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Multiple-Unit Holdings Yield Attenuated Endowment Effects

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Previous endowment effect experiments have examined circumstances in which people encounter a single unit of a good (e.g., one chocolate). We contrast single-unit treatments with multiple-unit treatments in which participants encounter several units of a good (e.g., five chocolates). We observe endowment effects of typical magnitude for singleton holdings but attenuated endowment effects for multiple-unit holdings. Moreover, endowment effects consistently arise for singletons even as the definition of a unit is altered. For instance, participants holding one piece of chocolate show an endowment effect of standard size, but so do participants holding one box of chocolates. Yet the box contains about 20 individual pieces of chocolate, and participants given that many separate pieces show a substantially attenuated endowment effect. We thus propose the property of "unit dependence": the definition of a unit can change, but contingent on any given definition, a pronounced endowment effect may emerge for singletons but not multiples.

Key words: endowment effect; loss aversion; prospect theory; value function; query theory
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1. Introduction

The endowment effect is a bias toward keeping rather than parting with one's possessions. Much experimental work has used small-stakes items such as mugs and chocolates to document two specific manifestations of the effect: reluctance to trade and seller–buyer pricing discrepancies. In an early demonstration of reluctance to trade, Knetsch (1989) gave one group of participants a mug and another group of participants a fancy chocolate bar and told everyone they could either keep the item they possessed or swap it for the alternative item. Only about 10% of the individuals in each group chose to swap. In an early demonstration of seller–buyer pricing discrepancies, Kahneman et al. (1990) observed that participants holding a mug required a higher price to sell that mug than other participants were willing to pay to purchase the same mug. Building on experimental work, many field studies have reported manifestations of the endowment effect with large-stakes items such as housing (Genesove and Mayer 2001) and investments (Benartzi and Thaler 1995, Odean 1998).

The classic account of the endowment effect (Thaler 1980; Tversky and Kahneman 1981, 1986) assumes that preferences are reference dependent; that is, people assess choice options by evaluating the changes these options entail from a reference point. It attributes the endowment effect to loss aversion, the notion that negative changes have greater impact than corresponding positive changes. To illustrate, consider Knetsch's experiment and identify participants' reference points with their status quo. From the status quo of mug holders, a trade yields two changes: the loss of a mug and the gain of chocolate. From the status quo of chocolate holders, a trade yields the loss of chocolate and the gain of a mug. If losses loom larger than gains, a simultaneous gain and loss will, on average, be a net negative. The loss of the possessed item will outweigh the gain of the alternative item. People will thus be reluctant to trade.

In this article, we experimentally examine whether the endowment effect is affected by an utterly commonplace but previously unexplored factor—the number of units of a good under consideration. To our knowledge, extant work has only examined circumstances in which participants were endowed (or not) with just one unit of a good. Knetsch, for example, endowed some participants with one chocolate. He did not endow any participants with two or more chocolates. That is where we come in. Using both pricing and trading paradigms, we contrast treatments in which participants encounter one unit of a good

with treatments in which participants encounter several units of the same good. We find that endowment effects of typical magnitude emerge in our single-unit settings but that these effects are attenuated in our multiple-unit settings. The attenuation can eventually be nearly complete: with sufficient units, we observe little endowment effect.

A natural follow-up question is, what happens as the prevailing definition of a unit changes? For instance, in one of our experiments, participants who hold one piece of chocolate show an endowment effect of standard magnitude, but so do participants holding one box of chocolates. Yet the box we use includes about 20 individual pieces of chocolate, and participants given that many separate pieces show a substantially attenuated endowment effect. We thus conclude that the endowment effect may be "unit dependent." The prevailing definition of a unit can change, say, from a piece to a box of chocolate, but behavior contingent on any given definition may show the same regularities, a pronounced endowment effect for one unit that is attenuated with additional units.

The notion of unit dependence accords with the existence of an endowment effect for both small-stakes items such as chocolates and large-stakes items such as housing. Our findings in no way imply that the presence or absence of the effect depends on the level of the stakes. They concern only the way in which the effect diminishes with multiple units. Each unit can itself be either low stakes or high stakes.

We next present an initial pricing experiment and a subsequent trading experiment. Each time, we collect preference data that show attenuated endowment effects given multiple units. In our trading experiment, we also have participants list the reasons for their keep/trade decision. After presenting our trading data, we discuss four mechanisms by which multiple units might attenuate the endowment effect. One of these mechanisms extends the Johnson et al. (2007) query theory to multiple-unit settings and is corroborated by an analysis of participants' lists of reasons. We hope our work helps establish the phenomenon of attenuated endowment effects for multiunit holdings, and we hope that future work more incisively examines the mechanisms we identify as well as additional mechanisms that may underlie this phenomenon.

2. Pricing Experiment

We recruited participants at the London Business School. They were paid £10 for an hour during which they took part in our experiment and then completed an unrelated study.

We investigated two single-unit and two multiple-unit treatments. In the single-piece treatment, participants encountered one individually wrapped piece of Lindt chocolate. In the single-box treatment, participants encountered one box containing about 20 pieces of chocolate. Boxes could contain slightly different numbers of chocolates because they were in original packages from Lindt, and Lindt sells chocolates by weight. We used 8.5-ounce boxes. In one multiple-unit treatment, participants encountered 5 pieces of chocolate, in the other, they encountered 25 pieces.

Participants took part in the experiment individually rather than in groups. That is, each participant was run through the experiment outside the presence of any other participants. Upon arrival at a scheduled time, participants were randomly assigned the role of seller or buyer. Sellers were given their endowment and told the chocolate(s) were theirs to keep. Buyers were asked to inspect the chocolate(s) available for purchase. Participants then made a series of choices between the chocolate and different cash amounts. Sellers indicated whether they would sell their chocolate for each amount; buyers indicated whether they would buy at each amount. The appendix contains sample instruction sheets. To create incentive compatibility, the instructions indicated that one of the choices would be randomly selected and that the participant's preference in that choice would be enforced. Buyers used their own money to complete a purchase.

We did not allow "partial" transactions. For example, participants offered the opportunity to buy or sell 25 chocolates could not buy or sell only some of the 25 units—they were required to buy or sell all the units under consideration. The restriction to "all-or-none" transactions is purely a matter of methodological consideration. We are, of course, interested in the possibility of endowment effects in all kinds of transactions, including partial transactions. However, all-or-none transactions provide a clean test for an attenuated endowment effect, whereas partial transactions do not. In particular, all-or-none transactions do not confound the impact of endowment with potentially asymmetric influences of marginal utility. To explicate, consider a seller who holds 25 chocolates and who offers a partial sale of $n < 25$ of these chocolates to a buyer. In assessing the potential transaction, the seller may consider the marginal utility of his or her nth through 25th chocolates, and the buyer considers the marginal utility of the 1st through nth chocolate. The impact of being endowed (or not) with the chocolates will thus be confounded with the asymmetric impact of marginal utility on the two parties. In contrast, when the seller and buyer consider an all-or-none transaction, there is no differential impact of marginal utility on the two parties (for risky choice, the relationship between marginal utility and loss aversion is studied by Erev et al. 1999, Erev et al. 2008, Ert and Erev 2008).

Our decision to have participants come to the experiment one at a time rather than in groups was meant to ensure that only all-or-none transactions were easily achievable. We believed that convex preferences—a taste for some chocolate and some cash, over a lot of one and little of the other—might predominate. If so, then participants would find partial transactions appealing, especially in the 25-unit treatment. For instance, a participant given 25 chocolates may immediately see these chocolates as "too much" and consider giving up some of the chocolates for cash. We worried that simply banning partial transactions within a group-based design would prove insufficient; individuals placed together could engage in partial transactions surreptitiously during the experiment or freely upon departing from it. We were also worried that conducting all-seller or all-buyer groups might prove insufficient, because, for instance, two sellers, one of whom had sold his or her chocolates and one of whom had not, could engage in a partial transaction upon departing the experiment. In sum, running participants in isolation was a good way to ensure that only all-or-none transactions were easily achievable.

Finally, recall that the classic account of the endowment effect implies that selling prices will exceed buying prices in every treatment. In contrast, we anticipated that in the single-piece and single-box treatments, selling prices would indeed exceed buying prices but that this discrepancy would be attenuated in the multiunit treatments.

2.1. Results

Table 1 presents our study results. Shown are the units of chocolate used in the relevant treatment, split by selling and buying data. Row 1 displays the number of participants in each role in each treatment, and row 2 presents median prices.

A simple, initial approach is to consider the ratio of median selling to median buying prices in each treatment. As row 3 of Table 1 indicates, the ratio is 2.00 for the single-piece treatment, declines to 1.60 for five pieces, and falls to 1.14 for 25 pieces. The ratio goes back up, to 2.50, when we return to a single-unit treatment, this time with an entire box of chocolates. Past studies often report ratios of about 2. Thus, the findings from our single-unit treatments are very much in line with past work. Nevertheless, our multiunit treatments produce attenuated pricing discrepancies.

A related, informal approach simply records, for each treatment, where the median selling price falls in the buying price distribution. For a single piece, the median selling price of £1 exceeds 14 of the 15 buying prices. Similarly, for five pieces, the median selling price of £2 exceeds 18 of the 20 buying prices. However, for 25 pieces, the median selling price of £4 exceeds only 9 of the 15 buying prices. Finally, in the single-box treatment, the median selling price of £5 exceeds all 20 buying prices. These observations indicate that in the single-piece treatment, sellers demand higher prices than buyers are willing to pay; as we move to multiple units, this pattern at first persists with five pieces, but it largely collapses with 25 pieces; and finally, when we return to single units, in the box treatment, the pattern reemerges. Row 4 of Table 1 provides nonparametric tests that reinforce the story. It shows one-tailed p-values from Mann–Whitney U-tests comparing the full distributions of selling and buying prices in each treatment. The distributions are highly significantly different for all but the 25-piece treatment. Rows 5 and 6 present corresponding parametric tests; these rows show means, standard deviations, and one-tailed p-values for two-sample t-tests that accord with the Mann–Whitney tests. In sum, the endowment effect is obtained with single units, whether a unit is defined as one piece or an entire box of chocolates, but it is attenuated given sufficient units.

An additional aspect of our data concerns a contrast of the box and 25-piece treatments. Because the box contains about 20 individual pieces, these treatments offer comparable amounts of chocolate. In essence, all that is varied across them is the relevant unit. Median and mean selling prices are roughly equal

Table 1 Pricing Results

Units of chocolate:	1 piece		5 pieces		25 pieces		1 box	
	Seller	Buyer	Seller	Buyer	Seller	Buyer	Seller	Buyer
1. No. of participants	17	15	20	20	17	15	19	18
2. Median price	1.00	0.50	2.00	1.25	4.00	3.50	5.00	2.00
3. Ratio of sell to buy	2.00		1.60		1.14		2.50	
4. One-tailed p-value for Mann–Whitney U-test	< 0.01		< 0.005		0.105		< 0.001	
5. Mean price (SD)	1.06 (0.59)	0.58 (0.40)	1.76 (0.64)	1.19 (0.41)	4.68 (1.71)	4.10 (1.86)	5.03 (2.32)	2.06 (1.31)
6. One-tailed p-value for two-sample t-test	0.01		< 0.005		0.18		< 0.001	

either way ($t = -0.59$, two-tailed $p = 0.55$; Mann–Whitney $U = 151.5$, two-tailed $p = 0.75$). Yet buying prices are markedly unequal, much lower for the box than for the 25 individual chocolates ($t = 3.41$, two-tailed $p < 0.01$; Mann–Whitney $U = 42$, two-tailed $p = 0.001$). In our data, then, enlarging the unit from individual pieces to boxes does not impact selling prices much but dramatically decreases buying prices.

To appreciate this pattern, it is necessary to distinguish between two potential forms of unit dependence. We have already broached the unit dependence of loss aversion. As the definition of a unit is enlarged from pieces to boxes—so that a constant amount of chocolate corresponds to fewer units—this form of unit dependence can push up selling prices but will have no impact on buying prices (assuming no loss aversion for money). Another relevant form of unit dependence concerns utility per se (apart from loss aversion). Importantly, this form of unit dependence will impact both selling and buying prices and can either pull down or push up both types of prices. Utility will be unit dependent simply because packing chocolates into a box may alter consumers' experience. It will decrease if the box is unattractive, cumbersome, or somehow detracts from perceived per-piece value and will increase if the box is attractive, useful, or enhances perceived per-piece value.

In general, the combined impact of the unit dependence of loss aversion and utility can engender two types of patterns. First, when enlarging the definition of a unit decreases utility, buying prices will fall. Unit dependence of loss aversion will then be a counteracting force so that selling prices fall by less, do not change, or actually increase. This is the pattern that may have arisen in our experiment. Second, when enlarging the definition of a unit increases utility, buying prices will rise. Unit dependence of loss aversion will then be a complementary force so that selling prices rise by even more.

3. Trading Experiment

As before, we recruited participants at the London Business School and paid them £10 for our experiment and a later, unrelated study. We investigated 10 treatments: two concerned single-unit endowments, seven concerned multiple-unit endowments, and one concerned a hybrid endowment we explain momentarily.

In a baseline, single-items treatment participants received either one Ferrero Rocher chocolate or one Atlantis pen and could choose to keep their item or trade it for the alternative. In what we termed the "regular boxes treatment," participants received either one box that contained about 20 chocolates or one box that contained 12 pens. The boxes were original packaging; they were made entirely of cardboard, so participants could not see the contents inside. Importantly, we presume that the two single-unit treatments bring to mind distinct definitions of a unit. The single-items treatment may bring to mind one piece of chocolate and one pen as the prevailing unit. The regular boxes treatment may bring to mind boxes as the prevailing units.

In a "clear boxes treatment," participants received either one box that contained 10 chocolates or one box that contained 10 pens. In this treatment, the quantity of chocolates or pens inside the boxes was eminently visible. We constructed the boxes ourselves, and they had a clear plastic window that revealed the exact contents inside. Because this treatment concerns boxes, yet participants can view the contents of the boxes and see the individual chocolates and pens, it might bring to mind individual items or boxes as potential units, or perhaps both. As a result, the clear boxes treatment may constitute a hybrid of singleton and multiple endowments. With individual items as the unit, this treatment corresponds to a multiple-unit endowment; with boxes as the unit, this treatment corresponds to a single-unit endowment. The clear boxes treatment may therefore yield an intermediate trading rate, greater than the two singleton treatments but lower than the seven multiple-unit treatments.

In each multiple-unit treatment, participants received either a number of loose chocolates or a number of loose pens. (The specific numbers of units of each good in each treatment are summarized in Table 2.) We settled on these numbers on the basis of three objectives. First, we wished to hit many points on the interval from just one unit to what seemed like the largest number of units a participant could collect and walk away with. Second, we wished to include both treatments in which the numbers of chocolates and pens were equal and treatments in which they were unequal. Third, we sought numbers of chocolates and pens that, by our intuition, made the two sets of goods approximately equally attractive, thereby allowing "room" for an endowment effect to emerge.

An experimenter began each treatment by giving the participant his or her endowment. Next, the experimenter handed the participant a form (see the appendix) stating that the participant could keep the endowment or trade it for the alternative. The experimenter showed the participant the alternative and asked him or her to inspect it. At that point, the participant used the form to indicate a keep/trade decision. The experimenter carried out a trade if one was requested.

We were again worried that convexity of preferences would make partial transactions highly attractive. Thus, as before, we had participants take part

in the experiment individually. We also once more permitted only all-or-none transactions. For instance, someone endowed with five chocolates and offered seven pens could accept or decline this trade but could not swap, say, four chocolates for six pens.

We wish to emphasize that our analyses rest on *within-treatment comparisons* of pen holders versus chocolate holders. In singleton treatments, distinct endowments should lead to different preferences; in multiples treatments, distinct endowments should lead to relatively similar preferences. On the other hand, we do not make predictions about how the preferences of pen holders will vary across treatments offering different numbers of pens and chocolates. Nor do we make predictions about chocolate holders across treatments. Cross-treatment comparisons necessarily implicate differences in the marginal utilities of pens and chocolates.

After participants' keep/trade preferences were recorded and any desired trades consummated, we asked participants to list the thoughts that led to their decision. Our specific wording instructed participants to "please write down the thoughts you had during the moment of decision. What went through your mind when you were deciding whether to trade?" To be clear, we made no mention of thought listings before participants indicated their keep/trade preference; participants first made their decision and only then encountered the instructions to list thoughts leading to that decision. We return to these thought listings later, when we consider the psychological mechanisms that may account for our results.

3.1. Results

Figure 1 provides an initial summary of participants' preferences. Collapsing across the two singleton treatments, 31% of participants traded, which constitutes a statistically significant endowment effect ($\chi(1)^2 = 15.39$, $p < 0.0001$). The hybrid treatment showed an intermediate trading rate of 35%, which also constitutes a significant endowment effect ($\chi(1)^2 = 5.02$, $p = 0.026$). However, no endowment effect was found across all the multiple-unit treatments with 46% of participants deciding to trade ($\chi(1)^2 = 2.54$, $p = 0.111$).

Figure 1 The Endowment Effect Is Unit Dependent

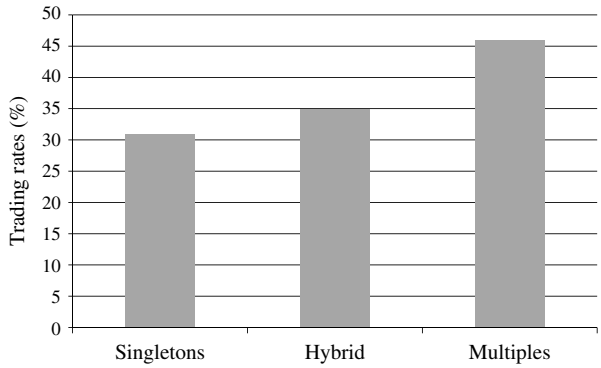

Table 2 presents a more detailed look at the data. Indicated are the number of units of each good in the relevant treatment and the total number of participants in that treatment. In every treatment with but one exception, the counts of participants endowed with each good were equal. For instance, in the baseline single-items treatment, a total of 50 participants were evenly split, 25 to 25, into chocolate holders and pen holders. The exception was the clear boxes treatment, in which 25 participants were pen holders and 26 were chocolate holders.

To assess the extent of any endowment effect in a particular treatment, we compare the percentage of chocolate-endowed participants who chose chocolate by keeping their endowment, displayed in row 2, with the percentage of pen-endowed participants who chose chocolate by trading their endowment, displayed in row 3. In other words, we compare the rate of preference for chocolate across endowments. Conducting statistical tests this way (rather than on trading rates) controls for a general preference for chocolate over pens that arose in our data; overall, 55.8% of participants (284 out of 509) chose chocolate ($p = 0.01$ by binomial test).

As anticipated, in the baseline treatment, the percentage of chocolate-endowed participants who preferred chocolate is more than twice as large as the percentage of pen-endowed participants who preferred chocolate; this ratio and the corresponding difference are displayed in rows 4 and 5. An endowment effect of such magnitude is in line with past work. We test the null hypothesis of no endowment effect by using a one-tailed, two-sample test of equality of proportions. The result of the test, presented in the next-to-last row (row 6) of Table 2, rejects the null hypothesis ($p = 0.002$).

The column headed "All" under "Multiple-unit treatments" aggregates across subsequent columns, which provide information on each particular multiple-unit treatment. In the aggregate, the multiple-unit treatments indeed reveal a significantly curtailed endowment effect relative to the baseline single-items treatment. Let *Pcs* and *Pes* represent the proportions of chocolate- and pen-endowed participants who end up with chocolates in the baseline single-items treatment (where *s* stands for single unit); let *Pcm* and *Pem* represent the proportions of chocolate- and pen-endowed participants who end up with chocolates in the multiple-unit treatments (where *m* stands for multiple units). We test the null hypothesis that $Pcs - Pes = Pcm - Pem$. This null hypothesis allows all four quantities to be of any value; it only requires that the differences be equal. The *p*-value for this two-tailed

Table 2 Trading Results—Preferences

	Singleton treatments				Multiple-unit treatments							
	All	1 pen/ 1 chocolate	1 regular box pens/ 1 regular box choc.	1 clear box pens/ 1 clear box choc.	All	2 pens/ 1 chocolate	4 pens/ 3 chocolates	4 pens/ 4 chocolates	7 pens/ 5 chocolates	11 pens/ 9 chocolates	10 pens/ 10 chocolates	21 pens/ 17 chocolates
1. Total no. of participants	104	50	54	51	354	52	52	50	52	50	50	48
2. % of chocolate owners choosing chocolate	79	72	85	73	59	40	46	64	58	52	72	79
3. % of pen owners choosing chocolate	40	32	48	44	50	41	35	56	35	56	68	63
4. Ratio of row 2 to 3	1.98	2.25	1.77	1.66	1.18	0.98	1.31	1.14	1.66	0.93	1.06	1.25
5. Difference between rows 2 and 3	39	40	37	29	9	−1	11	8	23	−4	4	15
6. Two-sample, one-tailed test of equality of proportions[a]	<0.0001	0.002	0.002	0.018	0.054	0.478	0.198	0.282	0.048	0.388	0.379	0.102
7. Pairwise comparison w/baseline, 1 pen/ 1 chocolate treatment			0.866	0.556	0.032	0.034	0.133	0.096	0.367	0.025	0.054	0.205

Notes. With the exception of the clear boxes treatment, every treatment included an equal number of pen-endowed and chocolate-endowed participants. The clear boxes treatment included 25 pen-endowed and 26 chocolate-endowed participants.

[a]Null: Diff = 0.

test is equal to 0.032 and appears in the very bottom row of the table.

Considering the various multiple-unit treatments individually further corroborates the story in the following ways: (a) The raw numbers from all seven treatments reveal a smaller endowment effect than the baseline single-items treatment. (b) Per row 6 in Table 2, only one of these treatments individually reveals a statistically significant endowment effect. On the other hand, (c) as row 7 of the table shows, two of the multiple-unit treatments are individually statistically distinguishable from the baseline treatment and two more are marginally significantly different. (d) The patterns just described arise both when the numbers of chocolates and pens are unequal and when they are equal. The four pens/three chocolates treatment and four pens/four chocolates treatment attenuate the endowment effect to about the same extent. So do the treatments with 11 pens/9 chocolates and 10 pens/10 chocolates.

Furthermore, returning to a single-unit treatment, this time the regular boxes treatments, reestablishes a significant endowment effect ($p = 0.002$) that is not statistically distinguishable from that of the baseline single-items treatment ($p = 0.886$). Finally, relative to singleton endowments and multiple-unit endowments, the hybrid, clear boxes treatment yields an intermediate impact of endowment, albeit one that is not statistically distinguishable from either the aggregated multiple-unit treatments ($p = 0.157$; note that this test is not reported in the table) or the baseline single-items treatment ($p = 0.556$). In short, our trading data are consistent with our pricing data: singletons, whether they are individual items or boxes, engender a standard endowment effect, whereas multiples engender an attenuated effect.

Recall that our pricing data revealed a gradual attenuation of the endowment effect. Pricing 5 chocolates still yielded a significant seller–buyer pricing discrepancy; only pricing 25 chocolates did not. In contrast, the present trading results essentially reveal an immediate and complete attenuation of the endowment effect. Even in the most minimal multiple-unit treatment, which pits two pens against one chocolate, pen holders and chocolate holders show nearly identical preferences (though, to be cautious, attending just to the two pens, one chocolate treatment might be cherry-picking; the next most minimal treatment, which pits four pens against three chocolates, engenders an endowment effect of about half the size of the singleton treatments). Next, we discuss psychological mechanisms that may account for our data, and we will draw on that discussion to consider why pricing and trading might differently attenuate the endowment effect.

4. Psychological Mechanisms

Our work aims to establish the possibility of attenuated endowment effects Future work could more incisively explore the mechanisms that may underlie this phenomenon. Accordingly, we next present four such mechanisms.

All the mechanisms we present focus on the domain of transactions and exchange and do not address the domain of risk. This is because, in our view, mechanisms that explain attenuated endowment effects must also accommodate *non*-attenuation of loss aversion in risky choice. People tend to decline fair gambles that offer equal likelihoods of winning or losing $\$x$. This pattern is typically attributed to loss aversion: losing $\$x$ hurts more than winning $\$x$ feels good (Tversky and Kahneman 1981, 1986). It obtains whether x is equal to 1, 5, 25, or much larger amounts. In other words, it is not attenuated when risky prizes comprise many units of a good.

Three of the mechanisms we present implicate preference convexity, meaning a taste for moderation. A preference for convexity can arise for many reasons, including a policy or meta-preference for variety or compromise (Drolet 2002, Drolet et al. 2009, Ratner et al. 1999, Simonson 1989). Moreover, because it predominates in multiple-unit settings but is not relevant in single-unit settings, mechanisms implicating this factor may be especially good targets for investigation.

4.1. Queries

The first mechanism we consider is based on the Johnson et al. (2007) query theory. Query theory attempts to explain why people are loss averse. It attributes loss aversion to an interaction of reference points with properties of recall and argument generation.

The theory is based on three premises. First, individuals construct preferences via self-generated queries. For instance, to set a selling price, an individual might search for reasons to sell and reasons not to sell. Second, initial queries tend to seek reasons to maintain the status quo. For example, a chocolate holder may be apt to start by asking for reasons not to sell. Third, arguments brought forth early on facilitate similar arguments and inhibit dissimilar arguments. So starting with reasons not to sell might prompt additional reasons for not selling and make it relatively difficult to generate reasons for selling. The three premises jointly imply that the entire set of arguments a person constructs will tend to be biased toward current holdings. By this view, people are loss averse because they amass more information favoring an item when it is in their possession than when it is not.

When query theory was constructed, the extant evidence concerned only single-unit endowments. The theory was, in a sense, built for singletons. The mechanism we propose amounts to an extension of the theory to multiple-unit settings. This extension of the theory does not question the first two premises just reviewed, which assert that people construct preferences via queries and that initial queries tend to search for advantages of the status quo. Thus, we predict that both single- and multiple-unit settings will bias people to start with arguments favoring current holdings.

Our extension of query theory generalizes the third premise, which asserts that the initial bias favoring the status quo will be perpetuated. Whereas singleton holdings may perpetuate the initial bias, we posit that multiple-unit holdings will not. The reason is preference convexity. If people tend to have a taste for moderation in multiple-unit settings, then arguments for both current and alternative holdings will be salient and available. Thus, people may amass roughly equivalent sets of arguments for a bundle whether or not they possess it. They may therefore show little loss aversion.

To test our extension of query theory, we examined participants' lists of the reasons for their keep/trade decisions and categorized each reason as favoring either current holdings (positives about the current holding, negatives about the alternative), alternative holdings (negatives about the current holding, positives about the alternative), or neither (other thoughts). To be clear, using participants' lists of reasons allows us to see whether a specific dichotomy obtains: Both singleton and multiunit holdings should yield initial arguments biased toward current holdings. However, only singletons should perpetuate this bias into subsequent arguments; multiple-unit settings should not.

The data, aggregated by type of treatment in Table 3, corroborate the predicted dichotomy. Rows 1 and 2 redisplay participant counts and trading rates.

Table 3 Trading Results—Process

	All singleton treatments	Hybrid treatment (clear boxes)	All multiples treatments
1. Total no. of participants	104	51	354
2. Trading rate (%)	31	35	46
3. Total no. of arguments	4.87	5.08	4.83
4. Mean bias in initial arguments	0.35	0.04	0.16
(SD)	(0.86)	(0.91)	(0.88)
5. p-value for chi-square test	<0.005	0.950	0.01
6. Mean bias in noninitial arguments	1.43	0.49	0.10
(SD)	(3.00)	(2.52)	(2.61)
7. Two-tailed p-value for one-sample t-test	<0.001	0.18	0.45

Notes. The measures of biases are defined in the text. One participant in a multiples treatment did not complete the arguments listing task and thus was not included in the analyses of rows 3–7.

Row 3 displays the mean total number of arguments listed in each type of treatment; importantly, participants produced roughly equal numbers of arguments whether they held singleton, multiple, or hybrid endowments. Row 4 presents a measure of bias in the very first argument listed. To derive this measure, we assigned +1, −1, and 0 to arguments favoring the current holding, the alternative holding, and neither holding, respectively, and then calculated cross-participant means. As anticipated, initial arguments show a bias favoring current holdings for both singletons ($M = 0.35$, $\chi^2(1) = 14.34$, $p < 0.005$) and multiples ($M = 0.16$, $\chi^2(1) = 10.60$, $p < 0.01$). The bias is marginally more pronounced for singletons than multiples ($\chi^2(2) = 5.20$, $p < 0.10$). Interestingly, hybrids do not yield much bias ($M = 0.04$, $\chi^2(1) = 0.10$, $p = 0.95$). Incidentally, arguments that favored neither holding comprised 15% of initial arguments for singletons, 19% for multiples, and 18% for hybrids.

Row 5 presents a measure of bias in noninitial arguments. To derive this measure, we again assigned the values +1, −1, and 0 to arguments supporting the current, alternative, and neither holdings, respectively. Next, we calculated within-participant sums. For example, a participant who listed three total arguments and whose second and third arguments both supported the current holding would generate a sum of 2. Then, we calculated cross-participants means of the within-participant sums. Note that the resulting measure of noninitial bias is unbounded, whereas our measure of initial bias is bounded by −1 and +1. As anticipated, singletons revealed a substantial noninitial bias favoring current holdings ($M = 1.43$, $t = 4.86$, $p < 0.001$), but multiples showed little noninitial bias ($M = 0.10$, $t = 0.75$, $p = 0.45$). The difference between singletons and multiples was significant ($t = -4.07$, $p < 0.001$). The hybrid treatment did not engender a significant noninitial bias ($M = 0.49$, $t = 1.36$, $p = 0.18$).

Finally, we regressed keep/trade decisions on the overall bias evinced by a participant, by which we mean the sum of a participant's initial and noninitial biases. The effect was highly significant in the predicted direction ($B = -1.36$, SE $= 0.126$, $\exp(B) = 0.257$, Wald$(1, 509) = 116.57$, $p < 0.001$).

In sum, our data show that an initial bias favoring current holdings is perpetuated for singletons but not multiples. This finding lends credence to the query-based mechanism we have proposed. The hybrid data, however, suggest that there may also be more to the picture. Hybrids revealed neither initial nor noninitial bias yet engendered a statistically significant endowment effect.

4.2. Aspirational Reference Points

In formulating prospect theory, Kahneman and Tversky (1979) observed that the reference point from which options are evaluated often corresponds to the status quo. Accordingly, the classic account of the endowment effect portrays a person's current holdings as his or her reference point. However, Kahneman and Tversky also observed that reference points often correspond to aspirations or desires. If multiple-unit settings make partial transactions attractive, it stands to reason that partial transactions will sometimes shape reference points. Such reference points can account for attenuated endowment effects.

To explicate, consider the 25-chocolate pricing treatments (and for simplicity, assume no loss aversion for money). Though our method precludes it, suppose sellers wish they could end up with 15 chocolates. Further suppose that this aspiration becomes a sellers' reference point. Then selling all 25 chocolates will not be coded as a loss of 25 chocolates but as moving from "10 above" the reference point to "15 below" it—in other words, as a foregone gain of 10 chocolates and a loss of only 15 chocolates. Thus, the sellers' aspirational reference point exposes fewer chocolates to loss aversion than a status quo reference point. Turn now to buyers. Suppose buyers wish to end up with 10 chocolates, and this aspiration becomes their reference point. Then purchasing all 25 chocolates will not be coded as a gain of 25 chocolates. Relative to holding 10 chocolates, purchasing all 25 chocolates entails moving from "10 below" the reference point to "15 above" it. In other words, buying all 25 chocolates yields an avoided loss of 10 chocolates and a gain of 15 chocolates. Thus, the buyers' aspirational reference point exposes more chocolates to loss aversion than a status quo reference point. All in all, with less loss aversion for the seller and more loss aversion for the buyer, the endowment effect will be attenuated.

Of course, the same logic can apply in trading. Consider the treatment in which participants endowed with three chocolates can trade for four pens. Suppose trading away all three chocolates is evaluated relative to an aspirational reference point of ending up with one chocolate and three pens. In that case, only two of the three chocolates that might be parted with will be coded as a loss.

In general, different sellers will have different aspirations and may thus have different aspirational reference points. Similarly, not all buyers will hold the same aspirational reference point, nor will all participants endowed with a given set of goods that they may trade. As the average aspirational reference point held by participants on one side of a transaction converges toward the average aspirational reference point held by participants on the other side of the transaction, the observed endowment effect will become smaller and smaller.

4.3. Overgeneralization of Learned Behavior

It has been argued that some endowment effects, especially seller–buyer pricing discrepancies, in part reflect overgeneralization of learned, strategic behavior. In real-world settings, prospective buyers of some good often have an incentive to play down their valuation of it, whereas sellers have an incentive to play up their valuations. As a result, people may learn to "shade" their valuations whenever asked for them. If so, then even experimental settings in which the prevailing incentives encourage truthful revelation may elicit "shaded" responses and thereby yield selling prices that exceed buying prices (see, e.g., Coursey et al. 1987, Weaver and Frederick 2012).

An overgeneralization could also partially underlie our results. Because of preference convexity, in many real-world settings, individuals holding numerous identical units of a good will have an incentive to part with some units. For instance, most people do not need, say, 17 pens. Most people holding 17 pens would benefit from exchanging some pens for some chocolates. Our methodology bans partial transactions and thus eliminates incentives to trade excess, duplicate units. However, if participants have learned to try to part with excess, duplicate units, they may follow this tendency even in our experiments.

Appreciating the role of preference convexity in the three mechanisms we have outlined so far might help explain why our pricing data revealed a gradual attenuation of the endowment effect, whereas our trading data revealed a more immediate attenuation. The trading paradigm includes two consumption goods. The pricing paradigm includes just one consumption good. To be sure, pricing implicates two goods, the second of which is money. However, money is a special type of good. Thus, there is a sense in which a pricing paradigm is focused on just one good. By focusing on just one good, pricing may be slower to engender a taste for some of each of two goods over much of one and little of the other. Relative to trading, pricing may thus be slower to activate the three mechanisms we have outlined.

4.4. Attachment

One mechanism that does not implicate convex preferences draws on recently popular attachment theories of the endowment effect (Ariely et al. 2005, Carmon et al. 2003, Peck and Shu 2009). These theories do not invoke reference points nor do they posit the existence of loss aversion. Instead, they assume that receiving an item rapidly induces a minimal attachment to that item and that people are averse to breaking even minimal attachments. Research quite far from the topic of the endowment effect indicates that attachments to singletons are often more profound than attachments to multiples. For instance, people identify more with a single victim of a crime or misfortune than with a group of victims and often are willing to donate more to help a single victim than a group of victims (Kogut and Ritov 2005, Slovic 2007, Small et al. 2007, Smith et al. 2013, Västfjäll et al. 2007). By analogy, it may be that stronger attachments are promulgated by singletons of consumption goods like chocolate and pens than by multiples of such goods, and that this difference in attachments engenders the stronger endowment effect for singletons than multiples.

5. Discussion

The results of our pricing and trading experiments are highly consistent. Single units give rise to standard endowment effects, but multiple units reveal attenuated endowment effects. In addition, a single unit yields an endowment effect whether narrowly defined, as an individual item, or broadly defined, as an entire box of items, suggesting the possibility of unit dependence.

5.1. Consumers' Perceptions of What Constitutes a Unit

If endowment effects tend to arise with singletons but not multiples, then people's perceptions of what constitutes a unit is of paramount importance. Such perceptions are likely to be malleable. A person holding one individual chocolate or many individual chocolates might naturally conceive of "one piece" as the relevant unit, thereby engendering an endowment effect in the former but not the latter case. A person given one box of chocolates might by default take "one box" as the relevant unit. But what about a person who receives one box as well as one additional individual chocolate? Or consider a person who receives a dozen individual pieces. For this person, is "one piece" or "one dozen" the natural unit? Exactly this sort of issue is raised by the hybrid treatment in our trading experiment. Though it is beyond our scope of inquiry, future research may examine determinants of what constitutes a unit. Put cheekily, researchers might ask, when is life like a box of chocolates?

We speculate that financial markets are one domain in which it might be especially fruitful to examine perceptions of what constitutes a unit. Are many shares of the same asset commonly perceived as multiple units or one bundle? There is a great deal of homogeneity across shares of the same asset. What about a mutual fund composed of many individual securities that are less homogeneous? Or a set of distinct equities bought at once (heterogeneous in some ways but homogeneous with respect to purchase timing)? Or shares of many different securities from the same asset class (also heterogeneous in some ways

and homogeneous in others)? Such questions bear substantial economic significance.

We highlight the issue of homogeneity versus heterogeneity only to point out that the rules governing perceptions are unlikely to have a simple structure. For instance, the experiments we have reported suggest that complete homogeneity is not a sufficient condition for a bundle of items (e.g., five chocolates) to be perceived as a single coherent unit. It would be interesting to ascertain whether there are some degrees or forms of homogeneity that form a necessary condition. With this in mind, we note that Lerner et al. (2004) found standard pricing discrepancies for a variety pack of many differently colored highlighters.

5.2. All-or-None Trades and Partial Trades

Recall that our experiments allowed only all-or-none trades and no partial trades. We implemented this restriction for methodological reasons. However, just as Knetsch (1989) was interested in more than mugs and chocolates per se, we are interested in both all-or-none trades and partial trades. It makes sense, then, first to consider the extent to which all-or-none trades arise in real-world markets and, second, how our results might inform the understanding of partial trades.

A large number of real-world settings induce binding constraints on partial trades and thus engender many trades that may be seen as all-or-none. Often the issue is one of packaging size, shipping fees, and the like. To take a simple retail example, at most grocery stores in the United States one cannot purchase a single can of beer; beer is sold only in six-packs or twelve-packs. At convenience stores, on the other hand, singletons are commonly available. With a few dollars, then, a grocery shopper might purchase one or another brand of six-pack but often cannot, in effect, make a partial trade that nets three bottles of each brand. Likewise, brokers typically require that their customers buy or sell some minimum amount of shares in each transaction; such rules may necessitate that a customer choose between, say, selling 1,000 shares of stock A to buy 1,000 shares of stock B without the ability to consider selling only 500 shares of A to buy only 500 shares of B. There are also many idiosyncratic reasons that can induce related constraints. For example, to optimize driving performance, automobile tires are typically purchased only in pairs or quartets; it is rare for a consumer to purchase a single tire or two tires of different types.

In the realm of partial trades, the presence or absence of endowments effects may often hinge on people's perceptions of marginal units. Suppose some individual holds 12 chocolates and 15 pens and may trade one of his chocolates for an additional pen. Will we observe an endowment effect? The answer may depend on malleable perceptions. If the chocolate and pen are perceived as singletons ("the chocolate I can trade away" and "the pen I can get"), an endowment effect may materialize. On the other hand, if the chocolate and pen are each perceived as the marginal element of a multiple ("my 12th chocolate" and "a pen to add to my 15 pens"), an endowment effect may not materialize. Thus, the importance of unit dependence: the definition of a unit may often determine when endowment effects arise and when they do not.

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Appendix. Sample Forms Used in Experiments

First Page of the Form Given to Participants Designated as Sellers—Pricing Experiment, Five-Unit Treatment

You have here five Lindor Milk Swiss chocolates. The Lindor Milk is a shell of Lindt's finest Swiss chocolate that surrounds a unique smooth melting centre. You now own these five chocolates. They are yours to keep.

You have the option to sell these chocolates if a price, which will be determined later, is acceptable to you. For each possible price in the next page, please indicate whether you wish to (1) receive this price and sell the chocolates you currently own *or* (2) not sell them for this price.

NOTE: After you finish filling in this form, I will randomly draw a ticket that indicates the price we would buy them for. This will determine whether you receive the indicated amount and sell the chocolates or keep the chocolates.

If you indicated a minimum selling price that is smaller than the amount on our ticket, you will sell us the chocolates for the price on the ticket. If you indicated an amount that is larger than the amount on the ticket, you will keep the chocolates.

First Page of the Form Given to Participants Designated as Buyers—Pricing Experiment, Five-Unit Treatment

We have here five Lindor Milk Swiss chocolates. The Lindor Milk is a shell of Lindt's finest Swiss chocolate that surrounds a unique smooth melting centre.

You have the option to buy these chocolates if a price, which will be determined later, is acceptable to you. For each possible price in the next page, please indicate whether you wish to (1) pay this price and receive the chocolates to take home with you *or* (2) not buy them for this price.

NOTE: After you finish filling in this form, I will randomly draw a ticket that indicates the price we will sell the chocolates.

If you indicated you would buy for the price of our ticket, then you will indeed buy the chocolates. If you indicated that you would not buy for the price on the ticket, then you would not buy the chocolates.

First Page of the Form Given to Participants Endowed with Chocolate—Trading Experiment, Baseline Single-Items Treatment

Your Chocolate

You have received a Ferrero Rocher chocolate. This chocolate is yours to keep.

Second Page of the Form Given to Participants Endowed with Chocolate—Trading Experiment, Baseline Single-Items Treatment

Your Chocolate

To reiterate, the Ferrero Rocher chocolate is yours to keep.

But if you would like to trade it for a BIC Atlantis pen, you can do so.

Please place a check mark next to one of the options below.

—— I will keep my chocolate
—— I will trade my chocolate for a pen

First Page of the Form Given to Participants Endowed with Chocolates—Trading Experiment, 7 Pens/5 Chocolates Treatment

Your Chocolate

You have received five Ferrero Rocher chocolates. These chocolates are yours to keep.

Second Page of the Form Given to Participants Endowed with Chocolates—Trading Experiment; 7 Pens/5 Chocolates Treatment

Your Chocolate

To reiterate, the five Ferrero Rocher chocolates are yours to keep.

But if you would like to trade them for seven BIC Atlantis pens, you can do so.

Please place a check mark next to one of the options below.

—— I will keep my chocolates
—— I will trade my chocolates for pens

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