THE SHOW MUST GO ON

AN ANALYSIS OF THE IMPACTS OF DYNAMIC PRICING REGIMES IN THE LIVE MUSIC INDUSTRY

by

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Abstract

The music industry has seen a recent explosion in ticket prices to see particularly popular acts. Some of these acts have utilized dynamic ticket pricing models, which seek to return rents to the artist rather than the secondary market. A subgroup of these sufficiently popular artists has instituted a novel dynamic pricing system that engages in price competition with the secondary market. The benefits of this addition may partially accrue to the consumer, as competition impacts prices. My research documents and analyzes the effects of this additional competitive mechanism. First, I set forth a two-period sequential framework that describes the mechanism. Then, using an Ordinary Least Squares regression, I find that the firm can set higher prices than scalpers do in the resale market in the secondary period. I also identify what I call a "second mover advantage" gained by the firm. Finally, I find the pricing regime results in the best possible Pareto allocation within the set of feasible options. If correct, the analysis illuminates the effects of dynamic pricing in the music industry.

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1 Introduction

The music industry, over the last decade, has been swept by a modernization of its ticket pricing conventions. What was seen by many as systematic underpricing and overly simple approaches has been quickly replaced by sophisticated ones such as auctions, lotteries, and most importantly for the scope of this paper, dynamic pricing models. Dynamic pricing models tend to be implemented in the case of rigid utilization deadlines (and limited capacity); they seek to adaptively set ticket prices based on demand for varying levels of ticket quality. This is purported to quell rent seeking activity in the secondary market and return rents to the collective "firm", which henceforth in this paper will be understood as primary price-setting entities, primarily the artist, or agents that act on behalf of the artist. The exact pricing methodology adopted by primary price-setting entities is still concealed. Some, like Ticketmaster, have turned to the tracking of website traffic and other related metadata during ticket on-sales, allowing it to price tickets in real time based on how many fans select certain tickets of different qualities. If done perfectly, this method would be a highly effective (if not perfect) price revelation tool. However, these types of methods may come with high associated costs upfront.

So, as is the case in this paper, some artists have turned to another mechanism. I was granted data from one concert played by a highly popular group.[1] The tenets of this approach will be developed in the theoretical aspect of this paper, but the price setting rule adopted by the firm essentially uses the secondary market as a heuristic for effective price revelation, with the firm engaging in price competition with the secondary market particularly for high quality seats. The goal of this paper is to establish a theoretical framework for this novel form of dynamic pricing and then empirically test how predictions from the model hold. I assess how the implementation of such a rule affects the distribution of revenues, markups and profits between the primary and secondary market entities. I find that the firm successfully competed with scalpers on the secondary market and that its pricing rule is the only way it can directly sell to consumers of high willingness to pay.

2 Literature Review

There is a well-established body of literature on ticket pricing and scalping within the music industry; however, there is little work done into pricing regimes that deviate from the industry conventions. Chen and Jeziorski (2023) find that dynamic pricing in the airline industry may

[1] For the purposes of confidentiality, I have agreed to not disclose the name of this group, the location of the concert, or any defining characteristics. That being said, I can confirm this contact is within the industry and credible.

simultaneously benefit the consumer and the airline, resulting in a Pareto improvement brought out by the pricing rule itself. A similar resolution is thought to be possible in my setting.

Furthermore, there is general agreement that tickets are systematically underpriced for artists that face sufficiently high demand. Courty and Pagliero (2014) acknowledge this and reconcile it by suggesting that artists are not simply profit-maximizing entities, and that perhaps within their objective function is a preference to not price out a subgroup of loyal fans.

Work done by Leslie and Sorensen (2014) builds a practical consumer decision model in the face of ticket scalping, which helps to motivate the model I later build out. They find that the existence of scalping markets may lead to cases in which opportunistic agents seek to buy underpriced tickets, leading to welfare losses for consumers that (1) do not wish to compete to buy tickets when the originally go on sale and (2) do not wish to pay a premium to those who compete in the on-sale for the sole purpose of future rent-seeking. However, the existence of the secondary market in this case may play a beneficial allocative role.

Furthermore, Courty and Pagliero (2012) explore the effects of varying levels of price discrimination within the music industry. They find that the more price points, and thus price discrimination, that exist for a given concert, the higher the levels of revenue. Contributing to this effect is better ticket-consumer pairing. Similarly, they confirm that this effect is most evident in markets with higher levels of demand heterogeneity. This type of demand is also explored by Hendel and Lizzeri (1999), in which they find that consumers with heterogenous valuations for quality could benefit from the allocative role that secondary markets play. This could likely be extended to the music industry.

The consensus with regards to the music industry is that, for particularly popular acts, there is systematic underpricing. This means that tickets sell out immediately at on-sale and then robust secondary markets form in which realized prices tend to be far higher than face value; This implies that a certain proportion of consumers were willing to pay far more than the prices offered at on-sale, representing an inefficiency in pricing efforts by the primary price-setting agent. However, due to the relative recency of modern dynamic pricing models and the industry secrecy around them, there is little analysis done on them so far.

3 Pricing Mechanism

This section will establish the specific pricing mechanism utilized by the firm. First, we take it as a given that the firm will have a particular concert on a particular date. That is- for the intent and purposes of this paper, the decision of whether the firm should change the timing or location aspects of the concert is of no concern.

This established, the exact pricing mechanism that the firm instituted is as follows. First, the firm has a fixed number of tickets *K* to price and sell.[2] It has the option to price the tickets by the industry convention (which is established as systematically underpriced) and subsequently sell these tickets at on-sale or withhold any portion of these tickets. [3] The portion of *K* which will be known as $s \, \varepsilon \, [0,1]$ of tickets that is withheld then is priced based on the secondary market, which it, most often, directly undercuts. For tickets of varying qualities, the firm observes how the secondary market is pricing them, then the firm has the decision of whether to "release" some portion of withheld tickets to the market. When it does so, the firm undercuts the current market rate for tickets of that quality. Alternatively, the firm will release a portion of tickets from *sK* to experimentally price above the secondary market to probe whether consumers would still transact at that price. The process is streamlined below.

(1) On-Sale: Firm prices and sells $(1 - s)K$ tickets at on-sale at conventional prices p_g^o, simultaneously withholds *sK* tickets across various quality levels, prioritizing highest quality seats among the withheld tickets[4]
(2) Firm observes prices revealed by the secondary market
    a. Firm releases tickets from *sK* and engages in Bertrand competition with the secondary market; the firm sets an arbitrary upper bound for prices set via this mechanism to four times face value;
    b. Firm retains any remainder of *sK* and allows secondary market to proceed
(3) Rarely (but possibly) the firm will release some portion of the remaining tickets in *sK* in an experimental effort to understand how the secondary market will respond as well as whether consumers will buy at this price. This behavior deviates from the core mechanics of the mechanism but is observed in the data

This process occurs up until the date of the show, with the firm attempting to "time" ticket release such that it sells out of *sK* tickets immediately before the show takes place, with the rate of those sales being close to continuous on the given time interval from the firm's perspective. One assumption of Leslie and

[2] The capacity for this concert was 19,000.
[3] Tickets sold at on-sale will, by definition, instantly sell out. See section 4.
[4] *s* represents the portion of withheld tickets. *K* is total ticket quantity, and p_g^o are on-sale price levels for tickets of varying qualities

Sorensen (2014) is that most transactions in the secondary market happen in close proximity to the date of the event. The firm's pricing mechanism is distinct in the sense that tickets are dispensed uniformly.

4 Assumption of Excess Demand

Throughout the theoretical and empirical portion of this paper, it will be assumed that the firm faces "excess demand" for tickets offered for this specific concert. The purpose of this section is to briefly clarify and justify this assumption. The firm has ticket capacity of K, which in this case is exactly 19,000. For all recent occurrences of this event, tickets have immediately sold out at on-sale and the secondary market has formed, with almost all sales occurring on it being high above face value. More recently, as the firm has instituted the dynamic pricing rule described above, tickets sold at on-sale are still priced conventionally, however the secondary market has still operated, albeit to a smaller extent. These circumstances all combine to suggest that there are more consumers M that wish to buy tickets, than total tickets available at on-sale prices, or $M > K$.[5] It is later shown how quality factors into this consideration.

5 Model

I consider a sequential two-period model in describing equilibrium behavior in the primary and secondary market. Assumptions based around timing in the model are critical. There are two periods in the model. The first period is on-sale, while the second period is the window in which the firm institutes the pricing rule outlined above. First, due to excess demand and systematic (industry convention) underpricing, all tickets immediately sell out at on-sale. This is true such that with a total of M consumers in the market (including all consumer types), with a total ticket capacity of $(1-s)K$ in the first period, consumers of all types have a probability of $L = \frac{(1-s)K}{M}$ of being selected via lottery in the first round to purchase tickets at on-sale. While scalpers would likely maximize profit by specializing in the highest quality tickets, they also expect the price of all ticket types to be above their face value, and thus simply try to win tickets via the lottery in the first period.

Firm

Following from the pricing mechanism above, the firm, for this individual concert, maximizes profit at on-sale and then again in the secondary period. Prices at on-sale are taken as given. It is important to note that prices at on-sale, as per Courty and Pagliero (2014), may be set to adhere to an objective function that isn't solely based on maximizing profit. While profit is a component, the objective

[5] This assertion can be understood as externally verified. Due to the confidential nature of the venue, artist, and date, I cannot disclose any of those details to corroborate claims about the nature of demand past describing it abstractly.

function at on-sale is thought to also include a combination of consideration for loyal fans and a general "stickiness" to the industry standard.

This notwithstanding, for a value of *s* denoted *ε(0, k)* where a value of zero means the firm sells all tickets at on-sale and *k* is the theoretical limit of *s* at which the use of the secondary market as an efficient pricing heuristic breaks down, the firm maximizes equation 1 below

$$\pi^e \ = \ K[(1-s)\left(p_g^o - c_g^o\right) + s\sum_{t=1}^{T}\sum_{g=1}^{G}\left(p_{g,t}^d - c_{g,t}^d\right)]$$

Equation 1

The expression in the sum above represents the cumulative profits from selling tickets through dynamic methods across various quality levels g, and across distinct price-updating periods, *t*. p_g^o and $p_{g,t}^d$ denote on-sale and dynamically priced tickets, respectively.

With on-sale prices taken as given, and their total on-sale profits represented as $\pi^o(p_g^o, s)$, the above can be rewritten as to equation 2 below

$$\pi^e = \ \pi^o(p_g^o, s) \ + \ sK\sum_{t=1}^{T}\sum_{g=1}^{G}\left(p_{g,t}^d - c_{g,t}^d\right)$$

Equation 2

It is assumed that $\pi^o(p_g^o, s)$ is decreasing over the relevant range of *s* while π^e is increasing. $p_{g,t}^d$ is upwardly bounded by the prices determined by the secondary market, it naturally follows that this expression is maximized when s approaches *k*, as prices at which tickets withheld in *s* are sold at are greater than prices that they would have otherwise been sold in the first phase and contained within $\pi^o(p_g^o, s)$. [For more explanation on this assumption see Appendix A.]

The transportation cost or cost of effort to monitor the secondary market closely is considered to be entangled within the artist's existing management structure such that popular enough artists generally will be under contract with managers that adopt sophisticated technology or pricing conventions by necessity. In other words, the additional cost the firm/artist faces by engaging with its additional post on-sale mechanism is considered to be negligible especially in the very short term such as one concert. This is important to assume because it implies that for individual tickets, the firm incurs no additional cost to pricing tickets dynamically, so $c_g^o \ = \ c_{g,t}^d$ in the very short term.

Consumer Problem

This paper follows a simplified form of that used by Leslie and Sorensen (2014) in their analysis of ticket resale. There are thought to be *M* consumers in the market, β of which are scalpers. All consumers decide to demand tickets in the first period (at on-sale prices), have a probability *L* (defined above) of being selected in the lottery. Consumer *i*'s willingness to pay for quality is denoted by δ_{g}. They are also sensitive to increases in price denoted by α_i, of which they can be "low" or "high". The values of δ_{g} and α_i are defined in such a way that consumers of "low" type enter the lottery for all tickets at on-sale prices (in the data $125 and $140) but stop demanding tickets at prices that only slightly exceed face value. On the other hand, high type consumers are far less resistant to price changes. For simplicity, it is modelled that consumers of all types agree on δ_{g}, but vary in their resistance to price changes.

Consumer *i's* net utility would be

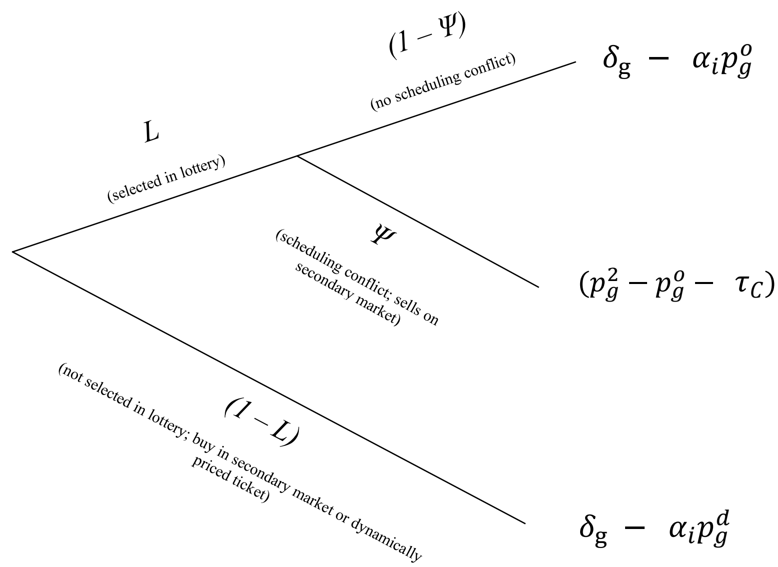
$$U(\delta_g, \alpha_i, p_g^o) \; = \; \delta_{\mathrm{g}} \; - \; \alpha_i p_g^o$$

That is, a consumer's net utility is their utility derived from attending the concert for a seat of quality g less the consumer's sensitivity to price of a seat of that quality level, $\alpha_i p_g^o$. In the case that the consumer (1) wins the ticket in the lottery in the first phase, and (2) attends the concert.

Two cases of uncertainty are necessary to be introduced. First, the consumer may not be selected in the first period with a probability of *(1-L).* Alternatively, the consumer may win the lottery in the first period but be unable to attend the concert due to a scheduling conflict of some sort. The probability of scheduling conflict is ψ. I assume that the probability of scheduling conflicts resolves between the first and second periods; if the consumer purchases a ticket in the secondary market, it is modelled that they will certainly attend the concert, as the scheduling conflict has resolved. In the case that the consumer is not selected in the first period, they will inform themselves of the prices on the secondary market and evaluate whether to buy at those given prices via the utility function above.

Due to the assumption in section [4], consumers and scalpers alike form expectations about the prices that will be realized in the secondary market after on-sale, and both parties correctly expect that the secondary market will realize ticket prices that exceed face value for all quality levels. Because of this, all consumer types inexorably enter the lottery in the first period, simplifying my analysis considerably.

In the case that a consumer experiences a scheduling conflict after the first period, she will attempt to sell the ticket on the secondary market, taking prices as given. The possible probabilities and payoffs for a consumer are shown below:



A consumer's expected utility, then is simply

$$E[U] = (p_g^2 - p_g^o - \tau_C)(L\psi) + L(1-\psi)\,(\delta_g - \alpha_i p_g^o) + (1-L)(\delta_g - \alpha_i p_g^d)$$

It is important to clarify that the above only holds when non-scalping consumers don't inform themselves of the prices on the secondary market after they successfully purchased a ticket in the first period. It would likely be the case that low type consumers that were allocated tickets through the lottery would sell at prices revealed by the secondary market. However, there is thought to be a high learning cost associated with engaging with the secondary market. The only case in which consumers act as scalpers is when they face a scheduling conflict and are forced to liquidate their ticket. Otherwise, when low type consumers are allocated tickets in the first period, they attend the concert inexorably.

Scalper Optimization Problem

A scalper's maximization problem is straightforward. She will maximize profits based on the expectation of ticket prices across varying levels of quality less the transportation costs, or market friction, presented by reselling in a later period. This is represented below:

$$\pi_B = E[p_g^2] - p_g^o - \tau_B$$

A scalper's expectations of the price of a seat of quality g in the second period is caught in the term $E[p_g^2]$. Under normal circumstances, this term would present a distinct computational challenge, as it hinges on a constellation of factors all of which are uncertain in nature. However, the firm only institutes dynamic pricing under market conditions in which it is widely evident to all parties that there will be excess demand for the show.[6] Thus I assume that scalpers know of the systematic underpricing that exists for shows that face such demand, and suspect to a high degree of certainty that the future price of tickets obtained through conventional methods will yield a higher price on the secondary market and eclipse any cost of effort to sell them as well. This expectation is reflective of the data as well, with all secondary market transactions taking place at prices higher than face value.

6 Data

The data acquired for the empirical pursuits of this paper are novel and originate from an anonymous, credible source within the music industry. The dataset documents ticket sales in the primary market and secondary market for one given concert by one sufficiently popular group.[7] Due to an agreement of confidentiality, no specific characteristics relating to the band, venue, date, or industry connection may be revealed.

Data were "pulled" multiple times, resulting in observable time effects prior to the occurrence of the concert. Four unique snapshots of data were obtained prior to the show. Each of these snapshots contained all ticket bundles purchased up to that point in time, allowing me to observe the time period in which certain transactions took place as well as the rate at which tickets were being sold.

The individual unit of observation in the set is a ticket purchase transaction. I observe whether the transaction took place on the primary or secondary market (noted by the variable "dynamic"), the price per ticket, the face value of the ticket in the on-sale period, seat section and row, as well as how many

[7] That is, the group is popular enough such that demand in this instance can be taken as far greater than supply. Its tickets for these events instantaneously sell out at price points determined by convention. It is clear excess demand exists at the on-sale price. See section 4.

tickets were sold in the transaction. The dataset is detailed and thorough, but some issues did arise. Principally, the dataset does not include the discrete seat locations for ticket purchases on the secondary market, only section and row. Because of this, it is possible that ticket purchases that are recorded within the same section and row at different price levels were the same ticket being resold multiple times. Furthermore, observable time effects are blunt and only an implicit byproduct of receiving the data multiple times. I do not observe when specific transactions took place nor the distribution of ticket sales volume over time. Nevertheless, the dataset presents a unique opportunity to calculate revenues and to disentangle quality effects and pricing effects.

Convenience Fees and Prices Faced by Consumers

It is important to note that convenience fees when purchasing through primary and secondary channels vary. It is estimated that convenience fees in the primary market vary heavily based on the artist, venue, and promoter in question. For entries in the data that were priced dynamically, fees were not included within those prices, but are around 14.9% of ticket value. Fees were not included for sales that originated on the secondary market either. Those transactions were inferred to be between 30% and 33% of ticket value. For this research, I adjusted the price of tickets that were sold on the secondary market by 31.5% upward, accounting for the fact that most ticket transactions occurred on StubHub, which was found to be on the lower bracket of convenience fees.[8]

While fees may not be initially clear to consumers when shopping for tickets, it is asserted for the sake of simplicity, that consumers ultimately make decisions off the complete price of tickets, including convenience fees. I assume that consumers do not have different price elasticities of demand for ticket prices versus convenience fees, which is potentially invalidated by the sequential learning of such fees. This presents a potential limitation of my work, and an interesting area for future inquiry.

[8] This fact was asserted to me by my contact in the industry; the exact channel of every secondary market sale is unknown.

7 Summary Statistics

I observe 1,366 transactions. On average there were 1.9 tickets purchased per order, with over half of orders (52%) constituting 2 tickets. Accounting for tickets per order, the dataset contains 2,606 individual ticket observations. As constructed above, these observations all take place after on-sale. Average prices across all levels of quality priced dynamically (by the firm) as well as those observed on the secondary market appear below.

Sales Channel	N	**Mean**	SD	Min	Max
Secondary Market					
Price	822	**283.285**	144.054	116.31	1099
Price (With Fees)	822	**372.52**	189.431	152.948	1445.185
Dynamically Priced Tickets					
Price	1784	**413.148**	138.216	189	999
Price (With Fees)	1784	**474.707**	158.810	217.161	1147.851

To further contextualize this finding, see table 1 below. It is often the case that the secondary market sold tickets at the highest price, but simultaneously many of the lowest priced tickets were realized in the secondary market because (1) they were tickets of lower quality in general and (2) potentially because of the coordinated supply timing wielded by the firm. It is often the case that the dynamically priced market sells multiple tickets of a given price point (presumably) after observing a price revelation by the secondary market more often for tickets of higher quality, aligning with the original assertion that the firm withholds more high-quality tickets than lower quality ones. To highlight this point, there were 265 GA tickets sold on the dynamically priced market whereas there were only 22 on the secondary market.[9]

Many seating sections are accounted for in the data, with the most common being GA, box seats behind GA, and seats that extend into staggered "upper ring" setups in the venue. While the firm prioritized premium seats, it did reserve some seats of lower quality.

[9] GA is short for "General Admission" – these are tickets that allow fans to stand in a designated rectangular space in front of the stage; these tickets are regarded within the space as being high quality and very sought after.

Accounting for Ticket Quality

Leslie and Sorensen (2014) account for ticket quality with the clever inclusion of Ticketmaster's proprietary "best available seats" internal ranking system. They ordinally rank seats by quality and then quantify the quality level of each seat by standardizing it to its position within the ranking. In effect, they position all seat quality levels on a continuum on (0, 1] that are equidistantly placed. This, in effect, passes on the burden of undergoing the nuanced consideration that is section, row, seat type, angle from the stage, distance from concessions/refreshments (to a lesser extent) and other factors. This study is limited in the sense that I was not granted this tethering of seat quality, so other measures are taken to account for it here. First, while the venue that the show took place in cannot be stated in this paper, it is known to me. Because of this, I was able to manually assign seats to what I will henceforth refer to as "angular groups". These angular groups are further consolidated to low, medium, and high quality groups reflecting their physical and price similarities.

With two exceptions (GA seats and the high-quality seats that lie directly behind GA seats), seats were grouped by angle to the stage, with those groups being roughly thirty to forty-five degrees. This convention seems to reflect price differences in the data, with some less desirable angular groups displaying clearly lower prices on average. Group eight, which denotes the section of seats positioned behind the stage, displayed notably lower prices than other more advantageously positioned angular groups. While this is an imperfect approach, it will allow me to capture the effects of quality to some degree.

Revenue, Markup, and Channel Distribution

Including convenience fees, total revenue generated in the secondary period was $1,153,089, with 26% of that being realized on the secondary market and the remaining 74% being realized on the dynamically priced market. Accounting for the counterfactual prices defined in section 5, the "lift" generated in the second period was $755,798; $573,779 of this was to the firm and the remaining $182,019 to the secondary market.[10] This breakdown is displayed in table 5. When convenience fees are not considered for either purchase channel, the firm then generated $510,000 in lift in the secondary period while scalpers cumulatively generated $129,780.

Similarly, markup can be computed with or without the consideration of convenience fees. From the consumer's perspective, the theoretical framework set forth asserts that consumers make decisions

[10] Lift is calculated as the price the consumer faced in the secondary transaction less the price they would have faced in the first period; convenience fees are thus included within both secondary and primary terms. In the industry, this is typically done free of convenience fees for transparency.

based on the price of a ticket in full, including convenience fees. However, the firm will only net some portion of convenience fees and the scalper will almost certainly not net any portion of them. So, for the sake of thoroughness, both cases are documented. Purely calculating for the markup on the stated price of tickets (free of fees), the secondary market realized an average markup of $157 and the dynamically priced market realized that of $286. As convenience fees on the secondary market of ~31.5% are over double that on the dynamically priced market of 14.9%, this difference consolidates after accounting for fees. After doing so, the dynamically priced market levied an average markup of $321 while the secondary market, an average of $221; an exactly $100 difference.

8 Second Mover Advantage

A phenomenon that may help explain this observed discrepancy in markup is what I call a "second mover advantage" gained by the firm. Because of the setup of its pricing rule, the firm decides to withhold a relatively high proportion of overall ticket capacity, with s in this case being slightly under 10%. Because of this, the firm has access to nearly 2,000 tickets to sell in the secondary period leading up to the concert. What is evident in the data is, with a few key exceptions that represent the firm setting experimentally high probing prices to test whether tickets would sell (and response by the secondary market), the firm tended to sell far more dynamically priced tickets than the secondary market for high quality seats at prices slightly below that of the secondary market. See table 1 for the price distribution of dynamic and externally priced tickets.

For GA tickets, which are some of the highest quality tickets in the dataset (as evidenced by some of the highest prices on average), it is observed that the firm sold a far higher volume of tickets of 267, but at a lower price point of (on average) $535 while the secondary market sold far fewer tickets, 22, but at a higher average price point of $676. This is represented in the output in table 4. A section of seats situated behind GA within the venue displayed the exact same trend as above, but for prices on the secondary market and dynamically priced market higher on average.

Furthermore, on November 10th, the date of the first data snapshot, 199 GA tickets had been sold on the dynamically priced market and ten GA tickets had been sold on the secondary market. Moving forward to the final data, the dynamically priced market sold 68 additional tickets over the entire period while the secondary market only sold 12 more. The average prices of tickets sold up to the first snapshot are functionally identical to those above. What is learned from the above analysis is crucial. The firm allows the secondary market to efficiently reveal the prices of GA tickets in a small number of transactions, but once this is revealed in a few purchases, the firm then capitalizes and steadily releases a small portion of supply over time such that the tickets are priced slightly lower than those on the secondary market (following its stated pricing rule) and simultaneously precluding significant competition from the secondary market, as tickets being sold through the original channel at prices generated by the dynamic regime now only warrant very small, nearly negligible markups on the secondary market after accounting for some positive cost of effort faced by scalpers as well as tax and other convenience fees.

Accordingly, one significant result of this study is the principle that the dynamically priced market gained a significant learning advantage from the secondary market. With only a small number of sales observed, the firm exploited its position with this information and slowly but assuredly released tickets from the initial amount withheld (especially for tickets of high quality) in order to capture much of the rents that would have otherwise been unrealized or captured by the secondary market, which likely would have operated on a larger scale in the absence of the dynamic pricing regime.

9 An Example Model of Consumer Entry and Exit

As was previously established, a consumer's net utility from concert attendance is

$$U(\delta_g, \alpha_i, p_g^o) = \delta_\text{g} - \alpha_i p_g^o$$

The above is true across seat quality levels g. In the data, g is accounted for by manually grouping angular sections of the same quality level. Both price and location in the venue are taken into account. The results of the procedure are shown below. Prices are inclusive of convenience fees.

Prices Across Quality Levels

Quality Level	On-Sale	Secondary Market & Dynamic Pricing
Low (n = 345)	$150	$281
Medium (n = 1035)	$150	$407
High (n = 1226)	$154	$516

Table Notes: Prices in columns two and three are both calculated with the inclusion of convenience fees. Quality levels were assigned by grouping angular sections that shared similar positions in the venue and exhibited average price similarities.

As was assumed and verified in the data, all tickets exhibit prices above face value in the secondary market, even tickets in the lowest quality group. It is also immediately evident that there was almost no variance in the prices set at on sale and subsequently faced by the consumer. In fact, there were only two observed price points originally set by the firm, $125 and $140 (excluding convenience fees), with the second price point *only* applying to GA seats. It is clear that prices at on-sale were not fully calibrated to account for the demand for seats of various qualities, which is in alignment with past work on the topic and with prior assumptions about the nature of on-sale prices. If one interprets the prices in the secondary market as consumers' revealed willingness to pay, it is clear that as the quality level of a ticket increases, the ratio of willingness to pay to on-sale prices increases.

Regardless, if any consumer *i* were to win a low quality ticket in the lottery and experience no scheduling conflict, their utility would be

$$U(\delta_L, \alpha_i, p_L) \;=\; \delta_{\mathrm{L}} \;-\; 150.65\alpha_i$$

However, in the case the consumer did not win a ticket in the lottery and didn't experience a scheduling conflict, then their utility for a low quality seat would be

$$U(\delta_L, \alpha_i, p_L) \;=\; \delta_{\mathrm{L}} \;-\; 281.757\alpha_i$$

Thus, the change in consumer *i*'s utility incurred by not being selected in the lottery and buying a low-quality ticket in the secondary market is

$$\Delta U(\delta_L, \alpha_i, p_j) \;= -\,281.757\alpha_i \;+\; 150.65\alpha_i$$

Which can be simplified to

$$\Delta U(\delta_L, \alpha_i, p_j) \;= -131.107\alpha_i$$

The change in a consumer's utility is simply their disutility from the change in price brought about by buying in the secondary period. For high type consumers, it is supposed that their utility remains positive even after this change but becomes negative for low type consumers across all quality levels. This process could be similarly iterated across all quality levels.

10 Predicting Price with Regime, Controlling for Quality

As a result of the consumer decision process above, it is modelled that the consumer will rationally select the lowest priced ticket for a given quality level in the secondary period. This would suggest that, after controlling for quality and adjusting for convenience fees, tickets on the secondary market and those priced dynamically should exhibit similar prices if competition were strong. In order to assess this, I regress the log of price on a dummy variable for buying a dynamically priced ticket and seat section fixed effects yields the results shown in Table 6.[11]

[11] Log transformation is done to account for both outliers and nonlinearity that quality may have on demand and thus price.

The regression displays that, when quality is controlled for via angular groups and convenience fees are factored in for both channels of purchase, the dynamic pricing regime is correlated with a statistically significant 15 percent increase in price. While this finding isn't causal, there are a few interpretations of this result. First, consumers may be willing to pay a premium to the firm because they would rather purchase through an official channel and "support the artist". They may believe that in doing so, they aren't benefiting an anonymous scalper, but helping the artist. There may be added utility to this rationale for some consumers.

Additionally, we may observe this effect because consumers may be wary of the authenticity of tickets purchased through the secondary market. Indeed, there is risk associated with secondary market sales such as the ease of transfer of the ticket or overall whether the online posting is legitimate. However, this risk declines as ticketing technology becomes more sophisticated and integrated with online sales platforms.

Regardless, the findings of this regression are in alignment with the firm's second mover advantage. Perhaps it is the case that across all quality levels, the firm gains the ability to dominate the market upon the observation of a relatively small number of transactions on the secondary market. In the case that agents in the secondary market are uncoordinated and ticket sales occur sporadically over time, the firm is enabled to exploit its position as one coordinated entity and sell tickets at higher prices after controlling for quality.

11 Allocation and Pareto Efficiency

The purpose of this section is to provide brief commentary on the allocative gains from the firm's pricing mechanism. There are three core scenarios that could have occurred instead of what was observed: (1) all tickets priced conventionally while secondary trade is legal, (2) all tickets priced conventionally with secondary trade illegal, and (3) most tickets priced conventionally, secondary trade is legal, and the firm institutes its dynamic pricing rule.

In the first case, the firm prices all tickets by industry convention, *M* consumers enter the lottery and the distribution of consumers that receive tickets is identical to the overall distribution of consumers within the market at large. Any willingness to pay by high-type consumers who wish to attend the concert or high willingness to pay by opportunistic scalpers is completely inaccessible to the firm. In the case that consumers derive high net utility of concert attendance and are allocated tickets in the lottery, this willingness to pay is simply never fully captured by any selling entity and the consumer greatly benefits. However, in the case that scalpers access these tickets, they can form a robust and fully operating secondary exchange and net all rents possible from consumers of high willingness to pay who were not allocated tickets in the lottery. The secondary market would, as modelled, result in the successful transfer of tickets from low type to high type consumers, specifically when they face scheduling conflict. Any scalpers allocated tickets in the first round would only sell to high type consumers in the second round, precluding any inefficient allocation that is the result of secondary exchange.

In the second case, there are now a reduced number of consumers, as any consumers who only intended to scalp the concert now cannot operate legally; so only $(1-\beta)M$ consumers still enter the market. This new level of consumers is M'. All consumers come to market and enter the lottery, and again the lottery allocation is identical to the overall distribution of low and high type consumers. In this case, there is a portion of consumers that are high type but are not expected to be selected in the average lottery draw. There is an inefficiency in this setup as neither the secondary market nor the dynamic pricing regime can solve this.

Finally, in the case of legal trade and dynamic pricing, surplus is distributed as follows. $(1-s)K$ of tickets or 17,216 are allocated to consumers via lottery. Like prior iterations, this allocation shares all attributes of the overall composition of M. However, as a result of the firm's dynamic pricing mechanism, around 9% of tickets can now be priced such that they are allocated to high type consumers. Of course, some tickets initially allocated via lottery will go to scalpers, these scalpers will reveal prices on the secondary market and the firm, with advantages outlined in section 8, can capitalize on this and target high type consumers as well. This is the only method in which the firm can directly sell to high-type consumers. This is at least as Pareto efficient as the case in which secondary sale is legal, while holding the potential to increase profits above those gained through industry convention pricing.

12 Conclusion

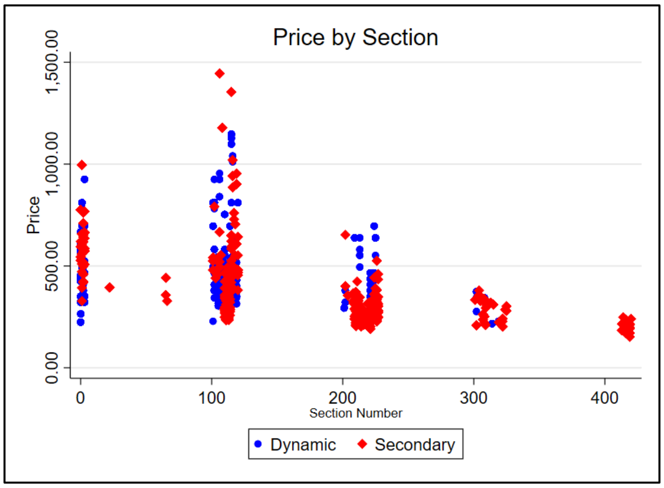
Recent conversations regarding the music industry have surrounded skyrocketing ticket prices to see popular artists and potential monopolistic behavior by Ticketmaster. With respect to skyrocketing prices, this can be widely attributed to the advent of modern pricing regimes like auctions and (more often) dynamic pricing models similar to those adopted in the airline and hotel industries. These regimes allow artists to price their tickets more precisely to match consumer willingness to pay.

This paper both documents and analyzes the effects of one version of a dynamic pricing regime instituted by a sufficiently popular artist. It is found that the firm, after controlling for quality, can compete with scalpers in the secondary market, which is likely contributed to by the consolidated nature of the firm in competition with a landscape of uncoordinated scalpers; this is the possible mechanism that creates what can be understood as a "second mover advantage". It is also found that the firm generates most of the revenue, and likewise, extracts most of the rents in the system. The firm evidently rationally withheld tickets of high quality and then intelligently released supply from this withheld portion once informed of prices or to experimentally assess consumer willingness to pay.

Ultimately, it is found that the firm successfully dominated the secondary market in this given case and furthermore contributed to a Pareto efficient transfer of tickets from consumers of low willingness to pay to those with high willingness to pay which, under the set of options available to the firm, is the only way to accomplish this process. The pricing mechanism documented in this paper is evidently intelligent to institute in the case of excess demand (outlined in Section 4) at the chosen on-sale prices. Under these circumstances the firm can, with very low risk, use the secondary market as a learning tool to reveal consumer willingness to pay. As demonstrated, even with a low number of transactions and listings on the secondary market, the firm can opportunistically coordinate itself to dominate most transactions in the secondary period.

Tables

Table 1: Price by Section for both Sales Channels



Notes: The above table contains price data for all sections in the data. GA sections are included as if they were Section 0. Dynamic denotes ticket purchases that were dynamically priced while "External" denotes tickets that were priced and sold on the secondary market.

Table 2: Summary of Prices

Summary statistics

Sales Channel	N	Mean	SD	Min	Max
Dynamically Priced Tickets					
Price	822	283.285	144.054	116.31	1099
Price (With Fees)	822	372.52	189.431	152.948	1445.185
Secondary Market					
Price	1784	413.148	138.216	189	999
Price (With Fees)	1784	474.707	158.810	217.161	1147.851

Table 3: Markup by Sales Channel (With Fees)

	Markup		
Channel	221.43	321.63	Total
Secondary	822		822
Primary		1784	1784
Total	822	1784	2606

Table 4: Summary of Adjusted Prices for GA Tickets Across Sales Channel

Summary of Price for GA Seats Across Sales Channel

Variable	Obs	Mean	Std. Dev.	Min	Max
Dynamically Priced Tickets	267	535.468	86.821	425.13	667.569
Secondary Market	22	676.303	113.731	527.823	775.85

Table 5: Markup Distribution Across Sales Channel

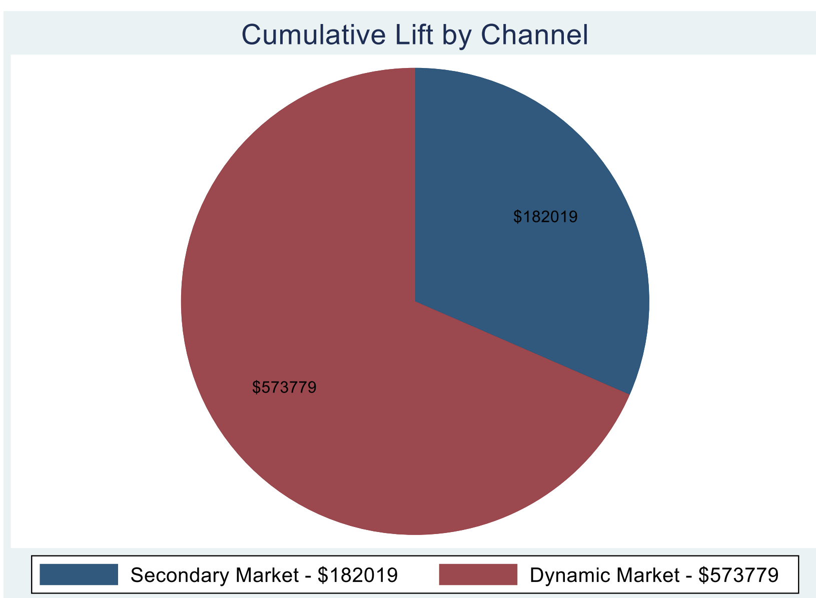


Table 6: Regression of Pricing Rule and Ticket Quality on Price

VARIABLES	(1) Log(Price)	(2) Price
Dynamic	0.149***	46.36***
	(0.0141)	(7.054)
Quality Group 1	0.0922***	-70.82***
	(0.0342)	(12.62)
Quality Group 2	-0.0681**	-122.8***
	(0.0337)	(12.51)
Quality Group 3	0.0600	-119.9**
	(0.101)	(49.29)
Quality Group 4	0.333***	42.59***
	(0.0347)	(13.06)
Quality Group 5	0.266***	-105.4***
	(0.0344)	(13.69)
Quality Group 6	-0.00851	-119.1***
	(0.0357)	(17.17)
Quality Group 7	-0.0771**	-148.0***
	(0.0371)	(14.81)
Quality Group 8	0.137***	-57.52***
	(0.0332)	(11.82)
Quality Group 9	-0.322***	-238.7***
	(0.0337)	(12.73)
Quality Group 10	-0.0303	-122.5***
	(0.0363)	(14.33)
Constant	5.884***	503.4***
	(0.0306)	(11.06)
Observations	2,606	2,606
R-squared	0.351	0.255

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: All Prices are adjusted to include convenience fees according to the underlying assumption that consumers make decisions based on final prices.

Appendix

Appendix A

The reduction alluded to in the firm section of this paper will be further elaborated on here. It was asserted that the firm's profit function in the scope of this concert can be summarized by equation 1 shown below.

$$\pi^e \ = \ K[(1-s)\left(p_g^o - c_g^o\right) + s\sum_{t=1}^{T}\sum_{g=1}^{G}\left(p_{g,t}^d - c_{g,t}^d\right)]$$

Equation 1

It was then further asserted that this can be restated as equation 2 shown below.

$$\pi^e = \ \pi^o(p_g^o, s) \ + \ sK\sum_{t=1}^{T}\sum_{g=1}^{G}\left(p_{g,t}^d - c_{g,t}^d\right)$$

Equation 2

One potential risk of this logic is choice variable *s* is endogenous to $\pi^o(p_g^o, s)$. Logically, if the firm decides to withhold a higher proportion of tickets $s' > s$, then $\pi'_o < \pi_o$ by definition (if on-sale prices are fixed). Furthermore, profits in the secondary period would be greater than otherwise would be realized for lower possible levels of *s*, assuming the show still fully sells out after the second period. That being said, because prices are necessarily strictly greater in the secondary period (because of the assumption of extreme excess demand), then the increase to profits generated in the secondary period due to an increase in *s* would always outweigh the decrease of profits in the primary period due to an increase in *s*, under the assumption that the firm would not alter its on-sale prices according to a change in *s*. When those prices are given, under the assumption in section [4], any ticket that is withheld within *sK* will be sold for a higher price than it would have been had it been sold in the first period. In short, it is assumed that total profits are increasing in *s* over the relevant range of consideration.

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