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THE PRICE DECLINE ANOMALY IN CHRISTMAS SEASON INTERNET AUCTIONS OF PS3s

Thomas Andrews, Cynthia Benzing, and Matthew Fehnel

ABSTRACT

This paper examines 3,797 eBay auctions of Playstation 3s (PS3) during Christmas season 2006 to determine how the time remaining until Christmas and the supply of goods influence a bidder's willingness to pay for a good. The number of days between the auction end date and Christmas influenced the bid, with higher final bids occurring earlier in the Christmas season. This evidence of a "holiday price decline anomaly" means that sellers who sold earlier in the holiday season were more likely to obtain higher bids than those who sold later. The final bid was also influenced by the eBay supply, such that the greater the number of auctions ending around the same time, the lower the final bid.

INTRODUCTION

During the last decade, growth in e-commerce holiday sales has been unparalleled in the retail industry. According to the U.S. Department of Commerce (2010), e-commerce retail sales in the fourth quarter of 2006 were 24% higher than they were in the same quarter one year before. Online spending between Thanksgiving and Christmas grew 21% between 2006 and 2007 (comScore, Inc., 2007). Unique names like "Cyber Monday" and "Green Monday" have been given to the Monday after Thanksgiving and the Monday two weeks later because e-commerce retail activity on these days is generally stronger than other days during the Christmas season. Auction sites like eBay exhibit similar seasonal patterns of online sales; consequently, they report their strongest sales during the fourth quarter of each year. Because auction markets generate quality sales data on pricing, these data can provide information about how buyer, seller, market, and product characteristics affect a consumer's willingness-to-pay and final bid during the Christmas season.

Data from almost 4,000 eBay auctions were examined to determine how supply and time to Christmas affected a bidder's willingness-to-pay for PlayStation 3s (PS3) during the 2006 Christmas season. This study is one of only a few (Chan, Kadiyali & Park, 2007; McDonald & Slawson, 2002; Melnik & Alm, 2005) that explicitly includes a supply variable, and one of only two (Halcoussis & Mathews, 2007) that examines the "price decline anomaly" over a multi-day period culminating in an event. While many economists have observed the "price decline anomaly" in sequential auctions over

the same day, this study examines how time to an event, like Christmas, might affect a bidder's willingness-to-pay for a good. Only three articles have examined the behavior of retail prices during the Thanksgiving–Christmas holiday period. These studies (Levy, Chen, Müller, Dutta, & Bergen, 2010; Müller, Bergen, Dutta, & Levy, 2006; and Müller, Bergen, Dutta, & Levy, 2007) of food and basic items sold in supermarkets found greater price rigidity during the holiday season. This study explores how the willingness-to-pay for a popular new game system, likely to be a gift, varies during the holiday season when purchased through online auctions.

LITERATURE REVIEW

During the last ten years, many researchers have studied how prices are determined in Internet auctions, but few have analyzed how supply and time until an event affect the bid price. This study uses the example of PS3 gaming systems to determine whether the willingness-to-pay during the holiday season is related to its supply availability on the Internet auction site and the number of days until Christmas.

Economic theory suggests that the level of competitiveness influences prices. The greater the supply offered and the lower the demand, the lower the bids or price. In McDonald and Slawson's (2002) study of collector Barbie doll auctions on eBay, final price decreased as the number of auctions ending on the same day increased. Melnik and Alm (2005) also found a decrease in the final price of coins sold at eBay auctions as the number of auctions ending on the same day increased. According to a study of

2,322 auctions of notebook computers in the Korean Internet market (Chan, Kadiyali & Park, 2007), the willingness-to-pay declined as the number of similar products listed concurrently increased. During the 2006 holiday season, the availability of PS3s fluctuated due to manufacturing issues. Although the supply was severely limited at initial offering, the supply did not decline monotonically toward Christmas. For that reason, the eBay supply is examined independent of the number of days until Christmas. This study expects the eBay supply to have a significant effect on the willingness-to-pay with fewer offered PS3s resulting in a greater willingness-to-pay.

Studies of in-person auctions have observed a “price decline anomaly” for sequential auctions that occur during the same day. Ashenfelter (1989) and McAfee and Vincent (1993) observed that prices in sequential auctions of wine decline as the auctions proceed, such that bidders are willing to pay more early in the day and less later in the day for identical cases of wine. This effect has been observed in English auctions of livestock (Buccola, 1982), real estate (Ashenfelter & Genesove, 1992), art (Beggs & Graddy, 1997) and porcelain objects recovered from shipwrecks (Ginsburgh & van Ours, 2007). Three researchers, van den Berg, van Ours, and Pradhan (2001), observed the same effect in Dutch auctions of flower bulbs. In some cases the effect has been attributed to the decline in the quality of lots as the day or auction proceeds (Beggs & Graddy, 1997). For auctions involving homogeneous goods, the effect has been attributed to auction rules that allow the winner of the first lot the option of buying future similar lots at the same price. This rule creates a valuable option related to the first sale. In contrast to the aforementioned auction studies, Raviv (2006) found that prices in an in-person used car auction actually increased early in the auction and then stabilized. Raviv concluded that, in car auctions, bidders may need to “warm up” and tend to bid lower at the beginning of the day. In addition, bidders take time to adjust to asymmetric information in the early rounds of a used car auction.

The declining price phenomenon has been explained a number of ways. The decline in prices in auctions of homogeneous goods may be related to the opportunity cost of waiting for the next auction. Buyers may be willing to pay a premium equal to the value of the personal time saved by securing the product earlier. Further, buyers may be willing to pay a premium in an earlier auction to avoid future uncertainty. Risk averse buyers may be willing to pay more to eliminate the probability that supply may be even less in the future or demand and prices may be even higher. This study hypothesizes that the same

day price decline anomaly will not be a determining factor of final bid prices in eBay auctions of PS3s. Because an Internet auction can begin and end at any time of day, the same day effect would not be observable because the earliest time period of the day is not necessarily when bidding would begin, and the end of the day is not necessarily when an Internet auction ends. In other words, the rolling effect of the auctions would reduce any same day effect on price.

Only one study of Internet auctions has examined the price decline anomaly with respect to simultaneous and sequential Internet auctions over a number of days until the occurrence of an event. Halcoussis and Mathews (2007) studied the price of concert tickets for a rock band and found that a variable representing the length of time between the close of an auction and the concert was directly related to the price paid. According to Halcoussis and Mathews, the price declined \$0.93 per day per ticket as the auction’s end date approached the date of the concert. Because the product was not usable until the concert, this is similar to the purchase of a Christmas gift that is not usable until Christmas. On the other hand, in contrast to a concert ticket, a PlayStation 3 would be usable for an extended period (perhaps years) after the date of purchase. Also, PlayStation 3s may be purchased for purposes other than Christmas and, in that case, may not be subject to a price decline anomaly leading up to December 25.

Relatively few studies have examined price behavior during the Thanksgiving–Christmas holiday period. In one study of foods and basic items sold in supermarkets during the Thanksgiving–Christmas holiday period, Müller et al. (2006) found greater price rigidity for private label products relative to nationally branded products. Examining similar supermarket products during the Christmas season, Müller et al. (2007) found that fewer new products are introduced or discontinued during this period. Lastly, Levi et al. (2010) concluded that retail prices of supermarket items are more rigid during the holiday period because of the opportunity cost related to changing prices. During the busier holiday season, stores must use more resources to stock shelves, answer customer questions, and ring up sales. There are fewer resources available to re-price products.

HYPOTHESES

This is the first study to examine the willingness-to-pay for a popular entertainment system during the Christmas season. The newly released model of PlayStation was more likely to become a Christmas gift than the food and basic items tracked in previous studies. In contrast to supermarket studies by Müller et al. (2007) and Levi et al. (2010), the prices in an

auction are very flexible since they can be adjusted with relatively no cost to the buyer, seller, or auction site. This study hypothesizes that the greater flexibility in prices (and, consequently, final bid) could result in an observable pattern during a holiday season that extends in this case from the introduction of the PS3 (November 17) to seven days before Christmas. Since the time period culminates with a significant event, it is hypothesized that the “price decline anomaly” will be observable over the entire time period, such that higher final bid prices will be observable at the beginning of the holiday season. This “holiday price decline anomaly” would tend to exist for the same reasons as the same day price decline anomaly. Gift buyers are more willing to pay a premium to secure a popular item early in the holiday season to avoid the risk of paying a higher price later or perhaps not even obtaining the item because it has sold out.

The two hypotheses tested in this study are as follows:

Hypothesis #1: The final bid will be inversely related to the eBay supply of PS3s, such that fewer offered PS3s will result in a greater final bid.

Hypothesis #2: The final bid will be directly related to the number of days until Christmas, such that the greater the number of days until Christmas the greater the final bid. This result would support the “holiday price decline anomaly.”

THE DATA

The data used in this study were drawn from eBay auctions of PS3s with at least one bidder that ended between November 17, 2006 and December 18, 2006 (seven days prior to Christmas day). At the time of this study, eBay supplied historical auction data, but these data were less comprehensive than those available today. For instance, neither the buy-it-now (BIN) price nor the final price was included in the historical information for closed auctions. The variables obtained for each closed auction were the following: the final bid, the characteristics of the product, shipping costs, the number of other competing auctions, the total number of bids, and the time the auction ended.

On November 17, 2006 the much anticipated PS3 was released in North America. The release of the PS3 had been delayed numerous times in 2006, so Sony decided to release the game system in November despite its inability to meet expected demand. According to pricing theory, a shortage or

constrained supply in the face of strong demand should lead to increases in the price of a product. The PS3 is an example of a product considered in short supply when it was released in November 2006. Thousands of consumers were quick to buy the product at the manufacturer’s suggested retail price only to resell it at a premium on an Internet auction site. These “scalpers” could choose to sell the PS3s immediately after release of the product or sell them closer to Christmas. If there exists some pattern to holiday retail prices, the timing decision could significantly influence the price or high bid received.

All PS3 auctions with at least one bid were considered whether the auction resulted in a sale or not. Auctions do not always result in a sale if, for example, the seller has specified a minimum acceptable bid (the reserve price) and this reserve has not been met. Auctions that offered multiple units of the PS3 or other unrelated products were removed from the sample. Four bids that were more than three standard deviations outside the mean were removed from the sample. These bids might be the result of shill bidding which occurs when a seller bids on his or her own item to either elicit higher bids from potential buyers or to cancel a sale at less than the seller’s reserve price. Auctions occurring within seven days of Christmas were deleted because these items were less likely to be received before the Christmas holiday and were, therefore, less likely to have been purchased as holiday gifts. The number of remaining auctions with at least one bid was 3,797. The variables are defined in Table 1. The descriptive statistics for each variable are shown in Table 2.

The reputation of the seller was not included in the dataset because reputation ratings were not included in eBay’s historical data summary page used in this study. Although reputation could have been obtained from the seller’s account information, the reputation at the time it was obtained could have been different from the reputation rating at the time of the auction. In addition, most studies (Melnik & Alm, 2002; Melnik & Alm, 2005; Houser & Wooders, 2006; and Lucking-Reiley, Bryan, & Reeves, 2000), have shown that the reputation effect is a relatively small component of the final price with stronger reputational effects for non-homogeneous items.

The number of bidders was not available on eBay’s historical dataset, only the number of bids. As a result, the number of bids was used as a proxy for demand and is an imperfect measure of the number of customers seeking the product. Similar to Snir (2006) this study includes the number of bids on the premise that the number of bids is a reflection of bidding intensity and demand.

Table 1
Dependent and Independent Variables

Dependent Variable	Description
<i>BID</i>	Final bid (\$) if the PlayStation was not sold and price (which may or may not be the final bid) for PS3s that were sold.
Independent Variables	
<i>SUPPLY1</i>	The number of other PS3s being auctioned in the hour around that particular auction.
<i>SUPPLY24</i>	The number of PS3s being auctioned in the 24 hours around that particular auction.
<i>DAYS</i>	Number of days until Christmas as of the end of the auction.
<i>GB</i>	Dummy = 1 if unit is 60 gigabytes; 0 if unit is 20 gigabytes.
<i>BUNDLE</i>	Dummy = 1 if the unit includes a player bundle.
<i>GAME</i>	Dummy = 1 if the unit includes at least 2 games with the PS3.
<i>CONT</i>	Dummy = 1 if the unit includes an extra controller.
<i>MOVIE</i>	Dummy = 1 if the unit includes at least one movie.
<i>SHIP</i>	Cost (\$) of shipping the PS3. The SHIP variable = 0 if costs are paid by the seller.
<i>NUMBIDS</i>	Number of bids
<i>TIME1</i>	Dummy = 1 if the auction ends between 12 AM and 6 AM.
<i>TIME2</i>	Dummy = 1 if the auction ends between 6 AM and 12 PM.
<i>TIME3</i>	Dummy = 1 if the auction ends between 12 PM and 6 PM.
<i>WKEND</i>	Dummy = 1 if the auction ends on a weekend; 0 if the auction ends on a weekday.

Table 2
Descriptive Statistics of Variables
(N = 3,797)

Variable	Descriptive Statistics
<i>SUPPLY1</i>	Mean = 23; S.D. = 19
<i>SUPPLY24</i>	Mean = 253; S.D. = 155
<i>BID</i>	Mean = \$800; S.D. = \$254

<i>GB</i>	60GB = 53%; 20GB = 47%
<i>BUNDLE</i>	Bundle = 4%; no bundle = 96%
<i>GAME</i>	Game = 6%; no game = 94%
<i>CONT</i>	Extra controller = 5%; no extra controller = 95%
<i>MOVIE</i>	Movie = 3%; no movie = 97%
<i>SHIP</i>	Mean = \$32; S.D. = \$32 (Shipping paid by seller in 27% of auctions)
<i>NUMBIDS</i>	Mean = 13; S.D. = 11
<i>TIME1</i>	Time1 = 6%; other times = 94%
<i>TIME2</i>	Time2 = 25%; other times = 75%
<i>TIME3</i>	Time3 = 37%; other times = 63%
<i>WKEND</i>	Weekend = 13%; weekday = 87%

THE MODEL

In this study, regression analysis was used to explain variation in the final bid prices of PS3s based on the (eBay) supply of PS3s, the number of days until Christmas, as well as several other control variables. As described in the literature review section of this paper, this study hypothesizes that supply will be inversely related to the final bid and a price decline anomaly will be observable over the holiday season instead of over a day. The dependent variable represents the willingness-to-pay (*BID*). *BID* is the highest observed bid for items that received at least one bid. For items that did not sell, *BID* is the most any participating bidder was willing to pay. For items that did sell, the observed sale price (*BID*) might not reflect the highest willingness to pay because the winning bidder need only outbid the second highest bidder. Any amount that the winning bidder was willing to pay above what was required to win the auction is unobserved.

In addition to the independent variables of interest (the number of other competing auctions and the number of days until Christmas), there are other independent variables that must be included to avoid an omitted variable bias. Five of these variables are related to the characteristics of the PS3 and include the gigabytes, and whether the game system has a bundle, a game, a controller, and/or a movie. Further, prior research has identified several additional variables that affect final prices and/or bids in eBay auctions. These additional independent variables are

related to shipping costs; the number of bids; and when the auction ends. The product variables related to gigabytes and add-ons are expected to be positively related to the final bid. Based on the results of prior research, the number of bids variable is also expected to be positively related to the final bid, while the shipping costs variable is expected to be negative. Because the results of prior research on the effect of time on final bid/price have not been consistent, we do not hypothesize signs for the variables related to time the auction ends. More detailed discussion of the independent variables and their expected signs will follow.

The regression model is shown below. The expected sign of the coefficient appears in parentheses above the independent variable.

$$\begin{aligned}
 BID_i = & \beta_0 + \beta_1 \overset{(-)}{SUPPLY}_i + \beta_2 \overset{(+)}{DAYS}_i + \beta_3 \overset{(+)}{GB}_i \\
 & + \beta_4 \overset{(+)}{BUNDLE}_i + \beta_5 \overset{(+)}{GAME}_i + \beta_6 \overset{(+)}{CONT}_i \\
 & + \beta_7 \overset{(+)}{MOVIE}_i + \beta_8 \overset{(-)}{SHIP}_i + \beta_9 \overset{(+)}{NUMBIDS}_i \\
 & + \beta_{10} \overset{(+)}{TIME1}_i + \beta_{11} \overset{(-)}{TIME2}_i + \beta_{12} \overset{(+)}{TIME3}_i \\
 & + \beta_{13} \overset{(-)}{WKEND}_i
 \end{aligned} \tag{1}$$

Two supply variables were tested to determine the effect that the eBay supply of PS3s might have on final bid price. One supply variable (*SUPPLY1*) measures the total number of PS3 auctions ending in the hour before and after a particular auction. The other supply variable (*SUPPLY24*) is a broader measure that measures the total number of PS3 auctions ending within 24 hours of a particular auction. Studies by Melnik and Alm (2005) and McDonald and Slawson (2002) also measured supply as the number of auctions ending on the same day. The supply variables used in this model are limited in that the eBay supply of PS3s is only a small part of the total supply available. The market supply of PS3s would include those available in brick-and-mortar retailers like Toys-R-Us and GameStop, as well as other online retailers. Unfortunately, information about the total market supply of PS3s on a given day was not available. One might still hypothesize that the eBay supply of PS3s might be relevant if eBay bidders have customer allegiance to the site and limit their online purchases to eBay (as opposed to other auction or retail sites).

As discussed in the literature review section, the price decline anomaly is more likely to be observed over the course of the Christmas shopping season in that buyers might be more willing to pay higher prices earlier in the season to reduce the risk of not

being able to secure the product later in the season. As a result, we expect the number of days to Christmas (*DAYS*) to be directly related to the willingness-to-pay, such that the final bid is higher for PS3s auctioned earlier in the Christmas season.

A challenge with this analysis is that the product is not homogeneous. Consequently, the characteristics of each PS3 are expected to influence the final bid. The PS3 came in two basic models in 2006: 20GB and 60GB (which was called the Premium model). One would expect the 60GB model to command a higher price and, therefore, a higher bid. Since the dummy variable for the model is 1 for 60GB and 0 for 20GB, the sign of the coefficient for *GB* is expected to be positive. PlayStation auctions can also include “bundles.” Some bundles are created by the seller and include additional games, videos, and controllers. Other bundles were included by the manufacturer and could include specified additional games and possibly another controller. PlayStations with bundles should command higher bids. This study does not distinguish between manufacturer or seller bundles. Independent of whether the PS3 comes with a bundle, some PS3s come with additional games, an additional controller, and/or additional movies. In other words, a PS3 may have a bundle and controller in addition to the bundle; or a PS3 may not have a bundle, but may only have an additional controller. If a PS3 has a bundle, additional games, an additional controller, and/or at least one movie, one would expect the bid to be higher. As a result, the coefficients for *BUNDLE*, *GAME*, *CONT*, and *MOVIE* are all expected to be positive.

When shipping costs are borne by the buyer, the buyer is likely to adjust the bid downward to reflect the additional costs (McDonald & Slawson, 2002; Melnik & Alm, 2005). Online sellers have the option of paying shipping costs themselves or requiring buyers to pay the shipping costs. Studies have shown that higher nominal shipping costs reduce the highest bid (McDonald & Slawson, 2002). Melnik and Alm (2005) found that a \$1 increase in shipping costs will decrease the willingness-to-pay by \$0.55. Consequently, the coefficient for *SHIP* is expected to be negative.

The bid price is expected to be positively related to the demand for PS3s. As a result, the coefficient for the variable related to the number of bids (*NUMBIDS*) should be positive.

The effect of time of day on final price or final bid has been ambiguous and may be affected by the type of buyer and type of product. Andrews and Benzing (2007) found higher prices in eBay auctions of used cars that ended in the evening (between 5:00 PM and midnight). McDonald and Slawson (2002)

found significantly lower high bids for auctions of collectible Barbie dolls ending between midnight and 4 AM. Melnik and Alm (2005) found that time of day was not significant in online auctions of certified coins, but higher bids were received for non-certified coins sold between midnight and 6 AM. Snir (2006) found that used laptops auctioned later in the day on eBay received a lower price than similar ones offered earlier in the day. To make comparison with Melnik and Alm (2005) easier, this study broke the day into six hour increments such that TIME1 includes all auctions that ended between 12 AM and 6 AM Pacific time. The price decline anomaly observed in in-person auctions would not be related to time of day for PS3 Internet auctions because the auctions in this study are often rolling, multi-day auctions. There is no reason to believe that time of day will have any effect on the final bid.

Previous research on whether the final bid is higher for auctions ending on a weekend versus those ending during the week has yielded conflicting results. Standifird (2001) and Dewan and Hsu (2004) found that Internet auctions ending on the weekend had lower final bids and/or prices than auctions ending during the week. Melnik and Alm's (2005) study of noncertified coin auctions on the Internet found higher prices for auctions ending on the weekend. There is no reason to expect a weekend or weekday effect for PS3s during the holiday season.

RESULTS

Two regressions were performed to determine which variables most significantly influenced the final bid on PS3s during the 2006 Christmas season. White's test statistic for heteroscedasticity was computed for the preliminary regression. The statistic was significant indicating that there was heteroscedasticity of an unknown cause. To correct for the understatement of the error, the regression was recomputed using White's (1980) heteroscedasticity-consistent standard errors and covariance methodology. Table 3 presents the OLS regression results. The correlation matrix of all independent variables is shown in Table 4.

The results for the first regression indicate that the characteristics of the PS3 as well as the shipping costs, eBay supply, and number of days until Christmas have a significant effect on the final bid price. As hypothesized (hypotheses #1 and #2), the final bid was inversely related to supply and directly related to the number of days until Christmas. The number of bids, time of day, and weekend variables had no significant effect on the high bid. The *NUMBIDS* variable represented the number of bids in an auction and is only partially representative of the

market demand for PS3s at a given time. Had data been available on the number of bidders instead of the number of bids, the results might have shown a significant demand effect.

The second regression is a variation of the first regression using *SUPPLY24* instead of *SUPPLY1*. *SUPPLY1* includes all PS3 auctions ending within one hour of an auction; *SUPPLY24* refers to all PS3 auctions ending within 24 hours of an auction. As shown in the first regression, the number of PS3 auctions ending in the hour before or after an auction (*SUPPLY1*) was inversely related to the willingness-to-pay. For every additional auction, the final bid was reduced \$1.38. If the supply variable was broadened to include all auctions that ended within 24 hours of an auction (*SUPPLY24*), the final bid was reduced by \$0.16 per auction. Although this may seem like a small nominal amount, the average number of auctions ending within 24 hours of an auction was an average of 253. This result supports hypothesis #1 that supply has an inverse relationship to the willingness-to-pay.

According to the results, buyers were willing to spend approximately \$156–\$159 more for the 60 gigabyte version of the PS3. Bundles, extra games and an extra controller also added value. In contrast, an extra movie did not show a statistically significant relationship to the final bid.

Shipping costs could be shifted to the buyer without a one-to-one reduction in the highest bid. For every dollar in shipping costs absorbed by the buyer, the seller only lost between \$0.30 and \$0.34. This means that it is in the seller's interest to shift shipping costs to the buyer. This result is similar to that observed by McDonald and Slawson (2002) and Melnik and Alm (2005).

Auctions that ended farther before Christmas got higher final bids than auctions ending nearer to Christmas. The coefficient for *DAYS* supports hypothesis #2, the "holiday price decline anomaly" for simultaneous, multi-day online auctions. As hypothesized, the willingness-to-pay was lower in later auctions of identical items. The positive coefficients in both regressions indicate that the final bid decreased by approximately \$12 per day as the number of days before Christmas decreased. The results are most directly comparable to Halcoussis and Mathews (2007) who reported a decline in the price paid for concert tickets as the auction's end date approached the concert date. In this study the price decline anomaly is consistent with buyer risk aversion. Buyers may be willing to pay a price premium earlier in the holiday shopping season to avoid the risk of not obtaining the item in time for Christmas or of paying a higher price later in the season. The "holiday price decline anomaly"

observed in this study may be stronger than that for most products because the PS3 game systems were in short supply during Christmas season 2006 and, thus, buyers faced greater uncertainty than they might face for other holiday gift items.

From a seller's perspective, the "holiday price decline anomaly" indicates that sellers of a product in short supply might experience higher bids earlier in the holiday season rather than later. It should be noted that, although the number of similar auctions on eBay was considered in the *SUPPLY* variable, we did not control for the total supply available through retail establishments and other auctions. In addition, the number of bidders was not measurable. Consequently, the observed price decline anomaly could be the result of an unobservable increase in total supply or a decrease in demand for PS3s as the holiday approached.

CONCLUSION

This study shows that the willingness-to-pay in eBay auctions of PlayStation 3s during the 2006 Christmas season was significantly related to the eBay supply of PS3s and the number of days until Christmas. As hypothesized, the greater the number of PS3 auctions on eBay ending in the hour or 24 hours around an auction, the lower the high bid. The existence of a "holiday price decline anomaly" was also observed in that the high bid was lower for auctions that ended closer to Christmas.

According to the results of this study, sellers can obtain higher bids on limited-supply items auctioned earlier in the holiday season. The reason behind this behavior may be related to risk aversion. Gift buyers may be willing to pay a premium for a gift item that is in short supply to avoid the risk of paying more later. Also, those bidders who are purchasing Hanukkah gifts are in the market earlier in the holiday season and, thus, might contribute to a holiday price decline anomaly by increasing market demand earlier in the traditional Christmas season.

Of course, one must recognize that some of the bidders are not purchasing the PS3 as a holiday gift, but are purchasing it for themselves for immediate use. Some "gamers" might be willing to pay more just to be the first to own the new version of a game system. In that case, there might be an observable price decline anomaly for any new and popular entertainment or technologically sophisticated item—especially one with limited availability. Based on the extent of such non-holiday gift purchases, the results of this study may overstate the holiday price decline anomaly effect. More study needs to be done to better understand how prices behave during the holiday season compared to non-holiday periods.

Economists could enhance their understanding of how markets work by examining how price is determined in online auctions. Areas of research that need further study include: 1) comparing the behavior of prices in online auctions to in-person auctions; 2) analyzing the behavior of prices during holiday and non-holiday seasons; and 3) studying the behavior of prices for different types of products. Compared to just a few years ago, much more information is available through market research databases supplied by eBay and other auction sites. Although these databases were designed to help sellers better understand their markets, they are ready-made for economists studying market behavior. During the next few years, we anticipate many other studies about online auction behavior. Hopefully, some will shed further light on the effect of auction supply on the willingness-to-pay as well as whether a "holiday price decline anomaly" exists for other products sold on Internet auction sites during the Christmas shopping season.

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Table 3
Regression Results Using White Heteroscedasticity-Consistent Standard Errors and Covariance
Dependent Variable: *BID*

Independent Variable	(1)	(2)
<i>Intercept</i>	448.40*** (13.30)	462.25*** (13.46)
<i>SUPPLY1</i>	-1.38*** (0.24)	
<i>SUPPLY24</i>		-0.16*** (0.03)
<i>DAYS</i>	12.41*** (0.48)	12.20*** (0.47)
<i>GB</i>	159.03*** (7.26)	155.88*** (7.36)
<i>BUNDLE</i>	152.48*** (21.89)	152.27*** (22.16)
<i>GAME</i>	125.01*** (17.18)	122.75*** (17.37)
<i>CONT</i>	40.77** (17.00)	39.34** (17.21)
<i>MOVIE</i>	27.04 (29.05)	25.64 (29.08)
<i>SHIP</i>	-0.34*** (0.11)	-0.30*** (0.11)
<i>NUMBIDS</i>	0.06 (0.36)	0.01 (0.36)
<i>TIME1</i>	9.01 (18.22)	7.18 (18.27)
<i>TIME2</i>	-5.86 (9.28)	-6.16 (9.30)
<i>TIME3</i>	-10.88 (8.59)	-8.35 (8.60)
<i>WKEND</i>	-7.01 (9.03)	-8.00 (9.07)
Adjusted R^2	0.2924	0.2941
SE of Regression	213.8003	213.9087
F-statistic	121.6531	121.2348
Prob (F-stat)	0.0000	0.0000

Note: The standard error appears in parentheses below each coefficient.
*** indicates significance at the 1% level.
** indicates significance at the 5% level.
* indicates significance at the 10% level.

Table 4: Correlation Coefficients of Independent Variables

	<u>SUPPLY24</u>	<u>DAYS</u>	<u>GB</u>	<u>BUNDLE</u>	<u>GAME</u>	<u>CONT</u>	<u>MOVIE</u>	<u>SHIP</u>	<u>NUMBIDS</u>	<u>TIME1</u>	<u>TIME2</u>	<u>TIME3</u>	<u>WKEND</u>
<u>SUPPLY1</u>	0.624 (0.000)												
<u>SUPPLY24</u>		0.347 (0.000)											
<u>DAYS</u>			-0.128 (0.000)										
<u>GB</u>				0.011 (0.499)									
<u>BUNDLE</u>					0.058 (0.000)	0.090 (0.000)							
<u>GAME</u>							0.259 (0.000)						
<u>CONT</u>								0.085 (0.000)	0.021 (0.196)				
<u>MOVIE</u>										0.002 (0.838)			
<u>SHIP</u>											-0.063 (0.000)		
<u>NUMBIDS</u>												0.015 (0.344)	
<u>TIME1</u>													-0.142 (0.000)
<u>TIME2</u>													
<u>TIME3</u>													

#The p-value is shown in parentheses underneath the Pearson correlation coefficient. A p-value equal to or less than 0.01 indicates significance at the 1% level; 0.05 indicates significance at the 5% level; 0.10 indicates significance at the 10% level.

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Matthew Fehnel was an undergraduate student majoring in economics at West Chester University who participated in this research project as part of his senior seminar in economics. He obtained the data from eBay and did the initial analysis of the data. Matthew currently works for SEI Corporation.