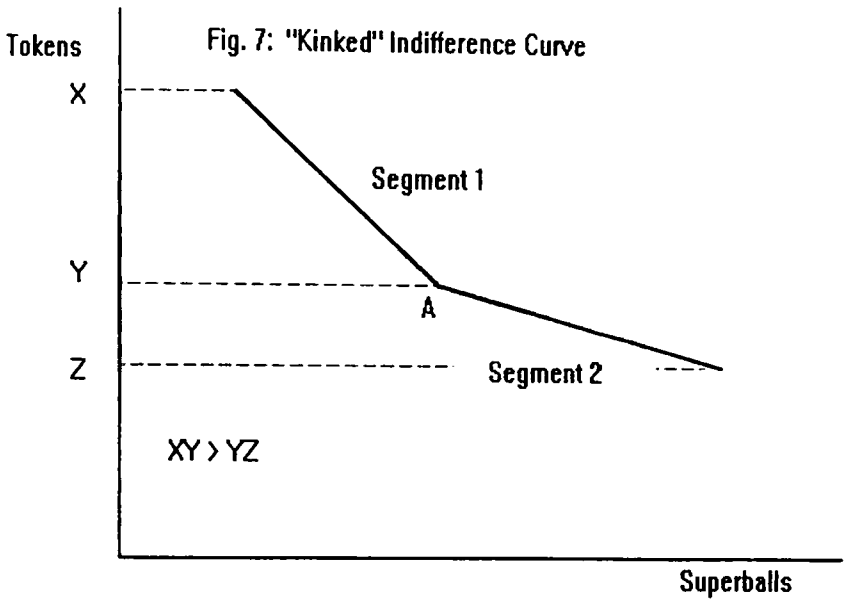

Figure seven is a typical kinked indifference curve for tokens and superballs. Under conventional consumer theory, the indifference curve would have been drawn without reference to the initial endowment as all points on the curve would be equal. However, because of the endowment effect, avoiding disposing of a good is preferred to gaining a good. Hence segment 1 of figure seven has a steeper slope to represent the "higher cost" of disposing of superballs. Conversely, segment 2 has a relatively flat slope as acquisitions of superballs are not cognitively coded as a loss. It is important to note that kinked indifference curves are similar to conventional indifference curves in that they both represent bundles of goods that provide identical levels of utility, the difference lies in the fact that kinked indifference curves incorporate the endowment effect and more importantly, the curves are drawn with reference to each unique endowment of goods.

Their have been many experiments that have produced evidence of an endowment effect.[6] The experiments all share a common set of procedures. The experiments used college age or older subjects, half of whom were endowed with some sort of good such

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[6]For experimental evidence see Coursey, Hovis, and Schulze (1987); Kahnman, Knetsch, and Thaler (1990); and Knetsch and Sniden (1984)

as a coffee mug, candy bar, or lottery ticket. The subjects who were not endowed with the good were then given an opportunity to buy the endowed item using their own money, while those subjects endowed with the good had the opportunity to sell their item. The exchange rate was then determined via a random number generated either arbitrarily or by a bidding mechanism that utilized the preferences of the subjects. These methods of determining exchange prices were used to remove the element of strategic behavior from the experiments Exchanges then took place and the process was repeated over several iterations. The results of the experiments were similar. In particular, each of the experiments found a significant disparity between willingness to pay and willingness to accept compensation, although the Coursey, Hovis, and Schulze experiment did report a substantial decrease in the WTP-WTA gap over time. This result has been disputed based on the sensitivity of their conclusions to outliers.[7]

In addition to the empirical conclusions drawn from the experiments, the experimenter's conclusions also firmly couched the endowment effect as a cognitive rather than market induced phenomenon. In one of the first papers citing evidence of the endowment effect, Knetsch and Sinden state, "the observed reluctance to give up money or assets seems likely to be, at least in part, due to various cognitive biases and such motives as an incentive to protect against a feeling of regret that might accompany a deliberately made change in asset position."[8]

The fact that the endowment effect is apparently a cognitive reaction to possible choices is very important because the cognitive capabilities of a human being change over time. By testing for the endowment effect in children we can easily determine if the endowment effect is an innate characteristic, meaning a trait that is naturally occurring such as breathing; or if the endowment effect is an acquired characteristic, a trait that is

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[7]Knetsch and Sniden (1987)
[8]Knetsch and Sniden (1984) p.517

learned over time through observation or experience. As all of the testing for the endowment effect has been run on adults, there is a possible shortcoming in the existing body of knowledge pertaining to the endowment effect. It is quite possible that a child will react differently than an adult to the prospect of giving up an endowed good. This paper will add to the existing work on the endowment effect by testing whether there is an endowment effect in children.

IV. METHODOLOGY

The goal of my experiment was to test the hypothesis that the endowment effect is a trait present in children. As subjects for the experiment I used a mixed class of twenty-three fourth and fifth graders at Central Linn Elementary school. The experiment consisted of five rounds of a simulated market. The students were divided in two groups and were alternately endowed with either small goods or tokens. The students were then subsequently given the opportunity to bid on the good in question if they were initially endowed with tokens. Conversely the students initially endowed with the good could attempt to sell the good for tokens, which could be redeemed for small items at the end of the experiment.

For the first two rounds of the experiment one half of the subjects were given ten white tokens having a value of one each; and the other half of the students were given single red tokens having a value of five. The students having red tokens were given the opportunity to sell their "value five" token for "value one" white tokens. Alternately, the students having white tokens were given the opportunity to buy a red token. The endowments of tokens alternated each round, so every student had a chance to either sell or buy a red token. The purpose of these iterations was to establish that the market could work efficiently in the absence of the endowment effect. The logic behind that assumption was that because the value of the red token is so transparent, over repeated rounds the reservation buying and selling prices should converge at five. The first iterations also served to familiarize the students with the procedures of the experiment and provided a good opportunity to answer their questions.

For the final three rounds of the experiment, the students were alternately endowed with small goods: a paper glider, colorful pencils, and a yo-yo; or with five white tokens. The students endowed with the good were given an opportunity to sell the good back to me in exchange for white tokens, while students endowed with the tokens had an opportunity to buy the good using their accrued tokens. At the end of the experiment, small goods were auctioned off as a means of paying off the value of the subject's acquired tokens.

In using this type of simulated market experiment I was attempting to induce the students to reveal their willingness to pay and willingness to accept compensation, which was the data I needed to collect in order to determine if their was an endowment effect present. However, one of the chief obstacles in any experiment that attempts to capture the preferences of an individual is the fact that often subjects do not reveal their true preferences. Some subjects may attempt to respond in such a manner as to attempt to please the experimenter, or there may be strategic reasons for a subject to deliberately hide his true preferences. As this experiment is free of normative decision making, I was not worried about students trying to please me through their responses. However, the experiment does utilize a market format, so there would be an incentive for the students to hide their true preferences. For instance, in the case of a student attempting to buy a good, it would be in her best interest to understate her willingness to pay thereby reducing the amount she gives up in order to increase her utility. The opposite assumption holds true for those students attempting to sell the endowed good. In order to remove the element of strategic thinking from the experiment, the bids were elicited utilizing the BDM procedure.[9]

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[9]Becker, DeGroot, and Marschak (1964)

The BDM procedure uses a random number generator, in my case a ten sided die, to determine exchange prices. The random nature of the exchange price makes it in the best interest of the students to reveal their true preferences. Here is how I applied the BDM procedure in the experiment. "Buyers," students who were not endowed with a good, were asked to state their reservation prices, a number from zero to ten. Then I used a die to determine the exchange price. If the number exchange price was equal to or lower than the stated reservation price, than an exchange was made at the exchange price. If the exchange price was higher than the stated reservation price, no exchange could be made as the price was higher than the highest amount the spender was willing to give up: his reservation price. To elicit seller prices, the same logic was applied.

The BDM method works because the random nature of the exchange price insures that the price an individual pays is independent of the price they reveal. Therefore, it is always the dominant strategy to reveal your true preferences. For instance, if a seller's true reservation price is five but he reports a six, he faces two possible outcomes. One, the die could come out a six or higher, in which case the seller would receive the value of the die roll in tokens. If the seller had reported truthfully, he would have received an equal number of tokens as six or more is higher than his reservation price, so "cheating" confers no advantage. Two, the die could come up a five or lower, in which case the seller would not receive any tokens as his false reservation price is higher than five. However, if the seller had reported truthfully he would gain five tokens on the roll of a five. In this case, the seller looses out on a potential welfare gain by cheating. The same logic holds true for buyers as well. Thus in the absence of certainty, it is irrational not to reveal your true preferences. A copy of my experimental protocol can be found in Appendix A at the end of this thesis.

V. RESULTS

I applied a linear regression in order to detect for the endowment effect. A linear regression is a statistical technique that attempts to explain movement in one variable, known as the dependent variable, "as a function of movements in a series of other variables, known as the independent variables, through the quantification of a single equation."[10] An alternate method of analyzing my data would have been to analyze my data as panel data, a method of using linear regressions while controlling for variations in a subject's responses over repeated trials. While this method is probably the recommended technique for this type of experiment, my results should be similar because I only ran a small number of trials.

The relationship I was interested in exploring was the relationship between the endowment of a good and the offered price of the good. Put simply, I wanted to test whether subjects endowed with a good required more compensation to sell their good than subjects attempting to buy the good were willing to offer. In order to test this relationship I used the following functional form: $V= b_0+b_1Y_1+b_2D_e+E$

In this equation, "V" represents the dependent variable "price" which measures either a subjects willingness to pay or willingness to accept compensation for a particular good. "b_0" is a constant term which is a standard feature of regression analysis and accounts for the level of the dependent variable when the independent variables equal zero. "Y_1" is an independent variable that represents the wealth of the subjects in tokens, and "D_e" is an intercept dummy variable. A dummy variable is an independent variable

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[10]Studenmund (1992) p.22

that is only "active" in the equation under certain circumstances. In this case, "D_e" only affects the intercept of the dependent variable when the subject has been endowed with a good.

The dummy variable is very important to my analysis because it is the variable that will determine if there is a WTP-WTA gap. This is how that process works. The value of the dummy variable is given as a "1" when the subject in question was endowed with a good or a "0" when the subject was not endowed with the good. When the value of the dummy is zero, the variable adds nothing to the constant term. When the value of the dummy is one, the weight of the dummy coefficient is added to the constant term. If there is an endowment effect present, I would expect to find that the dummy coefficient is significantly positive, meaning that the intercept increases, representing the WTP-WTA gap. If there is no endowment effect present, then I would expect to find that the coefficient on the dummy variable is not significantly different than zero. As my experiment took place over three rounds, it was necessary to run three regression with each regression maintaining the same functional form but using separate sets of data. My results are summarized in Appendix B.

The results confirm that there is an endowment effect in children. In particular, all the dummy variable coefficients are positive and according to the t-scores, significant. A t-score is a statistical test used to determine if a coefficient is significantly different than zero. In my case, I can claim a coefficient is significantly different than zero if the t-score is greater than the critical value 1.96. All my dummy variable coefficients pass this test. However, of my remaining independent variables only Y_1 is significantly different than zero. In particular the coefficient is positive, indicating that the endowed good in the first round of the experiment is a normal good. A normal good is a good whose consumption is positively related to income. Aside from the "goods" rounds of the experiment, a striking result is that there is evidence of the endowment effect in the first

two "token" rounds of the experiment. This is surprising, as conventional logic assumes the willingness to pay and the willingness to accept should converge on five. The results of the token rounds are summarized in Appendix C. Based on the overall robust results, I can comfortably claim there is an endowment effect persistent in the children that I tested.

VI. DISCUSSION

While the results are supportive of the endowment effect, there are several issues that may limit the usefulness of this study. One of the major problems I faced was utilizing the BDM procedure. In the first two trial rounds of the experiment in which the subjects were endowed with red and white tokens there was a distinct WTP-WTA gap. Theoretically this should not have occurred, thus there was obviously some unexplained factor at work. I believe the students were confused by the BDM procedure, however, it was certainly the subjects' prerogative to act irrationally if they felt it was in their best interests. It is also possible that the endowment effect is just really robust in children.

With respect to the remaining iterations of the experiment, it is hard to say whether the subjects were reporting their true preferences or not. Whatever the case, one trend that did emerge from the data was that the students were censoring their responses. This means that there were a number of "zeros" and "tens" reported, indicating that the subjects either were not interested in buying the endowed good at all or that the subjects demanded an even higher level of compensation to give up their good than the experiment allowed. The implication of this type of reporting means that the regression estimates underestimate the WTP-WTA gap because the variance of the responses are constrained by the limitations of the experimental protocol.

If I were to do this experiment again I would probably eliminate the BDM procedure because I perceived that the children would report honestly. I think using the BDM procedure only complicated things. In addition I might try allowing for a wider range of bid prices in order to capture some of the preferences that were censored in this experiment. In any case if I were to attempt to publish my findings, I would, at the very

least, run several more experiments to increase my sample size and improve the significance of my results. These limitations however, do not damper my enthusiasm for my results which definitely show the presence of the endowment effect.

I believe in the general importance of this study to economics. As my results suggest that the endowment effect is an innate characteristic, it is quite possible that this "aberration" in orthodox economic thinking is really a natural reaction that is the result of countless years of human evolution. For example, animals who bring down prey will fight to the death to protect their meal, while scavenger animals are easily driven off. In a world in which the survival of a species is contingent upon the collection and maintenance of scarce resources, I do not think it is wholly illogical to require the level of compensation to give up a resource to be greater than what it took to initially attain the resource. Proving that the endowment effect is a reaction native to humans in general, rather than a phenomenon only found in adults, does more to advance the validity of the endowment effect than yet another experiment on college age individuals. If the validity of the endowment effect can be confirmed, then I think economic theory needs to account for the effect, particularly with respect to consumer theory, contingent valuation, and various public economics issues such as the provisioning of public goods. These issues are relevant because they directly involve an individual's willingness to pay and willingness to accept compensation. For example with respect to externalities, the Coase theorem argues that by giving property rights to one party in a two party dispute, a mutually acceptable solution can be reached through the process of "buying off" the property owner. However, because of the endowment effect, the cost of producing a resolution may be higher than any single group or individual could bare.

Examining the behavior of children is the next logical step in exploring the origins of behavior that violates orthodox economic thinking. By examining individuals when they are just beginning to act as economic entities and comparing the results to

behavior in adults, I believe we can learn a significant amount about how economic behavior changes or does not change as children grow into adulthood.

APPENDIX A

Experimental Protocol

Testing for the Endowment Effect in Children

OVERVIEW:

The experiment will consist of trial markets utilizing tokens and various small goods as the relevant market commodities. The tokens will be redeemable at the end of the experiment for small items. For the purpose of the experiment, buying off the tokens will endow the tokens with a tangible value, increasing the "authenticity" of the tokens vis-à-vis real currency. The students will be divided into two groups and will be givin either 5 tokens or a single item which can be bought or sold in our trial market. Bids made in the trials will be induced via the BDM procedure. The BDM procedure uses a random number generator, in our case a spinner wheel numbered one to ten, to determine exchange prices. The element of chance, introduced by a random exchange price, will induces the children to reveal their true reservation prices.

GENERAL INSRUCTIONS:

When the tokens and items are first given out the students will be shown the store that has been setup and all the items that they will have a chance of purchasing with tokens. We do not put exact prices on items so that none of the student's decisions will be influenced by the fact that they want a particular item. At this point we divide up the class and teach the rules of the experiment.

The basics of the game: each student will have an opportunity to either buy an item by giving up their tokens if they were initially endowed with tokens; or to sell their item to accrue tokens if they were initially endowed with a good. The students also have the choice of not selling or not buying if they so choose. The price that all exchanges will take place at will be determined by a ten sided die. We will do a couple of practice rounds to illustrate how the mechanism works.

ENDOWED GOOD GROUP OUTCOMES:

The students endowed with goods will be asked to write down the least amount of tokens they will accept in exchange for their item. For example a student who valued their item highly might indicate a "9" or "10", while someone who had little value for the item might write down a "1" or "2". Once the die is rolled and the exchange price is revealed, a trade is made at the price on the die if the asking price indicated by the

student is lower or equal to the exchange price. If the revealed price is lower than the student's asking price, no exchange is made.

TOKEN GROUP OUTCOMES:

The students endowed with tokens will be asked to write down the highest number of tokens they would give up in order to purchase a particular good. For example a student who valued an item highly might indicate a "9" or a "10", while a student who had little value for a certain good could mark a "1" or "2". After the exchange price is generated, the students give up a number of tokens equal to the exchange price and receive the good only if their indicated willingness to pay is higher or equal to the exchange price. If the students willingness to pay is lower than the exchange price, no trade is made.

FINISHING THE EXPERIMENT:

Students can use their tokens to purchase items from the store. All the children are thanked for playing the game and for helping with the experiment.

ACTUAL DIALOGUE:

GENERAL INSTRUCTIONS:

"Good morning class. We are going to play a game today. We are going to divide you into two groups and all of you will receive some tokens. At the end of the game you may redeem your tokens for items in the store you looked at before. Anything you have at the end of the game is yours to keep. Now we're going to give half of you a random item."

At this point the class is divided into two groups and endowed with either five tokens or a small good.

"Those of you who have a _____ may give it up to me, if you want, in exchange for tokens that you can use at the store. Write down on the piece of paper provided the smallest number of tokens, a number between one and ten, that you would accept in trade for your item. Don't talk about what you wrote down and don't let anyone see your paper. We are only interested in what you think. Now if you were not endowed with a good you may purchase a _____ if you wish. Write down on your paper the most tokens, a number between one and ten, that you would be willing to pay to buy a _____.

Remember that you are writing down the most number of tokens you would be willing to pay to get the item, while those of you with the good are writing down the least number of tokens you would accept to give up your good. There is no right or wrong answer, we are only interested in what you think. Now let's look at this die."

A typical ten sided die.

"In a little bit I will roll this die to produce the price of the good. If you have the a _____ and the price is higher or equal to the number on your paper then you make a trade at the price on the wheel. If the price is lower than the number on your paper then you don't get to make a trade. If you have tokens and the price is higher than the number on your paper you don't get to make a trade. If the price is lower or equal to the number on your paper then you can make at trade at the price on the wheel. Are there any questions? Let's go over this again."

At this point I will go through the procedure pretending I am one of the students, answering questions as they arise. The goal is to make sure the process has been communicated properly. Problems and clarifications can be addressed as needed

"If I wanted a fuzzy pencil I might write down 6. If the wheel comes out a 4, then I would get to make a trade because I am willing to pay six tokens but I only need to pay four. If the wheel was to come out a 7, then I wouldn't get to make a trade because the most I am willing to give up is six, but the wheel say's the fuzzy pencil costs seven."

"I am going to roll the die for real now, everyone mark down how much you want to spend or how much you want to receive. Is everyone done? Okay, I'll roll."

After the exchange price is determined I will circulate and make exchanges for the students.

"Those of you who have tokens can now use them in the store. Thank you for playing this game. You all did very well."

APPENDIX B

STATISTICAL RESULTS: GOODS

ROUND 1

	COEFFICIENT	STD. ERROR	T-SCORE
CONST	-4.732	3.479	-1.361
Y1	0.503	0.205	2.457
DUMMY1	3.822	1.425	2.687

R-SQUARED	0.279	MEAN OF V	4.304
ADJ. R-SQUARED	0.207	STD DEV V	2.457
STD. ERROR	2.347	RESIDUAL SUM	2.842E-14
DURBIN-WATSON	2.244	SUM SQRD RESID	110.2
F STATISTIC	3.872		

ROUND 2

	COEFFICIENT	STD. ERROR	T-SCORE
CONST	4.887	2.551	1.916
Y2	-0.291	0.203	-1.431
DUMMY2	7.408	1.716	4.328

R-SQUARED	0.565	MEAN OF V	4.087
ADJ. R-SQUARED	0.521	STD DEV V	3.953
STD. ERROR	2.734	RESIDUAL SUM	2.398E-14
DURBIN-WATSON	1.645	SUM SQRD RESID	146.6
F STATISTIC	12.98		

ROUND 3

	COEFFICIENT	STD. ERROR	T-SCORE
CONST	1.811	3.275	0.553
Y3	-0.008	0.139	-0.056
DUMMY3	3.567	1.689	2.112

R-SQUARED	0.232	MEAN OF V	3.521
ADJ. R-SQUARED	0.155	STD DEV V	3.836
STD. ERROR	3.527	RESIDUAL SUM	-1.11E-15
DURBIN-WATSON	2.321	SUM SQRD RESID	248.8
F STATISTIC	3.014		

APPENDIX C

STATISTICAL RESULTS: TOKENS

ROUND 1

	COEFFICIENT	STD. ERROR	T-SCORE
CONST	5.091	2.119	7.521
DUMMY1	0.326	0.937	0.347

R-SQUARED	0.005	MEAN OF V	5.261
ADJ. R-SQUARED	-0.004	STD DEV V	2.199
STD. ERROR	2.245	RESIDUAL SUM	1.776E-15
DURBIN-WATSON	2.024	SUM SQRD RESID	105.8
F STATISTIC	0.121		

ROUND 2

	COEFFICIENT	STD. ERROR	T-SCORE
CONST	3.667	0.405	9.047
DUMMY2	2.878	0.586	4.912

R-SQUARED	0.534	MEAN OF V	5.043
ADJ. R-SQUARED	0.512	STD DEV V	2.011
STD. ERROR	1.404	RESIDUAL SUM	3.108E-15
DURBIN-WATSON	2.307	SUM SQRD RESID	41.39
F STATISTIC	24.13		

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