Secondary Ticket Markets for Sport Events

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Abstract: Resale markets for sports tickets have gone through unprecedented changes in the past twenty years. Large online resale ticket marketplaces have dramatically reduced search costs. Consumers can browse through wide ranges of ticket inventories. This review defines secondary markets, explains why they exists and how they have evolved, and discusses the legislations that restrict resale. We then present sponsored resale marketplaces and review the literature on price determination in secondary markets with an interest on price dynamics.

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1. Introduction

Secondary resale markets have gone through unprecedented changes over the past twenty years. While resale used to be local and each deal was idiosyncratic, most transactions now take place one a few centralized marketplaces. The two main players, Stubhub and Ticketmaster, report steady growth.[2] Laws restricting resale have been repealed or are not enforced anymore. Many sport organizations now endorse resale and sponsor official secondary marketplaces. Some teams have even started to integrate the primary and secondary markets to offer fans a single place, where they can browse through large inventories of tickets, sold by the teams themselves, brokers or other fans.

Several factors have contributed to the growth of secondary markets. The creation of online ticket resale marketplaces has changed the way tickets are exchanged. Brokers and fans are better connected than they ever were. Brokers list their inventories on multiple platforms and tickets aggregators offer fans a place to browse for tickets from a wide variety of sources. Price transparency has increased. Scale economies in online marketplace have led to consolidation, centralization of inventories, reduced search costs and have ultimately brought convenience and value to fans. The introduction of electronic tickets has delivered the long-needed technology to fight fraud and counterfeit.

Online marketplaces have also brought to the table powerful players that leverage economies of scale to innovate, shape markets, and lobby governments, sometimes on behalf of fans, for less regulation and more freedom to exchange tickets. Stubhub, for example, pushes for resale deregulatatation, offers sellers tools to optimize prices, and engages in partnership with sport's leagues, individual teams and event organizers. At the same time, teams and leagues have changed the way they sell tickets in the primary market, adopting variable and dynamic pricing. Primary and secondary markets are evolving together. What happens in one market shapes the other. Some event organizers have even decided to integrate the primary market and the sponsored secondary market.

This paper focuses on the main developments that have taken place in secondary markets. We define secondary markets, explain why they exists has how they have evolved, and discuss the legislations that limit resale. We then discuss the emergence of sponsored resale marketplaces. Finally, we review the literature on price determination in secondary markets with an interest on price dynamics.

A few caveats are worth a mention. A significant fraction of the academic work on secondary markets studies the top four North American sports' leagues. While this is also the main focus of this paper, we acknowledge that this small subset of sport events excludes college athletics, most sports, and most countries... We also focus on a few key issues that we believe raise important and novel economic questions. This choice was necessary for the sake of coherence and consistence. We recognize that

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[2] Information about the economic significance of ticket resale in sports is scattered. The secondary markets for tickets for sports event was estimated to be around $6 billions in 2011 (Drayer et. al, 2014). Ticketmaster's parent company, Live Nation, reports in its financials (http://investors.livenationentertainment.com) that "In 2015, secondary ticketing continued to be a major focus, now operating in 13 countries and delivering 34% growth in GTV for the year to $1.2 billion". Forbes (2017) reports that "StubHub revenues were up 30% and 15% on a y-o-y basis through 2016 and in Q1'17 to $937 million and $204 million, respectively". Although these figures include non-sport events, what is clear is that ticket resale is growing at a fast pace.

many authors have contributed to the literature and we apologize up-front if this review leaves some important works out.

2. Primary and secondary markets

We define the primary and secondary markets and document the main changes that have taken place over the past twenty years.   We also discuss the legal environment that governs secondary markets and argue that it puts limited restrictions on resale. We postpone a discussion of sponsored resale marketplaces by teams and leagues till the next section.

a. The traditional and modern secondary resale markets

Table 1 presents the main characteristics of the primary and secondary markets and the changes that have taken place in ticketing practices. To capture the major changes in the way tickets are sold and resold over the past twenty years, the table introduces two stylized benchmarks: the 'traditional' model that characterizes ticketing prior to the advent of online marketplaces and the 'modern' model that accounts for online ticket sale and resale.

In the traditional model, the event organizer offers tickets for the seats that remain after accounting for season tickets, guest tickets and other holds. This is called the primary market. Fans can buy tickets from the box office, the team club or authorized ticketing agents (e.g. Ticketmaster). Traditionally, all tickets were released at the same time, typically a long time prior to the event date and at a fixed price, called face value which is printed on the ticket. The face value is often based on cost consideration (Shapiro et al., 2016) and does not respond to changes in game interest, local conditions, and other demand shifters that may happen till the game starts. The price of tickets would also vary little from season to season. The price paid in primary markets is the face value plus various fees depending on the distribution channel. Tickets bought in primary markets are non-refundable but transferrable.

Tickets are resold in secondary (or resale) markets. The prices in secondary markets is agreed by the buyer and seller, may vary from transaction to transaction, and do not have to match the ticket's face value. Buyers are fans and sellers are either fans, brokers or scalpers. Brokers are licenced, often have official brick-and-mortar offices and may form networks to offer a broad inventory of tickets for various events and in a wide range of seating sections. Scalpers are not licensed. They may sell tickets through classified ads or at the last minute around the stadium, possibly violating resale legislations.

With the advent of the Internet, resale moved online to generalist auction sites such as eBay or to specialized online marketplaces such as Stubhub. Brokers list their ticket inventory on multiple marketplaces and fans use ticket aggregators to browse through a wide variety of tickets. In the modern model, there are four main actors in the primary and secondary markets: teams, fans, brokers and online marketplaces. Online marketplaces help fans exchange tickets (fan-to-fan sale) or buy from brokers (broker-to-fan sale). Online marketplaces compete over user-friendly event maps, ticket selection, guarantees to the buyer that aim to reduce concerns over fraud and counterfeit, price setting options for the seller, and fees charged to the buyer and seller. Fees are around 25%, shared between the buyer and seller, and this does not include the shipping cost for paper tickets. The main Online ticket marketplaces are Stubhub (acquired by eBay), TicketExchange and TicketsNow (part of Ticketmaster), and RazorGator. Seatgeeks and TicketiQ are ticket aggregator. They report inventories from multiple sources and offer price forecasts and other services. With the advent of modern resale markets, price transparency has increased and search costs have decreased.

The notion of primary and secondary markets has become blurred since some event organizers have started to dynamically manage prices in the primary market. They manage prices and inventory in a similar way as some large resellers do in secondary markets. The notion of face value becomes vague. Some event organizers even bypass the primary market and sell tickets directly in the secondary market. In fact, Drayer (2011b) made the case to fully integrate the primary and secondary markets. The Philadelphia 76er were the first team to do so in 2016. Most tickets available for sale are displayed on the same online platform. Only the tickets of sellers who prefer to operate outside the sponsored resale marketplace are excluded. This greatly facilitates the search for the best seats and the best price.

Table 1: Changes in ticketing practices

	Traditional Ticketing Model		**Modern Ticketing Model**
	Primary	**Secondary**	
Sellers	Teams	Brokers, scalpers and fans	Teams sponsor secondary online marketplaces. Primary and secondary markets are getting integrated.
Buyers	Brokers and fans	Fans	
Intermediation	Ticket box office Team club Season ticket	Traditional methods such as classified ads… Most broker deal with local events	Online resale marketplaces and aggregators reduce search costs Teams sponsor resale marketplaces
Tickets	Printed ticket with face value Physically exchanged (handling and mailing costs)		Electronic paperless tickets can be transferred at no cost until the event starts
Regulation and ticket restrictions	Tickets are non-refundable and transferable Regulations restricting the resale of paper ticket are difficult to enforce		Resale restrictions are enforceable on sponsored sites
Price determination	Fixed in advance and often cost based. Prices varies little with seat location and game's specifics	Brokers price according to market conditions.	Teams incorporate information from secondary market sales to optimize primary market prices for current and future events and for season tickets

Other important changes have been facilitated by the introduction of electronic paperless tickets. Electronic paperless tickets can reduce fraud because the block chain of ticket ownership can be centrally recorded by the event organizer. It also allows teams to regain some control of the secondary markets because they hold a monopoly of the certification of ticket legitimacy. Most importantly, paperless tickets give team valuable information about who sells tickets, who attends the event, and how much the attendees are willing to pay. This information can be used to adjust the prices of season tickets, sell ancillary goods, and better dynamically price each seat for each game.

b. Why do secondary markets exist?

A fan is a person who intends to attend the event and a broker a person who does not intend to attend, keeping in mind that the distinction is not always clear-cut especially in the case of season ticket holders. Ultimately, the secondary market exists because fans sometimes want to (a) buy tickets that are not available in the primary market or (b) sell tickets that they do not want to use anymore.

To start, people's plans change. Many fans need to book in advance to make travel and accommodation arrangements. They have to resale their tickets when something comes up that prevents them from attending. Using a large dataset from 56 rock concerts Leslie and Sorensen find that "46% of the resale transactions in our data were sold by non-brokers (i.e. consumers)." Other consumers find out only at the last minute that they want to attend the event. Courty (2003b) calls these consumers the 'busy professionals'. They find out only at the last minute whether they will attend the event.

Another source of resale is season ticket holders. Season ticket holders buy a subscription for the entire, or for part of, the season, and may not want to attend all the games, or cannot attend specific games. They use the secondary market to resell the tickets for the games they do not attend. Most teams do not disclose information about season ticket sales but there is no question that season tickets account for a large fraction of total attendance, if not the majority of ticket sales for many teams. For example, season ticket sales contribute for about 50 percent of total NBA tickets.[3]

Another reason for secondary markets is that matching frictions in the primary market prevent an efficient allocation. Seats are highly differentiated products and consumers have preferences over various seating options. Moreover, some fans come in groups and they want to seat together. Large groups pre-order blocks of seats and may not end up using all the seats. As mentioned earlier, a large fraction of tickets are owned by season ticket holders who may choose to stay home if someone offers a high price for their ticket. Some fans may not find their preferred seating section in the primary market. They may still buy their second choice option and use the secondary market to upgrade to their desired section. The point is that the efficient matching of supply and demand may take iterations and the secondary market helps achieving this goal. Secondary markets correct imperfection in the initial primary market allocation.

Finally, secondary resale markets cannot be understood outside the context of what teams do in the primary market. Secondary markets exist because event organizers can mis-price, or sometimes do systematically under-price, tickets in the primary market. It may be that the event organizer makes pricing mistake or that prices are not flexible enough to capture all differences across seats. The MBL, for example, offers about 100 million seats each season for different games, in different stadium, and different locations. It would be amazing that each seat was optimally priced in the primary market with no scope for arbitrage. In practice, the overall level of price may be too low, there may be too few

[3] The NBA reports selling 295K season tickets in 2015 which would represent about 55 percent of total tickets sold. http://www.sportsbusinessdaily.com/Journal/Issues/2015/10/26/Leagues-and-Governing-Bodies/NBA-tickets.aspx. Team specific evidence from the other three major sports league suggest that season tickets represent half or more of total ticket sales.

seating sections leaving the best seats in some sections grossly underpriced, or the price differences across seating sections may not capture the actual differences in seating experience.

There is also some evidence that sport leagues price in the inelastic part of the demand and the most profitable league in North America are no exception (Fort 2004, Diehl et al. 2015). Drayer et al. (2012) argue that 'the sport industry has traditionally underpriced tickets using a cost-based approach in order to maximize attendance and promote fan satisfaction.' This is known as the inelastic ticket pricing hypothesis. There is no doubt that tickets for some events such as the Superbowl are systematically under-priced (Krueger, 2001). Underpricing may be due to cost-based pricing, fairness concerns putting constraint on profit seeking, brand building, or lack of seller sophistication. For example, Rishe et al. (2014) show that it is difficult for the National Collegiate Athletic Association to predict demand for the 'March Madness' basketball tournament because there are multiple event locations and qualifying teams are not known till 5-6 days prior to the event. Xu et al. (2016) shows that dynamic pricing could increase revenue by 15 percent for a given MLB franchise.

It is also true that the pricing of tickets in the primary market has changed dramatically. The MLB has initiated the main changes in pricing amongst the major leagues. Variable pricing, which sets price for each game as a function of day of the week and opponent, was introduced in the MLB in 1999. Dynamic pricing, which changes prices for a given game from day to day, was also introduced in the MLB about ten years later. But other leagues were quick to follow up. Courty (2015) reports that most teams in all four leagues use variable pricing and a large number of teams use dynamic pricing.

Brokers offer liquidity to the fans who do not want to use their ticket, to those who could not find the seat they wanted in the primary market, and to those who want to change seating section. Brokers offer ticket inventory over a wide range of seats. Some brokers also bundle tickets with travel hospitality packages.

Sweeting (2012) reports that 88 percent of the sellers on eBay sold a single ticket and concludes that "many sellers are season tickets holders who do not want to attend all 81 home games." Sweeting and Sweeney (2015) study resale transaction for a specific MLB franchise. They show that most buyers only buy once and the few buyers who make multiple purchases do so in adjacent rows. This suggests that most buyers are fans. This is not the case for sellers. They have one large broker who accounts for 31.5 percent of all transactions. Two other sellers account for 3-6 percent of transactions and they also observe hundreds of 'small' sellers.

c. Resale laws and resale restrictions

Resale may be restricted by laws and by specific restrictions included by the event organizer. Broadly speaking, resale laws try to prevent intermediaries from capturing surplus that was meant for fans in the first place, prevent fraud and counterfeit tickets and reduce harassment of fans by street scalpers. Moreover, a ticket is a revocable license and the seller can in principle print restrictions that limit resale and transferability. Thus, resale depends on resale laws, and also on courts' decision, through the enforcement of resale restrictions. Such restrictions have been challenged on the ground of being unfair or unreasonable (Moore, 2009).

No US federal law restricts the resale of event tickets.[4] Resale legislations are issued by States legislatures or through local ordinances and have been in place since New York introduced an anti-scalping statue in 1922. In practice, there is much variation in resale laws in terms of the event covered (sports, arts, concerts…), where the trade takes place (classified ads, online, physical exchange close to the venue…), the premium charged relative to face value, the identity of the seller (broker and fans may be treated differently), how long prior the event the ticket is resold, and whether approval from the primary seller is required. Seatgeek.com listw the resale law and statute by US states and classify resale laws into three broad categories: prohibition of resale for profit, regulated resale and permitted resale. Regulation can be strict if resellers have to be licenced, accountable, and prices are constrained. It is weak if it restricts, for example, only resale at the event site a few hours before the game starts. According to Wikipedia, 38 of the U.S. states have laws allowing the reselling of event tickets as long as the sale does not take place at the event site. The other 12 states have varying degrees of regulation, including broker licensing and maximum markups. Resale laws have strong opponents. The economic argument against such legislations is that ticket resale increases welfare and corrects the inefficiencies created by event organizers who do not price each seat at its market value (Happel and Jennings, 1995).

Teams, leagues and secondary resale platforms lobby lawmakers and law enforcement agencies to design the secondary market that suits them (The Toronto Star, March 31 2017). The advent of electronic tickets and sponsored resale websites has greatly expanded teams' ability to influence resale. Teams may restrict resale to only some ticket categories (e.g. exclude season tickets) or may require that resale takes place through the sponsored exchange. For example, the Yankees tried in 2006 to revoke the season ticket subscriptions of fans who sold unused tickets on secondary websites. In 2015, the Golden State Warriors also threaten to cancel fan's subscription if they would not use the official Ticketmaster secondary ticket exchange. Punishing fans from not using the sponsored website is controversial.

Elfenbein (2006) estimates the impact of state resale laws on eBay transaction of NFL tickets between 2002 and 2005. He notes that state laws may not be binding in the age of Internet commerce because it applies only to within-state transactions. Only Federal laws can regulate interstate commerce and there are no Federal law about resale. Moreover, he argues that state laws are rarely enforced for online transactions. Despite this, he finds that resale laws reduce online transactions, increase markups and the chance of inter-state transactions. However, he also finds that prices and quantities in regulated states became more similar to those in unregulated ones over the period he studied.

Drayer (2011a) and Moore (2009) question the relevance of anti-scalping laws in the modern age of online ticket marketplaces. They conclude that laws remain despite being mostly obsolete and not accomplishing the stated goal of protecting consumers. Moore notes that resale laws are not being enforced because resale markets for sports tickets have gained acceptance and teams and leagues are

[4] The Better Online Ticket Sales (BOTS) Act of 2016 makes it illegal to use software, or (ro)bots, to purchase tickets or to resale tickets that were bought by bots. https://www.congress.gov/bill/114th-congress/senate-bill/3183 The law aims to protect fans and increase ticket availability for events that are significantly under-priced. This happens for some sports events but it is not as common in sports as it is for concert.

now active participants in online ticket marketplaces, making ticket resale a mainstream and legitimate practice.

To sum up, resale laws help prevent fraud and counterfeit. But price caps have not been very effective at dealing with the issue of resale for profits, which is less controversial in sport than for other events, and this is especially the case in recent years with the advent of sponsored resale marketplaces. That being said, courts play a key role in influencing what happens in resale markets, through the enforcement of ticket restrictions placed by event organizers. The real issue for modern resale is whether the court will enforce restrictions that limit ticket transferability and/or resale prices.

3. Sponsored resale marketplaces

After years of battling resale for profits, the sports' industry has largely changed its position. It followed the proverbial advice, "*If you can't beat 'em, then join 'em",* and now embrace resale. Take the case of the NLF: "For years, the NFL did whatever it could to combat scalping, routinely pressing police for arrests and scouring classifieds for brokers scalping season tickets. Team owners demonized ticket brokers as greedy, unscrupulous predators." (The Washington Post, December 20 2009, J. Grimaldi.) This is not the case anymore. In 2017, all NFL teams sponsored a resale marketplace. This new development started in 1999 with baseball when the San Francisco Giants partnered with Tickets.com to create "Double Play Ticket Window". The first sponsored resale marketplace was born. The Giants would collect ten percent from each transaction that took place on the sponsored marketplace. Ten years later, all four major leagues and most teams have sponsored resale marketplace.

Sponsored resale marketplaces aim to offer fans a frictionless experience to exchange tickets till the last minute. The agreement can be negotiated by the league, in which case teams can opt in or out, or by teams directly. An agreement typically includes a fixed guarantee from the sponsored marketplace to the team or league, an agreement to share price data back to teams, cross advertising and an exclusive certification of ticket authenticity. The sponsored marketplace may offer seller various pricing options (fixed price, decreasing price with daily increments, or market price matching current transactions) and may also set price floors and ceilings agreed with teams.

Figure 1 illustrates the adoption of sponsored secondary marketplace for the four main U.S. sports leagues. (See the Appendix for detailed team and league adoption timelines.) Each curve plots the fraction of teams in the league that have a sponsored marketplace.[5] The grey bars represent league wide deals: MLB and the NBA signed with StubHub and Ticketmaster respectively in 2007, the NHL and the NFL signed with Ticketmaster in 2008. The leagues all extended their deals in 2012, except the NHL, which did so in 2013.[6]

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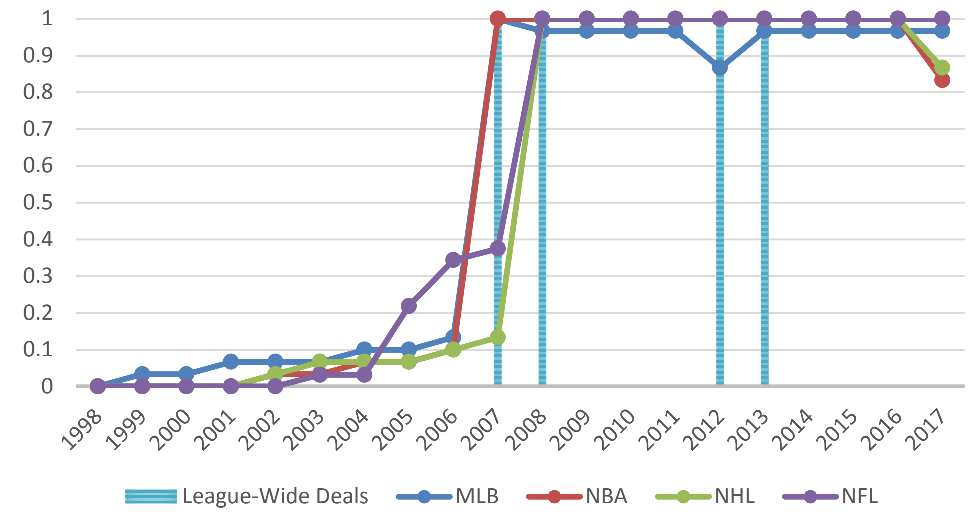
[5] The 2017 data was obtained by researching each team's website. When a league agreement is made, it is assumed that all teams agreed to it unless information was found that they opted out.

[6] The Las Vegas Golden Knights were excluded from the NHL analysis, as they officially entered the league while this article was being written.

Figure 1: Fraction of teams with a sponsored secondary ticket marketplace



Sponsorship agreements are typically exclusive. The event organizer offers the exclusive right to keep track of the chain of ownership which is the only effective measure against counterfeit and fraud. The advent of sponsored secondary markets is in part a response to buyers' fears of purchase fraudulent tickets. Teams receive a share of the profits from the resale transactions that take place on sponsored marketplaces. Financial figures are rarely made public but there are exceptions. For example, it was reported that the Redskin's received $5m from their 2006 deal with Stubhub. The MLB received a $250 million split of revenue for its sponsorship with StubHub in 2007. Ticketmaster agreed to pay $100 million to create the official NFL resale website.

Sponsored secondary markets serve several economic purposes. Fans want a place where they can search for non-fraudulent tickets. With sponsored marketplaces, fans get legitimate tickets with guaranteed access to the seat. Second, it reduces search costs. Fan value the ability to view large ticket inventories with multiple sections and seating options. For example, the NBA made in 2012 a deal with Ticketmaster to offer teams the option to present both primary and secondary ticket inventories next to one another. Third, teams have access to secondary markets resale data. This information is used to better predict demand and adjust prices in real time in response to demand shocks revealed by secondary market prices. Data analytics also tell teams when season ticket holders attend games and when they resale. They can better target potential buyers of season tickets, enhance relationship with sponsors and improve consumer analytics for the sale of merchandizing.

a. Empirical analysis of sponsored marketplace

With sponsored resale marketplaces, teams can better manage the pricing of season and game tickets. They find out information about the value of each seat in the stadium and can use secondary market information to dynamically price game tickets in the primary market. Zhu (2014) estimates a structural model of demand with data from a MLB franchise in season 2011. He shows that the franchise could increase profits by about 7 percent by changing prices dynamically to compete with the secondary market. Shapiro and Drayer (2012) show that primary ticket prices increased after the introduction of dynamic pricing by the San Francisco Giants but remained below the level of prices in the secondary market.

Watanabe et al. (2013) study the impact of the 2007 Stubhub agreement to become the official online seller of second hand tickets on price dispersion in the primary market. Price dispersion is measured by the number of price levels offered each season and the differences amongst levels. They find that the Stubhub agreement had a significant impact on price dispersion. They argue that the increased price dispersion is due to a better understanding of fan demand and a more extensive used of variable pricing.

b. Fairness and legitimacy

Resale markets have traditionally been perceived as fraudulent schemes to take surplus away from fans. Teams have tried to reduce the negative image of secondary markets by following two legitimacy strategies: lobby for the deregulation of anti-scalping laws and enter strategic partnership with secondary marketplaces. Drayer et al. (2014) documents how StubHub has built partnerships with event organizers and has lobbied governments to terminate anti-scalping regulation. They study the impact of these legitimizing strategies on the volume of tickets exchanged and the traded prices and find an impact on the former.

An important concern with the sponsoring of secondary marketplaces is that it may reduce brand loyalty, antagonize consumers, and discourage fans from buying season tickets. This is related to the old idea in macroeconomics that consumers can be antagonized by demand based pricing (Kahneman et al. 1986 and Blinder et al. 1998). Courty and Pagliero (2013) present evidence that some artists for popular music do not vary prices in response to demand. They argue that the systematic transfer of surplus to consumers is consistent with fairness concerns. There is some evidence that teams as well leave surplus on the table (recall the discussion of the inelastic pricing hypothesis from Section 2.b). But the common use of demand based pricing in sports (Courty, 2015) indicates that such concerns are not overarching.

Shapiro et al. (2016) study the impact of moving from cost-based pricing to demand based pricing on consumer fairness perceptions. As much of the price fairness literature in economics, they follow a survey approach but ask questions that are specific to sport events. Consumers perceive the primary market as fairer than the secondary market. Familiarity with demand based pricing increases consumer fairness perception. It has also been found that sponsored resale platforms can increase consumer acceptability of secondary markets. This explains the recent endorsement of the secondary market by teams and league and the emphasis on price transparency and consumer protection.

c. Design issues

As mentioned above, the event organizer has exclusive control over the certification of ticket legitimacy. This entitles sponsored resale marketplace with a competitive advantage over non-sponsored ones. That being said, this advantage is limited because tickets holders can always trade in non-sponsored marketplaces. Some event organizers have tried to use paperless tickets in order to restrict resale to the sponsored marketplace, by requiring credit card or identification for admission, but such actions have been challenged in court.

This raises a broader set of questions: (a) Should the event organizer promote or deter resale markets? (b) Should the event organizer control prices in the secondary markets? For example, the Yankees and Angels have had a price floor and the Broncos have required resale to be at face value. (c) Should the event organizer restrict resale in sponsored marketplaces? Some teams have tried to prevent season ticket holder to resale. (d) What is the optimal fee per transaction to charge the buyer and seller?

Several models have shown that the seller's attitude toward resale is mixed. In Courty's analysis (2003a), consumers are uncertain about their valuation ahead of the game. The event organizer can charge fans their expected value by releasing tickets early. But this strategy works only if resale is not allowed. In this analysis, the decision to allow resale is closely linked to the timing for ticket release. Karp and Perloff (2005) reaches the same conclusion that the monopolist's attitude toward is resale is mixed. In their model, resellers can price discriminate while the primary seller cannot but there are transaction costs associated with resale.

Cui et al (2014) consider a monopolist who sells to consumers who learn new information about their valuation close to the event date. The monopolist uses multi-period pricing and can also sell ticket options. A fan who buys a ticket option (which is non-transferable) can purchase the ticket for an additional fee later. If she choose not to do so, she loses only the value of the option. Resale always dominate no-resale. The reason is that resale achieves a more efficient allocation. Selling 'buying options' does even better. This is because there is a transaction cost associated with secondary markets. The only use of ticket option we are aware of is by the Baltimore Ravens.[7]

4. Price dynamics in secondary markets

A ticket can be resold till the event date after which it is worthless. Price dynamics describes how prices change from the time tickets are issued in the primary market up to the event date. Understanding secondary markets price dynamic is not easy. A given market has many independent sellers with possibly some dominant brokers who hold multiple listings (Sweeting and Sweeney, 2015). Each seller manages a perishable inventory, has to make inter-temporal trade-offs, while dealing with strategic consumers, demand uncertainty, and competing against other sellers. The environment is non-stationary because tickets are perishable. Finally, resale may entail important transaction costs due to imperfect information, imperfect certification and costly search.[8]

On the empirical front, the good news is that sports data is widely available and of high quality. The empirical literature has produced some insightful descriptive analyses. That being said, many important economic questions are beyond the reach of empirical work: What is the social benefit of secondary markets? Do sponsored ticket marketplaces benefit teams and fans? The empirical challenge is that the existence of secondary markets, and level of activity in these markets, is largely endogenous. It depends on a team's pricing decisions in the primary market (e.g. ticket split between season and regular), its choice of sponsorship deal, whether it dynamically manage prices in the primary market, and so on...

[7] The Daily Record, April 4 2010, 'Reserving Baltimore Ravens tickets early, for a price.'

[8] Leslie and Sorensen (2013) document search frictions due to inefficient allocations and transaction costs in the context of concert tickets.

a. Theory

The large literature on dynamic pricing is largely influenced by the airline revenue management problem. Most models make simplistic assumptions about demand (Talluri and van Ryzin, 2005, McAfee and Velde, 2006). Consumers are largely myopic and passive: they arrive randomly and do not anticipate future prices. Such simplicity is necessary to manage the complexity inherent with the inter-temporal trade-offs associated with the allocation of a fixed and perishable capacity. The literature assumes that tickets are non-transferable, leaving no room for secondary markets, and explains how prices change over time when a seller manages a fixed and perishable inventory. In these models, the price changes both as a function of inventory and time remaining.

Deneckere and Peck (2012) present a competitive equilibrium model of price dynamic with aggregate demand uncertainty. The approach is general and captures the main feature of sports secondary markets: competition, sequential arrival of strategic consumers, fixed capacity, and perishable good. The price in their model increases within trading period and then fall. The lowest price in each period follows a martingale and in expectation the 'law of one price' holds. As we will see, this prediction is at odd with much of the evidence from sports events showing that prices often decrease close to the event date.

Sweeting (2012) introduce the option value of inventory when sellers own a single ticket. A broker sets p_t to maximizes the following value function

$$V_t = Max_{pt}[p_t q_t + (1-q_t) E_t V_{t+1}]$$

where $q_t = q_t(p_t)$ is the probability to sell when the price is p_t. Sweeting reviews the revenue management literature and argues that the price path over time depends on the seller's opportunity cost of postponing a sale, $E_t V_{t+1}$, which is the expected value of keeping the ticket. He shows that under fairly general assumption, the expected value of a ticket falls over time; a prediction that is supported by his data. If consumers are drawn from a time invariant distribution and do not strategically postpone purchase, the option value does not change with remaining time to event and the seller's price decrease because the option value of waiting vanishes once the event starts. He shows that these conditions hold and concludes that a simple dynamic pricing model can explain the large observed price decrease in the last month prior to the event date in MLB. Moreover, he shows that dynamic pricing increases revenue by about 16 percent.

Sweeting and Sweeney (2015) extends the analysis to the case where there is a dominant seller (a broker with a large ticket inventory) in the secondary market. They are interested in studying a specific feature of tickets markets (and other markets for that matter): prices are not set simultaneously as is assumed in many industrial organization models. A seller who changes her price assumes instead that other sellers are not also changing their prices, although they may respond quickly to any price change. They show that `staggered' price setting can generate a rich set of price dynamics.

Sweeting's data from MLB suggest that consumers do not strategically delay purchase. This is strange because prices typically decrease by significant amounts. Many consumers could benefit from postponing purchase. Others have shown in the airline context that some consumers are strategic and understand the benefit of waiting. According to Li et al. (2014), about 19 percent of airline travellers strategically delay purchase. Dwyer et al. (2013) show that NHL fans are aware of the existence of price dynamics. Circumstantial evidence also suggests that some consumers spend time searching for tickets. Search aggregators such as seatgeek.com offer price forecasts and advices to buy tickets at the right price.

b. Empirical studies

The main robust finding from empirical studies is that secondary markets prices decrease on average toward the event date. Sweeting (2012) uses MLB data from eBay and StubHub on ticket resold by fans and brokers. He reports that prices decrease by 40 percent as the event approaches. There is also evidence that prices decrease toward game day for events that are sold out. Harrington and Treber (2014) study resale prices for the 2013 Super Bowl. They show that prices tend to decrease in the last few days prior to the event. They also argue that there is a benefit from search because there is much variation in the posted prices.

Sweeting and Sweeney (2015) study a MLB resale market where there is a large brokers who accounts for about 30 percent of all transactions. They show that sellers tend to cut price as the fixture approach, that the dominant broker tends to cut price more dramatically than others and that this influences the prices of other sellers. They conclude that the dominant broker can 'move the market'.

There is much evidence in support of the inelastic ticket pricing hypothesis in primary markets. In secondary markets, however, price elasticities are much higher. See Sweeting (2012) for evidence from NLB and Diehl et al. (2015) for evidence from NFL where secondary prices are being sold on average at 34 percent above face value.

Shapiro and Drayer (2012) study the introduction of dynamic pricing by the San Francisco Giants in the 2010 season. Prices in the secondary market are always higher than in the primary market. They report that the average season ticket was $31, the average price under dynamic pricing was $45 and the average price in the secondary market was $64. Moreover, the average price is higher in the secondary market relative to the primary market independently of the time to game. Prices in the secondary market decrease as the game day approaches. Long before the game day, prices may increase or decrease.

5. Conclusion

Resale markets for sports tickets have been thriving in the past twenty years. Resale is not anymore about frowned-upon greedy scalpers grabbing undeserved profits and feeding off fans and event organizers. Resale has become mainstream in most sports. It is endorsed by event organizers. The emergence of large resale marketplaces has greatly reduced search costs and also made the price determination process more efficient. Fans can access large ticket inventories in one click. Resale markets provide liquidity for fans who change their mind and help teams price tickets in the primary market. Moreover, sponsored marketplaces deliver unique data on who attend a game, when a season ticket holder resale her ticket, and on the value of particular seats and specific events. This information is used to price tickets, sell merchandizing and negotiate deals with sponsors.

The growth of resale markets raises new economic questions. Teams and leagues have regained significant control over secondary markets because they hold a monopoly over the certification of ticket authenticity. Many event organizers have asserted this power by renegotiating the terms of exclusive sponsorship. Some teams have tried to leverage their market power by imposing resale restrictions such as price floors and caps and excluding season tickets from the secondary market. But fans and competing resale platforms have challenged such restrictions. The enforcement of these restrictions is controversial and raises interesting welfare issues for economists.

The research on ticket pricing in secondary markets is in its infancy. With the progressive integration of primary and secondary markets, the quality of transaction data available to researchers is constantly improving. The key stylized fact from existing studies is that ticket prices tend to decrease close to the event date. Will this still be the case when more fans understand the opportunities available close to the event date? More generally, sports resale markets offers a unique laboratory to study competition in perishable good markets. The event organizer competes with brokers that have various levels of inventories and fans who often resell a single ticket. Each resale market for each team within a league can be analysed independently. It has its own dedicated set of brokers, giving it a distinct market structure, and more often than not, its own sponsored marketplace. The trading of a team’s tickets, season after season, offers a unique source of resale data to study price dynamics in perishable good markets.

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7. Appendix: Sponsorship adoption timelines

MLB

1999	San Francisco Giants partner with Tickets.com to create "Double Play Ticket Window"
2004	Los Angeles Angels of Anaheim sign with Ticketmaster to create their own tickets exchange
2006	Pittsburgh Pirates have a sponsorship deal with Razorgator but tickets.com is their official reseller
2007	Boston Red Sox sign with Ace Ticket
2007	MLB signs deal with stubub
2008	Boston Red sox opt out of StubHub deal
2012	MLB extends deal with StubHub for another 5 years
2012	New York Yankees, Los Angeles Angels of Anaheim, and Chicago Cubs opt-out of StubHub deal
2013	Los Angeles Angels of Anaheim re-sign with Ticketmaster to create their own tickets exchange
2013	New York Yankees sign with Ticketmaster
2016	Boston Red sox opt out of StubHub deal
2016	New York Yankees resign with StubHub
2017	Toronto Blue Jays sign with StubHub
2017	Los Angeles Angels of Anaheim sign with StubHub

NFL

2003	New York Giants sign with Tickmaster to create Ticketmaster's TeamExchange Service
2005	Indianapolis Colts sign with StubHub
2005	Houston Texans sign with StubHub
2005	San Diego Chargers sign with StubHub
2005	Chicago Bears sign with StubHub
2005	Detroit Lions sign with StubHub
2005	Atlanta Falcons sign with StubHub
2006	Washington Redskins sign with StubHub
2006	Denver Broncos sign with Ticketmaster to create "Broncos TicketExchange"
2006	Baltimore Ravens sign with Ticketsnow
2006	Cincinnati Bengals sign with StubHub
2007	Pittsburgh Steelers sign with Ticketmaster to create "Steelers Ticket Exchange"
2008	NFL partners with TicketMaster to create The NFL Ticket Exchange
2012	NFL and Ticketmaster sign a five-year extension deal of their NFL Ticket Exchange partnership

NHL

2002	Columbus Blue Jackets begin using Ticketmasters exchange
2003	Vancouver Canucks sign with Ticketmaster to create 'Prime Seat Club'
2006	Toronto Maple Leafs create a Ticket Exchange with Ticketmaster
2008	Pittsburgh Penguins sign with Tickmaster to create their own exchange
2008	NHL signs with Ticketmaster

2009	Florida Panthers and New Jersy Nets (NBA) create a ticket swap program
2010	Ottawa Senators create their own exchange, Capitaltickets.ca
2010	Ottawa Senators sign with Ticketmaster
2012	Philadelphia Flyers sign with StubHub
2013	Ottawa Senators sign with StubHub
2013	Montreal Canadiens add 'Ticket Vault' to their website for reselling
2013	NHL resigns with Ticketmaster

NBA

2002	New York Knicks create their own Ticket Exchange
2004	Los Angeles Lakers create their own ticket exchange
2006	New Jersey Nets sign with StubHub
2006	Washington Wizards sign with StubHub
2006	Cleveland Cavaliers' owner buys Flash Seats for their secondary market
2007	NBA signs with Ticketmaster
2009	Florida Panthers (NHL) and New Jersey Nets create a ticket swap program
2012	Ticketmaster signs with Barclays Center and therefore indirectly with Brooklyn Nets
2012	Golden State Warriors sign with Ticketmaster
2012	Oklahoma City Thunder sign with Ticketsnow
2012	NBA signs with Ticketmaster
2015	Minnesota Timberwolves sign with Flash Seats
2016	Philadelphia 76ers sign with StubHub