MODELING MARKETS FOR SPORTS MEMORABILIA

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ABSTRACT

A simple hedonic pricing model is developed for baseball cards, of the type often used successfully to model prices for artworks. The model is constructed based on insights contributed by both the sports psychology and finance literatures and is estimated for a dataset of twelve well-known players observed at eight points in time over a span of twenty years. Tobit estimates explain most differences among baseball card prices. Batting average and number of World Series appearances had significant positive impacts on price, but surprisingly, rookie cards tended to be worth relatively less than non-rookie cards. Results suggest famous players' cards generally are extremely attractive investment instruments.

INTRODUCTION

The economic literature on appreciation of non-financial investment assets has generally found low rates of return accompanied by high risk. Assets studied have included real estate, artworks, wines, and sports memorabilia. Sports memorabilia comprise an especially promising subject for further study.

Although sports memorabilia may be collected solely for its financial aspects, often collectors seek to identify with their heroes by collecting associated memorabilia. This is one metric in motivating athletes that is seldom examined (White et al 1998), and also motivates non-athletes who seek to emulate athlete behavior in a more general way. Although athletic performance and ability seem to characterize most of the athletes whose memorabilia is most prized by collectors, demonstrated ability to overcome adversity seems to make athletes especially valued as role models, both to other athletes and to collectors who do not also compete. Several baseball players in the sample examined here are famous for overcoming injuries or playing with pain over long careers, including Dimaggio and Mantle.

One essential feature rendering sports memorabilia more favorable subjects is the relative homogeneity of collectibles such as baseball cards, a feature clearly not shared by artwork or real estate. All cards of a certain issue should have their value determined by characteristics intrinsic to the card, such as a card's age, condition, and scarcity, and characteristics extrinsic to the card, such as the particular player's records, fame, and popularity. Intrinsic characteristics are generally properties of the whole issue and are shared by all cards of a given year printed by a given manufacturer, assuming that equal numbers of each player were printed. Obscure player's cards will be sought to complete sets of a given issue, and famous or star player's cards will face additional demand to complete sets or enhance partial sets of star player or team cards.

This paper develops a simple hedonic pricing model for baseball cards, of the type often used successfully to model auction prices for artworks. The model is estimated for an illustrative sample of cards for several different years. The paper is organized as follows: a review of the literature is followed by a development of the hedonic pricing model, a discussion of the data used, a brief introduction to the statistical methodology, presentation of the empirical results, and finally the conclusion.

LITERATURE

Several categories of scholarly literature were reviewed to develop the background necessary for this study. First the sport psychology literature on fan identification and behavior is used to develop an explanatory framework for a basic theory of why collectors demand sports memorabilia in the first place. Next, we discuss possible career characteristics players might possess which might plausibly enhance the desirability of associated memorabilia. A discussion of issues related to sports injury is provided next. We argue that athletes are especially prized as role models because they overcome obstacles, and that injury constitutes the most common and archetypal obstacle faced by athletes. An athlete's memorabilia will be more prized by collectors if the athlete either successfully overcame injury, or even if they failed to do so, but faced the obstacle with superior courage and character. Finally, after establishing reasons for a base demand for sports memorabilia, we turn to a discussion of purely financial considerations, drawing on the established literature on the investment demand for sports memorabilia and related assets, including artwork.

Identification and Fan Motivation

Fans provide the basic demand for sports memorabilia, at least initially. This section discusses the sports psychology literature addressing fan motivation in attending sports events and buying memorabilia, and in identifying with particular teams. In many situations, fans cannot purchase memorabilia unless they attend a sporting event (Jarrell and Mulligan 2002), so attendance, team identification, and base demand for memorabilia are inextricably linked.

On the most basic level, divorced from any financial investment considerations, memorabilia seems to be valued for its association with the sport activity, particularly if the memorabilia in question is particularly old and no longer resembles contemporary equipment, such as obsolete golf balls and clubs. On a higher level, memorabilia is associated with the success of the player or even the team. Fans value their association with winning teams more highly (End et al 2003a), and this presumably confers more value on associated memorabilia; fans desire the items in order to bask in reflected glory (BIRG) (Cialdini et al 1976; Cialdini and Richardson 1980; Lee 1985; Wann and Branscombe 1990; Wann et al 1993; End et al 1997; 2003b). An additional source of demand for memorabilia is fans' strong identification with certain teams and players (Tajfel and Turner 1986; Hirt et al 1992; Murrell and Dietz 1992; Wann and Branscombe 1993; Wann, Tucker, and Schraeder 1996; Dietz-Uhler and Murrell 1999). This effect is enhanced if the team enjoys success, but is present to some extent even for losing teams.

Though fan identification with teams and players can be negatively impacted by poor performance or sudden reversal of fortune (Mann 1974; Wann and Dolan 1994), demand for memorabilia such as baseball cards is generally not affected by such reversals. Much of the value possessed by a baseball card is based on the player's established performance. A record-holder's card probably does not fall in value when their record is surpassed. A famous player's later cards are always highly desired, even if their performance falters late in their career.

Motivations among Memorabilia Collectors

We turn next to the sport psychology literature about motivation of athletes, as opposed to fans. We attempt to draw conclusions from this literature about why memorabilia collectors might identify particularly strongly with certain athletes, and thus why associated memorabilia would be especially prized.

The goal perspective approach to explaining motivational processes among athletes (Duda 1989, 1992) emphasizes the differences in how athletes define success and judge their overall performance. Ames (1984, 1992) identifies two principal goals athletes seek, task orientation and ego orientation. We suggest here that similar motivating factors vicariously influence memorabilia collectors. Task-oriented collectors value memorabilia associated with a particular athlete based on the athlete's performance and achievement, but always taking into account extraordinary obstacles the athlete may have overcome. These collectors seek inspiration from the athletes they admire, and attempt to apply lessons learned from the athletes' live experience to problems faced by the collectors, normally outside the arena of athletic competition. These collectors particularly value memorabilia associated with athletes who are perceived as having demonstrated superior courage and character, in addition to those who have been particularly successful.

In contrast, ego-oriented collectors seek memorabilia associated with athletes and teams which are most famous or most popular. These collectors seek to bask in the reflected glory and are less likely to seek memorabilia associated with a fine athlete from a team with which they do not identify. The two goal orientations have supported the discovery of divergent behavioral patterns in athletes (Duda 1992, 1993). While we suggest that price data for sports memorabilia will not be sufficiently rich to distinguish between the two motivational paradigms for collectors, we believe both motivators exist in addition to purely financial factors to which collectors respond.

Athletic Injury: The Archetypal Hardship

The impact of injury on athletes has been extensively studied (Granito 2001). Although injury is not the only obstacle athletes have to overcome, it is the one most universal experience with which non-athletes can empathize, thus we argue that an athlete's injury response is one of the most important factors determining the value of associated memorabilia. Several studies found that athletic injuries at all levels of competition contribute to a variety of physical, physiological, and psychological hardship against which athletes struggle (Grossman and Jamieson 1985; Brewer and Petrie 1995; Leddy, Lambert, and Ogles 1994; Smith et al 1993). A significant literature in sport psychology research focuses on the psychological and emotional impact of athletic injuries (Heil 1993; Taylor and Taylor 1997; Pargman 1999).

The cognitive appraisal approach to explaining how athletes respond to injury emphasizes the athlete's perception of the injury (Brewer 1994; Wiese-Bjornstal et al 1998). This perception is influenced by interactions among personal factors such as physiological aspects of the injury and personal characteristics of the athlete, among situational factors including sport related factors, social aspects of competition and training, and among environmental factors (Wiese-Bjornstal and Shaffer 1999; Granito 2001). Wiese-Bjornstal et al (1998) emphasize that athletes' response to injury is dynamic and can change over time. Athlete response to injury depends on a large number of hypothesized variables (Wiese-Bjornstal et al 1988; Wiese-Bjornstal, Smith, and LaMott 1995). Evans and Hardy (1995) suggest that conventional quantitative research methodologies may fail to capture the full complexity of injury recovery. The cognitive appraisal approach offers an explanation for individual differences in responses to injury (Brewer 1994).

This range in injury recovery success helps explain why different athletes are more admired, and why their memorabilia is more desired by collectors, independently of the athletes' levels of achievement. Rose and Jevne (1993) and Shelley (1999) document the experience of injury and recovery, finding a four-phase process which is potentially arduous and protracted: 1) injury, 2) acknowledging the injury, 3) dealing with the impact, and 4) achieving a physical and psychosocial outcome, which might consist of recovery, adaptation, or acceptance of the injury. This process can be considered analogous to a standard archetype for how individuals in all walks of life face and overcome adversity. Bianco, Malo, and Orlick (1999) document a similar injury recovery process. Because athletic injury is such a direct metaphor for the hardships we all face, it is small wonder that non-athletes identify with, and strive to emulate, the athletes they admire. Evidence suggests the most competitive athletes, who identify most strongly with their sport, have an enhanced psychological response to injury (Brewer 1993).

Shelley (1999) found athletes' perceptions about injury change over the course of the process and emphasized the importance of the influence of coaches, teammates, and family members on athletes' emotional response. Social interactions seem to be an important part of a successful emotional response to injury and the frustrations of recovery (Udry et al 1997b; Zimmerman 1999). Cultural aspects and social influences impact the way an athlete experiences and talks about pain and injury (Young and White 1999). Since pain influences an individual's emotional state (Udry et al 1997a; Taylor and Taylor 1998; Heil and Fine 1999), it can impact an athlete's ability to overcome injury, and render their recovery that much more admirable. Certain athletes are particularly admired for their ability to play with pain, in particular Dimaggio and Mantle. Athletes can perceive benefits from injury, because it provides relief from the stress of competition and the pressure to perform, and often find rehabilitation stressful (Gould et al 1997a). Rehabilitation may be inherently painful, or an athlete may feel pressured to demonstrate rapid progress in order to return to competition.

Financial Aspects of Collecting Memorabilia

This section discusses some of the relevant economic literature on pricing sports memorabilia and other non-financial investment assets, such as artwork. Stoller (1984) provides a valuable analysis of the Fleer v. Topps antitrust case as well as a discussion of the underlying economics of the baseball card business. The loss of Topps' monopoly power in 1980 and the introduction of competition (Stoller 1984, p. 23) may have caused the collapse of a speculative bubble in card prices. Stoller (1984, p. 19) documents a 31.6 percent annual return on Topps cards.

Nardinelli and Simon (1990) and Andersen and La Croix (1991) both found that a player's race significantly affected the price paid for baseball cards on the secondary market. These studies focus on the secondary market for sports memorabilia to isolate consumer discrimination from co-worker and employer discrimination. McGarrity, Palmer, and Poitras (1999) found little evidence of racial discrimination in the market for baseball cards, using a dataset with constant supply and where effects from speculative demand are largely removed by considering only retired players, and using a variety of econometric specifications to allow assessment of robustness of results. Fort and Gill (2000) study racial discrimination in baseball card markets using continuous, non-binary racial perceptions of market participants, as reported by surveys. They find evidence of discrimination against black and Hispanic hitters and against black pitchers, but not Hispanic pitchers. Gill and Brajer (1994) use baseball card prices to demonstrate monopsony exploitation of non-free-agent players. Comparison of the distribution of salaries among free-agent and non-free-agent players with the competitive secondary market prices of their baseball cards, shows that non-free-agent salaries are systematically depressed.

The literature on pricing artwork has significant implications for sports memorabilia markets. Ekelund, Ressler, and Watson (2000) examine how an artist's death affects the demand for that artist's work. They find a clustered rise in artwork's values immediately around the time of the artist's death. This phenomenon has two implications for the sports memorabilia market. The supply of baseball cards is effectively frozen for a particular player when the player retires from the game, rather than at death. Ancillary memorabilia, including autographs, can continue to be supplied until the player's death however, and it seems plausible for death to induce an interest and nostalgia-generated increase in card prices as well.

Rengers and Velthuis (2001) study determinants of artwork prices based on characteristics of the artwork, artist, and gallery. This approach generalizes fairly readily to baseball cards, which have characteristics attributable to the player, team, year of issue, and card issuer. Reneboog and Van Houtte (2002) find that artworks significantly underperform compared with financial assets, owing the very high risk of investing in art, the heterogeneity of artworks, high transactions costs, and high costs of insurance, transportation, security, and resale. It is particularly worth noting that none of these negative features generally applies to sports memorabilia. Baseball cards of a given player, issue, and condition are always non-unique, homogeneous assets.

MODEL

This section develops the model tested in the results section in the context of three kinds of data which might be used to estimate a model: time series data, cross-sectional data, and panel data. Only the cross-sectional model is tested in this paper.

Time Series Models

Time series data measure characteristics of an individual member of a population or sample, or of the sample or population as a whole, as they evolve over time. As more time elapses, more data are observed and more subtle models can be estimated. An optimal timing model is used to express the value of any asset that appreciates over time. The value V of an asset at any point in time is an exponential function of the initial value K and the time elapsed t during which the asset appreciates:

$$V = K\, e^{\sqrt{t}} \quad [= K \exp(t^{1/2})]$$

Alternatively, the simpler formulation $V = K\, t^n$ can be used. This class of models is broadly applicable to many different assets, including wine, agricultural crops, renewable natural resources such as lumber forests, and non-renewable natural resources such as petroleum deposits. The important characteristic of the K

t^n term is that it can grow at an increasing or decreasing rate, depending on whether n is greater or less than one. Sports memorabilia should increase in value at a decreasing rate: formulating the model this way allows for testing whether $n < 1$.

Adapting this model to sports memorabilia, certain differences must be noted. Unlike wines, baseball cards and other sports memorabilia do not acquire chemical changes as they age which improve their taste, quality, and desirability. In fact, the chemical changes to which sports memorabilia are subject over time normally detract from their desirability, and collectors attempt to prevent or delay chemical changes.

Nevertheless, cards appreciate in value in a fashion similar to wine, though for different reasons. The supply of cards of a particular brand, player, and year is initially limited. Only so many of a particular card were ever printed. Surviving copies appreciate in value as some of the initially limited supply are lost, destroyed, or decay in condition as time passes. This gradual diminution of the supply of cards is similar to what happens as vintage wines are consumed, mature forests are harvested for lumber, or petroleum deposits are pumped out of the ground.

The prices of sports memorabilia are also affected by changes in demand. Demand normally increases with an increasing population, and in addition, demand for sports memorabilia increases with interest in the particular sport or athlete, as well as interest in the memorabilia for its own sake and as investment assets. Demand effects can occasionally be negative, as documented for the collapse of baseball card prices caused by the end of monopoly pricing in 1980 (Stoller 1984, p. 23), but fortunately that has been an exceptional event.

Sports memorabilia have unique characteristics which call for generalizing the standard optimal timing model. Though old baseball cards of comparable significance, condition, and quality are generally more valuable than newer cards, the career performance and general fame of the player make a card more sought after and therefore more valuable. All cards of a given issue had the same price when new, and appreciate over time. A rookie card of an average player appreciates much less than that of a more well-known player. A rookie card of a presumed hot-prospect may appreciate rapidly early on, but plateau or even decline in value as the player's career fails to achieve its initial promise. Some players' cards are especially desirable due to tragically brief careers.

To capture these kinds of effects, the exponent of the optimal timing model is augmented with a multiplicative vector of exponentially-weighted factors S. These factors include the player's career longevity, records held, retirement, hall-of-fame induction, and death. Including the factors which distinguish average from well-known players is accomplished mathematically by inserting the product of each factor variable, each weighted by its own exponent:

$$V = K\, S\, t^{n} \quad [= K \prod (S_i^{a})\, t^{n}) = K \prod (A^{a} B^{b} C^{c} \ldots)\, t^{n}]$$

Taking natural logarithms of both sides,

$$\ln A(t) = \ln K + a \ln A + b \ln B + c \ln C + \ldots + n \ln t$$

This is the equation of interest for time series estimation. This can also be considered a generalized hedonic price equation, and the reduced form of supply and demand functions in the same arguments.

$$P_{it} = \textstyle\sum_t a_t X_t + \sum_t b_t Z_t + e_,$$

where X and Z are vectors of observable characteristics, both intrinsic and extrinsic to a specific card. Extrinsic characteristics are associated with specific players and vary across cards of a specific issue.

Cross-sectional Models

Cross-sectional data provides a description of an entire population or sample at a given point in time. Cross-sectional estimation is appropriate when researchers want to distinguish among factors which influence population behavior or characteristics but do not have observations at many different points in time. Time series estimates would allow for estimating the price and the return as functions of the explanatory variables. Cross-sectional estimates only allow for computing the return between two observed cross-sections. Cross-sectional estimates can also be useful to investors, because they can be used to evaluate the likely change in price whenever one of the explanatory variables changes, for example, if a current player improves his batting average, or appears in the World Series, or if a retired player is elected to the Hall of Fame.

Building on the significant literature studying race as a determinant of sports memorabilia prices, we include dummy variables for race in the specification. Batting average is included as the single most important measure of a player's performance. Note that earned run average would be used for pitchers, who would generally have to be priced with a separate model. Rookie cards are commonly thought to be more desired by collectors, and generally to be rarer, especially for famous players. If rookie cards are valued in any way differently from ordinary cards, including a dummy variable for rookie card status should improve the model's forecasting performance.

The player's age serves as a proxy for the age of the card, and generally cards of older players should be more valuable. Death is measured with a dummy variable, as is hall-of-fame status. The number of World Series appearances improves the desirability of a player's cards, though a player's team is more likely to make it to the World Series the better the player's performance, as captured by batting average, for example. The number of years elapsed from the start, and from the end, of a player's career, like age, proxies for age of the card. Because the difference of these two variables gives the player's career longevity, if longevity has a positive impact on card price, the expectation is that the more years elapsed from the start, and the fewer elapsed from the end, the higher the price. This effect can be washed out by the general phenomenon that older cards are more valuable.

A hedonic pricing model is often specified in a less restrictive exponential form, and then estimated in its linear logarithmic transformation. However, because several of the right-hand-side variables are dummies, which can only take on values of zero or one, the model is specified here in levels.

$$P = a + bBLK + cHSP + dBA + eR + fA\mathit{nn} + gD\mathit{nn} + hHOF\mathit{nn} + iWS\mathit{nn} + jS\mathit{nn} + kE\mathit{nn}$$

This is the model which is estimated in the results section. Card price is thus asserted to be a function of the player's race, batting average, rookie card status, age, death, hall of fame status, number of world series appearances, and career longevity as captured in years elapsed from start and from end of career. The variables are described in Table 1. The race, rookie card, death, and hall-of-fame status are measured with dummy variables which take on values of zero or one depending on whether the relevant condition is satisfied, as described in table 1.

Panel Data Models

Panel data is the term applied to data which describes the cross-section of the population or sample, but where each characteristic is observed at many points in time. Thus panel data represent a cross between time-series and cross-sectional data. These data are also called pooled time-series and cross-sectional data. Kmenta

(1971, pp. 508-517) discusses panel data estimation. Although panel estimation should provide the best results, it also calls for the most intense computational and data resources. Mulligan, Jarrell, and Grube (2003) present and interpret panel estimates.

Table 1: Variables in the Hedonic Pricing Model

P	= card price in current dollars from the Price Guides	
BLK	= 1 if player is black	= 0 otherwise
HSP	= 1 if player is Hispanic	= 0 otherwise
R	= 1 if card is a rookie card	= 0 otherwise
BA	= player career batting average	
A*nn*	= player age at year of Price Guide	
D*nn*	= 1 if player was deceased prior to year of Price Guide	= 0 otherwise
HOF*nn*	= 1 if player was in Hall of Fame prior to year of Price Guide	= 0 otherwise
WS*nn*	= number of world series appearances prior to year of Price Guide	
S*nn*	= number of years from start of career to year of Price Guide	
E*nn*	= number of years from end of career to year of Price Guide	= 0 for players who were still playing during year of Price Guide
Price Guides from 1982, 1983, 1984, 1985, 1988, 1993, 1999, and 2002. *nn* indicates variables that change from one Price Guide to the next, and serves as a placeholder for the year, e.g., A82, A83, etc.		

DATA

This section documents the data used to estimate the model. A sample of twelve well-known players, listed in table 2, was chosen to obtain illustrative estimates of the model. Prices for one card for each player were taken from the Price Guides for eight different years over a twenty-year span from 1982 to 2002.

One significant difference between these data and the auction prices used in empirical examinations of artwork prices should be noted. Artworks are unique and each auction price for a given artwork records a unique transaction at a unique point in time. In contrast, the Price Guide observations of card price in a given year are taken from dealer surveys. There is never any specific, single exchange which can be documented at the listed price.

Table 2: Sample of Baseball Cards				
Player	Years Played	Teams	Card Issuer and Year	Card #
Aaron, Hank	1954-76	MLN ATL MIL	1954 Topps	128
Bench, Johnny	1967-83	CIN	1968 Topps	247
Brett, George	1973-93	KCR	1975 Topps	228
Carew, Rod	1967-85	MIN CAL	1967 Topps	569
Fisk, Carlton	1969-93	BOS CHW	1972 Topps	79
Jackson, Reggie	1967-87	KCR OAK BAL NYY CAL	1969 Topps	260
Mantle, Mickey	1951-68	NYY	1952 Topps	311
Musial, Stan	1941-63	STL	1948 Bowman	36
Robinson, Jackie	1947-56	BRO	1949 Bowman	50
Rose, Pete	1963-86	CIN PHI MON	1963 Topps	537
Williams, Ted	1939-42 & 1946-60	BOS	1950 Bowman	98
Yastrzemski, Carl	1961-83	BOS	1960 Topps	148

Generally, the Price Guide is used as an authority for dealers to price and update their inventory. Many transactions occur at the price listed in the Price Guide because it is widely accepted as an authoritative source. However, the listed card price is logically prior to the prices of actual transactions. In the art market, in contrast, the auction price is logically prior to any compilation of art values. A further difference derives from the fact that there are many identical copies of a given card, even in the same grade of condition, but an artwork is always absolutely unique.

METHODOLOGY

This section explains the statistical estimation technique used in the results section. Because the left-hand-side variable, baseball card price, cannot be negative, a censored estimation technique is employed, introduced in econometrics by Tobin (1958) and called the Tobit model. If left-hand-side variables are limited in some way, ordinary least squares estimates are asymptotically biased (Kennedy 1993, p. 232). Ordinary least square estimation can provide negative estimates of the left-hand-side variable, which can never be negative in reality, a shortcoming avoided through censored estimation.

McDonald and Moffitt (1980) showed that Tobit estimates combine properties of standard linear regression, namely the predicted value of the left-hand-side variable and its changes for observations beyond the relevant limits, with properties of the probit estimator, namely the probabilities and changes in the probabilities of being outside the limits. Tobit estimates are obtained through maximizing the likelihood function (Greene 1981, p. 508).

Descriptions of the Tobit estimation procedure are provided by Abramovitz and Stegun (1972, p. 299), Amemiya (1981), Greene (1981), Maddala (1983, pp. 151-155), Davidson and MacKinnon (1993, pp. 537-542), and (Judge et al pp. 783-785). Hall (1984) reviews software available for Tobit estimation. The Tobit model is an iterative, restricted maximum likelihood estimate.

Estimates are reported below for sample datasets taken from eight different annual Price Guides. The estimate did not converge for some years, or yielded a near-singular matrix or a negative standard error, probably because the model devours nearly all available degrees of freedom; eleven coefficients, including the constant, are estimated on twelve observations of each variable. These problems vanished when one variable was omitted from the specification. Including more cards in the sample would probably avoid these estimation problems.

RESULTS

This section presents the results of econometric estimation. Tables 3 through 10 present estimated Tobit models for cross sectional data samples taken from eight different Price Guides.

Table 3: Tobit Model of Baseball Card Prices				
1982 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-3642.540	360.2244	-10.11186	0.0000
BLK	412.3077	69.14140	5.963253	0.0000
HSP	-245.1361	48.18435	-5.087462	0.0000
BA	9732.350	974.7919	9.984028	0.0000
R	-491.6519	30.37142	-16.18798	0.0000
A82	56.47143	12.96109	4.356997	0.0000
D82	-264.7751	86.78959	-3.050770	0.0023
HOF82	-141.8288	131.5777	-1.077909	0.2811
WS82	156.3141	7.421117	21.06342	0.0000
S82	-64.62543	15.39043	-4.199067	0.0000
E82	-19.12512	3.730426	-5.126792	0.0000
R-squared	0.998321	Mean dependent var	178.8333	
S.D. dependent var	435.0034	Akaike info criterion	10.93275	
Sum squared resid	3494.350	Schwarz criterion	11.41765	
Log likelihood	-53.59649	Hannan-Quinn criter.	10.75322	

This model was estimated over a sample of twelve well-known players. Very high R-squares and adjusted R-squares are impressive, but may be due more to small sample properties than any particularly sterling qualities of the specification. Nevertheless, high R-squares suggest the model should serve investors and collectors as a useful tool.

Race coefficients are positive and significant for black players in the sample for 1982, 1983, 1984, 1993, and 2002, but not significant in 1985, 1988, and 1999, suggesting race became less important in determining card price over time, though clearly the positive effect on price remains in the 2002 dataset. In contrast, the race coefficient is negative and significant for the lone Hispanic player, Rod Carew in 1983, 1984, 1993, not significant in 1985, 1988, 1999, and becomes positive and significant in 2002. This is likely a small sample characteristic which results from the relatively higher prices initially paid for cards of very famous non-Hispanic players in the sample, and the relatively rapid appreciation of the Rod Carew card.

Table 4: Tobit Model of Baseball Card Prices

1983 Data Cross Section

	Coefficient	Std. Error	z-Statistic	Prob.
C	-3516.604	910.7125	-3.861377	0.0001
BLK	511.4870	191.1275	2.676156	0.0074
HSP	-266.6450	125.0442	-2.132407	0.0330
BA	10881.65	2679.818	4.060592	0.0000
R	-471.2385	75.38311	-6.251248	0.0000
A83	34.36457	32.34181	1.062543	0.2880
D83	-425.1508	251.7122	-1.689036	0.0912
HOF83	-268.5695	359.6466	-0.746760	0.4552
WS83	158.4635	19.75503	8.021424	0.0000
S83	-43.76523	38.61433	-1.133393	0.2570
E83	-12.61742	9.396278	-1.342810	0.1793
R-squared	0.989107	Mean dependent var	179.8417	
S.D. dependent var	434.6804	Akaike info criterion	12.72936	
Sum squared resid	22640.95	Schwarz criterion	13.21426	
Log likelihood	-64.37613	Hannan-Quinn criter.	12.54983	

Table 5: Tobit Model of Baseball Card Prices				
1984 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-2500.287	367.8762	-6.796544	0.0000
BLK	311.0981	78.05443	3.985656	0.0001
HSP	-173.5807	51.84731	-3.347922	0.0008
BA	8363.918	1064.941	7.853881	0.0000
R	-412.8758	29.58992	-13.95326	0.0000
A84	8.240391	2.254256	3.655481	0.0003
D84	-117.4760	98.94498	-1.187287	0.2351
HOF84	-238.9534	134.0693	-1.782313	0.0747
WS84	142.8158	8.011905	17.82544	0.0000
E84	-31.29713	4.034931	-7.756546	0.0000
R-squared	0.998729	Mean dependent var	195.6667	
Adjusted R-squared	0.986020	S.D. dependent var	389.8842	
S.E. of regression	46.09906	Akaike info criterion	10.81732	
Sum squared resid	2125.123	Schwarz criterion	11.26182	
Log likelihood	-53.90394	Hannan-Quinn criter.	10.65275	

Batting average has a very strong positive impact on card price. The coefficient is always positive and significant and almost always an order of magnitude greater than any other coefficient, except in 1988. Rookie card status always has a negative impact on price, which is always statistically significant except in 2002. This is probably a small sample effect. Player age has a positive and significant impact on price in 1982, 1984, 1985, 1988, 1993, and 1999, but not significant in 1983 or 2002.

Table 6: Tobit Model of Baseball Card Prices				
1985 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-1121.022	189.0700	-5.929136	0.0000
BLK	-5.327959	39.55047	-0.134713	0.8928
HSP	-22.53180	25.55713	-0.881625	0.3780
BA	2895.855	520.7312	5.561133	0.0000
R	-324.4782	16.26105	-19.95432	0.0000
A85	13.28342	1.335820	9.944018	0.0000
D85	350.0922	51.12925	6.847199	0.0000
HOF85	222.6048	68.23334	3.262405	0.0011
WS85	79.80095	4.030060	19.80143	0.0000
E85	-40.01059	2.190951	-18.26175	0.0000
R-squared	0.999029	Mean dependent var	143.4167	
Adjusted R-squared	0.989320	S.D. dependent var	268.1490	
S.E. of regression	27.71181	Akaike info criterion	9.641930	
Sum squared resid	767.9447	Schwarz criterion	10.08643	
Log likelihood	-46.85158	Hannan-Quinn criter.	9.477361	

Deceased players' cards generally sell for more than those of still-living players, at least for this limited sample. This outcome is not surprising in light of the empirical literature on artwork valuation, which shows death of the artist has a positive impact on the value of his or her work. Death is different for card valuation, however, as a player stops generating new card issues when he retires, rather when he dies. Death is statistically significant and negative only for 1982, significant and positive for 1985, 1988, 1993, and 1999, and not significant for 1983, 1984 and 2002. The significant positive coefficient on death in 1982 indicates that in that year, for this sample of players, the living players' cards were worth more than dead players'. The result may have been reversed later on as more star players in the sample passed on.

Table 7: Tobit Model of Baseball Card Prices				
1988 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-16888.58	6427.465	-2.627565	0.0086
BLK	1672.837	1003.078	1.667703	0.0954
HSP	-658.5319	698.8496	-0.942309	0.3460
BA	29512.94	12756.28	2.313601	0.0207
R	-2089.132	387.4653	-5.391793	0.0000
A88	592.2054	297.6067	1.989893	0.0466
D88	1108.047	1763.161	0.628443	0.5297
HOF88	81.24800	1720.452	0.047225	0.9623
WS88	603.7357	96.71123	6.242664	0.0000
S88	-763.7149	383.8863	-1.989430	0.0467
E88	109.8458	109.2591	1.005369	0.3147
R-squared	0.984770	Mean dependent var	742.9167	
S.D. dependent var	1818.894	Akaike info criterion	16.13852	
Sum squared resid	554255.8	Schwarz criterion	16.62343	
Log likelihood	-84.83114	Hannan-Quinn criter.	15.95899	

Hall of Fame status has a negative but statistically insignificant effect in 1982, 1983, 1984, but its impact becomes positive and significant in 1985, 1993, 1999, and 2002, and is positive but insignificant in 1988. Insignificant coefficients for many years probably result from multicollinearity; Hall of Fame status should have a positive impact on card price, but that impact is likely captured better by two other variables included in the model, batting average and the number of World Series appearances.

Table 8: Tobit Model of Baseball Card Prices				
1993 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-45258.40	5130.998	-8.820584	0.0000
BLK	2246.530	604.2588	3.717827	0.0002
HSP	-2268.757	920.8260	-2.463828	0.0137
BA	120963.4	9041.685	13.37841	0.0000
R	-7969.344	767.4725	-10.38388	0.0000
A93	318.0706	88.38023	3.598889	0.0003
D93	7865.327	2787.320	2.821824	0.0048
HOF93	6467.120	875.5687	7.386193	0.0000
WS93	2352.526	94.24879	24.96081	0.0000
E93	-843.0741	117.7661	-7.158887	0.0000
R-squared	0.996144	Mean dependent var	2543.333	
Adjusted R-squared	0.957583	S.D. dependent var	6768.140	
S.E. of regression	1393.917	Akaike info criterion	17.44062	
Sum squared resid	1943005.	Schwarz criterion	17.88512	
Log likelihood	-93.64374	Hannan-Quinn criter.	17.27605	

The number of World Series appearances is always positive and significant as expected. Two variables are included to capture time elapsed from each player's period of professional activity, and career longevity: years elapsed from the beginning and end of the player's career. These variables broadly capture the relative age of the card as well. Years since the start of the player's career is negative and significant in 1982 and 1988, and negative but insignificant in 1983. Years since the start of the player's career was omitted from the 1984, 1985, 1993, 1999, and 2000 regressions because the Tobit model would not converge without removing one variable from the model. Statistically significant negative coefficients are surprising, and may be due to multicollinearity with player age and years since the end of the player's career.

Table 9: Tobit Model of Baseball Card Prices				
1999 Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-24163.55	3930.125	-6.148290	0.0000
BLK	1112.228	821.5341	1.353842	0.1758
HSP	1004.742	921.0848	1.090824	0.2754
BA	35945.08	14140.94	2.541916	0.0110
R	-3937.315	956.3839	-4.116877	0.0000
A99	368.5283	80.12773	4.599260	0.0000
D99	11184.69	2907.367	3.847017	0.0001
HOF99	2425.958	722.4471	3.357973	0.0008
WS99	1014.841	236.4284	4.292380	0.0000
E99	-511.8389	63.85813	-8.015250	0.0000
R-squared	0.990732	Mean dependent var	2177.083	
Adjusted R-squared	0.898056	S.D. dependent var	5631.749	
S.E. of regression	1798.142	Akaike info criterion	17.81578	
Sum squared resid	3233315.	Schwarz criterion	18.26028	
Log likelihood	-95.89468	Hannan-Quinn criter.	17.65121	

Years since the end of the player's career is negative and significant in 1982, 1984, 1985, 1993, 1998, and 2002, and statistically insignificant in 1983 and 1988. This means there is an aura effect which elevates the value of cards for players who have recently retired, and that as more years pass, card price declines, or at least grows less rapidly. Multicollinearity may also account for this outcome.

Table 10: Tobit Model of Baseball Card Prices				
2002 Data Cross Section				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-26918.56	9566.457	-2.813848	0.0049
BLK	1942.812	711.5880	2.730249	0.0063
HSP	1754.909	988.9637	1.774493	0.0760
BA	60821.88	9669.695	6.289948	0.0000
R	-2708.483	3498.638	-0.774153	0.4388
A02	168.1110	112.5893	1.493134	0.1354
D02	2308.123	3814.893	0.605030	0.5452
HOF02	3744.651	1170.177	3.200071	0.0014
WS02	1799.813	161.5804	11.13881	0.0000
E02	-345.4981	121.2549	-2.849354	0.0044
R-squared	0.985945	Mean dependent var	2004.583	
Adjusted R-squared	0.845395	S.D. dependent var	5060.267	
S.E. of regression	1989.689	Akaike info criterion	17.73438	
Sum squared resid	3958864.	Schwarz criterion	18.17887	
Log likelihood	-95.40626	Hannan-Quinn criter.	17.56981	

CONCLUSION

A conceptual framework to explain the demand for sports memorabilia was developed from the sports psychology and finance literatures, and used to construct a formal hedonic pricing model. This model was estimated on a sample of twelve baseball cards with prices observed in eight years over a twenty-year period. This model was estimated separately for each of the eight years and performed extremely well in explaining differences among baseball card prices. Race had a positive but diminishing effect on card price for black players. For the only Hispanic player, the effect of race was initially negative but became positive in the last year estimated. Race effects should not be taken as overturning the results of earlier researchers, as they may be due to small sample properties.

Batting average and player age have positive impacts on price, but surprisingly, rookie cards tend to be worth relatively less than non-rookie cards. A player's death generally increases the value of his cards, but in at least one year, 1982, the reverse was found to be the case. Hall of Fame status only began to have a significant and positive impact on card value starting in 1985; before that it was not significant. World Series appearances also add to the value of a player's cards. Career longevity, as measured by years since the start and end of a player's career gave ambiguous results, but results suggest that retirement adds to the value of a player's cards, though years since retirement detracts from card value. Years since the start of a player's career also detracts from card value, at least where that variable was included in the model.

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