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The common finding that selling prices exceed buying prices (the so-called endowment effect) is typically explained by the assumptions that consumers evaluate potential transactions with respect to their current holdings and that the owners of a good regard its potential loss to be more significant than nonowners regard its potential acquisition. In contrast to this "pain-of-losing" account, the authors propose that the endowment effect reflects a reluctance to trade on terms that appear unfavorable with respect to salient reference prices. In six experiments (and eight more summarized in appendixes), the authors show that manipulations that reduce the gap between valuations and reference prices reduce or eliminate the endowment effect. These results suggest that the endowment effect is often best construed as an aversion to bad deals rather than an aversion to losing possessions.

Keywords: endowment effect, reference prices, transaction utility, loss aversion, fairness

A Reference Price Theory of the Endowment Effect

In economic theory, buying and selling have a deep symmetry. When an apple is traded for an orange, there is no basis for even distinguishing the "buyer" from the "seller"; these labels can be uniquely assigned only when money is one of the goods being exchanged. Correspondingly, most theorists would view maximum buying prices and minimum selling prices as alternate expressions of a good's value and expect them to coincide (Henderson 1941; Stigler 1966; Willig 1976).[1]

In practice, they do not. In their review of 59 studies that used ordinary market goods, Horowitz and McConnell (2002) report that selling prices are nearly three times higher than buying prices. Thaler (1980) terms this disparity the "endowment effect" and recognizes it as a manifestation of loss aversion (Kahneman and Tversky 1979; Tversky and Kahneman 1991). By his account, consumers evaluate potential trades with respect to their current holdings, and selling prices exceed buying prices because owners of a good regard its potential loss as more significant than nonowners regard its potential acquisition.

In contrast to this "pain-of-losing" account, we propose that the endowment effect is often better understood as the reluctance to trade on unfavorable terms. Consumers evaluate potential trades with respect to salient reference prices, and selling prices (or trading demands) are elevated because the most common reference prices—market prices—typically exceed valuations. In six experiments, we show that manipulations that reduce the gap between valuations and reference prices tend to reduce or eliminate the endowment effect. These results suggest that the endowment effect is often best construed as an aversion to bad deals rather than an aversion to losing possessions (see also Isoni 2011).[2]

VALUATIONS, REFERENCE PRICES, AND TRANSACTION DISUTILITY

Thaler (1985) proposes that consumers consider not only the benefits from the good they might buy or sell but also

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[1]Income effects and transaction costs permit some disparity between the two measures but typically only a small fraction of the observed effect.

[2]Thaler (1980) uses the term "endowment effect" to refer both to the finding that selling prices tend to exceed buying prices and to his preferred account of that phenomenon: the aversion to relinquish an endowment. We use the term only to refer to the empirical pattern.

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the perceived merits of the deal—whether the actual price is higher or lower than they expect. In one study, participants imagined sitting on a beach with a friend who had just offered to bring them back a bottle of their favorite beer. When told that beer would be purchased from a fancy hotel, participants authorized their friend to spend $2.65, but when told the retailer was a run-down grocery store, they were willing to pay just $1.50. In other words, the *expectation* to pay less became a *willingness* to pay less. Analogously, participants who contemplated selling tickets to a hockey game they could no longer attend demanded more if their original purchase price was higher. These examples are supported by other research (Emery 1970; Monroe 1973; Winer 1986) suggesting that consumers tend to evaluate transactions with respect to reference prices and that transactions that diverge from the reference price can invoke "transaction utility" (Thaler 1985). In particular, a potential transaction price that compares unfavorably with the reference price generates transaction *dis*utility, which diminishes the attractiveness of the contemplated trade.

We propose that the endowment effect is due in large part to transaction disutility, which typically acts to increase selling prices (though it may sometimes reduce buying prices). A simple model will help us state our claim more precisely. Assume that a consumer's desire for any given good can be expressed as his or her valuation v, which indicates in monetary units the consumer's expected benefits from using the good—their "consumption utility" (Koszegi and Rabin 2006). If this were all that mattered, the consumer's maximum buying price and minimum selling price would converge at v. In contrast, we argue that bids are distorted to alleviate the disutility that arises from the prospect of a "bad deal"—when trading at one's valuation is less favorable than trading at some salient reference price r. Thus, we expect that when r > v, sellers will demand more than v and that when r < v, buyers will not be willing to pay v. The larger the difference between r and v, the greater these distortions and the greater the divergence between buying and selling prices. Figure 1 illustrates this relationship for a fixed v as r varies.

This model is intended to encapsulate our theory of when and why buying and selling prices diverge. We do not attempt to incorporate every factor that affects such prices, and a few simplifications are worth noting. First, we omit any direct influence of reference prices on valuations themselves, as when price signals quality. This may occur, but it does not illuminate buyer/seller *disparities*. Second, we exclude positive transaction utility (i.e., any distortions resulting from the pleasure of trading at v when v compares favorably with r). We do not deny this possibility but expect that its force, when present, is weak. Our predictions hold provided that positive transaction utility is weaker than negative transaction utility (see the Web Appendix at www.marketingpower.com/jmr_webappendix; see also Isoni [2011], who independently develops a more general theoretical model that incorporates similar assumptions).

Although transaction disutility can create price gaps either by inflating selling prices or by depressing buying prices, elevated selling prices are much more typical because reference prices are predominantly based on market prices, and most people are unwilling to buy most products at the

Figure 1

AN ILLUSTRATION OF THE HYPOTHESIZED EFFECT OF
TRANSACTION DISUTILITY ON RESERVATION PRICES
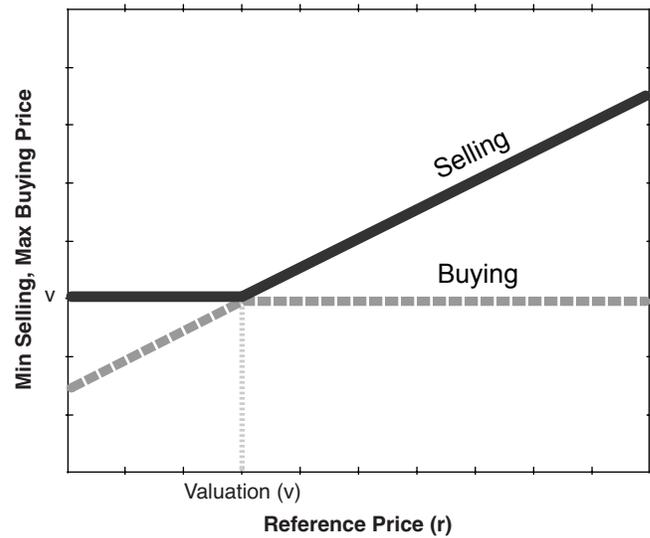
market price.[3] As a consequence, transaction disutility typically distorts selling prices upward, whereas buying prices are unaffected and therefore equal to consumers' valuations.

The pain-of-losing account presumes that sellers and buyers experience a transaction differently: Sellers experience the act of selling as "losing" the item being sold, whereas "the buyers in these transactions do not appear to value the money they give up in a transaction as a loss" (Tversky and Kahneman 1991, p. 1055). In contrast, we propose that there is no inherent difference in the psychology of selling versus buying. Although we also attribute most price gaps to sellers, we believe this is only because reference prices tend to exceed valuations. Both theories explain the endowment effect in terms of loss aversion, but they differ with respect to the reference point from which gains and losses are evaluated. With the pain-of-losing account, the relevant referent is endowment status (whether the person currently possesses the good), whereas with our account, it is the good's reference price.

The notion that the endowment effect might reflect reference price comparisons has received some support in recent research. Investigating how consumers justify disparities between buying and selling prices, Brown (2005) finds that concepts akin to transaction disutility were cited much more often than concepts akin to pain of losing. Simonson and Drolet (2004) show that buying prices were influenced by arbitrary anchors that referred to perceived value, whereas selling prices were influenced by anchors that referred to market prices. They conclude that reservation prices in general reflect both personal value and market price but that buyers give more weight to value and sellers give more

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[3]This asymmetry is reliably reflected in experimental data. For example, in Kahneman, Knetsch, and Thaler's (1990) Experiment 1, the average participant was willing to pay only $2.25 for a coffee mug priced at $6.00 and just $.75 for ballpoint pens priced at $3.98.

weight to market price. Although we draw on this prior research, we believe that this is the first study to test a reference price account against other prevailing theories. We turn to those empirical tests next.

EXPERIMENTAL TESTS USING REFERENCE PRICE MANIPULATIONS

Most previous studies on the endowment effect cannot differentiate the pain-of-losing and reference price accounts because they involve goods whose reference prices exceed most consumers' valuations. This confounds the effect of endowment (sellers are endowed, whereas buyers are not) with the effect of transaction disutility (which would then primarily affect sellers rather than buyers). To distinguish the two accounts, we manipulate both endowment status and reference prices. If the endowment effect is caused primarily by differences in ownership status, reference prices should not matter, but if it is caused primarily by owners' aversion to making bad deals, the effect should shrink when the reference price is closer to typical valuations. Thus, our model makes two predictions: that the gap between buying and selling prices diminishes as a good's reference price is reduced from high to moderate and that this convergence is driven by lower selling prices. Manipulations of r in this range should have comparatively little effect on buyers.

It is important to clarify that we characterize reference prices as low, moderate, or high with respect to the typical consumer's valuation. Although valuations cannot be observed directly, we do observe buying and selling prices and, from these, can infer the relationship between r and v. This inference can be made at the individual level, but we assign general characterizations by using average buying prices in a given treatment, as shown in the following table[4]:

Observation	Inference	Conclusion	Characterization of r
r < B	B < v	r < v	Low
r ≈ B	B ≈ v	r ≈ v	Moderate
r > B	B ≈ v	r > v	High

Although these characterizations are post hoc—to label r, we must first observe buying or selling prices—they are not ad hoc, because the data do not permit arbitrary labels. Therefore, although pretests can help verify that a particular reference price has the presumed relationship to valuations, such pretests are not required, because the experimental data perform the same function. Note also that if v is heterogeneous, r cannot equal v for everyone. Thus, we do not necessarily expect to find any r at which the gap disappears altogether; however, if valuations are clustered near a widely adopted reference price, the disparity should be small.

Study 1: Manipulating Reference Retailer

Method. Participants (N = 125) were recruited for laboratory sessions from two universities. The target good was a large box of candy such as those sold at movie theater concession stands. All our participants first examined four

candy options (Raisinets, Milk Duds, Goobers, and Jelly Belly Sours) and indicated their favorite. Then, using a 2 × 2 between-subjects design, we varied whether respondents were (or were not) endowed with a box of their preferred candy and also the reference price we suggested (high or moderate). In the high r condition, respondents were told the following: "As a point of reference, the Harvard Square Theater sells this candy for $4.00 per box." In the moderate r condition, they were told the following: "As a point of reference, the Target store in Watertown sells this candy for $1.49 per box." Both statements were true.

Next, we elicited minimum selling prices from candy owners and maximum buying prices from nonowners. To encourage truthful bids, we used an incentive-compatible procedure that Becker, DeGroot, and Marschak (1964) designed, in which participants submit reservation prices in the context of some unknown transaction price that is potentially binding. Written and oral instructions emphasized that truthful bids were in the participants' best interests and that outcomes would be enforced: Nonowners whose bids exceeded the randomly generated transaction price bought their preferred candy at that price, and owners whose bids were less than the transaction price sold their candy back to the researcher at that price. To avoid introducing other potential reference prices, we did not provide a menu of possible bids or reveal the range from which the transaction price would be drawn ($0–$5).

Results. As we predicted, reducing the reference price reduced the endowment effect. In the high r condition, the average selling price significantly exceeded the average buying price (S = $2.88 vs. B = $1.54; t(62) = 4.05, p = .0001, two-tailed test), but in the moderate r condition, the gap was not significant (S = $1.58 vs. B = $1.20; t(59) = 1.53, p = .13). In addition, as we expected, manipulating the reference price significantly affected the bids of sellers (t(53) = 3.62, p = .0007) but not buyers (t(68) = 1.45, p = .15). An analysis of variance (F(3, 121) = 12.11, p < .0001) indicates significant effects of endowment (t = 4.13, p < .0001), reference price (t = 3.95, p = .0001), and their interaction (t = 2.30, p = .02). Note that the average buying (and selling) prices confirm that $4.00 is indeed a high reference price and that $1.49 is moderate (see the following table; for full distributions of individual-level data from this and subsequent studies, see the Web Appendix at www.marketingpower.com/jmr_webappendix).

	Reservation Prices for Movie Candy in U.S. Dollars (Standard Errors in Parentheses)	
	Moderate r	*High r*
Sellers	1.58(.18)	2.88(.31)
Buyers	1.20(.17)	1.54(.17)

Study 2: Manipulating Sticker Price

While the candy study supports our hypotheses, it presents a potential confound because the reference price manipulations might also have suggested different consumption contexts: eating candy at the movies versus at home. Although this account does not explain why only sellers would be affected, we nonetheless attempted to repli-

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[4]Equivalent rules can be defined in terms of S (the average selling price).

cate our findings using a different good and different design.

Method. With the promise of a $10 show-up fee, we recruited 155 participants to attend experimental lab sessions at Harvard University. The focal good in this study was a Pentel mechanical pencil. As in Study 1, we varied endowment status and reference price in a 2 × 2 between-subjects design. Here, following a reviewer's suggestion, we manipulated r by varying the sticker price attached to the product, which we affixed with the kind of pricing gun retailers commonly use. In the high r condition, we specified the pencil's actual retail price of $2.29; in the moderate r condition, we used $.79—much lower, but still a plausible retail price.

In the endowed sessions, all participants were given pencils and were instructed that the items were theirs to keep if they desired. In sessions in which participants were not endowed, we passed around samples for inspection. This procedure both familiarized participants with the product and exposed them to its reference price. After the samples were collected, participants privately recorded their reservation prices. We then determined the actual transaction price for all participants by publicly drawing a price from a "bingo ball" cage containing balls with values ranging from $.30 to $3.00 in $.30 increments. As in the candy study, we did not reveal this range to participants (for full instructions, which we borrowed in part from Burson, Faro, and Rottenstreich [2012], see the Web Appendix at www.marketing-power.com/jrm_webappendix).

Results. The results broadly reproduce those of Study 1. In the high r condition, selling prices substantially exceeded buying prices (S = $1.51 vs. B = $.68; t(82) = 3.51, *p* = .0007), but in the moderate r condition, the difference was not significant (S = $.82 vs. B = $.92; t(69) = .48, *p* = .63). As in the candy study, manipulating r significantly affected selling prices (t(75) = 2.49, *p* = .02) but not buying prices (t(76) = 1.47, *p* = .15). An analysis of variance again reveals a significant interaction effect between endowment and reference price (t = 2.90, *p* = .005). The main effect of endowment is significant (t = 2.28, *p* = .02), but that of reference price is not (t = 1.42, *p* = .16). (For supportive results from three additional studies that either manipulated reference prices or used adopted reference prices as a selection variable, see Appendix A, Table A1.)

	Reservation Prices for Mechanical Pencils in U.S. Dollars (Standard Errors in Parentheses)	
	Moderate r	High r
Sellers	.82(.16)	1.51(.22)
Buyers	.92(.13)	.68(.10)

BUYER-DRIVEN PRICE DISPARITIES

Because reference prices usually exceed consumer valuations, sellers, but not buyers, typically perceive the prospect of transacting at v as a bad deal. The first two studies suggest that lowering the reference price toward v reduces the endowment effect by alleviating the transaction disutility that sellers experience. However, our model makes different predictions when r < v. In this region, r should not affect selling prices (because selling at v is not a bad deal) but will depress buying prices (buyers will be reluctant to bid v, because the low r makes transacting at v a bad deal).[5]

These collective predictions yield a surprising implication: If r can be credibly varied across a sufficiently wide range, the endowment effect will be a U-shaped function of r. Price disparities will be substantial if r is very low (because buying prices will be depressed) or very high (because selling prices will be inflated) but smaller when r is close to v. This prediction further distinguishes our reference price theory from the prevailing pain-of-losing account, which neither cites reference price as an important factor in the endowment effect nor explains the U-shaped pattern we observe in the studies described next.

Studies 3a and 3b: Manipulating Salience of Possible Outcomes

Because we contend that the endowment effect depends on the distance between r and v, we need to manipulate r without affecting v. Such a manipulation is difficult for many goods, because respondents may infer quality from price (e.g., by concluding that a low-priced carton of milk is spoiled). To address this issue, we chose lottery tickets as our target good. For these unusual goods, we expected to be able to suggest a broad range of reference prices without markedly affecting participants' conception of what was being purchased or sold.

Method. We conducted one study with 159 students at the Massachusetts Institute of Technology. It involved a small-stakes lottery: a one-third chance of winning $2.50, which we actually paid out. We conducted a follow-up study with 368 members of a university-sponsored website that involved hypothetical valuations of a one-third chance of winning $250. Both studies used a 2 × 3 between-subjects design in which participants were assigned to be buyers or sellers and to receive a low, moderate, or high reference price.

For the small-stakes lottery study, the conditions were worded as follows:

- Low r: "Remember that if you buy [keep] this ticket, there is a 2/3 chance that it will be worth $0."
- Moderate r: "Note that if you had many lottery tickets just like this one, on average each one would win 83¢."
- High r: "Remember that if you buy [keep] this ticket, you can win as much as $2.50."

For the large-stakes lottery study, the conditions were worded as follows:

- Low r: "In a prior study, the most common amount that participants would pay for this ticket was $5."
- Moderate r: "In a prior study, the average amount that participants would pay for this ticket was $24."
- High r: "Lottery tickets like this one pay out an average of $83."

For the study involving actual payments, we randomly generated a transaction price, using a bingo ball cage, from $0 to $2.50. Then, for participants who acquired or retained tickets (i.e., buyers who bid above the transaction price or sellers who bid below it), we resolved the lottery and paid the winners.

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[5]Buyer-driven price gaps show the fallibility of the term "endowment effect" as a generic synonym for evaluation disparities. Casey (1995) makes a similar observation.

Results. In both studies, the endowment effect showed the predicted U-shaped relationship with r (see Table 1). For the small-stakes lottery, selling prices are approximately twice buying prices when r is low (t(60) = 3.51, *p* = .001) or high (t(47) = 3.93, *p* = .0003), but the two measures nearly coincide for the moderate r treatment (t(46) = .25, *p* = .80). For the large-stakes lottery, the gap between selling and buying prices is generally larger and is significant in every treatment (all *p*s < .0001), but the pattern of larger disparities for low and high r is replicated.[6] Moreover, both studies sup-

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[6]The finding of a substantial endowment effect at moderate r (S/B = 2.0) may seem surprising. However, recall that there is no guarantee that we chose the value of r that minimizes the effect. Moreover, some respondents may have rejected our suggested r in favor of something else. In general, such heterogeneity in valuations and unintended reference prices can be regarded as obscuring noise, through which the effects predicted by our model may nevertheless be observed.

port our specific predictions that buyers' bids will be depressed in the low r treatments and sellers' bids will be inflated in the high r treatments. Otherwise, our manipulation of r exerted little influence, as the t-tests in Table 2 show. Figure 2 presents a visual summary of changes in the endowment effect as the reference price is varied.

It may seem peculiar that we used expected value as the moderate reference price for the small lottery but as the high reference price for the large lottery. However, in line with prior research examining the effect of stakes on risk aversion (see, e.g., Green, Myerson, and Ostazewski 1999; Hershey and Shoemaker 1980; Rachlin, Brown, and Cross 2000; Weber and Chapman 2005), we expected respondents to be approximately risk neutral for small stakes. Table 1 confirms this expectation, as \$.83 is close to average bids of both buyers and sellers. However, because larger amounts typically induce greater risk aversion, we used \$83 as the

Table 1
PRICE GAPS ARE U-SHAPED AS REFERENCE PRICES VARY FROM LOW TO HIGH

	Reference Price		
	Low	*Moderate*	*High*
Small-Stakes Lottery			
Sellers	.91 (.12)	.87 (.11)	1.45 (.12)
Buyers	.44 (.06)	.82 (.12)	.84 (.09)
Large-Stakes Lottery			
Sellers	39 (4.20)	44 (3.02)	85 (4.53)
Buyers	13 (2.05)	22 (2.52)	25 (3.84)

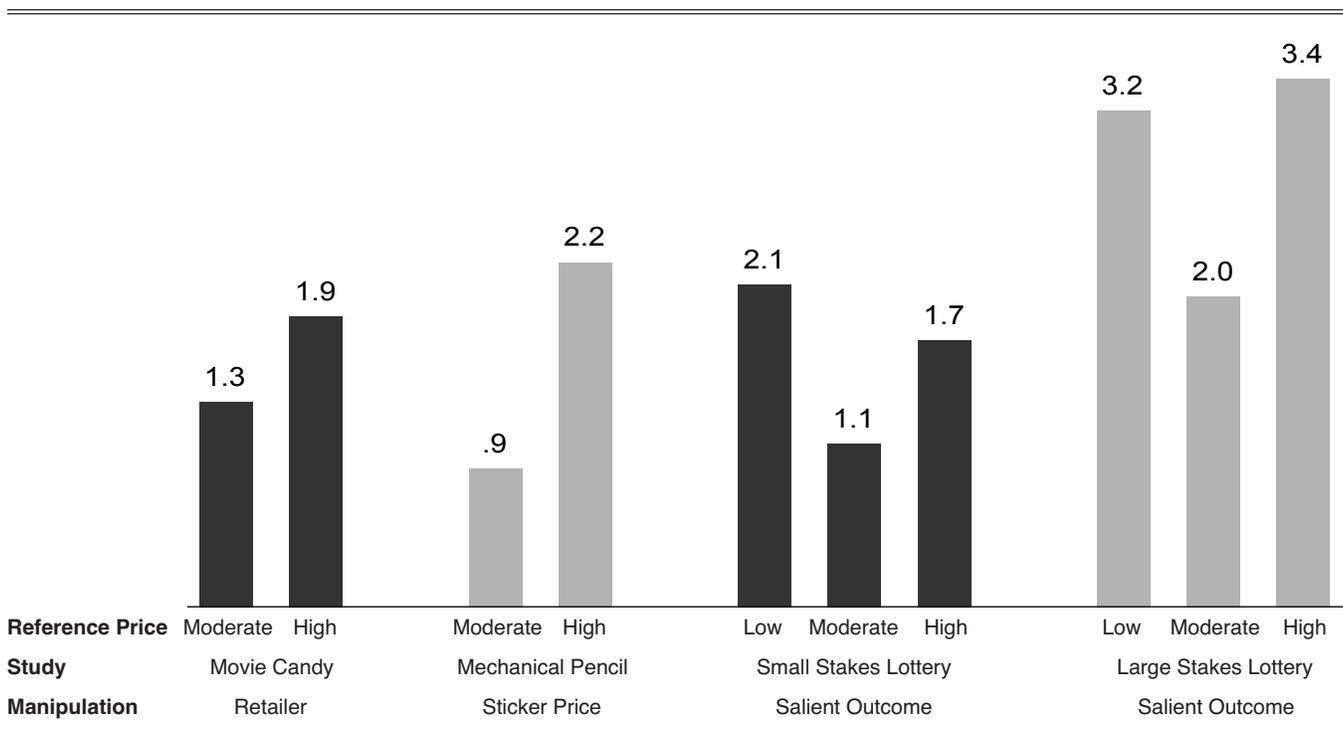Notes: Parenthetical numbers indicate standard errors of the means. All amounts are in U.S. dollars.

Table 2
T-TESTS CONFIRM THE MODEL'S PREDICTIONS ABOUT DIFFERENCES BETWEEN ALTERNATIVE MEASURES OF RESERVATION PRICES

Small-Stakes Lottery	
$B_{low} < B_{mod + high}$	\$.44 vs. \$.83; t(74) = 3.81, *p* = .0003
$B_{mod} \approx B_{high}$	\$.82 vs. \$.84; t(43) = .13, *p* = .90
$S_{high} > S_{low + mod}$	\$1.45 vs. \$.89; t(81) = 3.74, *p* = .0003
$S_{low} \approx S_{mod}$	\$.91 vs. \$.87; t(57) = .25, *p* = .81
Large-Stakes Lottery	
$B_{low} < B_{mod + high}$	\$13 vs. \$24; t(176) = 3.12, *p* = .002
$B_{mod} \approx B_{high}$	\$22 vs. \$25; t(118) = .75, *p* = .45
$S_{high} > S_{low + mod}$	\$85 vs. \$41; t(189) = 8.99, *p* < .0001
$S_{low} \approx S_{mod}$	\$39 vs. \$44; t(125) = 1.07, *p* = .29

Figure 2
SUMMARY OF OBSERVED PRICE GAPS, AS MEASURED BY RATIO OF MEAN SELLING TO BUYING PRICES

Reference Price	Moderate	High		Moderate	High		Low	Moderate	High		Low	Moderate	High
Study	Movie Candy			Mechanical Pencil			Small Stakes Lottery				Large Stakes Lottery		
Manipulation	Retailer			Sticker Price			Salient Outcome				Salient Outcome		

Values: 1.3, 1.9 (Movie Candy); .9, 2.2 (Mechanical Pencil); 2.1, 1.1, 1.7 (Small Stakes Lottery); 3.2, 2.0, 3.4 (Large Stakes Lottery)

high reference price for the large lottery study, and the results confirmed that v was indeed well below $83.

EXPERIMENTAL TESTS USING VALUE MANIPULATIONS

It is evident that the gap between valuations (v) and reference prices (r) depends on both quantities. We have thus far tested our theory of the endowment effect by manipulating r. An alternate approach is to manipulate v. For the typical situation in which r > v, manipulations that increase v should affect buying prices more than selling prices because most buying prices equal v, whereas most selling prices are a weighted average of v and r.[7] As a consequence, in the typical case in which r > v, increasing v should reduce the endowment effect.

There are many ways to manipulate v independently of r. We could modify the description or contents of the good (e.g., by adding either chili powder or macadamia nuts to a chocolate bar). We could manipulate the state of the person doing the evaluation (e.g., having the participants consider a chocolate bar when they are more or less hungry).We could endow participants with substitutes or complements for the good in question (e.g., a sugar cookie vs. red wine). We could manipulate the time at which the good is received (in which case, we would predict a stronger endowment effect for goods delivered in the future than those delivered in the present because delay would cause valuations to be discounted but not reference prices). We could also manipulate the quantity of good being considered (in which case, we would predict that the endowment effect would be increasing in quantity because valuations would reflect diminishing marginal utility but reference prices would not). Each of these manipulations yields a readily testable prediction, and any could be used to falsify (or circumscribe) our theory. In the following study, we use one of the proposed tests, by effectively modifying the contents of the focal good.

Study 4: Manipulating Product Utility

Method. The participants in this study were 40 students in a graduate marketing course. Our stimuli were two flavors of Vosges brand chocolate bars: "Wooloomooloo," made with milk chocolate and coconut, and "Oaxaca," made with dark chocolate and chili pepper. Pretests indicated that the sweet and salty Wooloomooloo bar was generally preferred over the bitter and spicy Oaxaca bar. Their original price tags ($7.50) were clearly visible, though we did not direct attention to them. We asked each student to report, for each flavor, both the most he or she would pay to buy a bar and the least he or she would demand to sell it. To motivate participants to reveal their true bids, we explained that we would use the incentive-compatible procedure described previously to enforce the decisions of four randomly selected students: one buyer and one seller for each flavor. After collecting the students' responses, we randomly generated a price and, for the selected students, exe-

cuted the transactions (or not) according to the specified rules.

Results. Maximum buying prices were significantly higher for the Wooloomooloo bar than the Oaxaca bar ($3.59 vs. $2.75; t(39) = 2.05, p = .05, paired t-test), but flavor had no effect on minimum selling prices ($5.18 vs. $5.28; t(39) = .27, p = .78, paired t-test). Correspondingly, the endowment effect was smaller for the high-value (Wooloomooloo) bar than for the low-value (Oaxaca) bar. This follows from our model because both flavors share a high reference price, and the average consumer valuation should be closer to this r for the tastier bar.

	Reservation Prices for Gourmet Chocolate Bars in U.S. Dollars (Standard Errors in Parentheses)	
	Lower Value: Oaxaca	*Higher Value: Wooloomooloo*
Sellers	5.28(.43)	5.18(.41)
Buyers	2.75(.29)	3.59(.35)

Note that this study used a within-subject design: We elicited both buying and selling prices from each respondent. This design makes it possible to directly test the hypothesis that the endowment effect (as defined by the ratio of selling to buying prices) will be smaller for the tastier bar. The results confirm this prediction: S/B = 1.69 for the Wooloomooloo bar versus 2.50 for the Oaxaca bar vs. (z = 2.04, p = .04).[8]

The obstacle to conducting similar tests for the prior studies is that their S/B ratios exist only as summary statistics, not as individual-level data. A solution to this problem (proposed by a reviewer) is to apply the delta method, which uses Taylor series expansions to approximate the variance of a combination of random variables (in our case, S/B). This method requires a measure of the correlation between S and B, which we cannot compute directly for Studies 1–3 because they all used between-subjects designs. Therefore, we turned to reports of within-subject studies in prior literature to inform an estimate. Brown (2005) reports a median correlation between buying and selling prices of .49, and Frederick (2012) finds correlations averaging .62. In our Study 4, the correlations are .52 for the Oaxaca bar and .73 for the Wooloomooloo bar. Using these data, we estimated $\rho(B, S) = .5$. This value is conservative by comparison because the resulting test statistic increases with the correlation estimate. Using the variances computed from the delta method, we constructed z-statistics to test whether the S/B ratios in each study differ significantly between treatments. The results, shown in Table 3, further support our previous conclusions. The endowment effect is significantly different in every case our model predicts.

EXTENDING THE TRANSACTION DISUTILITY MODEL TO EXPLAIN DEPRESSED TRADE RATES

The endowment effect typically refers to the disparity between buying prices and selling prices. However, purchases and sales are special cases of a general class of

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[7]The more strongly consumers experience transaction disutility, the more strongly this prediction will hold. When consumers feel transaction disutility with extreme intensity, variations in v below r should not affect selling prices at all. The Web Appendix (www.marketingpower.com/jmr_webappendix) provides an elaboration of this point.

[8]Four people declared a maximum buying price of $0 for some flavor. To retain these respondents while avoiding division by zero, we added $.50 to every response. This transformation is conservative in the sense that it reduces the difference in mean ratios.

Table 3

SIMULATED WITHIN-SUBJECT ANALYSES USING THE DELTA
METHOD RECONFIRM THE EXPECTED PATTERN

Study	Treatments Compared	z-Score
Movie candy	High vs. moderate r	2.08*
Mechanical pencils	High vs. moderate r	3.75*
Small-stakes lottery	High vs. moderate r	2.91*
	Moderate vs. low r	3.20*
	High vs. low r	1.08[a]
Large-stakes lottery	High vs. moderate r	2.76*
	Moderate vs. low r	2.18*
	High vs. low r	.48[a]
Gourmet chocolate	Lower vs. higher v	2.04[b]

*Significant at $p < .05$.
[a]The absence of a significant difference between the high and low r conditions is consistent with our model.
[b]This test did not rely on the delta method; see Study 4 for details.

exchanges that need not involve money. Such exchanges have also been cited as examples of the endowment effect, as in Knetsch's (1989) classic study, in which only 11% of people endowed with a coffee mug preferred to trade it for a candy bar, whereas only 10% of those endowed with a candy bar preferred to trade it for a mug.

Viewed in terms of the long-standing pain-of-losing account, the reluctance to trade one good for another is almost self-explanatory. From our theory's perspective, the result is less obvious, but our argument is readily extended. Consider a participant who receives a chocolate bar he or she values at $2, with a $10 price tag prominently displayed. As we have demonstrated, the comparatively high reference price increases the amount of money participants demand in exchange for that chocolate. But this result presumably extends to whatever form of compensation is offered in exchange. To the extent that high reference prices elevate the compensation demanded above valuations, anything of comparable value (e.g., $2.00, seven oranges, a coffee mug) will be insufficient to induce a trade. This analysis suggests that reducing reference prices to levels more comparable with valuations should increase trade rates. We test this prediction next.

Study 5: Varying Reference Price in Trades Between Two Goods

To test the applicability of our theory to trades that do not involve money, we sought two products of comparable attractiveness whose reference prices could be plausibly manipulated. We chose a package of BIC highlighter pens and a package of Velcro cord straps used to organize computer cables and power cords.

Method. At a Harvard behavioral research laboratory, 133 participants were recruited to attend one of several sessions, each of which was dedicated to one of four experimental conditions. We varied the good with which respondents were initially endowed (highlighters or cord straps) and, using a pricing gun as in Study 2, the reference prices attached to those goods (high or moderate). In the high r condition, reference prices were the actual retail prices: $4.29 for the highlighters and $3.89 for the cord straps. In the moderate r condition, we chose prices of $1.19 and $.99, respectively.

Each lab session began by endowing each participant with one of the goods and explaining that it was theirs to

keep if they chose. Next, we passed around samples of the alternate item for inspection. Participants then indicated whether they wanted to retain the item with which they had been endowed or trade it for the alternative (for our full instructions, see the Web Appendix at www.marketingpower.com/jmr_webappendix).

Results. Pooling across both goods, only 35% of participants assigned to the high r treatment chose to trade ($\chi^2(1) = 10.37, p = .001$). In contrast, in the moderate r condition, the trade rate increased to 49% ($\chi^2(1) = .17, p = .68$), very close to the 50% expectation if endowment per se has no effect. For a more precise test of the effects of each independent variable and their interaction, we applied a logit model to the data. In such a model, an experimental manipulation can manifest as either a main effect or an interaction effect, depending on how the dependent variable is defined. Figure 3 shows the results in terms of the item participants ultimately chose: Initial endowment had very little effect on preference when the reference prices were moderate but a large effect when they were high. With this construction, the logit model shows no effect of reference price ($z = .63, p = .53$) but a main effect of endowment ($z = 2.59, p = .01$) and a significant interaction effect ($z = 2.13, p = .03$).

Alternatively, we can define the dependent variable as the participant's decision to retain his or her initial endowment (or not). By this definition, the interaction is not significant, but both main effects are. The two tests are formally equivalent, and both indicate that endowment had a statistically greater influence on preference when the goods were presented with high reference prices.

Apicella et al.'s (2012) study involving the Hadza hunter-gatherers of Northern Tanzania indicates that the endowment effect (as measured by trade reluctance for biscuits and lighters) was greater among Hadza who lived in a vil-

Figure 3

PREFERENCE BETWEEN TWO ITEMS DEPENDS ON INITIAL
ENDOWMENT WHEN REFERENCE PRICES ARE HIGH
(TYPICAL), BUT NOT WHEN MODERATE
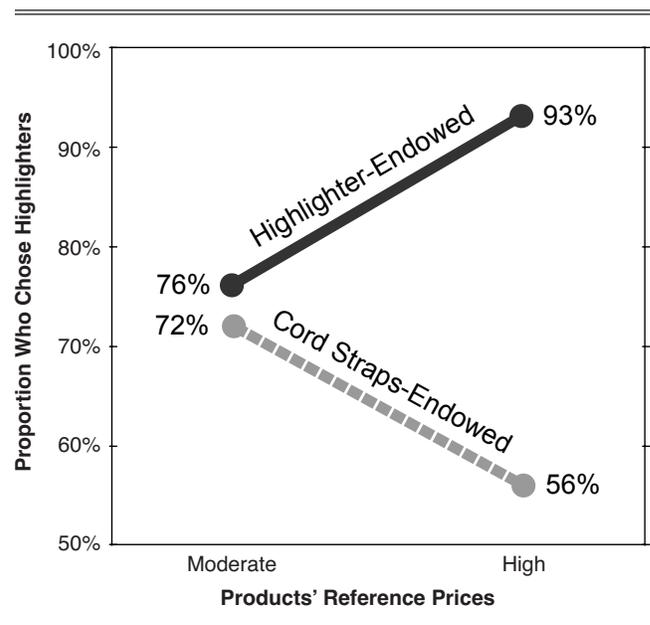
lage frequented by Western tourists than among those who were geographically remote and thus isolated from market activities. These results provide additional support for our model, by suggesting that exposure to modern markets may increase the endowment effect, perhaps by imparting notions about reference prices and fair exchange rates. These findings seem to conflict with List (2003), who reports that greater experience trading sports cards and collector's pins attenuated the endowment effect. We propose the following reconciliation: The isolated Hadza, because they had no prior exposure to markets, lacked the notion of a reference price that might dissuade a trade. In contrast, List's participants were familiar with this notion, but their extensive experience might have taught them that some reference prices are irrelevant with respect to what can be expected in exchanges and should therefore be ignored.

DISCUSSION

Six experiments support our contention that the endowment effect is often better understood as an aversion to transacting on unfavorable terms than as an aversion to parting with objects a person possesses (or imagines possessing). Although the pain of losing may also play a role, the typical characterization of the endowment effect as "the tendency to place a larger value on an item when it is in one's possession" (Brenner et al. 2007, p. 369) seems, at best, incomplete. However, any theoretical account of the endowment effect confronts a large set of experimental data to potentially explain. For example, Strahilevitz and Loewenstein (1998) find that people who possessed a coffee mug for 20 minutes demanded more to sell it than did others who had just received a mug. They also offered more to reacquire mugs that were taken away from them. This result seems more consistent with the pain-of-losing account than with our theory of reference prices. In light of such results, a reasonable conclusion is that our theory should supplement rather than supplant the prevailing view.

However, our model does comfortably accommodate several results that chafe other accounts. For example, it is common to find no endowment effect for money or monetary tokens, for the exchange of close substitutes, or for goods exchanged "as intended" (e.g., merchants selling retail goods). Proponents of the pain-of-losing account must treat such cases as exceptions (Novemsky and Kahneman 2005; Tversky and Kahneman 1991). By contrast, these results follow naturally from our model, as they are all instances in which v and r converge (as illustrated in Figure 1). For example, there is no endowment effect for a $5 bill because $5 is both the valuation and the reference price for all buyers and sellers. Similarly, we surmise that merchants experience no loss aversion because they ordinarily sell at or above the two most likely reference prices: wholesale and retail prices.[9]

Reference Prices Versus Focus on the Forgone

Carmon and Ariely (2000) propose an account of the endowment effect that they term the "focus on the forgone." By this account, sellers respond more to the quality of a good (which they forgo when selling) and buyers respond more to reference prices (because they are focused on the opportunity costs of the purchase). Our results contradict their account. First, in our chocolate bar study, manipulating the quality affected buyers more than sellers. Second, in the typical situation in which r > v, our model predicts that manipulations of reference price will affect sellers more than buyers—a prediction confirmed by our Studies 1, 2, 3a, and 3b and by additional studies summarized in Appendix A. Carmon and Ariely's model makes the same predictions as ours only when r < v. Although that situation is atypical, one of their studies used basketball tickets to the Final Four tournament and manipulated the stated face value between $15 and $45. They found that buying prices increased from approximately $65 to approximately $95, whereas selling prices remained essentially unchanged at approximately $175. However, note that even the highest reference price used in that study ($45) would be characterized as low by our model because it was well below typical buying prices and thus well below valuations.

Nonmarket Goods

Our model is not readily applicable to public or nonmarket goods, such as environmental quality, in which reference prices are unstated and difficult to impute. Yet such goods routinely exhibit a large endowment effect (see, e.g., Boyce et al. 1992; Brown and Gregory 1999). We suspect that many bids in such studies are intended as protest responses to avoid implied endorsement of a transaction regarded as offensive or illegitimate. This behavior reflects elements of both the reference price and pain-of-losing accounts: The adoption of a buying or selling role entails an assumption regarding current entitlement or ownership, and executing the specified transaction can be a source of disutility (e.g., discomfort, resentment, indignation, outrage).[10]

Implications for Practice

The prevailing account of the endowment effect conjures the image of consumers who "become attached to objects that are in their possession and are reluctant to part with them, even if they would not have particularly liked the objects had they not been endowed with them" (Van Boven, Loewenstein, and Dunning 2003, pp. 351–52). This characterization provides a rationale for the common marketing practice of offering free or low-cost trials. However, our

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[9]Koszegi and Rabin (2006, p. 1141) propose an expectations-based theory of reference dependent preferences, in part to accommodate such results. Their model "makes the extreme assumption that the reference point is fully determined by the expectations a person held in the recent past," in which case merchants do not encode sales as a loss of inventory and buyers do not encode purchases as a loss of money. Expectations play no special role in our account, and it is unclear how our manipulations (of reference price or valuation) would affect expectations. Thus, their account does not seem to explain, much less entail, our findings.

[10]For many public goods, such as endangered species, transaction disutility is thrust on those pressed into the role of sellers (any noninfinite selling price implies the presumption that the good is theirs to sell) or buyers (any nonzero buying price implies acceptance of responsibility for the good's fate). This predicament was cleverly manipulated by the operator of www.SaveToby.com, who threatened to kill an adorable rabbit ("Toby") unless he received gifts totaling $50,000. Avowing "God as my witness, I will devour this little guy," the website operator posted the recipe he planned to use, which included the line to "cut 1 Toby into bite sized pieces." The site provoked outrage and prompted calls to PayPal to shut down the "donations" link, reflecting visitors' repudiation of the transaction they were forced to contemplate. Toby's execution has been stayed several times, and his current welfare is unknown.

research suggests that the benefits of consumers' desire to maintain their entitlements might be overwhelmed by the negative impact of establishing low reference prices. Marketers might be better off restructuring free trials as money-back guarantees or emphasizing the post-trial price rather than relegating such information to the fine print.

Digital goods are particularly vulnerable to transaction disutility because consumers perceive (usually correctly) that the goods' marginal cost is near zero (see Nunes, Hsee, and Weber 2004). If adopted as a reference price, this may drive willingness to pay below valuations. Indeed, we suspect that this contributes to the popularity of Napster and its many quasi-legal successors, toward which otherwise law-abiding citizens flock to avoid paying the market prices that seem outrageous when compared with zero. To help justify nonzero prices, some recording artists (Radiohead, Nine Inch Nails) have published "special editions" of their music containing tangible extras such as glossy photographs and elaborate packaging.

Another important deterrent of paying a listed price is consumers' fear that they might subsequently discover that they got a bad deal. There are various ways to minimize the influence of this anticipated transaction disutility. For example, auction websites could post information about past transaction prices for similar products to allay bidders' concerns about overpaying. Firms could also do so through price guarantees (e.g., "find a lower price elsewhere, and we'll refund the difference"). Indeed, the travel website Orbitz goes one step further by automatically giving a refund if another customer subsequently buys the same itinerary at a lower fare.

Our reference price theory of the endowment effect is also pertinent to legal analysis. Because efficient allocation and entitlement decisions require a consensual measure of value, economic and legal scholars writing about the endowment effect frequently raise the question whether valuations are better represented by buying prices or selling prices. However, outside law journals, this important question is rarely raised and never answered.

Following Korobkin (2003), we suggest that the answer must depend, in part, on the reasons the measures diverge. To illustrate, suppose that buyers value widgets at $0 and owners value them at $2. Should they be produced for $1? Perhaps, if widgets have a surprisingly pleasant texture that can only be appreciated upon possession. However, if the elevated selling prices derive not from any experienced tactile utility but only from anticipated sadness accompanying a sale, their production would not seem justified—after all, why expend resources creating objects capable only of causing pain?

Most discussions of the endowment effect seem to either blend or alternate between these two conceptions and thus provide no clear justification for choosing one metric over the other. In contrast, we believe that our model and data do permit such a conclusion—specifically, that buying prices are the superior measure of valuation when $v < r$ (typical for market goods) and that selling prices are a better measure when $r < v$ (which might occur for nonmarket goods that people value but do not expect to have to pay for).

If we treat valuation as an underlying construct informed by various related observations (e.g., expressions of liking, interest, and knowledge; buying prices; selling prices; the number of hours one would wait to obtain the good), data can speak to the degree to which any specific measure correlates with that construct (e.g., the degree to which it loads onto the principle component of a factor analysis). This characterization provides a criterion for defining a particular metric as better or worse, much as an item on an IQ test might be regarded as good or bad depending on its degree of correlation with the overall test score.

In the studies summarized in Appendix B, v is below r, in which case we would expect buying prices to be the superior measure of valuation. This is what we observe. In these studies, each respondent reported a buying or selling price and at least one other measure plausibly correlated with valuation (e.g., gender, measure of baseball knowledge, liking of fossils). In all such cases, these alternate measures of valuation correlated more highly with buying prices than with selling prices, providing initial presumptive evidence that buying prices are the superior measure.

CONCLUSION

Our research builds on recent attempts to dissect loss aversion and better understand its role in the endowment effect (Ariely, Huber, and Wertenbroch 2005; Camerer 2005; Knetsch and Wong 2009; Novemsky and Kahneman 2005). Any conception of loss aversion requires a reference point against which gains and losses are defined. However, despite the considerable body of research on reference prices (Mazumdar, Raj, and Sinha 2005), their influence on the endowment effect has been largely overlooked and certainly underdeveloped. Notably, many relevant field studies can be understood in terms of transaction disutility arising from unfavorable comparisons with a reference price, including brand choice (Winer 1986), real estate sales (Einiö, Kaustia, and Puttonen 2008; Genesove and Mayer 2001), real estate rentals (Simonsohn and Loewenstein 2006), stock divestment decisions (Odean 1998), and a general tendency to evaluate transactions in nominal rather than real monetary terms (Shafir, Diamond, and Tversky 1997). All these examples reflect a reluctance to trade on terms that are unfavorable in comparison with a reference price as much as they reflect a reluctance to part with endowments.

APPENDIX A: THREE ADDITIONAL STUDIES DEMONSTRATING THE PREDICTED RELATIONSHIP BETWEEN REFERENCE PRICE AND ENDOWMENT EFFECT

Our model predicts a smaller endowment effect among respondents who adopt a more moderate reference price, whether r is manipulated (directly or indirectly) or selected (e.g., by soliciting estimates of market price). In this Appendix, we summarize three studies that support this prediction (for details, see Table A1). Additional details are available on request.

• Impulse toothbrush (hypothetical; $N = 133$): We described a high-tech toothbrush under development called Impulse (a product of our imaginations), which "promises to greatly improve oral health" with a brush head that "emits electromagnetic pulses that kill bacteria." Participants were randomly assigned to the role of buyer or seller and asked their reservation prices for this product. We then asked each respondent to estimate Impulse's retail price when brought to market; we

Table A1

OTHER DEMONSTRATIONS OF THE RELATIONSHIP BETWEEN REFERENCE PRICE AND ENDOWMENT EFFECT

		Reference Price	
Good	Role	Moderate	High
"Impulse" toothbrush	Sellers	24_{30}	102_{34}
	Buyers	24_{37}	73_{32}
	Ratio	1.0	1.4
Airline vouchers	Sellers	221_{25}	451_{34}
	Buyers	208_{26}	280_{35}
	Ratio	1.1	1.6
Chess set	Sellers	166_{32}	329_{34}
	Buyers	79_{35}	82_{34}
	Ratio	2.1	4.0

Notes: All amounts are in U.S. dollars. Subscripts indicate sample sizes.

regard these estimates as proxies for self-generated reference prices that might distort bids away from valuations. The median estimate was $70; we performed a median split to define two reference price groups, moderate and high. The estimates of the moderate r group averaged $24, and the estimates of the high r group averaged $88.

- Airline vouchers (hypothetical; N = 124): Picnickers waiting along the Boston Esplanade for the city's annual Fourth of July fireworks display first stated the most they would pay or least they would accept for two domestic tickets on American Airlines. Rather than providing a reference price, we later asked them to estimate the market price for such a pair, which, as in the toothbrush study, we used as proxies for the reference prices they adopted. We again defined moderate and high reference price groups in comparison with the median market price estimate ($300). The estimates of the moderate r group averaged $214, and the estimates of the high r group averaged $416.
- Chess set (hypothetical; N = 135): We depicted a hand-carved chess set and attempted to manipulate r indirectly by reporting that it took 20 (80) hours to produce for the moderate (high) condition. We intended this as an indirect manipulation of reference price because artisans presumably charge more for things that take longer to make.

APPENDIX B: FIVE ADDITIONAL STUDIES DEMONSTRATING THE PREDICTED RELATIONSHIP BETWEEN VALUATIONS AND ENDOWMENT EFFECT

We extended the results from Study 4 with five other studies showing that participants who care more about, know more about, or have greater interest in the focal good tend to exhibit a smaller endowment effect. In other words, however fandom is measured, "fans" tend to exhibit a smaller endowment effect than "nonfans." This appears counterintuitive from the pain-of-losing account, which suggests that people who most value a good will experience the most pain from giving it up. However, the results follow straightforwardly from our model because fans have higher valuations, thereby reducing the distance between v and r and the distortion caused by transaction disutility. The counterintuitive prediction that fans of a product will exhibit a smaller endowment effect than nonfans drew support from the five studies summarized next (for details, see Table B1):

Table B1

OTHER DEMONSTRATIONS OF THE RELATIONSHIP BETWEEN VALUATIONS AND ENDOWMENT EFFECT

		Average Interest Level	
		Low (Nonfans)	High (Fans)
Good	Role		
Wii	Sellers	251_{37}	255_{24}
	Buyers	110_{31}	201_{29}
	Ratio	2.3	1.3
Red Sox tickets	Sellers	264_{18}	263_{34}
	Buyers	98_{15}	160_{34}
	Ratio	2.7	1.6
Ammonite fossil	Sellers	27_{45}	14_{15}
	Buyers	5_{45}	8_{15}
	Ratio	5.2	1.8
Wicked musical tickets	Sellers	108_{86}	159_{199}
	Buyers	61_{92}	131_{200}
	Ratio	1.8	1.2
Vikings voucher	Sellers	27_{80}	24_{42}
	Buyers	13_{80}	19_{47}
	Ratio	2.1	1.3

Notes: All amounts are in U.S. dollars. Subscripts indicate sample sizes.

- Wii (hypothetical; N = 121): Participants indicated reservation prices for a Nintendo Wii video game system and also reported the types of video game systems they already owned and the number of hours per week they played video games. All were told (truthfully) that the typical street price of the Wii was currently approximately $350. Respondents were coded as fans if they owned one or more video game systems and reported a nonzero playing time. By this criterion, 44% of our respondents were fans.
- Red Sox tickets (real; N = 101): Participants (drawn from areas near Boston's Fenway Park) indicated their reservation prices for an actual pair of tickets to a home game against the Yankees two weeks hence. All were told (truthfully) that we had paid $300 for that pair of tickets on StubHub.com. The survey showed the location of the seats within the stadium and the view of the field from those seats. Each respondent was asked who the Red Sox defeated in the 2004 World Series—the team's first championship in 86 years. We defined those who produced the correct answer (St. Louis Cardinals) as fans. By this criterion, 68% of respondents were fans.
- Ammonite fossils (real; N = 60; within-subject design): Sixty MBA students at the Massachusetts Institute of Technology indicated both maximum buying and minimum selling prices for a polished ammonite fossil, with actual purchases or sales conducted according to second price auctions. We measured fandom by respondents' answer to the question "How much do you like fossils?" which was placed at the end of the survey. Respondents reported this on a scale ranging from 0 ("not at all") to 10 ("I love them!"). We defined as fans those respondents at or above the midpoint of the scale. By this criterion, 25% of our respondents would be characterized as fossil fans. Frederick (2012) uses these data for a different purpose.
- *Wicked* musical (hypothetical; N = 577): Participants from two universities and an online survey site indicated reservation prices for two center orchestra tickets to the musical *Wicked* at the Opera House in Boston. All were told (truthfully) that the face value of the pair of tickets was $175. Afterward, they were asked how much they enjoyed musical theater overall, answering on a seven-point scale anchored at 1 ("don't enjoy it at all") to 7 ("enjoy it greatly"). We defined a fan as those respondents at or above the midpoint of the scale. By this criterion, 72% of our respondents would be characterized as fans of musical theatre.

•Vikings voucher (real; N = 249): Participants on an online survey site hosted by Yale University indicated reservation prices for a lottery ticket that paid a $50 Amazon.com voucher if the Minnesota Vikings defeated the New Orleans Saints in the NFC championship game. The Saints were favored by 3 in that game (and won, by 3, in overtime, 31–28). Because men tend to enjoy both football and gambling more than women, we defined men as fans and women as nonfans. Thirty-six percent of our respondents were men.

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