The Endowment Effect and Evidence of Nonreversible Indifference Curves

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By JACK L. KNETSCH*

Indifference curves are normally taken to indicate corresponding tradeoffs of goods *A* for *B* or *B* for *A* over the same interval: "the rate of commodity substitution at a point on an indifference curve is the same for movements in either direction" (James Henderson and Richard Quandt, 1971, p. 12). However, recent empirical findings of asymmetric evaluations of gains and losses imply that the presumed reversibility may not accurately reflect preferences, and that people commonly make choices that differ depending on the direction of proposed trades.

The evidence from a wide variety of tests is consistent with the suggestions of Daniel Kahneman and Amos Tversky (1979), and Richard Thaler (1980), that losses from a reference position are systematically valued far more than commensurate gains. The minimum compensation people demand to give up a good has been found to be several times larger than the maximum amount they are willing to pay for a commensurate entitlement. For example, when questioned about the possible destruction of a duck habitat, hunters responded that they would be willing to pay an average of $247 to prevent its loss but would demand $1044 to accept it (Judd Hammack and Gardner Brown, 1974). Respondents in another study demanded payments to accept various levels of visibility degradation that were from 5 to over 16 times higher than their valuations based on payment measures (Robert Rowe, Ralph

d'Arge, and David Brookshire, 1980). Similar large differences in valuations of a wide variety of goods and entitlements have been reported in numerous survey studies.[1]

These valuation differences based on responses to hypothetical survey questions prompted further, more severe, tests of the disparity using a variety of real exchange experimental designs. The results have been much the same. Even when exchanges of real goods and actual cash payments motivated the evaluations, the compensation demanded to give up an entitlement has been reported to far exceed the comparable payment measure of value (Knetsch and John Sinden, 1984; Thomas Heberlein and Richard Bishop, 1985).

While some studies have found that the size of an initial disparity may decrease over successive valuation trials for some entitlements, differences between the measures generally remain (Don Coursey, John Hovis, and William Schulze, 1987, and Knetsch and Sinden, 1987). For example, Brookshire and Coursey found that the differences between payment and compensation valuations of trees in a park decreased substantially from initial hypothetical responses, but the ratio of the two measures remained at "approximately five to one" after the last real exchange iteration (1987, p. 563). Other more recent tests of the evaluation disparities, or endowment effects, have shown that the observed disparities between valuations of entitlements are not the result of wealth effects or income constraints, strategic behavior, or transactions costs, and that the differences persist over repeated binding iterations of

[1]See, for example, Ronald Cummings et al. (1986) for a summary of many earlier studies.

market trials (Knetsch, Thaler, and Kahneman, 1988).

The purpose here is to report the results of more direct tests of the reversibility of indifference curves. A variety of test designs were used in these exercises, but in each case one-half of a sample of participants were offered one good or money for another good, and the other half were offered a similar trade but in the opposite direction.[2]

I. Test 1: Exchanges of Two Goods

A straightforward preference exercise involving a choice between two goods was conducted with three comparable groups of University of Victoria students.

In one class, 76 participants were given a coffee mug and were then asked to complete a short questionnaire. The students had the mug in their possession while they answered the written questions. After the questionnaires were completed, the experimenter showed the participants a 400-gram Swiss chocolate bar and told them they could have one in exchange for their mug.[3] Participants were informed that they could either keep their mugs, or have a chocolate bar. They were instructed to hold up a colored paper with the word "trade" marked on it if they preferred the candy to their mug and wished to make an exchange. All desired trades were made immediately by one of four experimenters present, there was no uncertainty of receiving the other good and no effort was required beyond raising the paper to indicate a willingness to make an exchange.

The 87 participants in the second group were offered an opportunity to make the opposite trade of giving up a candy bar, which had been given to them initially, for a mug. All conditions were the same except for the direction of the exchange offer.

The 55 people in the third group were simply offered a choice between receiving a candy bar or mug.

The choices presented to people in each of the first two groups differed only in terms of which good they had to give up to obtain the other—incentives were compatible and there were no income, or wealth, effect possibilities, nor any wealth constraints. However, contrary to the expectation of an equal proportion favoring one good over the other in each group, based on the conventional assertion of economic theory and practice, the different initial entitlements and subsequent direction of potential trades heavily influenced the participants' valuations of the two goods.

The preferences indicated by the choices were:

Group	Proportion Favoring (In Percent)		
	Mug Over Candy	Candy Over Mug	N
1. Give up mug to obtain candy	89	11	76
2. Give up candy to obtain mug	10	90	87
3. No initial entitlement	56	44	55

When given a simple choice without a prior entitlement or reference position, 56 percent of the participants (Group 3) selected a mug in preference to a candy bar. But only 10 percent valued a mug more than a candy bar when they had to give up the candy to obtain a mug (Group 2), while 89 percent of those who initially received a mug (Group 1) declined to give it up for a candy bar. The preferences for a mug over a candy bar varied from 10 to 89 percent depending entirely on the reference position of the endowment at the time of the valuations.

In this simple experiment, participants' preferences were not independent of the direction of the exchanges, as is commonly assumed. They expressed a dramatic asym-

metry in valuations by weighing the loss of giving up their initial or reference entitlement far more heavily than the foregone gains of not obtaining the alternative entitlement.

II. Test 2: Minimum Acceptable Exchanges

The symmetry of exchange preferences was further tested in a second experiment involving real goods and actual cash payments. As in the first test, the design of this experiment also precluded the influence of a wealth constraint and the possibility of an income, or wealth, effect. The participants were 80 students in five tutorial groups of an introductory pre-principles economics class at Simon Fraser University. The exercise was repeated in the five tutorial meetings in a single afternoon.

Forty-one individuals in three of the groups were first given two 100-gram Swiss chocolate candy bars.[4] They were then asked to state the smallest amount of money they would accept to give up both of their candy bars.

The 39 members of the other two tutorial groups were each given two single-dollar bills. They were then asked the minimum number of chocolate bars they would require to give up their two dollars. The initial offering of money or candy bars was alternated over the five participating groups.

The method of obtaining the declarations of minimum acceptable trades was designed so that stating the smallest compensation each participant would agree to was in the person's best interest. To ensure that the individuals understood that this was the case, a preliminary instruction and screening test was conducted so that they could demonstrate their understanding before becoming participants in the real exchange exercise. This preliminary test involved a hypothetical, induced, or prescribed, value and the identical bidding mechanism that was used

to reveal preferences in the subsequent real good exchange.[5]

All participants were given the same form for the preliminary demonstration and screening test:

THIS FIRST PART OF THIS EXERCISE IS HYPOTHETICAL ONLY; NO ACTUAL PAYMENTS WILL BE MADE. HOWEVER, DEPENDING ON THE RESPONSE OF PARTICIPANTS IN THIS GROUP, A SECOND PART MAY BE CONDUCTED IN WHICH ACTUAL PAYMENTS WILL BE MADE.

IF THE SECOND PART IS CONDUCTED, YOU CAN ONLY WIN, YOU CANNOT LOSE.

Assume that the person conducting this exercise will pay you $2.50 for the ticket attached to this sheet.

Now assume that before you redeem the ticket you are given an opportunity to sell it. The price you will be offered for it will be determined by a random draw of one of six cards with the dollar amounts: $0, $1, $2, $3, $4, or $5 on them.

What is the smallest of these offer prices you would accept to give up your ticket?

$_____ (use only whole dollars— i.e., no cents). If the offer price on the randomly drawn card is the same or higher than the price you stated above, you will receive the amount of money on the card in exchange for your ticket. If the offer price on the card is lower

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[4] These candy bars sell for around $2.00 each in most shops.

[5] Real exchange experiments using such prescribed, or induced, values have been widely used to test the efficiency of various types of market institutions (for example, Vernon Smith, 1976).

A comparison of the outcomes of induced value markets with subsequent goods markets carried out with identical trading rules also provides a test for possible transactions costs and strategic behavior as possible sources of valuation disparities (Knetsch, Thaler, and Kahneman, 1988). If no inhibitions to trades are observed in the induced-value markets, none should then be expected from such causes in markets for goods that are valued by the individual participants themselves.

than your indicated minimum selling price, you will keep the ticket (and turn it in for the $2.50).

After the participants read the instructions for the preliminary test, the experimenter gave a further explanation and answered questions. Participants then completed the forms. The experimenter checked the forms to ensure that at least 75 percent of the individuals knew how to respond in a way that served their best interest (by stating $3 as the minimum acceptable price). If more than 25 percent failed to answer in this way the experiment was terminated for that whole group.[6]

Of the 80 individuals in the five groups that went on to the second part involving the real exchanges, only 14 (18 percent) failed to answer the first part correctly.[7] Before proceeding with the second part, the experimenter explained the bidding mechanism again, and pointed out the reasons why other answers could work to the disadvantage of the respondent. These further explanations, and the screening of participants by their demonstrated ability to reveal their true minimum values in this market, ensured that individuals participating in the real exchange experiment fully understood the value revealing incentives of the bidding procedure.

Participants in the second, real exchange, part of the experiment were given their endowment of either candy bars or dollar bills and were told that these were theirs to keep. Those with an entitlement of candy bars then received the following second form:

THIS SECOND PART WILL INVOLVE REAL PAYMENTS.
THERE ARE NO RIGHT OR WRONG ANSWERS, YOUR RESPONSE SHOULD REFLECT ONLY YOUR OWN PREFERENCES.

[6] This occurred in four other groups.
[7] All but 3 of the 14 individuals answering incorrectly specified a selling price *lower* than the most profitable one, an error that would bias the results toward lower evaluations of the initial entitlements and symmetry and away from the much higher values of losses subsequently revealed.

You have been given 2 candy bars. They are yours to keep. However, if you like—and the choice is entirely yours—you may be able to trade the 2 candy bars for money. We want to know about your personal preferences in terms of the smallest number of dollars you would accept to give up the two candy bars.

The amount you will be offered to give up your 2 candy bars will be determined in the same way as it was in Part 1 of this exercise. That is, an offer price, in dollars, will be determined by a random draw of one of the six cards with amounts ranging from $0 to $5.

If you are willing to give up the 2 candy bars for $5 or less, write the smallest of these offer prices that you would accept to give up both of the candy bars in the blank below.

If it would take more than $5 for you to agree to give up your two candy bars, then write a 6 in the blank, and you will then keep your candy bars.

$_____ (use only whole dollars—i.e., no cents). If the offer amount on the randomly drawn card is the same or higher than the number you have written above, you will receive the amount of money on the card in exchange for your 2 candy bars. If the offer on the card is lower than the number you have written above you will be allowed to keep the candy bars.

Individuals receiving an initial endowment of money were given a comparable form.

The bid procedure was then explained yet again and questions answered. The random draw of the card was made after the forms were completed, and exchanges were made according to the indicated minimum acceptable trades.

The results again demonstrated a strong aversion to giving up an initial entitlement.

The participants' dollar value of the candy bars is given either by the minimum amount demanded to give them up, or by the number of candy bars required to give up dollars. The proportions of the two samples valuing a candy bar equal to or greater than $1 and $2 are given in the following tabulation.

| | Proportion of Individuals Valuing Candy Bar Equal to or More than: | |
| | (In Percent) | |
Group	$1	$2
1. Give up Money to Get Candy Bars ($N = 39$)	33	8
2. Give Up Candy Bars to Get Money ($N = 41$)	95	37
Chi-Squared Value	35.05	9.57

The participants valued the candy or money significantly more when considering the prospect of giving it up than they did when they had the opportunity to acquire either in exchange for their original entitlement.[8] The average evaluations of the candy bars, based on the responses of all of the participants in each original endowment group, were approximately $1.83 with the entitlement and $0.90 without it. That is, the people starting with the candy bars valued them at a little over twice as much as the people did who were given money.[9]

As in the earlier test, the relative preferences of participants in this exercise depended on reference entitlements and the subsequent direction of trade offers.

[8] Based on 1 degree of freedom, both chi-squared values are significant at the 1 percent level.

[9] The differences indicated in the tabulation and the statistical significance of the disparity are, if anything, understated. First, for people stating minimum money demands the recorded numbers are those valuing the money *more than* the candy. Individuals in the other groups stating required candy bar payments include those who value the candy *equal to* as well as more than the various sums.

Second, the proportions of participants valuing the bars at the stated sums imply that the individuals valued all candy bars and dollars over the relevant range equally. If they in fact valued each successive candy bar or dollar by a decreasing amount—with diminishing marginal utility—then the surplus from the intra-marginal units would prompt an even greater demand for the other good, given the all or nothing nature of the choice.

III. Test 3: Survey Responses

While the results from the first two tests were from real exchange experiments, similar indications of large valuation disparities that varied with the direction of proposed exchanges were also obtained from general public reactions recorded in a series of telephone surveys.

These random household telephone interviews were conducted in metropolitan Toronto, with an equal number of adult males and females called during early evening hours. In each case, one subsample of respondents was asked if they would trade one good for another; a second subsample was asked if they would make the opposite exchange.

Two groups of respondents were asked about their preferences between a change of $700 per year in their current income and a 0.5 percent change in the chance of having an accident during the year that would result in some time in the hospital. Among respondents in the group asked if they would accept $700 to have their chance of an accident increased by 0.5 percent (from 0.5 percent to 1.0 percent), 61 percent ($N = 149$) refused, indicating that this proportion valued the negative change in risk more than $700.

In the group asked to trade a decrease of the same accident risk (over the same range of from 1.0 percent to 0.5 percent) for a reduction of $700 in their income, only 27 percent ($N = 146$) indicated a higher valuation of the positive increment of risk change by being willing to make the trade. Again, relative preferences varied greatly depend-

ing on the direction of the proposed exchange—39 percent preferred $700 to the change in risk one way, and 73 percent preferred $700 to the change the other way.[10]

In the same way, two groups of respondents were asked about their preferences between a new job that offered more or less pay and more or less vacation time than their current employment. When asked to trade an increase of $500 annual salary for one week less vacation, 66 percent ($N = 143$) indicated a greater valuation of the holiday time. For respondents offered the opposite exchange of more vacation for less pay, only 29 percent ($N = 147$) indicated a preference for an equal amount of time off.[11]

IV. The Asymmetry of Preferences

The evidence from these three tests is widely at variance with the conventional strong empirical assertion of completely reversible indifference curves. The tests used three different designs which varied in several dimensions: they included both real exchange experiments and surveys using hypothetical questions; they used student and nonstudent participants; they involved choices between goods and money and between two goods; they included small and large sums; and they included valuations that could be affected by wealth effects and income restraints and others which excluded such possibilities. The results, however, were all the same. In every case, people exhibited valuations and preferences that varied systematically and substantially with the initial reference entitlement and the direction of exchange offers.

Further, the windfall nature of the endowment in the real exchange tests could well lead to these results understating the extent of the disparities that might be expected under nonexperimental conditions. People

were given a good or money in these experiments, and their valuations were assessed in terms of what they would demand to give it up. However, individuals have generally been found to give up such windfall gains more easily than assets from their own original endowment (Thaler and Eric Johnson, 1989). The manipulations used in these experiments may therefore be weaker than might be encountered in most actual assessments—and indifference curves may be even less reversible.

The results of the exercises reported here are consistent with other empirical tests of people's evaluations. The greater value ascribed to entitlements that might be lost over ones that might be gained gives rise to the disparity between bid and offer values (Kahneman and Tversky, 1979 and 1984). This appears to be similar to the observed nonreversibility of indifference curves in the data reported here.

Substantial disparities between valuations have now been reported for a number of goods, including an array of environmental assets, lottery tickets, personal safety, and many consumer goods. Except for cases of transparent choices, such as the obvious worth of alternatives presented in induced-value experimental markets where specific values are assigned by experimenters and individuals act on the basis of these valuations, there is yet little indication of the limits to the range of goods and assets where such differences might not be found. This raises the possibility that the significant endowment effects and nonreversible indifference curves found in these exercises may exist in a larger class of cases. Only additional empirical study can determine the extent that this is the case.

If the existence of nonreversible indifference curves is pervasive, then the assumption of reversibility will represent a normative ideal but will not serve as a very useful description of actual economic behavior in most circumstances. Nor will the traditional assumption of symmetry of valuations and complete reversibility of indifference curves seem as useful a basis for predicting economic behavior or as defendable a basis for

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[10] The chi-squared value of 35.32 with 1 d.f. is significant at the 0.1 percent level.

[11] With 1 d.f. the chi-squared value of 43.77 is significant at a 0.1 percent level.

the common practice of substituting payment measures for compensation measures of welfare losses (Robert Willig, 1976). The common practice of assessing losses in economic well-being by people's willingness to pay to avoid the change may result in significant understatements if indifference curves are not reversible.

The widespread irreversibility of indifference curves would not imply that people will not make any trades, or that consumers will not change future consumption patterns in response to changing relative prices. However, the presence of irreversibilities would imply that fewer trades will be made than predicted by standard assumptions, and they offer little assurance that the shifts in future consumption will be as complete or as prompt as would be expected if indifference curves were reversible.

In a similar way, the presence of irreversibilities also suggests that common presumptions of the potential gains from trade may often be overstated. In terms of an Edgeworth box, the area representing mutually advantageous exchanges may be very much smaller, or may not even exist, if curves showing points of indifference when giving up initial allocations differ from those indicating trades in the other direction. An apparent reluctance to trade may be due to the availability of few real gains to the parties. And the commonly observed aversion to giving up concessions in negotiations may well be due to a similar asymmetry in valuations of gains and losses (Kahneman, Knetsch, and Thaler, 1986).

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