Dividing Online and Offline: A Case Study *

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Abstract

Every new method of trade offers an opportunity for economic agents to compare its costs and benefits relative to the status quo. Such comparison motivates sorting across market segments and reshapes the whole marketplace. The Internet provides an excellent example: it introduces substantial search cost savings over brick and mortar retail stores but imposes new obstacles for sellers to convey quality. Using sportscard trading as a case study, we provide empirical evidence on (1) the sorting of product quality between the online and offline segments, (2) the changes for retail outlets after the Internet came into place, and (3) how supporting industries such as professional grading and card manufacturing adapted to take advantage of the new market.

JEL: D40, D50, D82, D83, L10, L15.

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1 Introduction

Economists have identified search costs and adverse selection as two important factors reducing market efficiency. After the seminal works of Stigler (1961) and Akerlof (1970), a large literature examines how consumers with imperfect information on price and/or quality may become better informed via search or experience.[1] Another literature stresses that intermediaries such as dealers (Biglaiser 1993, Shin 1996) and professional certifiers (Lizzeri 1999, Mason and Sterbenz 1994) may play an important role in providing information about price, quality and trading partners, reducing both search costs and the degree of adverse selection.

These insights are useful in comparing online and offline commerce. On the one hand, the Internet is a valuable tool for buyers and sellers to find each other with. Buyers can shop thousands of offerings around the world by querying large databases at centralized marketplace sites such as eBay or Yahoo. Sellers can register at these marketplaces with an E-mail address and a credit card, selling to millions of potential buyers that they might never reach via a brick and mortar retail store.

On the other hand, there is a clear tradeoff of search cost savings for information when comparing offline and online trading. In traditional retail markets, buyers are able to examine the merchandise before a purchase and take possession immediately upon payment. In online markets, buyers cannot check the quality or authenticity of goods before committing to buy, and they must pay in advance of receiving anything.[2] In this way, Internet commerce at marketplace sites may aggravate the conventional lemons problem and introduce the risk of dealing with lemon sellers who do not deliver goods faithfully in a timely manner.

This paper examines how buyers and sellers of sportscards have adapted to deal with the trade-off between search cost savings and information, and how these changes have affected traditional retail markets. Essentially limited-edition photos of professional athletes mounted on a thin sheet of cardboard, sportscards were among the earliest and remain one of the most popular forms of collectibles. While it is difficult to quantify the exact market size of sportscards,

[1] One strand of the consumer search literature focuses on price search only. They examine consumers' optimal search strategy, firms' pricing decision in face of consumer search, and the equilibrium with consumer search. Examples include Salop and Stiglitz (1977), Diamond (1978), Wilde and Schwartz (1979), Benabou & Gertner (1993), Dana (1994), and Stahl (1989). A second strand allows consumers to search for both price and quality (Chan and Leland 1982), some of which also include experience as another channel to learn about product quality (Nelson 1974, Wilde 1980).

[2] This is the eBay norm and eBay is the largest online marketplace that links individual sellers with individual buyers.

their popularity is indicated by the 725,000 paid circulation of Beckett monthly sportscard magazines[3] and annual sales of collectible sports products from the Topps Company in excess of $100 million.[4]

The value of a sportscard depends greatly on its rarity and physical condition. As detailed in Section 2, the difficulty involved in locating rare collectibles makes the Internet particularly valuable to sportscard traders. As a result, the most popular form of sportscards – baseball cards – was one of the earliest high volume categories of eBay listings, and collectibles is consistently among its top ten largest categories in terms of gross merchandise sales.[5] At the same time, physical condition is a critical determinant of sportscard quality. While most buyers can investigate card condition via magnifying glasses in a retail store, the lack of verifiable information on card condition in online markets is troublesome for both buyers and sellers. We believe sportscard markets provide an excellent example that highlights both the benefits and challenges of moving transactions to an emerging market segment.

More interestingly, professional third party certification services have existed for sportscards since 1991. These for-profit grading companies employ experts to grade individual copies of sportscards for a fee. To the extent that these services supply credible information about card quality, the information asymmetry between online buyers and sellers is much less severe for graded than for ungraded cards. This allows us to examine how intermediaries supplying quality information may affect the sorting of agents between market segments. Finally, sending ungraded samples from retail and online markets to a professional grader makes it possible to obtain a direct measure of the lemons problem, if it is present.

We set up a theoretical model combining the general features of online and traditional retail markets with those specific to sportscards. The model yields several testable predictions on how the sportscard market divides itself between online and offline settings. First, because buyers can observe neither the quality of cards for sale nor seller conduct before purchase in online auctions but can examine both at leisure in traditional retail stores, the average quality of ungraded sportscards received in the retail segment should be higher; this is the traditional

[3]Beckett is the premier publisher of monthly sports collectibles magazines. The 725,000 circulation is a 2005 per issue figure for all Beckett titles combined. Source: http://www.beckett.com/mediarelations/aboutbeckett.html.

[4]The Topps Company, Inc. is one of the oldest and largest printers of sportscards. The reported sales figure is for fiscal year 2005; see Topps' 2006 annual report Note 18 for more details (SEC Form 10-K Commission file number 0-15817).

[5]According to eBay's 10Q quarterly report form November 2002, the ten largest categories for the nine months ending September 30, 2002 were: eBay Motors, Computers, Consumer Electronics, Books/Movies/Music, Sports, Collectibles, Clothing and Accessories, Toys, Jewelry and Gemstones, and Photos.

lemons problem. Second, the number of cards sent for third party certification should increase as sellers employ those services to overcome the information problems in online markets. While the highest quality cards may be graded even in the absence of online markets, increased liquidity online makes it profitable for sellers to grade progressively lower quality cards. In equilibrium, our model splits the overall market into a low quality segment trading cards online without certification, a middling quality segment trading cards in retail stores without certification, and a high quality segment trading cards online with certification.

To test these predictions, we gathered empirical evidence from observation of eBay auctions, field experiment data, and official grade distribution reports from third party certifiers. More specifically, after watching eBay listings of baseball cards for seven months, we purchased samples of ungraded cards from both online and traditional retail markets and sent them for grading. The professional grader's report shows that the retail sample was at least 0.255 grades better, on average, than the online sample (with standard error 0.11). Given the fact that the majority of collectible ungraded cards are concentrated between grades 7 and 8.5, this difference is non-trivial in real terms. This confirms the lemons problem at the low end of the quality spectrum: while the lowest acceptable quality cards are left ungraded and sold online, slightly better quality copies are left ungraded but sold in retail stores.

Comparing the quality distribution of ungraded and graded cards, we also find evidence supporting the predicted segmentation at the high end. Most copies in both experiment samples received grades between 7 (considered the lowest acceptable quality level by collectors) and 8.5, confirming the belief that virtually no top quality copies should remain ungraded. By comparison, more than 20% of the graded population carries a grade of 9 or better, and nearly half of the graded cards offered on eBay during our eBay watch period were graded 9 or higher. After standardizing different grading systems into the one that we used in the field experiment, these data suggest that graded cards are of significantly better quality than ungraded cards.

In addition, we observe dramatic changes in the graded population. Population reports show demand for grading services soared when online markets first appeared, with a downward shift of grade averages across the board. Our eBay watch and a nationwide telephone survey of retail store owners reveal that about 67% of the observed online listings were for graded copies, but extremely few retailers dealt in significant amounts of graded cards. All of this evidence is consistent with the model's prediction that more copies of lower quality will be graded and that nearly all graded copies would be sold online.

Finally, the model generates ambiguous predictions regarding changes in the size of the

retail market after the Internet appears. As a first attempt at seeing what actually happened, we examine data from the telephone survey of sportscard retail stores and the frequency of card shows on event calendars before and after major Internet events. These data suggest retail shrinkage after the arrival of widespread Internet trading. We also highlight changes in sportscard design as a potential consequence from the introduction of online trading.

This paper is related to a number of literatures. Many studies about online and offline commerce focus on the demand side, identifying which types of buyers are more likely to shop online and how much less those buyers pay than their offline counterparts.[6] To complement this, we focus on the balance between search cost savings and the online information problems, paying more attention to quality differences, the sorting of sellers, and the impact of segmentation on supporting industries. A second literature examines the Internet as a platform that caters to both sellers and buyers. These theoretical studies focus on how online intermediaries (such as eBay) choose pricing and other strategies to attract both sellers and buyers and exploit the network externality between the two sides of the market (Caillaud and Jullien 2001, 2003). In comparison, we take the traditional retail and the Internet markets as given alternatives, and focus on individual traders' decision of trading online or offline.

Since our online analysis focuses on Internet auctions, this paper also overlaps with the ongoing literature of Internet auctions. Many studies in this area focus on the differences between Internet and regular auctions, documenting and explaining Internet-specific phenomena such as last minute sniping (Roth and Ockenfels 2002) and shill bidding (Engelberg and Williams 2005). Other researchers concentrate on the overall functional similarity of online and offline settings as markets to exchange goods and services. They use Internet auctions as a laboratory to test traditional insights from topics like auction design (Lucking-Reiley 1999) and seller reputation.[7] Our study seeks a middle ground to connect these two views: we emphasize that although the economic factors underlying Internet auctions, namely search costs and adverse selection, are similar to what economists observe in traditional markets, the different composition of these economic factors is what drives the segmentation between online and offline commerce.

The emphasis in this paper is on the coexistence of the online and offline segments of the market, and on how economic agents decide to allocate their activities between the two. In a

[6]See Goolsbee 2000, Clay et al. 2001, Goolsbee 2001, Brown and Goolsbee 2002, and Scott Morton et al. 2001, 2003. Recent studies extend to sellers' pricing strategy and price competition among online/offline sellers. See Zettlemeyer 2000, Ellison and Ellison 2001, Ellison and Ellison 2003, Chevalier and Goolsbee 2003, and Scott Morton et al. 2004.

[7]Resnick and Zeckhauser (2002) and Bajari and Hortacsu (2004) provide excellent surveys for studies of online seller reputation.

forthcoming paper (Jin and Kato *forthcoming*), we used the same experiment to study economic behavior within eBay auctions. Specifically, we examined the empirical correlation between price and quality, with an emphasis on how buyers and sellers use reputations and seller claims to decipher the online market. We believe the two papers combined deliver a more complete picture regarding the commercial opportunities available to sportscard traders and related industries.

The evidence reported in this study goes beyond the trading of sportscards, and the conclusions drawn from this study can be applied to many situations where there is more than one method for acquiring a particular thing. For example, we might consider multiple markets for used cars involving auctions, direct sales, inspections of vehicles, and certifications of mechanics and inspectors. In this sense, this paper is also related to a larger literature of asymmetric information that has long existed before the onset of the Internet. Unlike most studies that infer the lemons problem from price data (Greenwald and Glasspiegel 1983, Genesove 1993, Pritchett and Chamberlain 1993, Wimmer & Chezum 2003), we conduct a field experiment to gauge the real quality difference, in an attempt to provide more direct and robust evidence.

The rest of the paper is organized as follows. Section 2 describes sportscard markets, followed by a theoretical model in Section 3 based on the institutions of those markets. Section 4 presents evidence for quality segmentation across online and retail markets, as well as changes in the population of graded cards. Section 5 provides further evidence relating online trading to the size of the retail market and card printing. Section 6 concludes.

2 Market Overview

Each year, card companies design and print photos depicting players and events from the previous sports season onto thin sheets of cardboard. Those sheets are then cut into small cards, about the same dimensions of a credit card, for sale in sealed packs of 10 to 15 random cards. Not every photo appears the same number of times on each printing sheet, so some cards in each set will be rarer than the others.[8] The value of a card depends on its scarcity, the player depicted, and the condition of that particular copy. By card condition, we mean the physical condition of the edges, corners, surface and centering of the printing. To track card condition, people often use a 10-point scale. For example, flawless characteristics (even under microscopic inspection) will rate a perfect 10 while obvious defects to the naked eye like minor wear on the

[8]The exact number of copies printed for a specific card is regarded as an industry secret, except for the insert cards discussed later in Section 5.

corners of the card might bring a corners grade down to 7. The card's overall grade is computed off all four characteristics.

Sportscards have transformed from hobby collectibles into valuable commodities over the last twenty years, and these limited edition cards are now traded for considerable sums of money. Though baseball cards with prints of popular athletes were originally used in the 1880s as a promotional giveaway by tobacco companies, the typical buyer of sportscards today is keenly aware of how valuable these collectibles are. The most popular publications in the industry are price guides published by Beckett (e.g. Beckett Baseball Cards Monthly), which are updated monthly with price changes and listings for new products. Prices for sportscards are extremely convex, increasing sharply above Near Mint 7 grades. For this reason, collectors are only interested in cards whose quality is at least worthy of a 7, and are very eager to find cards of level 10 quality. According to prices listed in the Beckett guides, grade 7, 8.5, 9, and 10 cards are about 0.5, 1.5, 2.5 and 20 times the value of an average card of approximately quality level 8. Lengthy inspections by both buyers and sellers with magnifying glasses and rulers prior to purchase of rare or expensive cards are commonplace.

Amid concerns over authenticity, Professional Sports Authenticator (PSA) began offering grading services in 1991 and its parent company Collectors Universe became a publicly traded NASDAQ company in November 1999. In terms of magnitude, its prospectus reported that PSA had graded 375,231 copies of sportscards in the calendar year of 1998. The Beckett Grading Service (BGS) and Sportscard Guaranty Corporation (SGC) entered the professional grading market in 1999. As of 2002, these firms remain the largest and most respected of the existing 10-15 grading services.[9]

For a fee, customers can submit cards for examination by an experienced professional evaluator, who then issues them official grades. Graded cards are encased in hard acrylic plastic and sealed with a sonic procedure that makes it virtually impossible to open and reseal the case without evidence of tampering. The casing indicates the grading service, grade received, and a bar code with serial number that identifies the particular copy of the card. Anyone with Internet access can go to the grader's web site and verify a particular card's grade by serial number. Because professional grading is voluntary and costs 6 to 20 dollars per card [10], this practice divides the market into two groups: graded cards and ungraded cards. For graded cards, buyers and sellers alike are willing to accept PSA or BGS grades as the "true" grade of

[9]This observation does not change if we include relative newcomer Global Authentication (GAI), which was founded in February 2002 by the original founder and President of PSA.

[10]Depending on package size and turnaround time, but independent of the actual grades received.

a card's condition.

Traditionally, retail stores or local card shows served as the main hubs of trading activity. The difficulty an individual collector faced when attempting to find a buyer in the past included not only locating and contacting other collectors dispersed throughout the population, but also finding the particular person who wanted the specific cards he was selling. The presence of a sportscard store in the community provided a central location where sellers could find a ready buyer (the store owner) and buyers could browse a relatively large stock of cards (the owner's inventory).[11] An alternate venue for card trading prior to the Internet was the card show. Local card shows were often held at shopping malls and convention centers, bringing anywhere from five to more than two hundred dealers to one location. Dealers at these shows paid a fee to occupy a table on the convention floor for selling, and buyers were often charged an admission fee. The mass of dealers at shows reduced the leverage store owners held over collectors, who often had to sell to local stores at deep discounts and buy at full book value because they had few good alternatives. However, because of the irregularity of the card show schedule, these shows supplemented shops as part of the retail marketplace but did not replace them. Both shows and retail stores continue to play these roles in the sportscard market as of 2006.

Incorporated in 1996, eBay provided the first standardized, user-friendly auction site where individual sellers and buyers could meet and transact conveniently. Ever since eBay went public on September 24, 1998, eBay has been and remains the most popular online place to trade single baseball cards today. The accessibility of eBay makes it convenient for both buyers and sellers of cards. Unlike retail stores or card shows, it is always open for business, reachable from anywhere with Internet access, and it provides the opportunity to trade with more fellow collectors than could be assembled at any card show.

These benefits are unfortunately accompanied by a severe reduction in the kinds of information that can be credibly communicated. After registering with eBay, the seller can describe the card condition in a brief title and web page including text and pictures.[12] If it is an ungraded card, it is impossible to verify the text description or prove any card depicted in a photo is the actual copy for sale. Even if it shows the card for sale, poor scan quality reduces the informational value of the picture. While centering on the front may still be observable, a blurry scan

[11] In a variation of this middleman role, many retail stores also run "buy boards." Regular customers can register with the shop and post cards with asking prices on a bulletin board for shop visitors to browse. The store holds the card in escrow, and takes a percentage of the sale price if a buyer appears. Store owners in general are otherwise extremely strict about preventing customers from selling to each other, and ban violators.

[12] Auction settings are standard, as described in Lucking-Reiley (2000), Melnik and Alm (2002), and Resnick and Zeckhauser (2002).

makes it impossible to judge the condition of the card's corners, edges and surfaces. Grading is one solution to this problem, since the description can include the name of the grader and the serial number which identifies the exact copy for sale.

3 Theory

3.1 Model

Consider a large number (M) of risk-neutral collectors who all desire (at most) one copy of a card.[13] Collector j has taste $\theta_j > 0$ and draws utility $u_j = \theta_j q$ from owning a card of quality q. He does not observe the other people's taste but knows that over the whole population θ conforms to a continuous density $f_\theta(\theta)$ that is positive for any $0 < \theta < \bar{\theta}$.

The game starts with nature choosing a large number of collectors (N, $N < M$) randomly and endowing each a random copy of the card. If collector j receives an endowment, he observes the quality of the endowed card but not the quality of the other cards. It is common knowledge that card quality is independent across copies and conforms to a continuous density $f_q(q)$ that is positive for any $0 < q < 1$.

Each collector maximizes his utility from owning a copy of the card. If a collector of taste θ has no endowment, he can choose between not buying anything (in which case $u = 0$) or paying price p for a copy of observed or expected quality q that maximizes $u = \theta q - p$. If he is endowed with a copy, on the selling side he can choose between holding the endowment, discarding it, or selling it in any of the market segments described below. On the buying side, he is free to buy or not buy. His selling and buying decisions maximize the overall utility which equals the utility from owning the copy he ends up with, plus the price he receives from selling (net of necessary search and grading costs), and minus the price he pays if he buys.

Before trade begins, each endowed collector decides whether or not to send his card for grading. If he does, he pays a constant grading cost c_g and the grader seals his copy in a tamper-proof plastic case marked with a grade equal to the true quality. If the card has been graded, he can sell the card as graded or crack open the case and sell it as ungraded. If he does not send the card for grading, he can only sell it as ungraded.

[13] In other words, a collector with multiple copies of the same card only places positive value on the best card in his collection.

Regardless of whether the card is graded or ungraded, sale may occur in either retail or online markets. There is no search cost in online markets, but selling in retail markets involves a search cost $c_r(q)$, which increases with the card's true quality because it is harder to find buyers willing to pay full value for a high quality card. In reality, instead of searching for a buyer by himself, a card seller may sell the card to an intermediary such as a retail store or a dealer at a card show. We were told that these middlemen often buy cards at a fraction (e.g. 30%) of the market price and sell them marked back up to full price. Since card dealing is competitive with free entry, we believe the price difference in buying and selling is a good proxy for the intermediary's operation cost. For this reason, we assume $c_r(q) = \alpha p(q)$ where α is a constant between 0 and 1.

Grading and market type define four segments – retail ungraded, online ungraded, retail graded and online graded. If a card is sold as graded, both the seller and the buyer observe the true quality. If a card is sold as ungraded in the retail market, we assume both the seller and the buyer observe the true quality because the buyer can examine the card carefully before purchase. The perfect observability of card condition is a simplifying assumption and not critical to the model. If a card is sold online as ungraded, the seller observes the quality but buyers observe nothing. Among the four segments, online ungraded is the only one that features asymmetric information between buyers and sellers. For simplicity, we assume away fraud (counterfeits and non-delivery) in the model but consider it explicitly later in the data section.

The equilibrium satisfies several conditions: on the demand side, if collector j buys, he buys a copy that maximizes his expected utility. On the supply side, if collector j sells, he sells in the segment that gives him the highest return net of the total costs associated with that segment. In equilibrium, demand equals supply in all segments. If two cards are offered in different segments but appear identical to buyers, their prices must be equal. In any segment where buyers cannot observe quality, they form a rational expectation so that the expected quality is equal to the average quality offered in that segment.

3.2 Equilibrium Properties

In a world without the Internet, buyers and sellers must trade in the traditional retail market, which involves positive search cost but no information asymmetry. Since both buyers and sellers observe the actual card quality before trade and the search cost is the same for graded and ungraded copies, no seller would bother to grade. This implies that all traded cards must

be ungraded before the Internet appears. [14] Furthermore, the equilibrium has the following property:

Proposition 1: In equilibrium, a retail market exists for every level of card quality, but not every copy of the card is traded.

Proof: Suppose quality q is never traded. Given the assumptions that every collector places positive value on the first copy of the card and the number of collectors (M) exceeds the number of cards (N), we can always find a positive price p at which at least one collector is willing to buy a card of quality q. For any $p > 0$, we can find a seller whose taste is sufficiently close to zero (i.e. $\theta < (1-\alpha)p/q$) such that it is more profitable to sell his endowment of quality q and employ his optimal buying strategy than to hold the copy and shy away from the market. Positive demand and supply implies that trade must occur in equilibrium. Over the whole quality range $0 < q < 1$, Appendix proves that the equilibrium price schedule $p(q)$ must be continuous, increasing, and convex. Now for the second part of the proposition, suppose for a collector with taste θ, the optimal card available on the market is of quality q_{best}. There exists a sufficiently small ϵ (i.e. $0 < \epsilon < \alpha p(q_{best})/\theta$) such that if the collector is endowed with quality $q = q_{best} - \epsilon$, it is optimal to hold it and does not participate in the market.[15] Since we assume N is large and both f_θ and f_q are independent and positive everywhere, such a collector always exists, which implies that at least one copy of the card will not be traded in the market.

After the arrival of the Internet, the logic of Proposition 1 still holds, but in a modified form. Every type of card quality can be found somewhere in the market, but now a card may be traded in one of three segments: online ungraded, offline ungraded, and online graded. The lack of an offline graded market is obvious: if a card were sold offline as graded, the same trading parties could instead trade it in the online graded market and split the positive retail search cost.

[14] This prediction is an over-simplification of reality. In fact, professional grading existed long before the Internet arrived, but this inconsistency can be easily resolved if we assume buyers in the retail market do not observe the actual quality but obtain an unbiased signal. Assuming perfect information on the sellers' side, this introduces information asymmetry between buyers and sellers and creates an incentive to use professional grading to resolve the asymmetry. Empirically, the asymmetric assumption is more realistic as sellers in the retail market often have more time to examine the copy. Sellers also know more about the authenticity of the card, which we assume away in the model.

[15] Specifically, holding the endowment yields utility $u(hold) = \theta(q_{best} - \epsilon)$. Selling the endowment and buying the optimal card yield utility $u(sell\&buy) = \theta q_{best} - p(q_{best}) + (1-\alpha)p(q_{best} - \epsilon)$. For any $0 < \epsilon < \alpha p(q_{best})/\theta$, we have $u(hold) = \theta(q_{best} - \epsilon) > \theta(q_{best} - \alpha p(q_{best})/\theta) = \theta q_{best} - \alpha p(q_{best}) > \theta q_{best} - p(q_{best}) + (1-\alpha)p(q_{best} - \epsilon) = U(sell\&buy)$.

How many and which of the three segments exist in equilibrium depend on the relative costs of doing business in each segment. For example, when α approaches 1, the retail search cost is so large that almost every seller is willing to sell in the online ungraded market at a price p_{eu} that is low enough to attract sufficient demand. Here the online ungraded market does not completely break down (due to the lemons problem), because some sellers with tastes close enough to zero would rather sell their endowments in the online ungraded segment even if the endowed quality is better than the average quality available in that segment (q_{eu}). Conversely, one can come up with examples where the search cost savings are not big enough to support an online ungraded market, or the grading cost is prohibitively high so the online graded market does not exist.

Whenever more than one segment exists, we have the following property:

Proposition 2: Cards sold in the online graded segment must have quality no worse than those sold in the retail ungraded segment, and card quality sold in these two segments must be no worse than those sold online as ungraded.

Proof: Assume trade appears in all three segments. Let $p_e(q)$ and $p_r(q)$ represent the price schedules in the online graded and retail ungraded segments. If q_h denotes the lowest quality sold in the online graded segment, optimal selling implies $p_e(q_h) - c_g \geq p_r(q_h) - c_r(q_h)$ and $p_e(q_h) - c_g \geq p_{eu}$. By arbitrage, $p_r(q_h) = p_e(q_h)$, and therefore $c_g \leq c_r(q)$. Since $c_r(q)$ and $p(q)$ increase in q, for any $q > q_h$ we have $c_g \leq c_r(q_h) < c_r(q)$ and $p_e(q) - c_g > p_e(q_h) - c_g \geq p_{eu}$, which implies that, if a seller is willing to sell $q > q_h$, it is optimal to sell it in the online graded segment. Let q_l denotes the highest quality sold in the online ungraded segment. Optimal selling implies $p_{eu} \geq p_r(q_l) - c_r(q_l)$ and $p_{eu} \geq p_e(q_l) - c_g$. For any $q < q_l$, we have $p_{eu} \geq p_e(q_l) - c_g > p_e(q) - c_g$ and $p_{eu} \geq p_r(q_l) - c_r(q_l) = (1-\alpha)p_r(q_l) > (1-\alpha)p_r(q) = p_r(q) - c_r(q)$. These inequalities suggest that if $q < q_l$ is traded, it is optimal to trade online as ungraded. The definitions of q_h and q_l suggest $p_e(q_h) - c_g \geq p_{eu} \geq p_e(q_l) - c_g$ and therefore $q_h \geq q_l$. If $q_h = q_l$, the above logic suggests that all $q > q_h$ on the market will be sold online graded, all $q < q_l$ if sold will be sold online ungraded and therefore any card sold in the retail ungraded segment must be of $q = q_h = q_l$. If $q_h > q_l$, any card traded with quality $q_l < q < q_h$ must appear in the retail ungraded segment because otherwise it contradicts the definitions of q_l and q_h. The same logic applies if only two of the three segments exist in equilibrium.

Besides market segmentation, one may find it tempting to compare the total combined market sizes before and after the arrival of the Internet. Unfortunately, it is difficult to obtain data on trading volumes. This is complicated not only by the fact that the total number of copies

in circulation is unknown, but also because there is no centralized recorder of transactions like a stock exchange. For the same reasons it is difficult to pin down precise average transaction prices in any of the sportscard markets. Although Beckett and other companies issue price guides, they report the upper and lower bounds of the price range for transactions reported to them rather than a single spot price. A before and after comparison of price data could also capture changes for reasons other than the Internet; for example, a career-ending injury to a promising young player may cause his cards' values to plummet. Instead of relying on transaction counts or price reports, we consider non-traditional sources of information to analyze the market growth/shrinkage question later in the paper.

In light of these difficulties, our empirical tests focus on quality segmentation. Unlike price data, third party certifiers offer direct and objective measures of card quality. This motivates us to sample ungraded cards from both online and retail markets and send them for professional grading. Over time, third party certifiers also report the quality distribution of the whole graded population, allowing us to track changes that coincide with the appearance of the Internet. In doing so, we can test a side prediction on the volume of professional grading. In the model, the demand for professional grading may increase after the arrival of the Internet for two reasons: first, the minimum quality that is worth grading declines (from infinity to q_h) because grading (and trading the graded copy online) provides a cheaper way to solve the information problem. Second, the Internet has a market expanding effect that may spread to the online graded segment.

Note that our model generates a strong prediction regarding market segmentation. Namely, *none* of the cards sold in the ungraded online sector can be higher quality than any of the cards sold in the ungraded retail sector, and *none* of the cards sold in the ungraded retail sector can have higher quality than any graded card. It is easy to give counter examples: if one seller misreads the card quality, he may end up in the wrong segment and violate the segmentation prediction.[16] Similarly, if a seller lives in a remote area with no access to retail stores or card shows, he may sell a relatively high quality ungraded card online. Since we have no reason to rule out these outliers in the real data, it would be difficult to test the market segmentation in its strongest form. Instead, our empirical test compares the *average* card quality across segments.

[16]In reality some card owners crack open graded cards and sometimes resubmit them in hopes of a higher grade. No "crack-open" cases appear in the model because we assume card owners observe their endowment quality perfectly and that certification companies issue grades consistent with the true quality of submitted cards.

4 Evidence on Market Segmentation

4.1 Quality segmentation in the ungraded sectors

To detect the quality segmentation of ungraded cards, we conducted a field experiment by purchasing the same types of ungraded cards from the online and offline markets and professionally graded them. The experimental procedures are designed to mimic buyer behavior as closely as possible.

Experimental Design The first regular issue of sportscards for young star players, known as "rookie cards," are often among the most sought after sportscards by collectors. After consulting more than 20 local dealers, we focused on five popular rookie cards that are relatively frequently traded – 1989 Upper Deck Ken Griffey #1, 1982 Topps Cal Ripken #21, 1985 Topps Mark McGwire #401, 1993 SP Derek Jeter #279 (foil), and 1994 SP Alex Rodriguez #15 (foil).

Retail store interviews suggested that an overwhelming majority of sportscard collectors are adults who only pay attention to cards of near-mint 7 or better quality. For this reason, both our retail and online purchases targeted cards that appeared to have such "collectible quality" given the information available at the time of purchase.[17] We considered all cards from accessible retail stores or local card shows in 11 metropolitan areas, and purchased those that were not disqualified by the above "collectible quality" rule. [18] In total, we obtained 126 cards from the retail markets.

After watching the eBay market for seven months prior to the experiment, we found that higher seller claims of ungraded card quality in an auction listing had significant positive effects on the number of bids and closing prices received. Details on this market watch are reported in a companion paper (Jin & Kato (forthcoming)). The systematic difference in auction outcomes

[17]For retail purchases, we examined the PSA and BGS grading standards and disqualified any cards that had at least one defect consistent with a PSA or BGS grade below 7. For online purchases, we ruled out all online auctions that mentioned specific defects that would have disqualified them from our retail purchases.

[18]These areas were picked to represent both cities with and without Major League Baseball franchises. They are Baltimore-Washington D.C, Philadelphia, Chicago, San Jose, Denver, Dallas, Los Angeles, San Diego, Tucson, and Detroit. Purchases in the mid-Atlantic areas were made by ourselves. In the other eight markets, purchases are made by male agents, age 25-35, who held at least a master's degree from a U.S. graduate school and were not active collectors at the time. To ensure agent knowledge about baseball card markets, we sent each a 21-page buyer instruction guide plus sample cards from the same sets as our targeted five cards. We also made follow-up phone calls to ensure the buying instructions were well understood and followed. Agents shipped all purchases to us using methods recommended by Beckett.

suggested there may have been a difference in the actual quality of ungraded cards being sold by sellers who made high claims and sellers who made modest or no claims. To account for this possibility, the cards we purchased online were separated into two groups so that the sellers of one group claimed systematically higher quality than the sellers in the second group.

This process does not leave out any specific part of the distribution because the typical supply of ungraded card consisted of three groups: one group of sellers indicated specific defects about the cards they were selling; a second group claimed their cards were of moderate quality or made no claims; the third group claimed their cards were of extremely high quality (Mint 9 or Gem Mint 10 depending on card type). We focus on the latter two groups as the first group is disqualified. Sampling the online market in this manner permits greater detail in our comparison of qualities available in online and traditional retail markets. As shown later, the oversampling of high claim cards does not hamper our ability to obtain a *conservative* measure of the total quality difference between the online and retail markets of ungraded cards.

Every week from December 8, 2001 to March 18, 2002, we searched for active auctions on Saturday and ranked the auctions by the professional grades corresponding to information given in the auction descriptions. After arranging all qualifying auctions in order from highest claimed quality to minimum acceptable claimed quality, we targeted the auctions for the best-ranked and median-ranked copies of each card for that week. Those targeted auctions were then tracked during the week and checked five minutes prior to their ending times to verify at least one other buyer bid in each auction. This precaution was designed to ensure that any card we targeted would have actually been traded online to someone else even without our bid. At that point, we attempted to win the auction by deliberately bid 10-15 dollars above the leading bid. Jin and Kato (forthcoming) contain more detailed descriptions of the procedures used.

In total, we paid for 107 cards online and received 96 of them before April 2, 2002, the date when we sent our purchases to BGS for professional grading. Of the remaining 11 cards, 7 were received after April 2, 2002 and the other 4 were never received. These 7 late cards were graded in a second round. Because including or excluding these 7 late cards does not affect our conclusion in any significant way, all results reported in this paper are conditional on the cards graded in the first package.

Results Although the model assumes all purchases are authentic deliveries, counterfeits may occur in both online and retail markets, and default may arise online. To provide a straight test, Table 1 first considers only authentic deliveries (Panel A) and then expands to the full sample including fraudulent transactions (Panel B). In both panels, we report the sample means

of professionally graded card quality, card value based on those grades, and price paid per card. Panel B also reports the incidence of defaults and counterfeits. These statistics are ordered by (1) retail sample, (2) online sample, (3) difference between the retail and online samples, (4) the online subsample of best rank, (5) the online subsample of median rank, and (6) the difference between the two online subsamples.

Conditional on authentic and delivered cards, the true quality from the best rank and median rank groups are extremely similar. The quality difference between the two online subsamples is as small as 0.07 and is not significantly different from zero by a parametric F test and a non-parametric Wilcoxon rank sum test.[19] This allows us to combine the two into a single online sample and compare it to the authentic deliveries in the retail sample. The comparison generates several statistics: the average quality in retail markets is 0.255 grades higher than the online counterparts. This result is significant in both the F-test (p=0.02) and the Wilcoxon rank sum test (p=0.01). We also regress quality on the "online" dummy variable after controlling for the five card types. The coefficient for the "online" dummy is -0.25, with standard error 0.11 and p-value 0.029. These results strongly confirm the prediction that the average quality of authentic ungraded cards sold in the retail sector is systematically better than for those sold online.

To evaluate the lemons problem, we map quality into value by using Beckett "low" book prices. We find the 0.255 grade quality difference accounts for a $2.05 difference in average value. The quality difference is statistically significant at the 98% level. However, due to large price dispersion, the difference in average value is not statistically significant.

Our model does not incorporate the possibility of fraud, so we do not have any formal predictions to test.[20] However, intuition suggests higher fraud risk online. Default, defined as non-delivery of goods after payment is made by the purchaser, is impossible in retail markets since the transfer is always made immediately in person. In long distance online auctions, though, participants rely on postal delivery of goods days or even weeks after payment is made. While counterfeit ungraded cards may be difficult to detect even after careful examination, buyers may at least inspect the goods before purchase in retail markets. Retail buyers surely possess comparable or better ways to protect themselves than online auction buyers who have zero credible information prior to payment.

[19] In the F-test, F=0.16, p=0.69. In the Wilcoxon rank sum test, z=0.19, p=0.89.

[20] An analysis of the patterns of online auction fraud and effectiveness of reputation mechanisms in identifying fraudulent sellers in this ungraded sportscard market is treated in detail in Jin and Kato (forthcoming).

Though we cannot provide a precise estimate on whether there is more fraud online, our experimental data highlights one method of facilitating fraud exclusive to the online market: while the average quality of authentic deliveries is uncorrelated with seller claims, the fraud rate rises with higher claims of quality. The fraud rate in the online sample (11%) is much higher than that in the retail sample (3.17%), and is mostly driven by the best-rank cards: 9 of the 11 online frauds came from the best-rank group.[21] Our experiences buying cards in retail shops and interviews with store owners found that such claims of quality simply do not occur in retail settings; it is something that is only exploited online. [22] Thus we believe the estimate of 0.255 is likely to underestimate the quality differences available in online and retail markets because it does not capture the added risks of fraud unique to the online segment.

4.2 Segmentation of graded and ungraded sectors

4.2.1 Evidence on the quality difference

We expect most cards with quality 8 or below to remain ungraded, because it costs $6-10 to have a card graded, but Beckett price guides list ungraded and graded NearMint-Mint 8 cards at the same price. Two facts are consistent with this conjecture: our experiment exhibits an average quality between 7.3 and 7.4 for ungraded cards, and cards with quality Mint 9 or higher are almost completely absent (only one out of the 226 cards is Mint 9).

The model assumes that sellers have perfect information about card quality. In reality, sellers may make a mistake in judging quality and keep some cards of quality 8.5 or higher in the ungraded retail sector. This may explain why we still observe some 8.5s and one 9 in our experimental data. However, the lack of very high quality cards suggests that such mistakes are not large in magnitude. The actual quality difference between graded and ungraded sectors is

[21] Combined with the fact that best- and median-rank subsamples have very similar quality in authentic deliveries, we conclude that the two online subsamples only differ in fraud rate. As a result, our over-sampling of best-rank cards may overstate the fraud rate in the online sector, but should not generate any bias in the estimate of card quality conditional on authentic deliveries.

[22] To give a rough calculation, in our eBay watch data (reported in details in Jin & Kato (2005)), 40% of ungraded card auctions had seller claims they were for mint or better quality cards. In our online experimental sample (of 100 cards), 66% claimed mint or higher and 11% were fraudulent. Of the 11 defaults/counterfeits, 9 had claimed mint or higher. If we assume the fraud rates can be extrapolated to the online ungraded market after taking into account the actual distribution of seller claims, the weighted fraud rate is approximately $9/66 * 40\% + (11-9)/(100-66) * (1-40\%) = 8.98\%$. This is statistically higher than the 3.17% fraud rate observed in the retail sample.

further confirmed in our eBay watch data. Jin & Kato (forthcoming) report that 88% of the graded cards listed in our eBay watch data were graded 8 or above, of which 56% were mint 9 or higher.

To be precise, Figure 1 presents four (cumulative) grade distributions for: (1) the graded cards sold in our eBay market watch between April and November 2001, (2) the graded card populations according to official grader reports as of 03/17/2002, (3) the authentic ungraded cards in our retail experimental sample, and (4) the authentic ungraded cards in our online experimental sample. To facilitate comparison, these distributions cover all five types of sportscards as seen in the field experiment.

Since real collectors may use professional graders other than BGS, adjustments are necessary to make the grades issued by each grader comparable to the BGS grades in our experimental sample. Exactly how much BGS' scale is shifted from the PSA or SGC scales is unclear, so we take a conservative approach that is likely to underestimate the overall quality in the actual aggregate graded population.[23] The converted grades are then consolidated into a single population of adjusted grades from all graders.

After these adjustments, Figure 1 shows that the quality distributions of graded cards are to the right of the ungraded cards, as theory predicts. Moreover, the quality distribution of graded cards sold on eBay is better than the quality distribution shown in the official grade report. That is because cards with poor grades are often cracked open and sold as ungraded. To push the data further, Table 2 reports formal tests on whether the graded and ungraded cards display the same mean, median and distribution of quality. Since the composition of the five card types may differ across samples, we control for a full set of card type dummies before conducting each test. In all but one test, results suggest that graded cards have significantly better quality, and the comparison versus the online ungraded sample is stronger than the comparison versus the retail ungraded sample. This pattern is consistent with the quality segmentation predicted in theory.

[23]Specifically, the Beckett price guide reports low and high price for graded cards by card type, grader and grade. Since eBay price closely tracks the low book price, we use the low book prices to make linear projection about the corresponding BGS grade. For example, given a specific card in a specific month, if the PSA9 price falls between BGS9 and BGS8.5, we consider PSA9 equivalent to a BGS grade of $(9 - (9 - 8.5) * (P_{BGS9} - P_{PSA9})/(P_{BGS9} - P_{BGS8.5})$.

4.2.2 Evidence on the trading of graded cards

The model predicts that all graded cards ought to be traded online. Due to empirical outliers, we expect empirical data to show graded card trading to be high online and very low in retail markets, even if the migration is not complete. Consistent with this, 67% of the listed auctions in our eBay watch were for graded cards. This confirms that a large amount of online sportscard auctions are for graded cards. To complete the comparison with the retail market, we conducted a telephone survey of sportscard stores about their trade in graded cards.

To locate sports card stores, we used the Yahoo! Yellow pages listings for all 27 U.S. metropolitan areas with Major League Baseball franchises.[24] We believe the listings were a comprehensive cumulative database that contained a majority of all sports cards stores in business anytime after 1997.[25] For completeness, we also called listings from areas without MLB franchises such as Alabama, North Carolina, South Carolina, Southern Maryland (other than Baltimore) and Northern Virginia.

The survey first verified the identity and continued existence of a store, and then inquired about how long it was open, its dealings in graded cards, and its involvement in online trading. Of the 1387 listings, we ruled out 390 that turned out to be businesses other than sports card stores. The remaining entries consisted of 455 (46%) that were still in operation, 542 (52%) that did not answer and were presumably out of business, and 17 (2%) who dealt with sports cards only through the Internet or by mail order. Of the 455 sports card stores still in business, we asked each one if they had a graded 1990 Leaf Sammy Sosa rookie card in their store.[26] Just 25 stores even had one, and only 7 of those 25 shops had two or three. Regardless of whether they carried a graded Sosa card, we asked each shop if graded cards were sold there at all: 448 out of the 455 stores answered this question, and 64.73% said they dealt in very few or no graded cards. Only 8.26% responded that they had at least one display case of graded cards in their

[24] Yahoo! Yellow pages obtains business listings from BellSouth and InfoUSA. A public company since 1997, InfoUSA claims to have databases of 14 million businesses compiled from 5000 white/yellow pages and hundreds of other sources. InfoUSA is also the only company of this kind that verifies every entry in the database by telephone at the time of the first listing. Although it is free for any business entity to list itself in InfoUSA database, significant effort is required to be removed.

[25] Rysman (2004) finds a network effect in the Yellow Pages market, so it is in the interests of each local Yellow Pages publisher to produce as comprehensive a directory as possible. Bresnahan and Reiss (1991) also use yellow pages as the main data source to analyze market structure.

[26] The 1990 Leaf Sammy Sosa is a popular rookie card, with at least 20 listings traded on eBay every week. We asked about the Sosa instead of any of the five cards under study because we did not want to give store owners an impression of a demand increase for any of the five cards and thereby contaminate the experiment data indirectly.

stores. These statistics suggest that graded cards are for the most part unavailable in retail stores.

Due to the difficulty of collecting transaction level data from individual sellers at sports card shows, we are unable to make similar comparisons to the card show portion of the retail market. From our own experience, though, graded cards do appear at shows, but the separation between shows and online auctions is not as clean as we have seen with retail stores. After haggling over the price of a graded Gem Mint card with a show table dealer, one collector told the buying dealer that his card was also listed on eBay and ending that day. Several table dealers gave us business cards with eBay seller IDs. These anecdotes suggest that it is difficult to draw inferences from the number of graded cards that appear in sports card shows.

In contrast, our phone survey suggests that most retail stores shy away from online trading. 303 of the 455 stores chose not to participate in online trading at all. Combined with the facts that two thirds of the cards in our online auction market watch were graded and there existed more than 1.2 million graded cards by mid-1999, this means that most stores were not participating in the very market where thousands of graded cards are sold. One explanation is that most retail storeowners are very experienced in card dealing and may have a comparative advantage in identifying good ungraded cards on inspection. This ability is most rewarded in the retail ungraded sector.

4.2.3 Evidence on changes in the graded population

The theory implies two changes in the demand for professional grading. First, the graded card population may grow as sellers take advantage of grading to move from high search cost retail markets to low search cost online auctions. Second, given the nature of market segmentation, the Internet may cause a relative increase at the lower end of the quality distribution of graded cards.

To detect the first change, Table 3 tracks the growth of PSA's graded populations for sports cards from 1995 to 1999 as reported in PSA's parent company's prospectus. [27] PSA was the only professional grader in the market before 1999, so this history captures the growth of the entire grading market before and after the rise of online trading in 1998. Table 3 shows that the volume of grading activity in sports cards remained relatively low until after 1998 but

[27] PSA is a subsidiary of Collectors Universe, a public company traded under the symbol CLCT since October 1999.

experienced a nearly five-fold increase from 1998 to 1999. To clarify the timing coincidence of online trading and professional sports card grading growth, Table 3 also reports the flow of PSA card grading activities by quarter from 1997 to 1999. With as few as 8 observations, statistics suggest that the PSA card grading activity has accelerated after eBay became a public corporation in September 1998. The slight slowdown of PSA grading activities in the second quarter of 1999 might be explained by the entrance of BGS and SGC as competitors. The above phenomena are certainly unexplainable by the slight increase of PSA grading fees over time.

To detect the second change, we compare the distribution of grades in the cumulative PSA population in 1997 and 2002.[28] For both periods we recorded the grade distribution for all 194 cards with at least 100 graded copies in the January 1998 report.[29] In rare cases, PSA provides qualified grades, which are difficult to convert into unqualified grades.[30] For this reason, cards with qualified grades are excluded from the analysis of the distribution shift.

To take advantage of the fact that we tracked a matched sample of distributions for each of 194 cards over time, we perform a t-test of equal means, a Wilcoxon rank-sum test of equal distributions, and a Peterson Chi-Square test of equal medians for each card. As shown in Table 4, for 188 of the 194 card distributions, the test rejects the hypothesis of equal mean grades in 1997 and 2002. A Wilcoxon rank-sum test rejects the hypothesis of identical grade distributions for 189 of the 194 cards. Equal medians are rejected for 182 of the 194 cards as well. [31] These results overwhelmingly suggest that there was a significant shift of grade distributions toward lower quality over time. Figure 2 graphically shows the shift in distribution for the 1989 Upper Deck Ken Griffey, Jr. card, the most frequently graded card in the PSA population. There were 43,455 graded copies of 1989 Upper Deck Ken Griffey Jr. as of March 17, 2002, as opposed to just 1,861 in 1997.

Consultation with local store owners produced two alternative explanations for the downward shift of average grades in the PSA grading population. First, for-profit professional graders may be stricter for newly submitted copies of cards that already have a large graded population. Second, over time the professional graders may become stricter at the high end, regardless of

[28]Sources: Grading Population Report published by PSA in January 1998, and PSA's online population database as of March 17, 2002.

[29]The sole exception is the 1993 SP Derek Jeter, which only had 75 graded copies in 1997.

[30]Instead of lowering the grade of a card with one relatively significant flaw, PSA will sometimes assign the higher grade with a qualifier. For example, if a card meets all of the requirements for grade 9 except in centering, PSA may give that card a grade 9 plus an OC qualifier indicating the card is not as well centered as a grade 9 card usually is. These qualifiers account for roughly 7% of the current population. Including or excluding these qualifiers produce very similar results.

[31]All three of these tests were run as two tailed tests at the 95% confidence level.

the existing graded population. Both policies tend to hold down the number of cards with high grades.

We test the first alternative explanation by regressing the t-statistics we derived from the comparison of equal mean grade from 1997 to 2001 on population size as of 1997 for each of the 194 cards. While the population size does have a weak negative effect on the t-statistics, it only contributes 10% of the average t-statistic. The second alternative explanation is addressed by excluding the top quartile of the grade distribution for each of the 194 cards. We find the remaining three quartiles still exhibit a significant decline in the mean grade for 95% of the 194 cards. Further robustness checks are carried out to account for the fact that PSA was the only grader in 1997 but not the only grader in 2001.[32] These modifications do not change any of the conclusions.

5 Further Evidence

5.1 Retail Shrinkage

While the model has relatively strong predictions about how cards will sort themselves between market segments by quality, whether the retail ungraded segment shrinks or expands depends on two competing forces. On the one hand, the Internet attracts some buyers and sellers who would have already been willing to buy and sell in retail markets. This is a market stealing effect. On the other hand, the Internet provides a low search cost option to owners holding their endowment, which may induce participation by owners who previously would not trade. As a result, the market expands and becomes more liquid for all other owners trying to sell as well as for buyers who now have more buying options. Taking both into account, the retail market would shrink (expand) if the market stealing effect dominates (is dominated by) the market expanding effect.

Empirically, it is difficult to identify retail shrinkage (or expansion) because there is no systematic data regarding the size of the retail market before and after the Internet. Here we refer to three suggestive measures: store closings, the age profile of surviving stores, and changes in the number of sports card shows over time. We also consider changes in baseball's popularity as an alternative explanation.

[32] To this end, we supplement the PSA grading population with the BGS and SGC grading populations for each of the 194 cards in March 2002 and re-run the tests.

In our telephone survey, ruling out the Yahoo! store listings that are probably not sportscard stores, we find that 53.4% of the 997 stores went out of business between 1996 and 2001. This is much higher than the 31.7% termination rate for all small businesses from 1996 to 2000 as reported by the Small Business Administration.[33] While not as complete or precise as a census of small businesses, the yellow pages data suggest that the termination rate of sports card stores is unlikely to be fully explained by the typical entry and exit frequencies of small businesses.

An obvious alternate explanation for the decline of sports card stores is a decline in baseball's popularity. Local retail store owners unanimously agreed that about half of all retail stores that opened after the baseball strike in 1994 have already closed for business. According to the owners, sportscard demand is mostly driven by hard-core sports fans who regularly attend games, rather than casual fans. Official attendance statistics from Major League Baseball as depicted in Figure 3 suggest slow but steady growth in average attendance from 1995 to 2001. Moreover, store interviews suggest that public interest during the home run record chases of Mark McGwire, Sammy Sosa, and Barry Bonds from 1998-2001 may have contributed to strong baseball popularity in those years. Contrary to the decline of retail sportscard stores, this information leads us to believe that the relevant popularity of baseball was actually on the rise in the late 1990s.

The age distribution of the 414 surviving sports card stores in our survey surprised us even more than the high rate of closing. At the mode, 149 card stores have operated for 9-12 years. As expected from a typical surviving process, the number of stores older than 12 years declines by age.[34] In contrast, the age distribution for newer stores shows a reverse trend: compared to the mode, 81 stores are aged 5 to 8 years, and only 71 stores are open for less than 5 years. The dropoff of stores aged 5-8 years could be due to a lower number of new startups following the strike. However, if the popularity of baseball experienced steady recovery since 1995, we would expect there to be a higher number of surviving stores 0-4 years old than 5-8 years old.[35]

[33] According to *Small Business Economic Indicators 2000* at http://www.sba.gov/advo/stats/sbei00.pdf, there were 8,414,906 small business firms in the U.S. that existed at least some of the time between 1996 and 2000, of which 5,750,600 survived by the end of 2000. This implies a 31.7% termination rate.

[34] Specifically, 62 stores are 12-16 years old, 27 are aged between 17 to 20 years, 17 have existed for more than 20 years and another 7 have been open for a long time without giving us specific age.

[35] We employ two assumptions here: proportional growth and increased attrition over time. The assumption that the number of existing stores is growing proportionally to baseball popularity is likely to hold because sportscard retail has very low fixed costs and very low profit margin. For the second assumption, suppose the first year survival rate is p_1 and the second year survival rate is p_2. The probability of surviving both years, $p_1 \cdot p_2$, is clearly lower than the probability of surviving one year (p_1). Here we assume exit rates $p_1, p_2, p_3, ...$ are

Similar time patterns apply to card shows. Using the monthly show calendars reported in the back of the Beckett guides from 1987 to 2001, Figure 4 tracks the number of card shows held nationwide each month. The period of strongest performance in retail markets in the form of card shows was between 1990 and 1993, corresponding to the large number of retail stores of 9-12 years old in the age distribution. Similarly, the number of card shows per month experienced a sharp and sizable drop immediately following the player strike in July 1994 and continued to decline along with retail stores through 2001 despite a recovery in popularity signaled by fans returning to the stadiums. These observations are confirmed in a more rigorous regression where we control for seasonality, a dummy for player strike, a dummy for the start of eBay (after May 1996) and a dummy for the IPO of eBay (after Sept. 1998). The coefficients for the two eBay variables are both negative and significant at 95% confidence.[36]

Above all, in the post-strike period from 1994 to the time of our study in 2001-2002, we observe a high termination rate for sports card stores, a reverse survival rate trend, and a steady decline in sports card shows, despite a popularity increase of the sport. While there may be other factors contributing to retail shrinkage, the data presented here are consistent with the argument that the Internet steals more business from the retail market than it creates.

5.2 Changes in Card Printing

If online markets expand at the expense of retail markets, we would expect card producers to create card designs well suited to online trading. For example, companies may produce a limited number of special types of cards and randomly insert them into their packs of normal cards. The value of an insert card depends on the special features of the card (such as foil embossing, prismatic surfacing, autograph, or a swatch of cloth from a game-worn jersey), its extreme rarity, and how easily a lucky pack buyer can find someone to sell his insert card to.

To elaborate, before eBay, search costs were relatively high in retail markets and restricted the liquidity of card owners. The illiquid market reduced the expected value of buying a pack and also discouraged printing companies from printing high value insert cards. After the arrival of online auctions, the increased liquidity of the online market allows individuals who draw an

independent of the overall level of market demand. This assumption is made in Caballero and Hammour (1994). Consistently, Dunne, Roberts, and Samuelson (1988) find the market share of a given cohort of (manufacturing) firms generally declines as it ages.

[36]The coefficient for the eBay start dummy is -476.3 (shows per quarter) with standard error 255.7, p-value 0.034 one tail. The coefficient for the eBay IPO dummy is -414.4 with standard error 215.2, p-value 0.029 one tail.

insert card to find buyers more easily, raising the expected value of buying a pack. [37] To avoid depressing the secondary market value of insert cards, which depend on scarcity, the printer will produce many unique insert card designs and restrict the quantity of each design. This strategy will be pursued until the marginal gains from secondary market rent extraction equals the marginal losses from lower primary market sales.

This logic is confirmed by the explosion of the types of insert cards introduced since the growth of online trading in eBay. As shown in Column 1 of Table 5, insert cards did not exist until 1986. From 1986 to 1996, the total number of sets that included insert cards was stable and between 3 and 18. Then in 1997 and 1998 during the early growth of eBay, insert card types per year jumped to 33 and then to 46. Following eBay's IPO, insert card types increased to 110 in 1999, 164 in 2000, and finally to 724 in 2001. As of 2004, every printer advertises the types of inserts contained in a set as the main feature of the set and Beckett frequently features stories of lucky collectors who happen to draw the rarest of insert cards. This rate of growth does not apply to the number of sets without insert cards (Column 2 Table 5).

To add rigor, we also regress the number of sets on a dummy of insert cards, its interaction with an eBay IPO dummy (after 1998), and a full set of year dummies (to capture an arbitrary time trend that is common for both regular and insert cards). The insert dummy is insignificant, but its interaction with the eBay IPO dummy is positive and significant at 95% confidence (one tail).[38] This confirms the argument that card manufacturers introduced more sets of insert cards after the arrival of the Internet.

Two examples are illustrative of this phenomenon. One local shop owner in Dale City, VA told us that a customer received a card featuring an authentic autograph of deceased Hall of Fame member Grover Cleveland Alexander. The production of this particular insert card was limited to one copy. The customer went online immediately and sold the card for $13,000. [39] Another shop owner in Halethorpe, MD informed us that about 20% of his business were conducted online, and these were almost exclusively sales of insert cards on eBay.

[37] High value in the online market is further assured by the existence of professional grading, which allows the insert card owner to avoid questions of authenticity.

[38] The coefficient for the insert dummy is -5.29 with standard error 64.75. The coefficient for the interaction of the insert dummy and the eBay IPO dummy is 210.79, with standard error 107.37, p-value 0.041 (one-tail).

[39] See Beckett Baseball Cards Monthly, March 2002 on p.108 "One of One Fine Day."

6 Conclusion

Every new method of trade offers a new opportunity that all economic agents will explore differently, for their own interests. This paper presents a case study confirming this intuition by comparing and contrasting how individual card collectors, retail store owners, sportscard grading companies, and other economic agents have reacted in different ways to the emergence of online auctions.

The advent of the Internet provides a coherent explanation for multiple phenomena in sportscard trading: (1)ungraded cards are traded in both retail and online markets but the average quality is systematically lower online; (2) graded cards are mostly traded online, and have higher average quality than the ungraded cards sold in the retail market; (3) grading services experienced substantial growth in the late 1990s; (4) the average quality of the graded population shifted down at the same time; (5) the number of retail stores and sports card shows declined; and finally (6) card printers reoriented their products towards short printed insert cards that are better suited for online trading.

This interpretation is subject to an obvious caveat: adoption of Internet trading is a one-shot event, and it is impossible to separate the causal effect of the Internet from other market changes over time such as changes in baseball popularity or collector demographics. We argue that these alternative explanations may succeed in explaining one or two of our empirical facts, but they cannot account for all of them in any coherent way. Consider baseball's popularity as a sport. It is possible that baseball's popularity declined over time while the Internet took off, and that a negative demand shock for sportscards could account for the decline in retail markets. However, at the same time card grading demand soared, and people were willing to take greater chances by paying to grade ever-lower quality cards. Card printing companies in fact expanded to not only more but higher quality sets of cards. Conversely, if sportscard demand experienced a positive shock[40], we would expect to see such an expansion in grading and card printing activities, but the retail shrinkage would not make sense. We believe that while the Internet may not have been the sole cause of the phenomena observed in this study, the fact it can explain every observed fact in a coherent way suggests it must have played a very important role.

This case study of online/offline trading of sportscards provides two lessons that may be useful for understanding the impact of other new markets. A new market, generated by either

[40]For instance, good prevailing economic conditions.

a new trading method (e.g. mail-order) or a product innovation (e.g. cellular phones), is likely to have both advantages and disadvantages over existing markets. It is the trade off between these advantages and disadvantages that drives different agents to behave differently, fostering the coexistence of old and new markets.

Moreover, a new market not only affects economic agents that face the choice between new and old markets, but also influences those who support the needs of such economic agents. The existing empirical studies of online trading primarily focus on buyers' choice of market or sellers' pricing strategy. This paper shows that the advent of the Internet may have contributed to changes in traditional retailing, professional grading services, and primary manufacturer decisions. These indirect effects are often overlooked because they deal with economic agents who are not actually participating in the new market segment: they are players in rival markets competing for "thickness," as well as upstream and downstream industries. From an equilibrium point of view, it is important to consider how supply meets demand in both old and new markets, and how the separation of old and new markets affect supporting industries.

7 References

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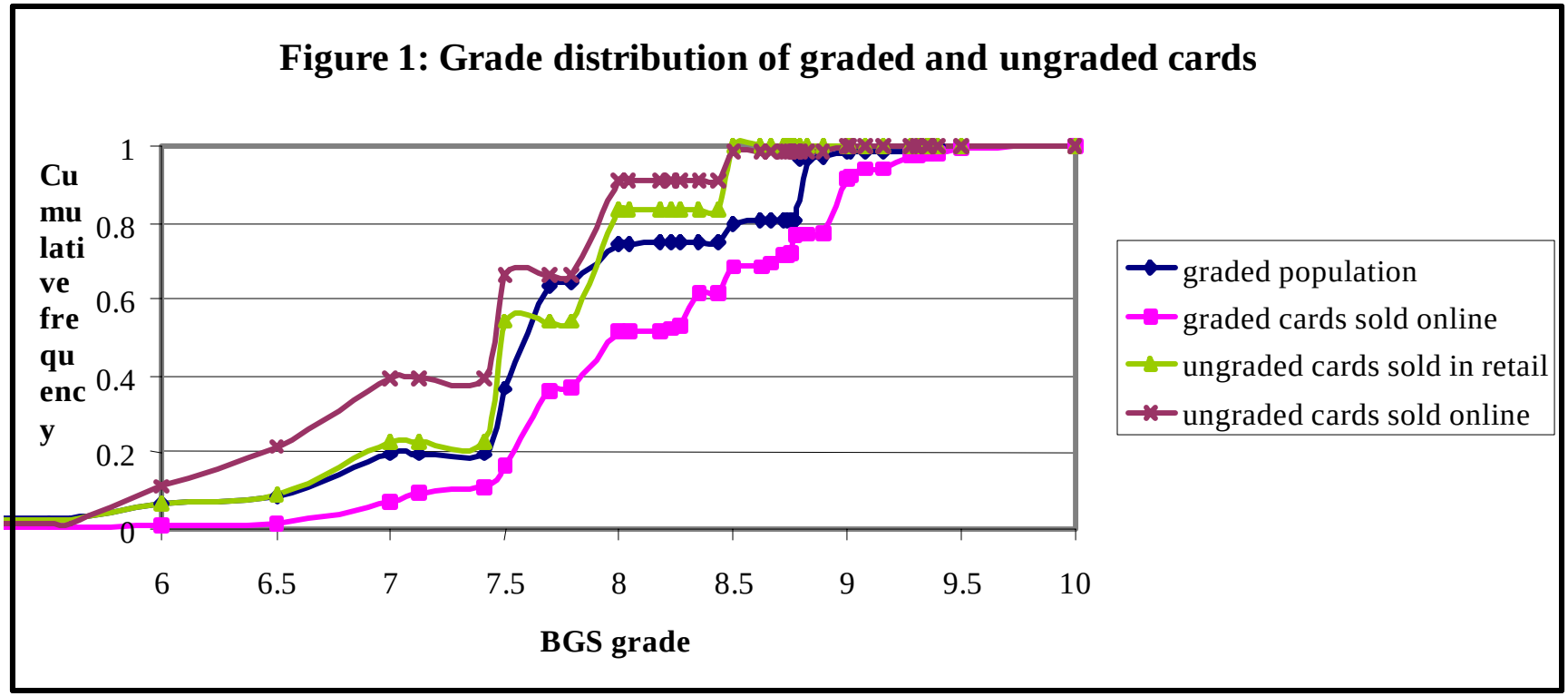
Appendix: The price schedule $p(q)$ is continuous, increasing and convex.

Because all consumers put positive value on quality, it is obvious that the price schedule cannot decrease in quality. For continuity, suppose $p(q)$ has a break at q_0, i.e. for any small increment ϵ, $p(q_0 + \epsilon) > p(q_0) + c$ where c is strictly positive. For this to be an equilibrium, there must be some θ satisfying $\theta(q + \epsilon) - p(q + \epsilon) > \theta \cdot q - p(q)$ for any $\epsilon > 0$. The condition is equivalent to $\theta\epsilon > c$, which will not hold for $\epsilon < \frac{c}{\theta}$, generating a contradiction. For convexity, suppose $p(q)$ is non-convex between q_1 and q_2. If $p(q)$ is concave between q_1 and q_2, there would be no demand for $q_1 < q < q_2$, contradicting the equilibrium condition. If $p(q)$ is linear between q_1 and q_2, consumers that demand for $q_1 < q < q_2$ must have $\theta = \frac{p(q_2)-p(q_1)}{q_2-q_1}$. The aggregate demand generated from this specific θ is strictly less than the aggregate supply for all q between q_1 and q_2, resulting in a contradiction.

Table 1: Summary of Field Experiment Data

	Retail Sample	Online Sample Overall	Retail vs. Online		Online Sub-samples			
					Best Ranked	Median Ranked	Best vs. Median Ranked	
Panel A: Authentic Deliveries Only								
N	122	89			44	45		
Card Quality	7.59	7.33	0.255	**	7.30	7.37	-0.07	
	(0.07)	(0.09)	(0.11)		(0.14)	(0.11)	(0.18)	
Card Value[2]	42.02	39.97	2.05		41.7	38.28	3.42	
	(1.64)	(3.99)	(4.31)		(7.51)	(2.98)	(8.08)	
Final winning price we paid ($)	61.95	60.43	1.52		73.18	47.96	25.22	***
	(1.32)	(4.54)	(4.73)		(8.49)	(2.35)	(8.81)	
Panel B: Full sample including frauds								
N	126	100			53	47		
N of defaults and counterfeits	4	11			9	2		
=1 if default or counterfeit	0.03	0.11	-0.08	**	0.17	0.04	0.13	**
	(0.02)	(0.03)	(0.04)		(0.05)	(0.03)	(0.06)	
Card Quality[1]	7.35	6.53	0.82	***	6.06	7.05	-1	**
	(0.14)	(0.24)	(0.28)		(0.40)	(0.24)	(0.47)	
Card Value[2]	40.69	35.57	5.12		34.62	36.65	-2.03	
	(1.75)	(3.99)	(4.35)		(6.59)	(3.07)	(7.27)	
Final winning price we paid ($)	62.19	61.34	0.85		73.49	47.65	25.84	***
	(1.30)	(4.13)	(4.33)		(7.16)	(2.27)	(7.51)	

Note: In parentheses are standard errors of sample means. Quality is measured by BGS grade. ***p<0.01, ** p<0.05, * p<0.1, two-tail. (1) Defaults and counterfeits are coded as zero quality. (2) Card value is calculated based on Beckett low book prices.



Source: Graded population is derived from the grade distribution reported in PSA, BGS and SGC population report as of 03/17/2002. Graded cards sold online are based on our eBay watch between April and Nov 2001. Ungraded cards sold in retail and ungraded cards sold online are based on our field experiment, authentic deliveries only.

Table 2: Comparison of grade distributions for graded and ungraded cards

	Ungraded cards sold in retail from our field experiment authentic deliveries only			Ungraded cards sold online from our field experiment authentic deliveries only		
Graded cards sold online during our eBay watch	T test of equal mean	8.28	***	T test of equal mean	19.21	***
	Chi2 test of equal median	30.82	***	Chi2 test of equal median	40.23	***
	Wilcoxon rank sum test of equal distribution	6.64	***	Wilcoxon rank sum test of equal distribution	9.17	***
Cards graded by PSA, BGS or SGC as of 03/17/2002	T test of equal mean	4.17	***	T test of equal mean	13.18	***
	Chi2 test of equal median	6.57	***	Chi2 test of equal median	3.83	**
	Wilcoxon rank sum test of equal distribution	1.29		Wilcoxon rank sum test of equal distribution	5.62	***

Note: All tests are based on the grade distribution derived from the row or column groups, all restricted to the five card identities we focused on in our eBay watch and field experiment. The numbers reported in each block correspond to the test statistics of the (mean, median, or distribution) of the row group minus the (mean, median or distribution) of the column group. For example, 8.28 in the upper-left block is the t-statistics testing the average quality of cards graded by PSA, BGS or SGC as of 03/17/2002 equal to the average quality of the ungraded cards sold in retail in our field experiment. It is significantly positive, indicating that the average quality is significantly higher in the row group than in the column group. All tests are conducted after controlling for a full set of card identity dummies. *** $p<0.01$, ** $p<0.05$, * $p<0.1$, two-tail.

Table 3: The number of cards graded by PSA

Panel A:

Year	Number of Cards graded by year
July 1994 - June 1995	12,500
July 1995 - June 1996	32,100
July 1996 - June 1997	93,500
July 1997 - June 1998	167,600
July 1998 - June 1999	898,800

Panel B:

Quarter	Number of Cards PSA graded by quarter	
Before eBay went public:		
1997-3	28,846	
1997-4	31,434	
1998-1	47,903	
1998-2	59,415	
1998-3	96,256	
After eBay went public:		
1998-4	171,657	
1999-1	291,907	
1999-2	339,000	
T-test of equality before and after eBay went public	5.387	***
T test of equality before and after eBay went public, controlling for linear time trend	1.83	*

Source: Prospectus of Collectors Universe Inc. (PSA's Parent), Nov. 1999. *** p<0.01, * p<0.1, one-tail.

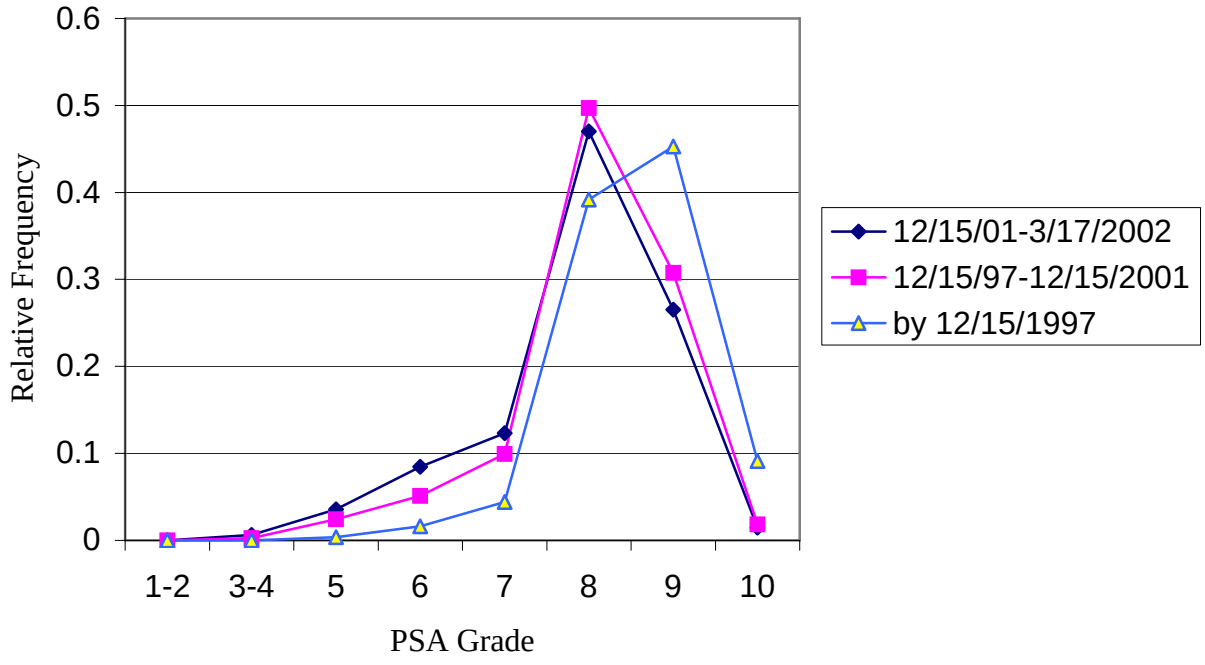
Table 4: Quality shifts in PSA graded population

Sample = grade distribution of 194 sportscard identifies that had at least 100 graded copies as of 12/15/1997.

Within-card Comparison of two PSA graded populations, one as of 12/15/1997 and the other as of 03/17/2002	Average test statistics	Average p-value (two-tail)	# of cards with p<0.05	% of cards with p<0.05
T-test on H0: equal mean quality	-5.572 (0.208)	0.017 (0.008)	188	96.91%
Wilcoxon rank-sum test on H0: same quality distribution.	5.017 (0.190)	0.008 (0.004)	189	97.42%
Peterson Chi2 test on H0: equal median quality	26.251 (2.425)	0.014 (0.004)	182	93.81%

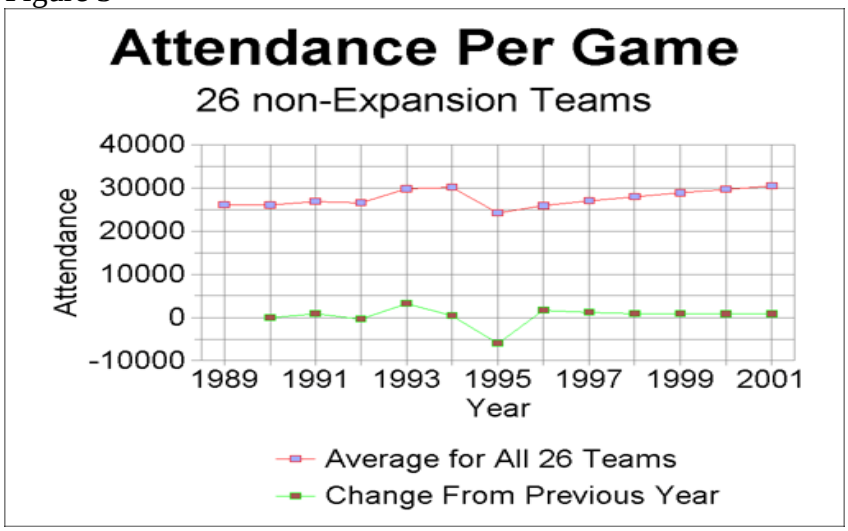
Notes: Each test is done separately within the same card identity. The numbers in parentheses are standard errors of the sample means across the 194 card identifies. Source: PSA population report as of 12/15/1997 and 03/17/2002.

Figure 2: Distribution of grades PSA assigned in different periods for 1989 Upper Deck #1 Ken Griffey Jr. (Rookie)

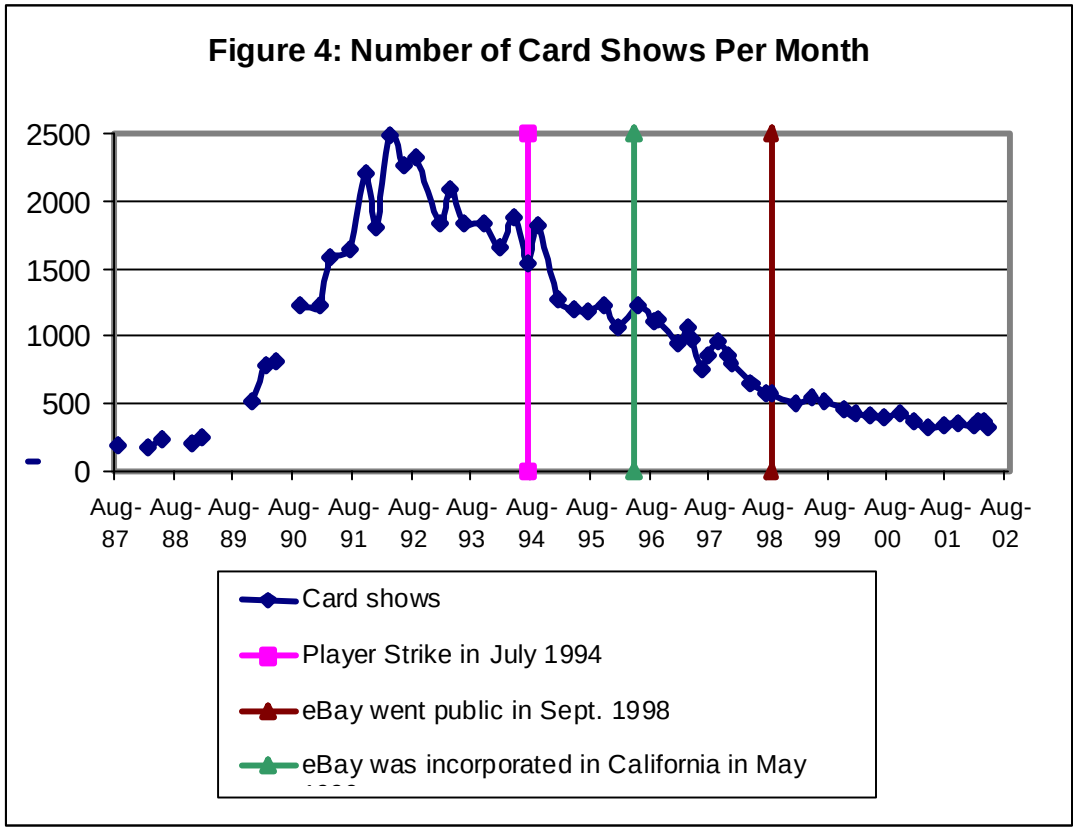


Source: PSA population report, as of 12/15/1997, 12/15/2001/ and 03/17/2002.

Figure 3



Source: Forman, Sean L. Baseball-Reference.com - Major League Statistics and Information. http://www.baseball-reference.com/. (March 20, 2002)



Source: Beckett Baseball Monthly, August 1987 to August 2002.