



Why more can be less: An inference-based explanation for hyper-subadditivity in bundle valuation [☆]

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Abstract

We conceptualize, develop, and test a multiple-item bundle valuation model through which decision makers are able to make inferences about the value of uncertain items based on the value of certain items. Results of four experiments indicate that bundling a low-value certain item with a high-value uncertain item, which are not substitutes, results in a bundle valuation lower than the value of the uncertain item alone. We refer to this highly unexpected and previously unexplained phenomenon as “hyper-subadditivity.” In addition we find that bundling a high-value certain item with a low-value uncertain item leads to superadditivity, even though the items are not complements. Hence, we find that when two objects are bundled together, and one has a more certain value, decision makers use the value of the certain item to infer the value of the less certain item. They might infer that the other (less certain) object must be worth an amount similar to the item with which they are paired. We further demonstrate that reducing uncertainty eliminates these effects, and that direct value inferencing (not simple numeric priming, nor inferences about quality) is the most likely mechanism driving these effects.

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People should not prefer less of a good thing to more. They certainly should not be willing to pay more for less. Despite this, work in several disciplines has demonstrated that violations of these expectations may occur. Under certain circumstances, people seem to prefer less to more, or seem willing to pay more for less (see [Hsee](#),

1998; [Johnson, Hershey, Meszaros, & Kunreuther, 1993](#); [Simonson, Carmon, & O’Curry, 1994](#)). While such findings have received both empirical and theoretical attention, they are often generated under highly specific circumstances or rely upon psychological processes far removed from the decision task (e.g. maintenance of positive self-image). We develop and test a multiple-item bundle valuation model which allows objectively less valuable bundles to generate higher willingness to pay amounts than objectively more valuable bundles. Our model, however, only relies upon two fairly straightforward conditions: (1) unequal item value and (2) unequal certainty about the value of the various items. Despite its simplicity, our model predicts novel outcomes which are highly counterintuitive. First, we show how an entity with positive utility on its own, when added to a bundle, can lower willingness to pay for the bundle. More is less! We refer to this highly counterintuitive phenomenon as

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“hyper-subadditivity” to facilitate comparisons with better-known economic concepts such as additivity, sub-additivity and superadditivity.

In addition, we use the same simple mechanisms to test the flip side of the “more-is-less” effect, superadditivity without complementarity. To our knowledge, this effect has not been previously demonstrated under any circumstance. Superadditivity without complementarity occurs when the value of the combined components (the bundle) is greater than the sum of the individual components added together, even though the items are not complementary. All previous demonstrations of superadditivity of which we are aware strictly require complementarity. Our model eliminates this requirement.

The paper proceeds as follows. We review the literature relating to: preference reversals, other more-is-less phenomena, departures from the economically rational expectation of additivity, and the extant bundling literature. We then introduce concepts from the inference-making literature, and explain how inference making can lead to hyper-subadditivity, and superadditivity without complementarity. We then test this inference-based model of bundle assessment in a series of two controlled field experiments (auctions) and two lab experiments. We conclude the paper with the implications of these studies and recommendations for future research.

Literature review

Preference reversals and unpacking

For years researchers have demonstrated that decision makers often depart in practice from the rigid expectations of economic theory. Preference reversals and unpacking are two such well-known departures. Preference reversals refer to a situation where A is preferred to B under one assessment method, but B is preferred to A under another assessment method (see Irwin, 1994; and Hsee, Blount, Loewenstein, & Bazerman, 1999 for a review). Within this literature, an additional departure from the expectations of economic theory has been observed. This departure has been termed the “more-is-less” effect (List, 2002) or, alternatively, as the “less is better” effect (Hsee, 1998; Johnson et al., 1993; Simonson, Carmon, & O’Curry, 1994). When assessing alternatives independently, contextual effects that can induce between subject dominance violations where people actually prefer less to more. That is, something with positive utility on its own reduces overall value when added to a bundle. People prefer less to more when assessing the two bundles independently, but prefer more to less when assessing the same bundles concurrently.

For example, Hsee (1996, 1998) and Hsee et al. (1999) demonstrated that a normatively less valuable item can be preferred to a more valuable option when options were

presented separately. Specifically, Hsee showed that respondents preferred a complete 24-piece dinner set over a set with 31 intact pieces and several broken ones (which included the same 24 intact pieces). Likewise, an over-filled 7-ounce serving of ice cream was preferred to an under-filled 8-ounce serving. He proposed that these results are based on the evaluability hypothesis, which argues that separate evaluations of items tend to be influenced by easy-to-evaluate attributes rather than salient ones. Hsee found that when the two sets are presented side by side, most people prefer more to less. Both the broken-dish set and the under-filled cone, however, clearly establish a reference point against which the actual offering performs poorly. Conversely, if decision makers use the value of certain items to infer the value of uncertain items, this requirement becomes unnecessary. To test this in our studies, we use super-ordinate sets that do not establish such an unachieved reference point.

Simonson, Carmon, and O’Curry (1994) also demonstrated that adding an unneeded feature to a product can reduce choice probability for that item even when the feature is merely an option to purchase something for a relatively high price, making “inferences about value and quality seem unreasonable” (p. 25). Our effects differ from theirs in that they added features which were (1) unneeded, and/or (2) frivolous, silly, or likely to generate ridicule by one’s peers. First, the item (feature) that we add is generally needed, as evidenced by the significant number of bids it receives in isolation. Second, the “reasons/inferences” account (which Simonson et al. believed best explains their results) seems to rely upon subjects wanting to avoid criticism by others (or self-criticism) about the unneeded (somewhat silly) feature. In fact, this aspect of the “features/inferences” account is supported by the fact that telling subjects they would need to justify their choices increases the negative impact of the unneeded feature on product choice. As before, if decision makers use the value of certain items to infer the value of uncertain items, the requirement that the added item be unneeded or frivolous becomes unnecessary. To test this in our studies, we add only items that are widely needed and thoroughly utilitarian.

The unpacking principle can also lead to the more-is-less phenomenon. This principle suggests that unpacking the description of a risk into specific parts can increase judged probabilities (Rottenstreich & Tversky, 1997; Tversky & Koehler, 1994). This may lead to violations of monotonicity in judgments of probability as well as the pricing of uncertain prospects. Johnson et al. (1993) provided an item example of how the unpacking principle can lead to hyper-subadditivity. They observed that participants were willing to pay more for health insurance covering “any disease or accident” than a policy covering “any reason.” While unpacking can certainly lead people to pay more for less, it seems that this type of hyper-subadditivity is most likely to apply

in situations where partial category lists contain more items than the typical respondent would generate from the category label. Our investigation of hyper-subadditivity, therefore, carefully avoids situations where unpacking might provide an alternative explanation for the results.

Departures from additivity

Additivity is the default economic assumption for the value of a bundle of items. It implies that the value of a bundle is equal to the sum of the values of the individual components (Adams & Yellen, 1976; Schmalensee, 1984). Two general departures from additivity have been described: superadditivity, where the value of the bundle is greater than the sum of its parts, and subadditivity, where the value of the bundle is less than the sum of its parts.

Economic theory can readily address superadditivity through the introduction of the concept of complementarity. If two or more items in a group (i.e., a bundle) are complements, then ownership of one item in the bundle enhances the utility of another item therein. A contemporary example of bundle complementarity leading to superadditivity is a digital camera and color printer, which share proprietary software. By purchasing both, a decision maker can gain benefits not available by mixing the camera of company A with the printer of company B. Thus, the value of the combined camera and printer may be higher than the sum of the individual values of each item. Examples of superadditivity due to the complementarity of items can be found in Guiltinan (1987) as well as Harlam, Krishna, Lehman, & Mela (1995).

Economic theory can also address the opposite: subadditivity. In this case, the value of the bundle is lower than the sum of the values of each component. The introduction of the concept of substitutability makes this possible. Bundle item substitutability is determined by the overlap in their sources of utility (i.e., benefit overlap). Because of this benefit overlap, the value of the bundle to an individual decision maker is not as high as the sum of her/his values for the individual items. An example of subadditivity due to substitutability might be a snowboard and a pair of skis. While a decision maker might have a high value for either item, the value of the two combined is less than the sum of the values of each one. Subadditivity of bundle valuation due to the substitutability of items has also been demonstrated in the decision making literature (Cooke & Pecheux, 2001).

Hyper-subadditivity is one step beyond subadditivity. In subadditivity, the value of multiple objects is less than the sum of their individual values. In hyper-subadditivity, the value of multiple objects is less than the value of a subset of those objects. Thus, adding an item or items (with positive value) actually decreases the value of the bundle. More is less! Economic concepts such as substi-

tutability and complementarity cannot account for hyper-subadditivity.

Prior bundling research

Behavioral scientists have performed experiments to determine how decision makers evaluate various bundling formats (Gaeth, Levin, Chakraborty, & Levin, 1990; Harlam et al., 1995; Johnson, Herrmann, & Bauer, 1999; Yadav, 1994). This stream of research has applied prospect theory (Kahneman & Tversky, 1979), mental accounting (Thaler, 1985), and anchoring and adjustment heuristics (Chapman & Johnson, 1999; Tversky & Kahneman, 1974; Yadav, 1994) to explain how decision makers evaluate bundles of items. Prospect theory proposes that because prices are perceived as losses, a bundle with a single price is more attractive than separate components with multiple prices (see, for example, Johnson et al., 1999).

Most of the previous bundling literature has focused on either complementarity or substitutability of items. It relies upon the relationship between the items to account for departures from additivity. The current research differs in that we rely upon inferential processes by the bundle assessor to show departures from additivity. Specifically, our model predicts that both superadditivity and hyper-subadditivity can be found when bundling items that are neither complements nor substitutes. Before describing this model, we briefly discuss previous work on inferences relevant to our model.

Decision maker inferences and bundle valuation

It is widely accepted that decision makers often have difficulty assessing the value of items (e.g., Simonson & Tversky, 1992), and that they frequently construct preferences when making a decision (Bettman, Luce, & Payne, 1998; Tversky, Sattath, & Slovic, 1988). Previous research has shown that individuals infer missing or incomplete data from other information provided (see, for example, Anderson, 1982; Ebenbach & Moore, 2000; Johnson & Levin, 1985; Levin, Johnson, Deldin, Carstens, Cressey, & Davis, 1986; Wills & Moore, 1996). Prelec, Wernerfelt, and Zettelmeyer (1997) showed that subjects who are unsure of item valuations will rely on the context, like the choice set, to make inferences about values. Not only do decision makers infer missing attributes from known attributes of a particular brand, but they can also assume missing attributes from information about other brands (Moon & Tikoo, 1997).

In assessing a bundle of items, decision makers may well use information from one of the bundled items to make inferences about other items in the bundle. Theoretically, this should be more likely when decision makers are more certain about the value of some items over

others (varied value-certainty). Because of this, we propose that decision makers use the value of certain items to make inferences about the value of uncertain items.

Conceptual model and hypotheses

The proposed model considers the question of how decision makers form valuations for multiple-item bundles under conditions of uneven value-certainty (when items with low value-certainty are bundled with items with high value-certainty). We propose that under these conditions, the value of the more certain item may be an informative indicator of the value of the less certain item.

First we consider the situation where a low-value certain item is bundled with a high-value uncertain item. We consider two individual level value distributions for two items, where the width of the distribution indicates a decision maker's degree of uncertainty concerning the value. Item 1 has a low value and a high degree of certainty (a narrow value distribution), while item 2 has a high value and a low degree of certainty (wide value distribution). In this case the low value of item 1 will be an informative indicator of low value, with the high level of certainty making it a strong indicator. Decision makers may then use this informative indicator to form their valuation of item 2, leading to a shift in the distribution for item 2 and a subsequent reduction in its value. It is important to note that while our theory proposes a possible scenario in which hyper-subadditivity may occur (when a low-value certain product is combined with a high-value uncertain product), it does not require it.

Next we consider the case where the certain item (item 3) has a high value. Under this condition, the certain item constitutes a high-value indicator, shifting the value distribution for item 2 to the right. Thus, uneven value-certainty can lead to the opposite outcome: superadditivity. In this way, our model permits superadditivity without complementarity. To provide the most conservative test possible of both implications of the uneven value-certainty mechanism, we always use bundle components that are neither complements nor substitutes.

In order to support this model of the bundle valuation process, our studies attempt to demonstrate several points. To begin with, most decision makers should arrive at their valuation of a bundle by first assessing the value of the individual components. Next, under conditions of heterogeneity in item certainty (i.e., one item is more certain than the other), decision makers should focus on the more certain item in the bundle. If the certain item has a low value, it should reduce value of the uncertain item. In contrast, if the certain item has a high value, it should increase the value of the uncertain

item. In the extreme case, this process might lead to hyper-subadditivity and superadditivity, respectively.

Our conceptualization makes four important contributions to the literature. First, we demonstrate that in cases of low certainty about the value of an item in a bundle, another item can influence the value of the first item so adversely that its net impact on the bundle valuation is negative. Second, we show that bundling a high-value certain item with a low-value uncertain item leads to superadditivity, even though the items are noncomplementary. Third, we employ psychological process measures which demonstrate that (contrary to Yadav, 1994) the majority of people begin by considering the most certain bundle item, even if it is less expensive or less important than the other items. Finally, our results appear to be driven by direct inferences about value, rather than (1) value inferences derived from quality inferences and (2) simple numeric priming.

Next we discuss four experiments designed to test these hypotheses. The objective of the first experiment is to test for the existence of hyper-subadditivity when bundling a low-value, certain item with a medium-value, uncertain item (which is not a substitute); and test for superadditivity when bundling a high-value certain item with a medium-value, uncertain item (which is non-complementary). In addition, we want to provide insights into how decision makers form valuations of a bundle. Experiment 2 demonstrates how greater certainty can eliminate both hyper-subadditivity and superadditivity. Experiment 3 shows that direct inferences about value appear to drive the observed effects, rather than numeric priming or inferences about quality. Experiment 4 unconfounds quality and value, and demonstrates that low value is a sufficient condition for hyper-subadditivity.

Experiment 1

The objective of the first experiment is to test our hypothesis that decision makers infer the value of uncertain items from the value of certain items. To do this, we investigate the impact of both a positive value indicator and a negative value indicator on a single uncertain item. Specifically, we bundle the same uncertain item with either (1) an item lower in value but high in value-certainty, or (2) an item higher in value and high in value-certainty. We expect that if these two certain items provide a sufficiently strong indication about the uncertain item, then in the first case we may see hyper-subadditivity, while in the second case we may in fact see superadditivity without complementarity. Finding evidence of both would be a convincing demonstration of our conceptual model, but it is a rather conservative test.

Table 1
Levels of complementarity and substitutability for the different bundles

Bundle	Mean complementarity	Mean substitutability
	How mutually complementary are the items in the bundle? ^a	What is the degree of substitutability of the two products, that is, to what extent the one product can replace the other?
DVD & Knife set	8.7 (1.9)	9.3 (1.8)
CDs & Knife set	9.3 (1.1)	9.2 (1.0)
CDs & DVD	7.4 (1.2)	8.2 (1.1)

^a Mean values and standard deviations in parenthesis, based on a “0 = very high” to “10 = very low” scale. All mean values are statistically significant from the midpoint 5.5.

In addition to looking for bi-directionality in the inference of value, we also wish to explore the mechanisms underlying any value inference phenomena observed. Specifically, we want to learn whether decision makers do in fact focus on the more certain item in the bundle, and whether they do so regardless of importance or price.

For the first experiment we conducted a series of second price, sealed-bid (Vickrey) auctions. In a Vickrey auction, the winner is the highest bidder, but s/he only pays the price equal to the second-highest bid (Vickrey, 1961). We believe this method of obtaining customers' valuations (or willingness to pay) is highly desirable for several reasons. First, it has been shown that in Vickrey auctions it is always optimal for participants to bid their true value (Milgrom, 2004).¹ Additionally, because these are real auctions where bidders are committing their own money, the bids represent economically-consequential assessments of value. Therefore, problems based on the inconsequentiality of other methods are avoided (Jorgensen, Syme, Smith, & Bishop, 2004).

The bidders were undergraduate business students at the University of Alberta. Participants were provided with detailed instructions, and were shown an example of a second-price, sealed-bid auction. They were told that if they were the highest bidder, they would be expected to pay for the item upon delivery (the following week) and that acceptable forms of payment were personal checks and cash (i.e. real auctions using real money). We explained to them that (1) there were several different auctions taking place, (2) they would each be randomly assigned to two of these auctions, and (3) they would be competing with about 9 other bidders. They were also told that all items would be sold to the highest bidder regardless of price (i.e., there was no reserve price).

We used a mixed design where each participant bid on all three items, but in one of three different bundle groupings. That is, each participant bid on one of the three items in isolation, as well as bidding on the other two in a bundle. Thus, all respondents participated in two auctions: one auction for a single item and a second

auction for a bundle consisting of the two other items. The order of presentation was counterbalanced. At the completion of the auction, participants filled out a survey with questions about all the items in the auctions. They were also asked which item they focused on when bidding on the bundle.

The three items used were intentionally selected for their mean values and the uncertainty surrounding those values. In addition, we selected items that were neither substitutes (to avoid inherent subadditivity) nor complements (to avoid inherent superadditivity). Pretesting was conducted to determine one low-value, certain item (a spindle of 50 blank CDs), one medium-value, uncertain item (a 16-piece knife set),² and one high-value certain item (a Toshiba DVD player).³ The 50 CDs were described as lower value units made in India, the knives were described more ambiguously concerning value, while the Toshiba DVD player was described as a high value product. Most students are familiar with 50-CD spindles and the Toshiba DVD payer, and were quite certain about their estimates of the local retail price. However, participants were far less certain about the value of the knife set.⁴

A pretest was also conducted to ensure that the items in the bundle were neither complements nor substitutes. Result of a sample of 32 subjects indicated that all three bundles were perceived to be non-complementary and non-substitutable (see Table 1).

² Set of kitchen knives were selected, since they tend to differ substantially in quality and cost, and students are generally uncertain about the value of these items. In addition, this was an item that had been selling well on a local, student oriented Internet auction site.

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⁴ Both the average bid amount and the average retail price indicate that the CDs are low value, the knife set medium value and the DVD player high value. Furthermore, we measured the degree of certainty about their estimate of the retail price (where 0 = very uncertain and 10 = very certain.). Participants were more certain about the value of the DVD ($M = 5.74$) and the CDs ($M = 5.43$), and less certain about the value of the knife set ($M = 3.89$). The differences between DVD and knife ($t = -6.53$, $df = 245$, $p < .01$) and CDs and knife ($t = 5.26$, $df = 244$, $p < .01$) are statistically significant, while the difference between CDs and DVD is not significant ($t = -.94$, $df = 247$, $p < .35$).

¹ In addition, Palfrey (1983) has shown that it is also an optimum strategy for bidders to bid their values for a bundle of items in second-price sealed bid auctions.

ves. We did not perform similar tests for the DVD player and knife set, since there are only 3 cases where decision makers were more certain about the retail price for the knife set.

Quality versus value inference

We have assumed that subjects draw inferences concerning the value of an uncertain item directly from the value of the certain item. However, it is possible that subjects may draw indirect inferences about value from intermediate inferences about quality. To consider this possibility we look at the quality ratings of the knife set (see Table 2) based on the question “How do you rate the quality of this product?” where 0 = very low quality and 10 = very high quality. If subjects draw quality inferences from the value of the other item in the bundle, we would expect the quality ratings for the knife set to be highest when bundled with the DVD player (group 2) and to be lowest when bundled with the CDs (group 1). This is clearly not the case, since the quality rating for the knife set was 6.11 when bundled with the DVD player and 6.60 when bundled with the CDs. The quality ratings from the different groups for the knife set are not statistically significantly different (the same is true for the quality ratings for the CDs and the DVD player).

Discussion

Results of this experiment indicate that bundling an uncertain item (knife set) with the low-value certain item (CDs) produces hyper-subadditivity. On average, participants bid 51% more for the knife set alone than for the bundle consisting of the knife set and the CDs. Bundling the same knife set with a high-value certain item (DVD player), however, resulted in the completely opposite outcome: superadditivity without complementarity. Here, average bids for the bundle of the knife set and

the DVD player were 39% higher than the sum of the average bids of the separate auctions for these two items. We are aware of no other research to generate this result without the usual necessity that the bundled items be highly functionally complementary (e.g., Harlam et al., 1995).

We also explored the mechanisms underlying the value inference observed. Specifically, we found that decision makers do in fact focus on the more certain item in the bundle, and they do so regardless of importance or price. In total, 82% of participants first considered the item they were most certain about. Together, these results provide a substantial amount of additional support for our explanation of value inference under different degrees of value-certainty. If our conceptual model is accurate, both hyper-subadditivity and superadditivity should be considerably reduced (or even eliminated) when participants become more certain about the value of the knife set. This issue is explored in Experiment 2.

Experiment 2

If the results of Experiments 1 are due to value inferences when bundling certain items with uncertain items, then it should be possible to reduce or eliminate these previous effects by simply reducing the uncertainty associated with the uncertain item (knife set). In Experiment 2 we attempt to reduce the uncertainty of the value of the knife set by providing participants with the average retail price of this item.

As in the first experiment, we used a Vickrey auction to determine the participants' valuations. The same three bundles were used as in Experiment 1, with the exception that we provided the local average retail price for the uncertain item (the knife set). Therefore, we directly manipulate the degree of uncertainty within item (the knife set), between Experiments 1 and 2. For the local retail price, we used the average estimated retail price from Experiment 1.

Note that providing an estimate of the average local retail price will reduce the degree of uncertainty, while not completely eliminating uncertainty, as retail prices still vary across outlets. Again we used a mixed design where each participant bid on all three items, but in one of three different bundle groupings. Participants bid in two auctions: one for a single item, and another for a bundle consisting of the two other items.

Results

One hundred and fifty-six students participated in this study, of which 130 placed meaningful bids in the auctions. A summary of the results of Experiment 2 is pro-

Table 2
Survey results for Experiment 1

Group	Quality	Certainty about quality	Need
<i>Ratings for knife set</i>			
1. CDs & Knife set	6.60	4.20	3.51
2. DVD & Knife set	6.11	4.24	4.51
3. CDs & DVD	6.48	4.26	3.31
<i>Ratings for DVD</i>			
1. CDs & Knife set	7.64	6.89	3.91
2. DVD & Knife set	7.80	7.00	4.09
3. CDs & DVD	7.07	6.25	4.07
<i>Ratings for CDs</i>			
1. CDs & Knife set	5.31	5.04	3.56
2. DVD & Knife set	5.70	5.54	4.93
3. CDs & DVD	5.72	5.37	4.42

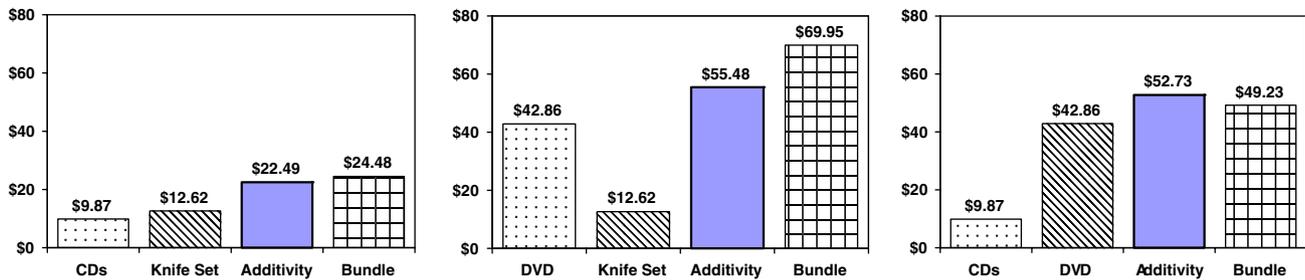


Fig. 2. Average bid amounts for Experiment 2.

vided in Fig. 2.⁷ In contrast to the first experiment, reducing uncertainty about knife set value eliminates hyper-subadditivity when the low-value certain CDs are bundled with the medium-value uncertain knife set. The average bid for the bundle of the knife set and the CDs was \$24.48, which was not significantly different from the sum of the bids for the two separate auctions, \$22.49 (t -test = 0.46, $df = 112$, $p < .65$). Reducing uncertainty about knife set value also eliminated superadditivity when the high-value certain DVD players are bundled with the medium-value uncertain knife set. The average bid for this bundle was not statistically significantly different from the sum of the separate components (t -test = -1.20, $df = 115$, $p < .23$). For the CDs and the DVD player, the bid for the bundle was not statistically significantly different from the sum of the separate components (t -test = -0.38, $df = 123$, $p < .71$). Therefore, we cannot reject simple additivity of valuations of the bundle components for any of the three bundles.

Discussion

It appears that uncertainty is indeed key in generating both hyper-subadditivity and superadditivity. When participants are uncertain about knife set value, we see both phenomena. When uncertainty is reduced, both effects go away. In all conditions in this experiment, we could not reject simple additivity of the bundle valuation, as the valuations for all three bundles are statistically equivalent to the sum of the component values. We see this as strong support for the critical role of value-uncertainty in our previous findings. That is, when bundle components are neither complements nor substitutes, and when the values of all components are relatively certain, bundle valuations are additive. When value-uncertainty is reduced, bidders behave as expected by basic economic theory.

⁷ The average bid amount for the knife set in Experiment 2 is considerably lower than the average values in Experiments 1. Because we specified an average retail price of \$75, the value distribution is truncated at this level in Experiment 2 (different from Experiments 1). Therefore, all bids were well below \$75.

Two issues remains to be investigated. First, we have assumed that the effects observed in Experiment 1 were the result of value inferences. It is possible, however, that the results are driven by simple numeric priming. That is, subjects are not making inferences about knife set value, but are merely being primed by the value of the more certain item when assessing knife set value. Second, if value inferences are being made about knives, it is not clear whether such inferences are direct, or derived through inferences about quality. These two issues are tested in Experiment 3.

Experiment 3

Experiment 1 clearly indicates that bundling can impact perceived value. It does not, however, establish whether bundling is necessary per se. Could these results in fact be the result of simple numeric priming? Nunes and Boatwright (2004) demonstrate that completely unrelated numbers can have a significant impact on willingness to pay. They refer to the impact of such totally unrelated numbers on willingness to pay as numeric priming (p. 461). The priming literature suggests that decision makers' interpretation of information is influenced by concepts and schemes that are currently active (e.g. Ratcliff & McKoon, 1988). Previous research has found that highly accessible attributes can be used to interpret other attributes that are difficult to assess. These priming effects may occur though decision makers are unaware of the activation process (e.g. Higgins, Bargh, & Lombardi, 1985). Therefore, items with a value that is easy to assess may serve as primes in determining the value of items that are difficult to assess. Although our subjects were not directly exposed to an actual numeric price for the CDs or DVD player, it is possible that once they had made their assessment of the certain item's value that this numerical representation was primed, resulting in the observed shift in value for the uncertain item (the knives). Such a mechanism requires no inferences to be made about knife set value.

An inference process on the other hand suggests a more cognitive process, where decision makers draw

inferences concerning the value of an item. There are several possible ways that they draw inferences. They may either draw inferences about the quality or directly about the value of an item.

One possibility is that people make direct inferences about knife set value based upon what they know about the value of the other bundle item. This might be due to lay theories about the range of price points provided by individual sellers, or similar assumptions about segment targeting (e.g. they may infer that an auctioneer may sell together items in a similar price class—low value CDs with low value knives). We refer to this inference mechanism as direct inferences about value. Under direct inference about value, people might assume that the knives must be worth an amount similar to the item with which they are paired. An alternative to direct inference about value would be an indirect inference about value based upon an intermediate inference about quality. Here a person might assume that the knives must be low/high quality, since they are paired with a low/high quality item, and therefore must be worth less/more. We refer to this inference mechanism as a quality derived value inference. While we found no effect of bundling on perceived knife quality in Experiment 1, it is possible that the single question about quality was uniquely insensitive. To more thoroughly investigate this issue, in Experiment 3 we directly ask several questions about knife quality, durability, etc., in each bundling condition.

If an inference-free mechanism were responsible for the results of study one, it should not matter whether the items were bundled in the same auction, or merely presented together. Simply presenting the certain item together with the uncertain one should result in the same amount of priming as presenting the two items as being sold in the same auction by the same seller. If simple priming is responsible, there should be no difference in the impact of pairing between (1) different seller, different auction format and (2) same auction, same seller format. If an inference mechanism is responsible, however, we might expect to see a much stronger impact of pairing under the same seller same auction condition, as it would be more reasonable for decision makers to make inferences about the uncertain object from the certain object in this case. We therefore include presentation format as a factor in the design of Experiment 3. Specifically, we either present the two products as part of a bundle in a single auction by a single seller, or we pres-

ent the two items as being sold in separate auctions conducted by different sellers.

Therefore Experiment 3 employs a 2 (item pairing CDs/DVD player) \times 2 (type of pairing same/different auction) + 1 (knives alone) design. Since the investigation of intermediate process was more important than external validity, we abandoned the actual auction procedure used in previous experiments in favor of a more controlled method of value elicitation. We simply showed subjects the auction information, and then surveyed them about: (1) their willingness to pay for each item; (2) several quality perception measures for each item; and (3) their reported willingness to pay for the bundle. We used the same products as in the first two experiments. The knife set was identical. For the CDs and the DVD player we used the same picture but updated the product description. The more certain item was always presented first, followed by the knives (except in the knives only condition).

Results

One hundred undergraduate business students participated in this study. The results are summarized in Table 3. The 2 \times 2 ANOVA revealed a main effect of item pairing ($F_{1,63} = 6.27, p < .015$). This effect, however, is qualified by a significant interaction between item pairing and type of pairing on willingness to pay for the knives ($F_{1,63} = 5.23, p < .026$). The follow-up simple tests revealed that in the same auction condition, there was a significant difference in willingness to pay for the knives based on whether they were paired with the CDs (\$20.47) or the DVD player (\$49.17; $F_{1,63} = 6.27, p < .015$). In the different auction condition, where the two items were merely presented together, there was no significant difference between the paired with CDs and paired with DVD player condition ($F < 1$). In the different auctions conditions, there was also no difference between the paired with CDs and the knives alone condition, nor between the paired with DVD player condition and the knives alone condition (all $F_s < 1$). However, in the same auction conditions the knives alone condition was significantly higher than the paired with CDs condition ($t = -4.95, df = 47, p < .0001$), and significantly lower than the paired with DVD player condition ($t = 2.54, df = 48, p < .014$). It appears, therefore, that simply presenting a certain item with the knives in separate

Table 3
Design and average willingness to pay for items in Experiment 3

	Separate auctions by different sellers	Bundled auction separate evaluations
CDs followed by knife set	Knife set \$46.72 CDs \$17.00	Knife set \$20.47 CDs \$18.87
DVD followed by knife set	Knife set \$49.17 DVD \$102.39	Knife set \$74.41 DVD \$140.59
Knife set sold separately	\$52.27	

auctions is not sufficient to generate a change in willingness to pay for the knives. This argues against numeric priming and for some type of inference-making about the value of the knives. We next turn to the nature of those inferences.

It is possible that pairing the knives with a more certain item changes willingness to pay by impacting perceived knife set quality. The data, however, provide no evidence of this intermediate mechanism. We asked five different questions about quality of the knives in the three different experimental conditions (see [Appendix A](#)). We compared the quality ratings for each of the five different quality measures (i.e. 15 *t*-tests) and found no significant differences, even at a very conservative $p < .15$ level (see [Hays, 1973, p. 850–853](#)).⁸ To us, therefore, it seems unlikely that perceived quality is a significant intermediate mechanism driving our effects.

We next test whether the results of the current study are consistent with superadditivity and hyper-subadditivity. The willingness to pay for the bundle of the knife set and the CDs was \$39.34, which is significantly less than the willingness to pay for the knife set (\$52.27) when presented separately ($t = 2.030$, $df = 47$, $p < .023$). Therefore, once again we observe hyper-subadditivity. The willingness to pay for the bundle consisting of the knife set and the DVD player (\$215.00) was significantly greater than the sum of the separate components (\$173.52), demonstrating super-additivity ($t = 2.655$, $df = 28$, $p < .013$).

Having established that there is a significant difference we next want to test that this is due to the shift in the willingness to pay for the uncertain item (knife set) and not the certain item, as our theory suggests. Since we obtained separate estimates of the willingness to pay for the DVD player/CDs, both in the bundled auction and in the nonbundled auctions, we can determine whether the willingness to pay for the certain item varies across the auction format (bundled or not). In both instances we find that the willingness to pay for the CDs ($t = -0.876$, $df = 65$, $p < .385$) and the DVD player ($t = -0.549$, $df = 65$, $p < .585$) is invariant to the auction format. Hence, we find that the willingness to pay for the uncertain knife set is influenced by the auction format (whether it is bundled with the DVD player or the CDs), but the willingness to pay for the certain item is not.

Finally we test whether people add the value of each product to form an overall value for a bundle. In Experiment 3 we also obtained subjects' willingness to pay for each of the products in the bundle separately, as well as

their willingness to pay for the bundle.⁹ This allows us to test whether the sum of the willingness to pay for the separate components equals the willingness to pay for the bundle. To do this we ran a regression analysis between these two variables. The *R*-square was 0.98, the intercept was not significantly different from 0, and the slope was not significantly different from 1, indicating a near perfect linear relationship and that individual item values were added together.

Discussion

Experiment 3 sought to determine whether consumer inferences about value were necessary to generate the previous findings, or whether simple numeric priming might explain these effects. It appears that inferences indeed play some role. When the two items were presented together, but described as being sold in different auctions, there was no impact of item pairing on willingness to pay. When they were described as being sold together in the same auction, there was a strong impact of item pairing on willingness to pay. This effect was so strong that we once again replicated both hyper-subadditivity (without substitutability) and superadditivity without complementarity. It seems that subjects are inferring something in the bundled conditions which they do not infer in the separate auction conditions.

Furthermore, it does not seem that inferences about quality are a significant intermediate mechanism in the shifting of value. That is, people seem to infer value directly, rather than inferring value subsequent to inferences about the quality of the knives.¹⁰ This is important as our low value item (the CDs) was also low in quality whereas the high value item (DVD player) was also high in quality. While the lack of inferences about knife set quality argues against a necessity that the low-value item also be low in quality, it does not rule it out. Experiment 4, therefore, attempts to replicate previous findings with items which are low in value but high in quality.

Experiment 4

Previous demonstrations of hyper-subadditivity were accomplished using the same low value item (blank

⁸ While with about 20 subjects per cell, we certainly did not have the statistical power necessary to "prove a null hypothesis" (see [Keppel, 1991 p. 89](#)) we can say that if any effect of item pairing on perceived quality does exist, it is considerably smaller than the direct effect of pairing on willingness to pay.

⁹ Subjects were first shown the separate auctions, from different sellers, on different pages. Next they answered several questions. After this they were shown the pictures of the two items (without seller identification) and asked them how much they would willing to pay for them as a bundle.

¹⁰ These results are consistent with finding that higher reference prices lead to significantly higher value perceptions ([Grewal, Monroe, & Krishnan, 1998](#); [Kristensen & Garling, 1997](#)), and open reserve prices in auction that serve as value indicators, influencing selling prices but not quality perceptions ([Ariely & Simonson, 2003](#); [Suter and Hardesty, 2005](#)).

CDs). In addition to being an item for which participants were highly certain about relatively low value, the CDs were also described in a way which implied that they might be of poor quality. Thus, low quality and low item value were fully confounded. This allows for the possibility that the hyper-subadditivity effect has been driven, in part or in full, by low quality, and not simply low item value as we have proposed. To eliminate the possible necessity of low quality, we attempt to replicate previous results using (1) high quality CDs, and (2) a high quality plastic pen. The high quality CDs serve as a check to see whether previous findings with CDs might replicate without the necessity of a low quality description. The high quality plastic pen was used to replicate the effect with a different product category.

Therefore in this experiment we bundled one of two low-value, high-quality items (a high quality CD spindle or pen) with the same knife set as in the previous studies. This resulted in a simple one factor design with three levels (knife set alone, CDs bundled with knives, pen bundled with knives). The high quality CDs were described as “25 premium Maxell pro recordable CD-R’s. The CDs have a triple coating for maximum scratch resistance and longer life, are made in Japan, and come with a lifetime warranty”. The pen was described as “a very high quality disposable pen, made of high quality plastic with a rubber grip for added comfort, made in the USA, and comes with a lifetime warranty”.

Similar to Experiment 3 we used a controlled method of value elicitation. We showed subjects the auction information, and then surveyed them about: (1) their willingness to pay for either the knife set or one of the bundles, (2) separate willingness to pay measures for the individual products (except in the knives only condition), and (3) quality perception measures for each item. The more certain item was always presented on the left hand side and the knives on the right hand side of the same page.

Results

Forty-nine undergraduate business students participated in this study. Results are summarized in Table 4. The bundled auctions were found to be significantly different from that of the knife set alone; $F_{2,46} = 4.83$, $p < .0125$. Specifically, we find hyper-subadditivity in both bundle conditions. The willingness to pay for the bundle of the knife set and the CDs is \$31.74, which is

significantly lower than the willingness to pay for the knife set alone \$43.81 (one tailed t -test = 1.762, $df = 30$, $p < .04$). Likewise, the willingness to pay for the bundle of the knife set and the pen (\$24.29) is also significantly lower than the knife set alone (one tailed t -test = 2.891, $df = 33$, $p < .004$). This again seems to be driven by the impact of the low-value certain items on the uncertain item. In both bundled conditions, perceived knife set value was less than half of the \$43.81 assessed in the knives only condition. In the bundled with CDs condition, the mean estimate of knife set value was \$21.06 and in the bundled with pen condition, average perceived knife value was \$20.61. As before, this was not due to differences in perceived knife set quality. The overall quality (“How do you rate the *quality* of this product?”) of the knife set did not vary significantly across the three conditions ($F_{2,46} = 1.38$, $p < .263$).¹¹

Discussion

It appears that low quality is not a necessary condition to generate hyper-subadditivity. Using two different high-quality, low-value items, we replicated the hyper-subadditivity effect. As before, this seems to be due to the substantial impact of the low-value certain item on the uncertain item. Also as before, there was no impact on perceived knife set quality, further supporting the direct value inference mechanism.

General discussion

The results of the four experiments provide strong support for our theory. We observed hyper-subadditivity in Experiments 1, 3, and 4. We also observed the opposite, superadditivity without complementarity, in Experiments 1 and 3. Self reports of bidders are consistent with our theory. Specifically, decision makers tend to use the more certain item in a bundle to make inferences about the value of other items in a bundle. These departures from additivity are eliminated when value-certainty is increased. These effects seem to be the result of inferences about value, and not simply numeric priming. These inferences about value also appear to be

¹¹ To ensure that the items bundled with the knives were perceived to be high in quality, we asked the following two questions: (1) How do you rate the *quality* of this product?, (2) I believe that *compared to other* CDs/pens, this one is one of the very *highest in quality*. The average quality ratings and standard deviations for the CDs were 7.44 (1.15) and 7.88 (1.15) and for pens 7.06 (1.56) and 7.12 (1.54). Where, 0 = low quality/strongly agree and 10 = very high quality/strongly disagree. The quality ratings differed significant from the scale midpoint in all instances. Participants were also reasonably certain about the value of the pens 8.21 (1.25) and the CDs 7.37 (1.32) on the scale “How certain are you about your estimate of your willingness to pay for this product”, where 0 = very uncertain, and 10 = highly certain.

Table 4
Mean willingness to pay for items in Experiment 4

Item	Knife set	CDs/Pen	Bundle
CDs & knife set	21.06	10.68	31.74
Pen & knife set	20.62	3.67	24.29
Knife set alone	43.81		

direct, rather than derived from inferences about quality. Low quality does not appear to be a necessary condition to obtain hyper-subadditivity: low value alone is sufficient (when paired with an item of higher, uncertain value).

While several studies have previously demonstrated less-is-more type phenomena, none have demonstrated what we have shown: adding a useful, wanted, undamaged item to a bundle can lower willingness to pay. All that is required for our effect is that people are reasonably certain that the added item is low in value, and that the other item is uncertain in value. We now turn to a discussion of the most similar previous findings in order to point out the differences between them and our conceptualization. Specifically, we compare our findings to the evaluability hypothesis and the “reasons/inferences” mechanism.

The evaluability hypothesis (González-Vallejo & Moran, 2001; Hsee, 1996) appears, at first glance, to be able to explain our findings. While the evaluability hypothesis can explain preference reversals in joint versus separate evaluations, this only occurs when important attributes are difficult to evaluate in isolation, but easy to evaluate in side-by-side comparisons. In other words, the evaluability hypothesis relies not upon ambiguity about a specific attribute level, but rather on ambiguity about the relative merit of a clearly stated attribute level. None of the items we used exhibited attribute levels that were clearly stated, but nonevaluable in isolation.

To reiterate, clearly there was ambiguity about the value of the knives in our studies. If one cares to view overall value as an attribute, then the knives can be said to have possessed ambiguity with regard to the level of this attribute. But this ambiguity was about attribute level, and not the merit of a particular stated level with respect to some benchmark. Because of this, the evaluability hypothesis cannot explain our findings.

The “reasons/inferences” mechanism (Simonson, Carmon, & O’Curry, 1994) also seems at first glance to be an alternative explanation for our results. This is also not the case. This is because the “reasons/inferences” mechanism relies upon the addition of an unneeded feature, which is often seen as useless or silly by participants (e.g. a Pillsbury collector’s plate). We, however, added useful, widely needed, utilitarian items (blank CDs, pens) to a bundle, and people paid less than those who did not have that item added. It seems unlikely that the addition of a pen or blank CDs would lead to the “reasons/inferences” mechanism described by Simonson and colleagues.

In addition to the principal demonstrations of hyper-subadditivity and superadditivity without complementarity, we have explored three boundary conditions. In Experiment 2, we found that without substantial uncertainty both effects vanish. We also looked to see whether low quality must be coupled with low value to obtain the

hyper-subadditivity effect in Experiment 4, and found that low quality is not required. Finally, we found that while these results obtain when the items are presented as being in the same auction, they disappear when the items are merely presented together, suggesting that “being sold together” is a necessary condition for the effect.

Several additional aspects of the phenomena, however, remain to be studied. For example, we always selected items that were neither substitutes nor complements. While such bundles are frequently observed in the real world (e.g., a free television comes with the purchase of a dining room set), future research should also consider the bundling of complementary or substitute items. We expect that the degree of complementarity will have a moderating influence on the value inference process. In particular, we expect that value inference will be stronger for products with a higher degree of complementarity. Noncomplementarity of items makes it more difficult to get superadditivity and nonsubstitutability makes it harder to get subadditivity. This makes the hyper-subadditivity and superadditivity reported in this paper more robust.

Future research might also wish to expand on our findings from Experiment 2. We manipulated (across studies) the level of certainty of the uncertain item, demonstrating a boundary condition. That is, it appears that substantial uncertainty is needed in the uncertain item to generate the effects. Future research might attempt to manipulate the certainty of the certain item as well. We used certain items which were very well known. It would be interesting to explore how moderately certain items would impact bundle valuations, and how varying levels of high and low certainty interact.

In addition, research into the underlying mechanism(s) involved here would be useful. One possibility would be to include varying numbers of bundle components. Perhaps valuing a bundle of two is unique or different from other numbers of bundle components. We believe that understanding combinatorial valuation might become an interesting endeavor in and of itself. Finally, future research is needed to determine the specific nature of the inference process. How do decision makers draw inferences about price levels? Do they do this based on the fact that items are sold by the same retailer, or because they infer that items sold in a bundle are more likely to be of similar value? If they base inference on the former, retailers may use their name to provide a value signal.

Conclusions

People should not prefer less to more. They certainly should not be willing to pay more for less. In this research we observed that auctions for two items

received lower bids than auctions for one of the two items. We called this hyper-subadditivity. This appears inconsistent with one of the fundamental tenets of economic theory: people have positive marginal utility for goods. By introducing a value inference process to the less-is-more phenomenon, however, it has become possible for decision makers, behaving in a mindful and rational way, to prefer less to more, and even to pay more for less.

Appendix A. Different measures of product quality used in Experiment 4

(1) How do you rate the **quality** of this cutlery set?

0 1 2 3 4 5 6 7 8 9 10
Very low quality Neutral Very high quality

(2) How do you rate the **durability** of this cutlery set?

0 1 2 3 4 5 6 7 8 9 10
Very durable Neutral Not durable at all

(3) I believe that **compared to other** cutlery sets, this one is one of the **very highest in quality**.

0 1 2 3 4 5 6 7 8 9 10
Strongly agree Neutral strongly disagree

(4) I believe that this is a **very low quality** cutlery set.

0 1 2 3 4 5 6 7 8 9 10
Strongly agree Neutral strongly disagree

(5) **Compared to the average** cutlery set what are your **expectations about the quality** of this one?

0 1 2 3 4 5 6 7 8 9 10
High quality Neutral Low Quality

References

- Adams, W., & Yellen, J. (1976). Commodity bundling and the burden of monopoly. *The Quarterly Journal of Economics*, 90(3), 475–498.
- Anderson, N. H. (1982). *Methods of information integration theory*. New York: Academic Press.
- Ariely, Dan, & Simonson, Itamar (2003). Buy buying, bidding, playing, or competing? Value assessment and decision dynamics in online auctions. *Journal of Consumer Psychology*, 13(2), 113–123.
- Bettman, R., Luce, M. F., & Payne, J. W. (1998). Constructive consumer choice processes. *Journal of Consumer Research*, 25, 187–217.
- Chapman, G. B., & Johnson, E. J. (1999). Anchoring, activation, and the construction of values. *Organizational Behavior and Human Decision Processes*, 79, 1–39.
- Cooke, A. & Pecheux, C. (2001). Subadditive bundle preferences and the value of variety. Unpublished working paper, Marketing Department, University of Florida Gainesville, FL 32611.
- Ebenbach, D. H., & Moore, C. F. (2000). Judgments and the environment: Incomplete information, inferences, and individual differences. *Organizational Behavior and Human Decision Processes*, 81, 1–27.
- Gaeth, G. J., Levin, I. P., Chakraborty, G., & Levin, A. M. (1990). Consumer evaluation of multi-product bundles: An information integration analysis. *Marketing Letters*, 2, 47–57.
- González-Vallejo, C., & Moran, E. (2001). The evaluability hypothesis revisited: Joint and separate evaluation preference reversals as a function of attribute importance. *Organizational Behavior and Human Decision Processes*, 86, 216–233.
- Grewal, Dhruv, Monroe, Kent B., & Krishnan, R. (1998). The effects of price-comparison advertising on buyers' perception of acquisition value, transaction value and behavioral intentions. *Journal of Marketing*, 62, 46–59.
- Guiltinan, J. P. (1987). The Price Bundling of Services: A normative framework. *Journal of Marketing*, 51, 74–85.
- Harlam, B., Krishna, A., Lehman, D. R., & Mela, C. (1995). Impact of bundle type, price framing and familiarity on purchase intention for the bundle. *Journal of Business Research*, 33, 57–66.
- Hays, W. L. (1973). *Statistics for psychologists* (3rd ed.). New York: Holt Rinehart and Winston.
- Higgins, E. T., Bargh, J. A., & Lombardi, W. (1985). Nature of priming effects on categorization. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 11, 59–69.
- Hsee, C. K. (1996). The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. *Organizational Behavior and Human Decision Processes*, 67, 247–257.
- Hsee, C. (1998). Less is better: When low-value options are judged more highly than high-value options. *Journal of Behavioral Decision Making*, 11, 107–121.
- Hsee, C., Blount, S., Loewenstein, G., & Bazerman, M. (1999). Preference reversals between joint and separate evaluations: A review and theoretical analysis. *Psychological Bulletin*, 125, 576–590.
- Irwin, J. R. (1994). Buying/selling price preference reversals. Preference for environmental changes in buying versus selling modes. *Organizational Behavior and Human Decision Processes*, 60, 431–451.
- Johnson, E. J., Hershey, J. C., Meszaros, J. R., & Kunreuther, H. (1993). Framing probability distortions and insurance decisions. *Journal of Risk and Uncertainty*, 7, 35–53.
- Johnson, M. D., Herrmann, A., & Bauer, H. H. (1999). The effects of price bundling on consumer evaluations of product offerings. *International Journal of Research in Marketing*, 16, 129–142.
- Johnson, R. D., & Levin, I. P. (1985). More than meets the eye: The effect of missing information on purchase evaluation. *Journal of Consumer Research*, 12, 169–177.
- Jorgensen, B. S., Syme, G. J., Smith, L. M., & Bishop, B. J. (2004). Random error in willingness to pay measurement: A multiple indicators, latent variable approach to the reliability of contingent values. *Journal of Economic Psychology*, 25, 41–59.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47, 263–291.
- Keppel, G. (1991). *Design and analysis a researchers handbook* (3rd ed.). New York: Prentice Hall.
- Kristensen, Henrik, & Garling, Tommy (1997). The effects of anchor points and reference points on negotiation processes and outcome. *Organizational Behavior and Human Decision Processes*, 71(1), 85–94.
- Levin, I. P., Johnson, R. D., Deldin, P. J., Carstens, L. M., Cressey, L. J., & Davis, C. R. (1986). Framing effects in decisions with completely and incompletely described alternatives. *Organizational Behavior and Human Decision Processes*, 38, 48–64.
- List, J. A. (2002). Preference reversals of a different kind: the more is less phenomenon. *American Economic Review*, 92, 1636–1643.
- Milgrom, P. (2004). *Putting auction theory to work*. Cambridge, UK: Cambridge University Press.

- Moon, J., & Tikoo, S. (1997). Consumer use of available information for making inferences about missing information. *Journal of Business Research*, *39*, 135–146.
- Nunes, Joseph C., & Boatwright, Peter (2004). Incidental prices and their effect on willingness to pay. *Journal of Marketing Research*, *16*, 457–466.
- Palfrey, T. R. (1983). Bundling decisions by a multiproduct monopolist with incomplete information. *Econometrica*, *51*, 463–484.
- Prelec, D., Wernerfelt, B., & Zettelmeyer, F. (1997). The role of inference in context effects: Inferring what you want from what is available. *Journal of Consumer Research*, *24*, 118–126.
- Ramsey, F. L., & Schafer, D. W. (2002). *The statistical sleuth: A course in methods of data analyses* (2nd ed.). Belmont, CA: Duxbury Press.
- Ratcliff, R., & McKoon, G. (1988). A retrieval theory of priming in memory. *Psychological Review*, *95*, 385–408.
- Rottenstreich, Y., & Tversky, A. (1997). Unpacking, repacking, and anchoring: Advances in support theory. *Psychological Review*, *104*, 406–415.
- Schmalensee, R. (1984). Gaussian demand and commodity bundling. *The Journal of Business*, *57*, S211–S230.
- Simonson, I., Carmon, Z., & O'Curry, S. (1994). Experimental evidence on the negative effect of product features and sales promotions on brand choice. *Marketing Science*, *13*, 23–40.
- Simonson, I., & Tversky, A. (1992). Choice in context: Tradeoff contrast and extremeness aversion. *Journal of Marketing Research*, *29*, 281–295.
- Suter, Tracy A., & Hardesty, David M. (2005). Maximizing earnings and price fairness perceptions in online consumer-to-consumer auctions. *Journal of Retailing*, *81*(4), 307–317.
- Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, *4*, 199–214.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124–1131.
- Tversky, A., & Koehler, D. J. (1994). Support theory: A non-extensional representation of subjective probability. *Psychological Review*, *101*, 547–567.
- Tversky, A., Sattath, S., & Slovic, P. (1988). Contingent weighting in judgment and choice. *Psychological Review*, *95*, 371–384.
- Vickrey, W. (1961). Counter speculation, auctions, and competitive sealed tenders. *Journal of Finance*, *16*, 8–37.
- Wills, C. E., & Moore, C. F. (1996). Perspective-taking judgments of medication acceptance: Inference from relative importance about the impact and combination of information. *Organizational Behavior and Human Decision Processes*, *66*, 251–267.
- Yadav, M. S. (1994). How buyers evaluate product bundles: A model of anchoring and adjustment. *Journal of Consumer Research*, *21*, 342–353.