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# Shrouded Attributes and Information Suppression: Evidence from Field Experiments\*

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## Abstract

The recent theoretical literature suggests that consumer myopia may lead firms to profitably suppress or shroud some attributes of the price. Empirical and experimental data also suggest that sellers gain by transferring a larger fraction of the price to the shrouded attributes. However, alternative theories, including mental accounting, could also explain these framing effects. Using field experiments, we show that the impact of this price framing on revenue vanishes when we explicitly reveal the prices of different attributes, while the framing effect persists only when we shroud some price attributes. Then, using data from a natural experiment that occurred on eBay, we find that when the price of a secondary attribute such as the shipping fee is prominently displayed, the framing effect also disappears. Moreover, average revenues for sellers seem to have increased after this institutional change.

**JEL Classification Numbers:** C93, D44, L86.

**Keywords:** Field experiments, natural experiments, shrouded attributes, add-on pricing, mental accounting.

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# 1 Introduction

Recently, the practice of dividing the total price a consumer pays for an item into various “fees” and making some more prominent than others has been a source of considerable controversy. So much so that class-action lawsuits have been filed in several states alleging harm to consumers staying at various hotel chains.<sup>1</sup> In the airline industry, the introduction of fuel surcharges—separate from quoted ticket prices—has been seen as a way to preserve profits in a difficult industry.<sup>2</sup>

In the online marketplace, a common strategy among retailers is to wait until the consumer fills his or her “shopping cart” in the virtual store before disclosing sometimes excessive shipping and handling charges for merchandise. Predating the online world, television offers for items “not sold in stores” routinely disclosed shipping and handling charges in small print and with speedy voice-overs in contrast to the large print and slow or repeated voice-overs for the “price” of the item. Even universities regularly adopt the practice of dividing the total price of the “product” into various components. For instance, an undergraduate student who is not a California resident coming to Berkeley will pay a nonresident tuition fee, a university registration fee, an educational fee, a Berkeley campus fee, a class pass fee, and a health insurance fee all as separate components of what might reasonably be considered the total “price” (tuition) of taking classes at Berkeley.

Why do firms (and universities) adopt this sales strategy? One possibility that firms are merely trying to inform “classical” consumers as to the various cost components resulting in a given total price—especially components, such as energy costs, that are more volatile. Under this scenario, consumers still only care about the total price of the item and are not systematically “fooled” by its decomposition into different components. While this may be a possibility, the strategy of reduced disclosure, either in the form of “small print” displaying the shipping and handling charges or of delayed disclosure of energy and other surcharges until the completion of the transaction appears counterproductive.

Another possibility is that firms are exploiting various biases and heuristics on the part of consumers and thereby increasing profits. One way this might arise is if some consumers use mental accounting to determine their purchase decisions. (See, for

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<sup>1</sup>Woodward, C., “Hotels face lawsuits on surcharges for phones, energy,” USA TODAY, September 26, 2004.

<sup>2</sup>It has also been seen as possibly an anti-competitive practice facilitating price fixing. See Timmons, H., “Inquiry targets airlines’ fuel fees,” *New York Times*, June 23, 2006.

example, Thaler, 1985.) Here, the decomposition of total price into separate mental accounting categories can actually affect the surplus a consumer obtains from a given purchase and hence affect purchase behavior.

Still another way this might arise is through cognitive processing limitations on the part of consumers. For instance, Gabaix and Laibson (2006) suggest that firms might exploit these limitations by presenting consumers with confusing information or withholding information entirely. In that case, a consumer might focus only on “salient” information in making a purchase decision and firms might strategically use this to raise profits. Under this framework, consumers focus on total price when this information is easily observed, but focus only on the salient features of price when the total price is decomposed into various parts which differ in their observability.

A central question, then, is how to distinguish among these competing explanations for price decomposition behavior on the part of firms and how to determine what the economic magnitude of any effect might be. To examine this question, we exploit the common practice in online retailing of sellers charging a shipping and handling fee in addition to the “price.” Specifically, conducted field experiments on Yahoo’s online auction platform in Taiwan. By varying the opening bid, shipping and handling charge and the timing of the disclosure of the shipping charge while selling matched sets of products with identical descriptions and an identical seller, our field experiments offer a relatively clean test of the competing hypotheses. In particular, with classical consumers who care only about total price, all of our treatments should yield the same revenues. Under mental accounting, revenues should vary with the shipping and handling charge but not with disclosure. Under the shrouding hypothesis, revenues should vary with the shipping charge only when shipping is “shrouded.”

Our main results are:

1. When the shipping charge is not shrouded (i.e. shipping is disclosed in the title of the listing), there is no revenue effect of changes in the shipping charge.
2. When the shipping charge is shrouded (i.e. shipping is disclosed in the body of the listing but not in the title), a seller earns higher revenues with a higher shipping charge.

To further examine this question, we take advantage of a natural experiment which occurred on eBay’s US site in November 2004. Prior to that time, the shipping information was not a sortable category on that platform. However, on November 1,

2004, eBay changed their user interface to allow users to sort via the shipping charge.<sup>3</sup> In effect, eBay’s natural experiment mimics the field experiments described above. Prior to November 2004, shipping was, for the most part, shrouded, while after that time, it was less shrouded. Using datasets from Tyan (2005), Hossain and Morgan (2006), a new dataset of eBay auctions before the changeover, as well as some field experiments that we conducted at the time of the changeover, we examine how the interaction between shrouding and the revenue effect of a given level of shipping. We find that eBay’s change in its disclosure of shipping led to a reduction in the revenue effect of shipping and handling charges. In our experimental data, we also find an intriguing result that if we compare the revenue from the shrouded and unshrouded treatments of auctions of the same product with the same opening price and shipping fee combination, the auctions with *revealed* shipping fee earned higher revenue. Thus, our experimental and field data suggest that although shrouded pricing seems to affect consumer decision-making, it is far from clear that “firms” (online auction sellers) are exploiting this in a profitable way. Our results also suggest that a simple change in the institutional design can succeed in reducing or even eliminating the impact of this behavioral bias.

The remainder of the paper proceeds as follows: In the next section, we discuss in greater detail the rationale for using field experiments to examine price decomposition effects. We specify more precisely the predictions of the competing hypothesis and how our experimental design seeks to distinguish between these. Finally, we describe the procedures we used in conducting the field experiment. Section 3 presents the results of the field experiment. Section 4 describes eBay’s natural experiment, the data we use to examine it, and presents the results of this analysis combined with the Taiwan field experiments. Section 5 contextualizes our results in view of the extant literature and section 6 concludes.

## 2 The Taiwan Field Experiments

### 2.1 Rationale for Field Experiments

In studying the effects of differing decompositions of total price on firm profits, one is faced with several significant challenges. First, a consumer’s willingness to pay

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<sup>3</sup>Specifically, eBay added a control that allowed a user to add a column displaying the shipping charge for items to his or her search results. On September 9, 2005, eBay made this the default search view for all users.

under various decompositions of total price is difficult to observe directly. Second, a consumer’s perception of a given price decomposition may be influenced by the overall context of the market in which the product is being offered. For instance, if a given price decomposition is rarely observed in a given product category owing to the behavior of competing firms, it is difficult to judge what the effect of a change in a given firm’s presentation of total price is likely to be. Finally, even in industries where there is sufficient variation in how total price is decomposed to make cross-sectional identification possible, one is still faced with the difficulty that observed differences in consumer behavior may reflect differing perceptions of the quality of the firm or product itself rather than the decomposition. For example, if sellers A and B use different price decompositions for a given product, it is difficult to disentangle the decomposition effect from heterogeneities across sellers.

In view of these difficulties, we report on results of field experiments we conducted in Taiwan on Yahoo’s online auction platform. The particular price decomposition we study is how the form of the reserve price—the opening bid amount plus the shipping and handling charge, affects firm profits. By using an auction platform, we allow the ultimate total price to be set via a bidding process, which presumably expresses, in some form, a consumer’s willingness to pay under a given decomposition. In addition, there is considerable heterogeneity among competing sellers using this platform; we exploit this by varying the price decomposition in a fashion that is similar to that of other sellers, thus alleviating some of the contextual problems described above. Finally, by using the same seller identity and selling identical products under different price decompositions, our field experiments offer a way to separate decomposition effects from seller heterogeneities in ways that are difficult using only field data.

## 2.2 Competing Hypotheses

To disentangle the competing explanations for the effects of price decompositions, we varied three components of the auction environment: the opening bid, the shipping and handling charge, and the level of disclosure (the “shrouding”) of the shipping and handling charge. The sum of the opening bid and the shipping and handling charge constitutes the *reserve level* of an auction. To vary the level of disclosure of the shipping charge, in some treatments (no shrouding) we disclosed the shipping charge in the header line of the auction listing. This is the line that all users see when conducting a search for a given item regardless of whether they click through to the body of the listing itself. In the shrouding treatment, we did not disclose the shipping

charge in the header line. In both treatments, we disclosed the shipping charge and method in detail in the body of the listing. To summarize, our treatments are:

		Not Shrouded	Shrouded
Low Shipping	High Opening Bid	A	D
High Shipping	Low Opening Bid	B	E
	High Opening Bid	C	F

where  $\text{Low Shipping} + \text{High Opening Bid} = \text{Low Shipping} + \text{High Opening Bid}$ .

We now proceed to develop hypotheses for this set of treatments under several competing explanations for the effects of decompositions and shrouding of total price. The hypotheses are based on the theory models in the existing literature discussed in section 5.

Under the “classical consumers” hypothesis where consumers only care about total price, the reserve level alone determines the revenues in an auction. Moreover, for sufficiently low reserve levels, auction theory suggests that revenues will be independent of the reserve.<sup>4</sup> As we describe below, our reserve levels were selected such that this is likely to be the case. Thus, we have

**Hypothesis 1.** Under the classical consumers model, all treatments are revenue equivalent.

Next, we consider the mental accounting hypothesis. Under this hypothesis, consumers have separate mental accounts for the product and the shipping of the product and hence different decompositions of price for a given reserve level are predicted to lead to different revenue realizations in the auction. However, the standard models are silent about the effect of shrouding. Thus, we have

**Hypothesis 2a.** Under the mental accounting model, revenues vary with the shipping charge regardless of shrouding.

Since the models are silent about shrouding, one could, in principle, consider a strong form of the mental accounting hypothesis.

**Hypothesis 2b.** Under the mental accounting model, revenues for a given price decomposition are independent of shrouding.

In contrast, the shrouding hypothesis predicts that, for a given price decomposition, the presence or absence of shrouding should have an effect. More precisely, it suggests that if a given decomposition of the total price is fully disclosed, there

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<sup>4</sup>Specifically, in an independent private values setting, if the reserve level lies below the lower support of the value distribution for all bidders, then the reserve is irrelevant to the expected revenues of the auction.

should be no differences in revenues; however, if shipping charges are shrouded, then revenues should differ. Thus, we have

**Hypothesis 3a.** Under the shrouding model, for a given price decomposition, revenues should vary with shrouding.

**Hypothesis 3b.** Under the shrouding model, if total price is not shrouded, then revenues are independent of the price decomposition.

**Hypothesis 3c.** Under the shrouding model, if total price is shrouded, then revenues should vary with shipping charges.

Finally, there is one additional competing explanation that is particular to the on-line auction environment. In that environment, items are listed (and may be sorted) by current bid price (exclusive of shipping) and hence, differences in the price decomposition for a given total reserve price lead to different displayed information when a consumer conducts a search. In particular, for a given total reserve, a higher shipping charge leads to a lower displayed price for an item when a consumer searches (at least initially). Thus, if classical consumers followed a search strategy of simply sorting listings by price and bidding on whichever item was currently the cheapest, one would obtain revenue differences even in the absence of mental accounting or cognitive processing limitations associated with computing the total price. To summarize:

**Hypothesis 4a.** Under the price search model, revenues vary with shipping charges, but, for a given price decomposition, revenues are independent of shrouding.

**Hypothesis 4b.** Under the price search model, for a given level of shipping charges, revenues vary with opening price.

Notice that Hypothesis 4a and the combination of Hypotheses 2a and 2b yield identical implications. However, the mechanism by which the price search model operates—low price auctions attract more bidders—is different, which provides for the distinguishing Hypothesis 4b.

## 2.3 Experimental Design

To examine the above hypotheses, we ran a series of auctions for brand new iPod portable music players by Apple on the auction sites of Yahoo’s Taiwanese auction website, <http://tw.bid.yahoo.com>. We chose “iPod shuffle” players with 512 MB and 1 GB memory and “iPod nano” players of 1 GB and 2 GB memory in both white and black colors. The colors for the iPod nanos were specified in the title and item description. We also put pictures of iPods of corresponding colors. Consumer preferences over the color of the nano run strong; hence it is reasonable to consider



the market for black nanos separate from the market for white nanos. We purchased these items directly from Apple and shipped them to consumers in Apple’s factory sealed packaging. We clearly stated that we allow only a standard shipping method and the shipping charge was fixed and non-negotiable.

In selecting this product and this platform, we wanted a market that was sufficiently thick that the introduction of our products would have a negligible effect on market conditions. We also wanted a product that was sufficiently commoditized that product heterogeneity would not be a key concern in the analysis. In other words, we wanted to choose a product where it seemed unreasonable that a consumer might infer a quality signal about the product from our particular treatments. Finally, we wanted a product where the bidders were likely to be mainly consumers purchasing for their personal use rather than as resellers. For all of these reasons, iPods offered a fairly ideal product. First, as Table 1 shows, the market for the four types of iPods we sold is quite thick on Yahoo’s Taiwan platform. An iPod is a readily available consumer product whose brand identity mainly stems from Apple’s reputation for design and quality rather than the reputation of an individual retailer; thus, we doubt that consumers inferred anything about the quality of our factory sealed iPods from our auction listings. Third, Apple maintains tight price discipline on resellers of its products; thus, it is quite difficult for a would-be reseller to earn a profit as an iPod “flipper.” Instead, the typical bidder for these products appears to be end-use consumers.

We wanted to appear to be a typical seller. To do this, we created a Yahoo account well before we ran the auctions and participated in numerous auctions as both buyers and sellers to get a reasonable feedback rating. We used this same seller identity for all auctions we ran.

Finally, we wanted a product with sufficient variability in how price is decomposed that our experiments would “blend in” in this setting. Table 2 presents some statistics on shipping costs of iPod auctions on Yahoo Taiwan in May 2005 showing that there is considerable variability in the shipping costs. For the high shipping treatments, we chose a shipping charge of 180 New Taiwan dollars (TWD) while for the low shipping treatments we chose a shipping charge of TWD 30. To make the total reserve the same for the low shipping + high opening and the high shipping + low opening treatments, we chose an opening price of TWD 750 for the high opening treatments and an opening price of TWD 600 for the low opening treatments. In no case did we use a secret reserve price, and this fact is automatically disclosed to

bidder on the site. The opening price and shipping fee combinations and the total reserve of the different treatments are succinctly presented in the following table:

	Low Shipping (TWD 30)	High Shipping (TWD 180)
High Opening Bid (TWD 750)	TWD 780 (Treatments A and D)	TWD 930 (Treatments C and F)
Low Opening Bid (TWD 600)	-	TWD 780 (Treatments B and E)

Compared to the retail prices (shown in Table 3), our reserve prices are quite small. Thus, it seems reasonable to suppose that the condition on the distribution of valuations of “serious” bidders required for (the strong form of) Hypothesis 1 is likely to hold.

Finally, as we stated above, for the no shrouding treatments we disclosed the shipping charge in the header line for the item while we did not disclose it for the shrouding treatments. The body of the item description was identical for all items and treatments save for the picture of the item, the name of the particular product and the shipping charge. Figures 1 and 2 display screenshots for one of the items under the no shrouding and shrouding treatments, respectively.

Between March 13 and March 20 of 2006, we ran three auctions each with treatments A, B and C for all six products. Yahoo allows the seller to post the shipping charge to be posted in a box at the top of the item description. It is not uncommon for sellers not to include any shipping fee there, and we followed that practice. Yahoo does not display the shipping charge when displaying a search result. We offered only a standard shipping method.

Between March 20 and March 27 of 2006, we ran three auctions each with treatments D, E and F for all six products without including the shipping and handling charge in the title of the auction. In these auctions, a bidder can only observe the shipping charge by checking the item description. Other than the difference in the title the set of auctions in this group was identical to the set of auctions started on March 13.

In every instance, the listed item sold on the site, and we received payment including the shipping charge.

### 3 Results of the Field Experiments

Table 4 displays the revenues obtained in each of the auctions under the various treatments. What is immediately apparent is that the revenues obtained for the same item vary considerably across treatments. One measure of this “price dispersion” commonly used in the literature on e-retail pricing is the percentage range in revenues. We compute this as the percentage difference between the highest and lowest revenue obtained for a given item across treatments. The results are reported in the column labeled “% range” in Table 4. As the table shows, percentage ranges vary between 5% and 19% depending on the particular iPod model. We now study whether the variation in revenues is systematic across treatments.

#### Shrouding

We begin by studying the effect of shrouding on revenues. Our experiments provide 18 matched pairs of auctions that differ only by whether the shipping charge was shrouded. Recall that the classical consumers framework (Hypothesis 1), the strong form of the mental accounting framework (Hypothesis 2b), and the price search framework (Hypothesis 4a) all predict that this treatment will have no effect. Comparing the matched observations, we observe that in 11 of the 18 cases the shrouded treatment yielded lower revenues, in 3 cases higher revenues, and in 4 cases the same revenues as the unshrouded treatment. This lop-sided distribution of outcomes is very unlikely to happen by chance. Formally, we can use a Wilcoxon matched-pairs signed ranks test to examine the hypothesis that the distributions of revenue outcomes under the two treatments are equal. Performing this analysis, we obtain a test statistic of 2.57, which indicates that we can reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 1% level. Additional support for this conclusion may be obtained by using a standard t-test with matched pairs. Performing this analysis, we obtain a t-statistic of 3.67, which leads us to reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 1% level as well.

To summarize, we find no support for hypotheses 1, 2b, and 4a in the dimension of shrouding. In contrast, we find support for hypothesis 3a—shrouding systematically affects revenues. What is interesting to note, however, is the *direction* in which shrouding affects revenues. The average revenues obtained in the field experiments for items sold without shrouding are 4,243 TWD while they *fall* to 4,113 TWD when shipping charges are shrouded—a 3% revenue reduction. Thus, while the evidence

supports an effect of shrouding on revenues, it does not support the idea that shrouding prices is a profitable strategy for sellers. Moreover, this difference in revenue cannot be attributed to the number of bidders. For the matched pairs of auctions, in 9 of the cases the shrouded treatment received bids by fewer bidders and in the other 9 cases there were fewer bidders in the unshrouded treatment. Obviously, the null hypothesis that the shrouded and unshrouded auctions attracted the same number of bidders cannot be rejected using a binomial test or a Wilcoxon matched-pairs signed ranks test at any reasonable significance level.

### **High versus Low Shipping Charges**

The classical consumers model predicts that, for a given reserve level, revenues should be independent of the shipping charge while the other models predict that, at least in some cases, revenues should vary. Since, as we showed above, shrouding seems to systematically affect revenues, we treat the shrouded and unshrouded cases separately.

#### *Shrouded Prices*

When prices are shrouded, all of the models save the classical consumers model predict variation in revenues for a given reserve level. To examine this, we compare the revenues for a given overall reserve level in the low shipping treatment (Treatment D) with the matched pair in the high shipping treatment (Treatment E). As Table 4 shows, in every case the high shipping treatment produces higher revenues. Formally, we can use a Wilcoxon matched-pairs signed ranks test to examine the hypothesis that the distributions of revenue outcomes under the two treatments are equal. Performing this analysis, we obtain a test statistic of 2.2, which indicates that we can reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 3% level. Additional support for this conclusion may be obtained by using a standard t-test with matched pairs. Performing this analysis, we obtain a t-statistic of 5.0, which leads us to reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 1% level.

The shrouding and mental accounting models also predict revenue differences when we vary the shipping charge while holding the opening price fixed. In contrast, the price search model predicts no revenue difference under this condition. As Table 4 shows, in 5 out of the 6 matched pairs of auctions, we obtained higher revenue with a higher shipping charge. Formally, we can again use a Wilcoxon matched-pairs signed ranks test. Performing this analysis, we obtain a test statistic of 2.1, which indicates that we can reject the null hypothesis of no treatment effect in favor of the two-sided

alternative at the 4% level. Similarly, a standard t-test with matched pairs yields a test statistic of 3.7, which leads us to reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 2% level.

Finally, the shrouding and mental accounting models also predict no revenue differences when holding fixed the shipping charge but varying the opening price. In contrast, the price search model predicts a revenue difference under this pair of treatments. As Table 4 shows, for two of the matched pairs of auctions, a higher opening price yields greater revenues, for two it yields lower revenues, and for two it yields the same revenue. This suggests the absence of a treatment effect. Formally, a comparison of treatments E and F using a Wilcoxon matched-pairs signed ranks test produces a test statistic of 0.2, which is not significant at any conventional level. Similarly, a t-test produces a test statistic of 0.48, which is likewise not significant.

To summarize, we find no support for the classical consumers model (Hypothesis 1) nor the price search model (Hypothesis 4b); however, the results of variation in shipping charges and opening prices are consistent with the predictions of the mental accounting model and the shrouding model (Hypotheses 2a and 3b).

#### *Unshrouded Prices*

When prices are unshrouded, the mental accounting and price search models predict variation in revenues for a given reserve level while the classical consumers and shrouding models do not. To examine this, we compare the revenues for a given overall reserve level in the low shipping treatment (Treatment A) with the matched pair in the high shipping treatment (Treatment B). As Table 4 shows, in five out of the six matched pairs, the high shipping treatment produces higher revenues. Formally, we use a Wilcoxon matched-pairs signed ranks test to test for systematic variation in revenues. We obtain a test statistic of 1.8, which indicates that we can reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 7% level. Similarly, a t-test produces a test statistic of 2.2, which also leads to a rejection of the null hypothesis at the 7% level. Depending on one's views about the appropriate level of significance, this result may be viewed as either supporting the mental accounting model or not.

The mental accounting model predicts revenue change when we vary the shipping charge while holding the opening price fixed. This prediction is shared by none of the other models. As Table 4 shows, in 4 out of the 6 matched pairs of auctions, we obtained higher revenue with a higher shipping charge for a fixed opening price. We can test these competing predictions using a Wilcoxon matched-pairs signed ranks

test. We obtain a test statistic of 1.57, which indicates that we can reject the null hypothesis of no treatment effect in favor of the two-sided alternative at the 12% level. A t-test produces a test statistic of 1.99, which is significant at the 11% level. At conventional significance levels, these results do not support the predictions of the mental accounting model.

Finally, only the price search model predicts a revenue difference when we hold fixed the shipping charge but vary the opening price. As Table 4 shows, for three of the auctions, a higher opening price yields greater revenues while for the other three it yields lower revenues. This suggests the absence of a treatment effect, and this is readily confirmed with a signed ranks test ( $z = 0.42$ ) and a t-test ( $t = 0.79$ ).

As was the case for shrouded prices, we once again find no support for the classical consumers model (Hypothesis 1) nor the price search model (Hypothesis 4b). If one holds the view that 5% is an absolute standard for significance, then we find support for the shrouding model (Hypothesis 3a) and against the mental accounting model (Hypothesis 2a).

### **Summary**

To summarize, the data from the field experiments appear to be most consistent with the shrouding model. None of its hypotheses are rejected (at the 5% level) by the data. We find some support for the mental accounting model. It performs as expected with shrouded prices, and is consistent with the directional change in revenues for the case of unshrouded prices. Put differently, when prices are unshrouded, the magnitude of the effects of changes in shipping suggested by the mental accounting model appears more muted. We find little support for the classical consumers or price search models.

## **4 The eBay Natural Experiment**

On October 28, 2004, eBay announced in a press release that it will make some changes and enhancements of the display format of search results and other features within a few days.<sup>5</sup> Starting from around November 1, when a potential bidder made a search query, she could adjust her user interface so that the shipping cost of the items returned in the search is also displayed.<sup>6</sup> Thus, bidders could know the total

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<sup>5</sup>Indeed, eBay's press listings on its website did not indicate that such a change would occur in advance of their implementing it nor was the exact date of the when the change occurred publicly disclosed.

<sup>6</sup>On September 9, 2005, eBay then made this view the default option for all searches.

current price even if the seller did not mention it in the title. Moreover, after the changeover, eBay displayed the bidder's bid and the shipping cost together before the bid is confirmed when a bidder places a bid. Previously, shipping charges contained in the body of a given auction listing were only observable to consumers by clicking through to the listing itself. All of these changes in the user interface on eBay might be expected to have the effect of reducing the shrouding of shipping charges on that platform. To study the effects of this change, we use two different datasets which we describe below.

**eBay Field Experiments.** We were unaware that eBay intended to make this change when we were in the process of conducting field experiments on eBay using a design that is conceptually identical to the Yahoo Taiwan experiments when the changeover occurred. Specifically, during October 25 to November 1 of 2004, we ran thirty auctions of the 10 most popular Xbox games on eBay. For these auctions, the shipping charge was unshrouded in a manner identical to the Yahoo experiments. Retail prices of these games in standard brick and mortar stores exceeds USD 50 with tax. Treatments A, B and C started at opening prices of USD 6, 2, and 6 respectively and charges shipping and handling fees of USD 2, 6, and 6 respectively. The only possible shipping method for the winner was standard United States Postal Service first-class mail. Thus, our total reserve price was at most USD 12. We ran a survey of other ongoing eBay auctions of the games that we sold during the time when we ran these three treatments. For each game, on average, 19.1 auctions of that game were listed on eBay at a given time. Thus, the three auctions run by us did not change the market supply that much. The average shipping cost charged in these auctions is USD 4.87 with a mode and median of USD 5 and a shipping cost of USD 6 for Xbox games should not be considered exorbitantly high. We also use a subset of these auctions as a benchmark dataset of field data in our empirical analysis. Summary statistics on these auctions can be found in column four of Table 5 as video games field data. In this dataset, the minimum price conditional on a sale was USD 26.49. One can easily argue that a total of reserve of USD 12 restricts more or less the same set of bidders as does an auction with a reserve of USD 8 as both of these reserves are likely to be above the valuations of virtually all bidders.

During November 8 to November 15, after eBay changed the search display format, we ran auctions under the same three price decompositions but without listing the shipping cost in the titles. Other than this difference in the title, the auctions were identical to those run on the last week of October 2004. Of course, since the

changeover in eBay’s display format occurred during the course of these experiments, it is not clear whether our experimental manipulation of shrouding was more or less superseded by eBay’s institutional change; however, our reading of the data suggests that it was.

### **eBay Field Data**

We obtained a dataset used by Tyan (2005) to study price decompositions. The period in which this data was obtained straddled the period of the changeover and thus allows for identification using this change in eBay’s display. Specifically, we used Tyan’s data for auctions of collectible gold and silver coins that resulted in sales and added various controls (described in detail below) to attempt to account for various product and seller heterogeneities. The interested reader should see Tyan (2005) for additional details about the collection methodology for this dataset.

### **Benchmark Datasets**

For purposes of comparison, we also obtained data from field experiments reported in Hossain and Morgan (2006) comparing shipping charges and opening prices for auctions of popular music CDs and Xbox games resulting in sales in the pre-changeover period. The interested reader should consult the above cite for details on this data. Additionally, we collected data on all successful eBay auctions for the 10 Xbox games in our field experiment that started after October 13, 2004 and ended by October 28, 2004 to create a benchmark dataset of field data.

Together with the iPod experimental data, this gives us six different datasets to compare price decomposition and shrouding.

### **Summary Statistics**

Wherever possible, the data is classified as either “hidden” or “revealed”. For experimental data, “hidden” indicates that shipping fees were not listed in the item title, while “revealed” indicates that the shipping fee was explicitly stated in the item title. For the field data, “hidden” and “revealed” auctions are classified by their date of completion. While eBay explicitly acknowledged changing its search results on November 1, 2004, there is evidence to suggest that eBay actually released the new results formatting several days ahead of schedule. However, eBay users may not have adjusted their behavior to immediately incorporate this new information into their decision-making. Users also had to adjust their eBay user preferences to include shipping in the display. To allow for both an unexpectedly early implementation of the change, as well as a learning period in which users adjusted to the new search result format, we define “hidden” auctions in the gold and silver coins dataset as those



finishing prior to October 27, 2004, and “revealed” auctions as those that started after November 10, 2004. All the auctions in the video games field data set were considered to be “hidden.” The main results are robust to variations in the cutoff dates for the changeover.

Table 5 summarizes revenues, opening prices, and shipping fees for the six different data sets. The mean and standard deviations are calculated by “hidden” and “revealed,” as described above. Revenues are calculated as the sum of the final price (on eBay, the final price is the second-highest bid plus a small increment) and the shipping charges.

Because the data relate to a range of products, the average revenues vary substantially. The most expensive items, iPods, have average revenues of over 4,000 New Taiwan dollars (approximately US\$125). The CD and video game sales yield much lower revenues per unit, with an average total price of approximately \$23. As Table 5 shows, for all of the datasets save the video game field experiments, revenues are higher when shipping charges are revealed compared to when they are not. Of course, the overall reserve level (shipping plus opening price) also appears to change in moving from hidden to revealed as does the composition of the reserve. In particular, in the revealed period, shipping charges represent a smaller fraction of the reserve level in the field data. All of this is suggestive that both shrouding and price decompositions affect revenue; however, given the variation in the data, it is difficult to draw any firm conclusions. To examine the effects of varying price decomposition and shrouding more systematically across these datasets, we describe an econometric specification that attempts to identify revenue effects of varying price decompositions and shrouding.

## 4.1 Estimation Methodology

Standard auction theory (and the classical consumers model) predicts that revenues in an auction are a function of the reserve level and independent of the particular composition of the reserve. This suggests the regression

$$revenue = \gamma_0 + \gamma_1 reserve + \gamma_x X + \varepsilon$$

where  $X$  is a matrix of item-specific controls, described below, and  $\varepsilon$  represents a standard error terms. Of course, we could equally well write the reserve as its separate components

$$revenue = \gamma_0 + \gamma_1 (opening + shipping) + \gamma_x X + \varepsilon$$

The alternative hypotheses suggest that, under some conditions, the relationship between the change in revenues and a change in the components of the reserve are not the same, which suggests modifying the specification above to

$$revenue = \gamma_0 + \beta_1 opening + \beta_2 shipping + \gamma_x X + \varepsilon$$

This specification then allows us to distinguish between Hypothesis 1 and the others. In particular, Hypothesis 1 implies the parameter restriction  $\beta_1 = \beta_2$  in the above specification while the other models do not.

The shrouding model suggests that the marginal effect of a given price decomposition will differ depending on whether shipping charges are shrouded or not. This suggests that we modify the above specification to allow for the flexibility. Specifically,

$$\begin{aligned} revenue = & \gamma_0 + \beta_1 opening + \beta_2 shipping + \beta_3 revealed & (1) \\ & + \beta_4 revealed \times opening + \beta_5 revealed \times shipping + \gamma_x X + \varepsilon \end{aligned}$$

We are now in a position to translate the various hypotheses above into parameter restrictions in the econometric model. Specifically:

**Hypothesis 1.** Since a given price decomposition is supposed to be revenue neutral, this implies

$$\begin{aligned} \beta_1 &= \beta_2 \\ \beta_3 &= \beta_4 = \beta_5 = 0 \\ \beta_1 + \beta_4 &= \beta_2 + \beta_5 \end{aligned}$$

**Hypothesis 2a.** Price decompositions are predicted to matter.

$$\begin{aligned} \beta_1 &\neq \beta_2 \\ \beta_1 + \beta_4 &\neq \beta_2 + \beta_5 \end{aligned}$$

**Hypothesis 2b.** Revenues are independent of shrouding.

$$\beta_3 = \beta_4 = \beta_5 = 0$$

**Hypothesis 3a.** Revenues are not independent of shrouding

$$\neg(\beta_3 = \beta_4 = \beta_5 = 0)$$

where “ $\neg$ ” is the logical negation symbol.

**Hypothesis 3b.** When shipping charges are revealed, price decompositions are revenue neutral.

$$\beta_1 + \beta_4 = \beta_2 + \beta_5$$

**Hypothesis 3c.** When shipping charges are not revealed, price decompositions are not revenue neutral.

$$\beta_1 \neq \beta_2$$

**Hypothesis 4a.** Revenues are independent of shrouding but price decompositions matter

$$\begin{aligned}\beta_3 &= \beta_4 = \beta_5 = 0 \\ \beta_1 &\neq \beta_2\end{aligned}$$

Collectively, the implied parameter restrictions almost allow us to separate each of the models. Without additional structure, we cannot separate the parameter restrictions in the mental accounting model from the price search model.

As a practical matter, we first test the null hypotheses  $H_0 : \beta_3 = \beta_4 = \beta_5 = 0$  using an F-test. If we cannot justify the inclusion of the shrouding interaction in the model, by failing to reject the null hypotheses that coefficients on these additional variables are statistically significant, then our empirical model is misspecified and we must estimate the model without the interaction term instead. Finally, standard tests reveal that the data is heteroskedastic; hence we correct for this using robust estimation.

#### **Item-Specific Control Variables**

Because the items used in this study vary substantially in form, quality and value, a series of item-specific variables were constructed to control for observed heterogeneity. Below, we briefly described the control variables used in matrix  $X$  in each set of regressions.

- *CDs and Video Games (Experimental Data)*: Dummy variables were created for each of the 20 music CD or video game for Xbox console
- *iPods (Experimental Data)*: Dummy variables were created for each of the six iPod models

- *Video Games (Experimental Data)*: Dummy variables were created for each of the 10 video games
- *Video Games (Field Data)*: Dummy variables were created for the condition of the game (new vs. used), whether the seller accepted Paypal, and whether the auction listing contained a photograph of the item for sale. Since there is evidence to suggest that seller reputation may influence the probability of a sale and the final price, we also controlled for sellers' eBay feedback rating through a series of reputation quartile dummies.
- *Gold Coins (Field Data)*: Dummy variables were created for coin grades (68, 69, 70 or none listed) and interacted with a indicator variable for the grading organization (PCGS, NGC, ICG, and ANACS). We included dummy variables to indicate whether the coin was listed as a "proof" or as "brilliant uncirculated" (BU), whether the seller accepted Paypal or credit cards, and whether the auction listing contained a photograph of the coin. We also controlled for sellers' eBay feedback rating through a series of reputation decile dummies.
- *Silver Coins (Field Data)*: Dummy variables were created to indicate whether the coin was listed as graded, whether the seller accepted Paypal or credit cards, and whether the auction listing contained a photograph of the coin. We also controlled for sellers' eBay feedback rating through a series of reputation decile dummies.

## 4.2 Regression Results

Table 6 presents the results for the six sets of auction data. The first column presents results from the CD and video games experimental auctions. We do not include the before-after interaction—because of the timing of these auctions, we knew *a priori* that there was no such distinction in the data. Thus, we can only test the parameter restriction  $\beta_1 = \beta_2$ . As the table shows, we reject this parameter restriction at the 1% level. Thus, the evidence from this dataset is inconsistent with the classical consumers model, but consistent with all the others.

Turning to the iPod dataset, we once again reject the parameter restriction  $\beta_1 = \beta_2$ , this time at the 5% level. Shrouding also appears to affect revenues—we can reject the restriction  $\beta_3 = \beta_4 = \beta_5 = 0$  at the 1% level. Interestingly, when shipping charges are revealed, we fail to reject the parameter restriction  $\beta_1 + \beta_4 = \beta_2 + \beta_5$

at conventional levels. That is, for the unshrouded or “revealed” treatments, the framing effects of differing price decompositions do not seem to affect revenues. Taken together, the evidence from this dataset supports the shrouding model and not the others.

For the field experiment of video games on eBay, one obtains only weak evidence of a shrouding effect. We can reject the parameter restriction  $\beta_3 = \beta_4 = \beta_5 = 0$  only at the 10% level, and we cannot reject the parameter restrictions  $\beta_1 = \beta_2$  or  $\beta_1 + \beta_4 = \beta_2 + \beta_5$  at conventional levels. If anything, this dataset is more supportive of the classical consumers model than any of the others. Again, it is important to note that the experimental manipulations in this dataset coincided with the eBay natural experiment; hence the results should be viewed with caution.

Finally, we turn to the field data. The video games dataset somewhat resembles the field experiment dataset; however, all of the observations in this dataset collected prior to the changeover and hence were “unrevealed.” We can reject the parameter restriction  $\beta_1 = \beta_2$  at 10% significance levels. Still, bidders for video games appear to care more about the overall reserve level in an auction and less about the particular price decomposition.

As Table 6 shows, however, bidders for collectible coins exhibit very different behavior than video games buyers. For silver coins, we can reject the hypothesis that shrouding is revenue neutral at the 1% significance level. Likewise, we can reject the parameter restriction that variations in price decompositions are revenue neutral when prices are shrouded at the 1% level. Both of these predictions are consistent with the shrouding model but not with the (strong form of) the others. However, we can also reject the prediction that, after shipping has been revealed, only the reserve level matters. Thus, the parameter restriction associated with a strong form of the shrouding model is also rejected.

For gold coins, we can again reject the hypothesis that shrouding is revenue neutral, but only at the 10% significance level. When shipping charges are shrouded, we can reject the restriction that varying price decompositions are revenue neutral at the 1% level. However, when shipping charges are not shrouded, we cannot reject the neutrality restriction at conventional significance levels. Taken together, bidders for gold and silver coins appear more consistent with the shrouding model than with the alternatives.

Finally, given the surprising result in section 3 that the revenue from iPod auctions of comparable treatments was lower in the shrouded setting (compared to the revenues

in the unshrouded setting), we also test if unshrouding leads to a higher revenue in the iPod experiments and the gold and silver coins field data. Specifically, we test if

$$\beta_3 + \beta_4 \times \text{average\_opening} + \beta_5 \times \text{average\_shipping} = 0.$$

As Table 6 shows, this F-test does not reject the null hypothesis that revenue did not change between the shrouded and unshrouded treatments for iPod auctions. The sample size for the iPod experiments is 36 and regression estimates cannot take advantage of the matched pairs nature of the data. We do not run this test for the video games experimental data given the small sample size and the fact that there does not seem to be a great difference between the “revealed” and “unrevealed” treatments perhaps because of the timing of the experiment. However, for the larger datasets of gold and silver coins, the F-tests reject the null hypothesis at the 5% and 1% significance levels respectively. This is also more significant because eBay had made the display system more transparent for all auctions, not just for a subset of auctions as done in the experiment. Thus, this result suggests that the institutional change to make shipping fee revealed made by eBay did not reduce seller’s revenue. In fact, the change may have helped in increasing the price.

In Table 7, we present the results for specifications with an item-specific random effect error. We perform Hausman tests and conclude that the random effects specification is statistically justified. The summary results discussed below are not hugely affected by inclusion of random effects. However, with the random effects model, for video games experimental data in column three, we cannot reject that  $\beta_3 = \beta_4 = \beta_5 = 0$  even at 10% significance level and hence do not present any analysis with the “Revealed” dummy in the table.

### Summary

The evidence from the regression analysis mainly supports the hypothesis that a seller’s revenues are determined not just by the overall reserve level, but also by the particular composition of opening bid and shipping charge comprising that reserve. The coefficient estimates suggest that a seller can increase revenues by systematically raising his or her shipping charge and lowering the opening price for an item. That being said, the data also suggests large differences in the susceptibility of bidders to this type of effect depending on the item being purchased. Video game buyers, in particular, appear to behave in a fashion closer to the predictions of the classical consumers model than buyers of the other commodities we considered. They appear to take into account the overall reserve level when making bids less dependent of

whether shipping charges are shrouded or not. Now, one might speculate that the difference in behavior might stem from demographic differences in the population of video game buyers versus the population of buyers for the other products in the dataset. While we do not have detailed demographic information about the pool of buyers for each of the products, other marketing studies would seem to suggest that the pool of video game buyers is both younger and less affluent than the buyers of collectible coins. Perhaps the combination of youth and tighter budget constraints leads to greater vigilance on the part of these buyers with respect to shipping charges. That being said, Taiwanese iPod buyers as well as US popular music CD buyers are likely to have similar characteristics to video game buyers, yet shrouding and variations in shipping charges clearly have an effect. It remains for future research to determine the buyer characteristics that lead to susceptibility to price decomposition effects.

## 5 Relation to Existing Literature

The theoretical predictions presented in section 2.2 follow from the existing literature in auction theory and behavioral economics. With “classical consumers,” standard auction theory directly leads to hypothesis 1. For a similar (more formal) exposition in an auction setting, see Proposition 1 in Hossain and Morgan (2006). Hypotheses 2a and 2b follow from the literature on mental accounting. Kahneman and Tversky (1984) and Thaler (1985) postulate that consumers retain separate mental accounts for different aspects of a purchase decision. Experimental evidences show that a decision maker makes different choices when presented with relevant data in different accounting formats. One plausible way this might happen in our setting is that bidders have separate accounts for shipping and for the good itself and they discount the surplus received from the shipping account. For a concrete example of how mental accounting can affect auction outcomes in the presence of different framings of the reserve price, see Hossain and Morgan (2006).

As mentioned in the introduction, Gabaix and Laibson (2006) show that firms may exploit consumer myopia by keeping some attributes of the price hidden even in a competitive market equilibrium. Ellison (2005) considers a model where products contain a base product and an add-on. In the equilibrium, firms may sell the base at a low advertised price and the add-on at a high unadvertised or shrouded price. Miao (2006) shows that firms can earn high profit from myopic consumers in a dynamic

model. In that model, shrouded or add-on prices may persist even if firms can costlessly educate consumers about the complete price structure. A theoretical setting in the line of these models can produce predictions like hypotheses 3a and 3b.

The price search models arise from comments by seminar participants and anonymous referees when presenting the field experiments in Hossain and Morgan (2006). The experimental design for the Yahoo auctions was devised at least in part for the purpose of distinguishing the implications of this hypothesis from alternatives.

The current paper is not the first one to empirically document the impact of shrouded pricing. As mentioned earlier, Hossain and Morgan (2006) and Tyan show that a higher shipping cost usually leads to a higher revenue in eBay auctions. Ely and Hossain (2006) also find similar results using data from a field experiment of eBay auctions. On the other hand, Smith and Brynjolfsson (2001) find that in online book retailing consumers are more sensitive to variation in shipping charges than to variation in price. Again, this is contrary to the notion that only the total price matters in determining demand albeit in a direction opposite to our findings. Using empirical data from a search engine for prices of computer memory, Ellison and Ellison (2004) find that firms frequently obfuscate the price to reduce the impact of price sensitivity among consumers. In their theoretical setting, some consumers endure a search cost and this makes obfuscation profitable. Their result is also consistent with our hypotheses 4a and 4b.

The impact of dividing the price into multiple attributes or making the final price opaque has been studied in laboratory settings too. An experiment by Morwitz, Greenleaf, and Johnson (1998) shows that, relative to a standard first price auction, bidders effectively bid more aggressively when the winner of the auction has to pay 115% of her bid. Bertini and Wathieu (2006) find that price formats affect the amount of attention consumers pay to various product attributes. They find that partitioned prices often “re-sanitize” consumers to the different product attributes.

## 6 Conclusions

Using field experiments as well as field data from a natural experiment conducted in two leading online auction marketplaces in two continents, this paper examines the impact of the price frames on revenue and explores the persistence of this effect under different transparency levels of prices to compare competing rationalizations of this framing effect. Our goal was to devise a field experimental design that cleanly



separated the several competing hypotheses surrounding these issues. We created different treatments by varying, in a way that naturally occurs on online auctions, the shrouding of various price attributes in online auctions. To avoid confounding effects from seller heterogeneities, product heterogeneities, buyer suspicion and so on, we attempted to be meticulous try to ensure that the auctions are identical in other respects and “blend in” with the other auctions occurring at the same time. Our “subjects” are familiar with the rules of bidding in this setting and the objects being auctioned are real. Experiments conducted in US and Taiwanese websites show that our experimental design can be used across different cultures and subject pools.

We showed that the impact of the price frames on revenue persists only as long as the costs of secondary attributes are kept shrouded. The framing effect goes away when all segments of the price are made transparent. Moreover, this kind of transparency can be achieved by making simple institutional changes. Our data also suggests the somewhat surprising result that making price compositions more transparent may actually increase seller revenue. Our results offer two broader (and to our minds somewhat hopeful) implications: First, the usual *homo economicus* description of consumers seems to be a reasonable model for consumer choice if the rules of the auction and various components of costs are transparent. Second, while price decompositions do appear to affect consumer choice when attributes are shrouded, the evidence seems to suggest that, for sellers, honesty (and transparency) truly is the best policy in terms of increasing profits.

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**Table 1. Number of Auctions of Brand New iPods Listed on Yahoo's Taiwan Auction Site on Two Different Dates**

Product	18-Mar-06	23-Mar-06
iPod shuffle 512m	93	109
iPod shuffle 1G	26	12
iPod nano 1G	48	42
iPod nano 2G	96	101

**Table 2. Retail Prices of iPods on Apple Taiwan's Website**

Product	Price (in TWD)
iPod shuffle 512m	2500
iPod shuffle 1G	3600
iPod nano 1G	5300
iPod nano 2G	6900

**Table 3. Summary Statistics on Shipping and Handling Fees in iPod Auctions on Yahoo Taiwan (in TWD)**

Mean	110.83
Median	100
Mode	100
Standard Deviation	34.29
Maximum	250
Minimum	50

**Table 4. Revenues Obtained in the Yahoo Field Experiments (in TWD)**

Item	Treatment						% Range
	A	B	C	D	E	F	
iPod nano 1G black	4,380	4,530	4,580	4,080	4,530	4,080	12%
iPod nano 1G white	4,330	4,630	4,480	4,330	4,480	4,480	7%
iPod nano 2G black	5,430	5,480	5,380	5,230	5,500	5,380	5%
iPod nano 2G white	5,430	5,580	5,980	5,230	5,480	5,580	14%
iPod shuffle 1G	3,130	3,100	3,380	3,080	3,280	3,280	10%
iPod shuffle 512m	2,190	2,210	2,160	1,860	1,980	2,180	19%
Opening Price	High	Low	High	High	Low	High	
Shipping Fee	Low	High	High	Low	High	High	
Shrouding	No	No	No	Yes	Yes	Yes	

**Note:** % Range is the difference between the highest and lowest revenue obtained for a given item across treatments as a percentage of the lowest revenue for that item. High and low opening prices equal TWD 750 and 600 respectively and high and low shipping fees equal TWD 180 and 30 respectively. If the shipping fee is stated in the auction title then there was "No" shrouding.

**Table 5: Summary Statistics for all Auctions**

Objects for Auction	<u>CDs &amp; Games</u>	<u>iPods</u>	<u>Video Games</u>	<u>Video Games</u>	<u>Gold Coins</u>	<u>Silver Coins</u>
Data type	Experimental	Experimental	Experimental	Field	Field	Field
Currency	US\$	New Taiwan \$	US\$	US\$	US\$	US\$
<b>Hidden shipping charge</b>						
Mean						
Revenue	25.534 (14.373)	4113.333 (1245.103)	37.784 (5.514)	38.399 (4.902)	62.116 (16.918)	44.629 (18.840)
Opening Price	2.950 (2.270)	700.000 (72.761)	4.667 (1.918)	11.655 (8.269)	9.039 (17.019)	20.669 (24.304)
Shipping Fee	2.943 (2.225)	130.000 (72.761)	4.667 (1.918)	4.835 (1.385)	4.805 (1.902)	4.964 (1.479)
# of observations	74	18	30	175	124	215
<b>Revealed shipping charge</b>						
Mean						
Revenue		4243.333 (1256.761)	35.672 (4.204)		67.453 (22.002)	45.722 (4.190)
Opening Price		700.000 (72.761)	4.667 (1.918)		12.168 (21.811)	24.104 (16.164)
Shipping Fee		130.000 (72.761)	4.667 (1.918)		4.553 (1.369)	5.078 (1.268)
# of observations		18	30		162	306

**Note:** The values in parentheses are standard deviations. "Experimental" data was gathered through controlled field experiments using online auction platforms. "Field" data was gather passively from uncontrolled online auctions. See the text for detailed descriptions of the auctioned objects. For experimental data, "Revealed" indicates that shipping charge was listed in item title. For field data, "Revealed" indicates that the auction occurred after November 1, 2004, the date on which eBay changed it search results listing format option.

**Table 6: Results for Regressions on Total Auction Revenue**

**Dependent variable:** total revenue (i.e. final price + shipping price)

Objects for Auction	CDs & Games	iPods	Video Games	Video Games	Gold Coins	Silver Coins
Data type	Experimental	Experimental	Experimental	Field	Field	Field
<b>Coefficient Estimates (<math>\beta</math>)</b>						
Shipping	0.720 *** (0.208)	1.600 * (0.398)	0.477 (0.454)	0.433 (0.251)	2.031 *** (0.569)	0.888 *** (0.178)
Opening	0.248 * (0.128)	0.300 (0.515)	-0.303 (0.358)	-0.067 (0.041)	0.013 (0.046)	0.079 *** (0.015)
Revealed x Shipping		-0.889 (0.572)	-0.290 (0.594)		-0.359 (1.218)	-0.290 (0.253)
Revealed x Opening		0.778 (0.779)	-0.079 (0.514)		0.048 (0.075)	-0.013 (0.021)
Revealed		-400.000 (603.961)	-0.021 (4.519)		4.053 (4.941)	4.261 (1.392) ***
<b>F-tests</b>						
$\beta_{\text{revealed}} = \beta_{\text{revealed} \times \text{shipping}} = \beta_{\text{revealed} \times \text{opening}} = 0$	d.f.	4.84 *** (3,25)	2.25 * (3,45)		2.1 * (3,261)	18.47 *** (3,499)
$\beta_{\text{shipping}} = \beta_{\text{opening}}$	d.f.	9.74 *** (1,52)	5.79 ** (1,25)	0.82 (1,45)	3.38 * (1,157)	11.95 *** (1,261)
$\beta_{\text{shipping}} + \beta_{\text{revealed} \times \text{shipping}} = \beta_{\text{opening}} + \beta_{\text{revealed} \times \text{opening}}$	d.f.		0.08 (1,25)	1.19 (1,45)	2.15 (1,261)	8.45 *** (1,499)
$\beta_{\text{revealed} + \text{ave opening}} + \beta_{\text{revealed} \times \text{opening}} + \text{ave shipping} + \beta_{\text{revealed} \times \text{shipping}} = 0$	d.f.		0.09 (1,25)		4.48 ** (1,261)	50.58 *** (1,499)
# of observations		74	36	60	175	286

**Note:** \*, \*\* and \*\*\* represent statistical significance at the 10, 5 and 1 percent levels, respectively. The values in parentheses are robust standard errors. "Experimental" data was gathered through controlled field experiments using online auction platforms. "Field" data was gather passively from uncontrolled online auctions. See the text for detailed descriptions of the auctioned objects. For experimental data, "Revealed"=1 when shipping charge was listed in item title. For field data, "Revealed"=1 when auction occurred after November 10, 2004. Datasets in columns 1 and 4 had no "Revealed" observation.

**Table 7: Results for Random Effects Regressions on Total Auction Revenue**

**Dependent variable:** total revenue (i.e. final price + shipping charge)

Objects for Auction	CDs & Games	iPods	Video Games	Video Games	Gold Coins	Silver Coins
Data type	Experimental	Experimental	Experimental	Field	Field	Field
<b>Coefficient Estimates (<math>\beta</math>)</b>						
Shipping	0.728 *** (0.172)	1.600 *** (0.496)	0.332 (0.289)	0.601 ** (0.282)	3.321 *** (0.722)	1.052 *** (0.181)
Opening	0.257 (0.169)	-0.300 (0.496)	-0.342 (0.289)	-0.124 *** (0.046)	0.143 (0.097)	0.070 *** (0.017)
Revealed x Shipping		-0.889 (0.701)			0.557 (7.330)	-0.452 * (0.257)
Revealed x Opening		0.778 (0.701)			0.893 (1.507)	-0.004 (0.024)
Revealed		-400.000 (543.726)			-0.068 (0.117)	4.761 *** (1.410)
<b>F-tests</b>						
$\beta_{\text{revealed}} = \beta_{\text{revealed} \times \text{shipping}} = \beta_{\text{revealed} \times \text{opening}} = 0$	d.f.		11.08 ** 3		4.06 3	45.84 *** 3
$\beta_{\text{shipping}} = \beta_{\text{opening}}$	d.f.	9.75 *** 1	4.9 ** 1	1.81 1	6.01 ** 1	11.48 *** 1
$\beta_{\text{shipping}} + \beta_{\text{revealed} \times \text{shipping}} = \beta_{\text{opening}} + \beta_{\text{revealed} \times \text{opening}}$	d.f.		0.07 1		11.91 *** 1	8.66 *** 1
$\beta_{\text{revealed} + \text{ave opening}} + \beta_{\text{revealed} \times \text{opening}} + \text{ave shipping} + \beta_{\text{revealed} \times \text{shipping}} = 0$	d.f.		0.09 1		2.89 * 1	38.33 *** 1
# of observations		74	36	60	175	286

**Note:** \*, \*\* and \*\*\* represent statistical significance at the 10, 5 and 1 percent levels, respectively. The values in parentheses are robust standard errors. "Experimental" data was gathered through controlled field experiments using online auction platforms. "Field" data was gathered passively from uncontrolled online auctions. See the text for detailed descriptions of the auctioned objects. For experimental data, "Revealed"=1 when shipping charge was listed in item title. For field data, "Revealed"=1 when auction occurred after November 10, 2004. Datasets in columns 1 and 4 had no "Revealed" observation and we do not include "Revealed" in analyzing the dataset in column three as the model seems to be misspecified if we include that variable.



Figure 1: Treatment A of iPod Nano 2G white



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### 全新未拆封IPOD NANO 2G(白色)!!! 運費台幣30元!!!

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#### 賣方資料

賣方(評價) : [terp898 \(27\)](#)

正面評價百分比 : 93.55 %

#### 付款方式

- 接受銀行或郵局轉帳

#### 交貨方式

- (郵寄)買方付運費
- 先付款再交貨

#### 商品新舊

- 全新

[賣方的所有拍賣商品](#) (0)

[賣方「關於我」](#) / [評價與意見](#)

[拍賣問與答](#) (0)

#### 拍賣檔案

目前出價 : 5,400 元

剩餘時間 : 已經結束([倒數計時器](#))

得標者 : [cheery080808 \(2\)](#)

商品數量 : 1

出價次數 : 38 ([出價紀錄](#))

起標價格 : 750 元

出價增額 : 100 元

所在地區 : 台北市

開始時間 : 2006-03-13 18:51

結束時間 : 2006-03-20 18:51

拍賣編號 : e12331412

#### 備註事項 :

- 拍賣時間不會自動延長。
- 賣方不願意將貨品運送到其他國家。

[拍賣商品資訊](#)

[出價紀錄](#)

[問與答](#) (0)

**Figure 1: Treatment A of iPod Nano 2G white**

<b>容量</b>	2GB
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這是一部全新未拆封的IPOD NANO 2G(白色). 除郵寄外, 賣方不接受其他的運送方式.  
運費為台幣30元, 運費不可議價.

買家請在拍賣完成10天內付款. 賣方只接受銀行轉帳現金.  
您的 iPod 包含 90 天的電話技術支援和一年的有限保固。

Figure 2: Treatment D of iPod Nano 2G white


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## 全新未拆封IPOD NANO 2G(白色)!!!

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### 商品新舊

- 全新

[賣方的所有拍賣商品 \(0\)](#)
[賣方「關於我」](#) / [評價與意見](#)
[拍賣問與答 \(2\)](#)

### 拍賣檔案

目前出價 : 5,200 元

 剩餘時間 : 已經結束([倒數計時器](#))

 得標者 : [c711123.tw \(57\)](#)

商品數量 : 1

 出價次數 : 33 ([出價紀錄](#))

起標價格 : 750 元

出價增額 : 100 元

所在地區 : 台北市

開始時間 : 2006-03-20 21:22

結束時間 : 2006-03-27 21:22

拍賣編號 : d18146669

### 備註事項 :

- 拍賣時間不會自動延長。
- 賣方 **不願意** 將貨品運送到其他國家。

[拍賣商品資訊](#)
[出價紀錄](#)
[問與答 \(2\)](#)

**Figure 2: Treatment D of iPod Nano 2G white**

<b>容量</b>	2GB
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