Pricing Decisions in a Vertically Integrated Live Entertainment Industry

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Abstract

Live Nation has recently been criticized for profiting from resales of tickets. This thesis examines in what way the pricing decision of a concert promoter differs when it acquires platforms that facilitate ticket scalpers. I find that a vertically integrated promoter has an incentive to set lower prices in the primary market for high demand events when artists obtain a sufficiently large share of the profits from the primary ticket sales and the promoter has a strong position in the secondary market. Vertical integration does have a welfare diminishing effect though, because, in contrast to an unintegrated market, it does not lead to an optimal allocation of the tickets.

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1. Introduction

In 2005 the Chicago White Sox made it to the World Series of Baseball for the first time in 46 years. Many fans wanted to witness this piece of Chicago history and the tickets for the four home games sold out in 18 minutes. Some tickets were later resold for thousands of dollars (Bell, 2006). This phenomenon of purchasing tickets for events with the sole purpose of reselling these tickets with a profit is often referred to as ticket scalping (Williams, 1994). Scalping was originally done by locals and it took place just outside concert venues and stadiums. After buying tickets from a scalper, the buyer still did not know for sure whether the tickets were valid. When tickets appeared to be fake, the seller was long gone. This "secondary market" is therefore often depicted as a shady business.

The internet has changed this secondary market. Today, anyone can buy a ticket for any event and resell it on the internet. There are special online marketplaces, also known as secondary ticketing websites, such as Viagogo, where scalpers can offer their tickets and fans can buy them. The rise of these websites also enabled scalpers to operate on an industrial scale. Estimations on the size of this market range from US$ 5 to US$ 8 billion a year (Guzman, 2015; Cookson, 2016). Although more and more of these websites can verify or guarantee that these tickets are valid (and notwithstanding the obvious advantages for fans to be able to resell their tickets when they are unable to attend the concert or to buy tickets at the very last moment), criticism on the secondary market remains. The higher than face value price is perceived as unfair by some who argue that the artist does not share in the profits made on this secondary market and scalpers raise prices without adding any value to the ticket. Several countries have prohibited or regulated ticket scalping. Belgium has prohibited resales of tickets above the face value. In various states of America, resale is prohibited or only permitted by licenced brokers. The internet did not only make it easier to resell tickets, but it also made it harder to enforce these laws. Online marketplaces might have their statutory seat in other countries or states, where different scalping laws are applied (Elfenbein, 2006). Belgium therefore opted for European legislation, as tickets for Belgium events can still be sold at Seatwave, a secondary ticketing website which has its registered office in the Netherlands.

Due to the ease of reselling and the complications in law enforcements, some artists do try to protect their fans with anti-scalping measures. Miley Cyrus required fans to identify themselves at the entrance of the concert. Adele partnered with Songkick, an independent ticket website, to allocate a percentage of the available tickets to her fan club. Concert promoters, who are hired by artists and their management to organize a concert or tour, are nowadays meeting the desires of these artists by implementing anti-scalping methods. Live Nation, the biggest concert promoter in the world, recently introduced a system in which it tries to limit ticket scalping; based on earlier purchases this system calculates the probability that a buyer is a fan or a scalper and tickets are allocated to those who have a high probability of being a fan.

Meanwhile, Live Nation also acquired secondary ticketing websites, such as Seatwave and Get Me In!. This way, the promoter does not only profit from the initial sales of tickets, but also receives commission on tickets that are resold on their secondary market. These acquisitions appear to be inconsistent with the introduction of systems that are developed to limit scalping. By some, it is also considered immoral from Live Nation to facilitate ticket scalping. "*Promoter of Adele concerts profits from reselling tickets*" is what Dutch newspaper Het Parool headlined in 2015 (Groenendijk, 2015) after the tickets for Adele concerts in the Ziggo Dome in Amsterdam were offered at Seatwave for as much as 50 times the face value (Kammer, 2015). After receiving signals of extremely high prices, the Netherlands Authority for Consumers & Markets (ACM) started in 2016 an investigation commissioned by the Netherlands Minister of Economic Affairs (ACM, 2016). Anti-scalping laws are currently under review by the Dutch First Chamber, which restricts the maximum resale price by 120% of face value. In 2016, Italy prohibited ticket resale. Also, since the merger of Live Nation and Ticketmaster, the largest ticket agency, the promotion and ticketing market is under supervision of the US Department of Justice. It is thus important for competition authorities to understand in what way the secondary market affects the live entertainment industry.

In the years after acquiring Seatwave and Get Me In!., Live Nation has often been criticized for its activities in the secondary market, e.g. for withholding tickets from the primary market and selling them directly on secondary platforms (Channel 4, 2012, *The Great Ticket Scandal*; Italia1, 2016, *La Iene*). In August 2018, Live Nation's subsidiary Ticketmaster announced to close its secondary ticketing websites in Europe (Savage, 2018). Live Nation decided to stop Seatwave and Get Me In!. because they "*want you, the fan, to have the ability to buy tickets for the event you want to go to. That's why we launch our own secondary platform on our website, where you can buy or sell your ticket for the original price, or less* (Ticketmaster, 2018)*."* This recent development limits the scope of potential welfare diminishing effects of vertical integration to be studied in this thesis.

There are various papers explaining the economics of ticket scalping. However, to the best of my knowledge there exists no paper that considers vertical integration between event promoters and secondary ticketing websites. This thesis shows that for high demand events, the event promoter may have an incentive to set lower prices on the primary market when it is vertically integrated with one or more secondary ticketing websites. Due to a “demand effect” and a “supply effect” profits on the secondary market increase when the price on the primary market decreases. These two effects may more than compensate the revenue loss on the primary market. The “demand effect” entails that the lower price on the primary market, leads to more revenues on the secondary market, due to the increased demand. The amount of tickets for a concert is limited and therefore, more fans are unable to obtain a ticket on the primary market when prices are low. This leads to higher demand for secondary tickets and scalpers can set higher prices. The vertically integrated promoter profits from these secondary sales when these tickets are resold through their platform. The “supply effect” rests on the assumption that the amount of tickets bought by scalpers on the primary market is decreasing in price. Therefore, a lower price will lead to a larger secondary market.

This thesis is organized as follows. Section 2 describes in more detail the ins and outs of the live entertainment industry and the related literature. The model of this thesis will be described in Section 3 and analyzed in Section 4. Results of three models will be compared. In Model 1 the concert promoter is not vertically integrated with a secondary platform; in Model 2 and 3 the concert promoter is. In Model 2, like in Model 1, the number of tickets bought by scalpers is assumed to be independent of the price. In Model 3 the number of tickets bought by scalpers is assumed to be decreasing in price. The conclusion follows in Section 5.

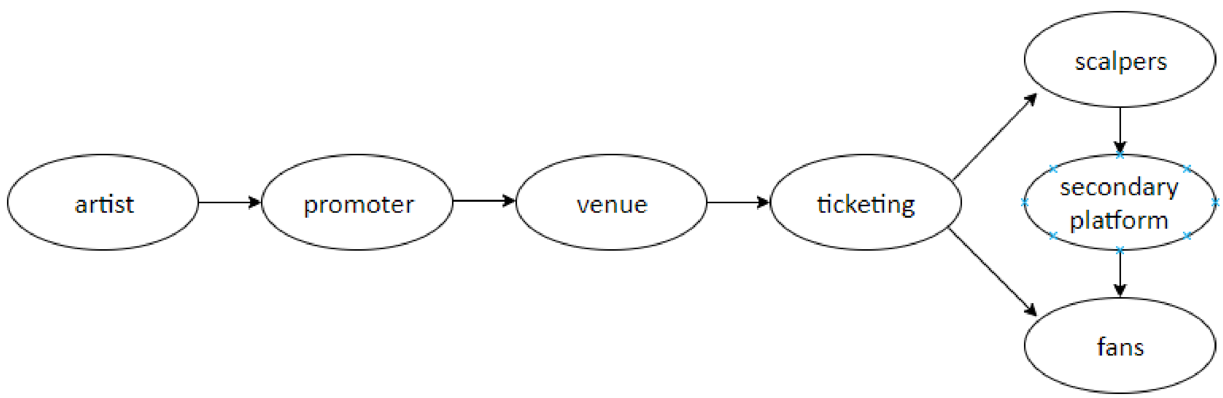
2. Live entertainment industry

In the new millennium, the live entertainment industry is more important to artists than ever. The main revenues for artists used to come from album sales. Concerts and tours were often used to promote a new album. Since the rise of piracy and illegal downloading of music in the late 1990’s, profits from record sales have diluted. Therefore, artists are now more and more depending on other sources of income, such as concerts. E.g., in the period from 1997 to 2005, the revenue of live entertainment in the USA has increased from US$ 1.3 billion to US$ 3.1 billion (Black et al., 2007). In the period from 1995 to 2006 average ticket prices increased from US$ 26 to US$ 65 (Yoshino, 2007).

When an artist decides to give a concert or go on tour, it hires a concert promoter to organize these concerts. The artist and the promoter together decide on the specific locations and venues. The sales of the tickets will be taken care of by a ticket agency, which facilitates the transaction between the concert promoter and the fans/scalpers. In the USA, the venue usually has a contract with a ticket agency.

In the Netherlands, in contrast, it is usually the promoter who selects the ticket agency for the larger events. The tickets are bought by either fans or ticket scalpers. When a ticket is sold to a scalper, it will be resold. In some cases the ability to resell the ticket is restricted by either the law or the event promoter, e.g. by prohibiting resales or by providing personalized tickets. However, personalization will have some practical implications, such as long queues at the entrance, since the identity of each fan needs to be verified. When a ticket is resold, secondary ticketing websites, such as Seatwave, Viagogo and Get Me In!, can be used to match demand and supply. These secondary ticketing websites may or may not be owned by event promoters. Prices on the secondary market are set by the scalpers who bought their tickets on the primary market or by fans who cannot make it to the concert. The secondary ticketing websites receive a commission from the buyer or seller per ticket sold on their website. Thus, if the ticket platform is owned by an event promoter, the commission is additional revenue for this promoter. The full value chain of the live entertainment industry is depicted in Figure 1.

Figure 1: overview of the value chain of the live entertainment industry



Today, Live Nation is the largest concert promoter in the world with over 150 concert venues, of which the majority is situated in the USA (Live Nation, 2018). In 2005 the company was spawn from Clear Channel Communications, the number one radio station owner in the USA (Davis, 2010). In 2006 it acquired House of Blues, a large chain of concert halls in the USA. This acquisition gave Live Nation control of a large share of major concert venues. In 2010 the company merged with Ticketmaster, the world's largest ticket agency. At the time of the merger, 80% of the tickets sold in the USA were sold by Ticketmaster. These expansions made Live Nation the largest event promoter in the world. In 2010 it had a market share of over 90% in 33 countries in the ticketing industry and in 2015, 21 of the 25 biggest tours in the world were facilitated by Live Nation (Davis, 2010; Hu, 2016).

As both Live Nation and Ticketmaster were leader in their market, the merger announcement led to a lot of criticism in the media and to a review by the Department of Justice in the USA. Consumer organizations opposed the merger as they believed the merger would have a competition dampening effect. Nevertheless, in 2010 the merger was conditionally approved by the Department of Justice (Varney, 2010). The most important conditions were that Live Nation had to sell Paciolian, a ticket agency that it had acquired previously, and Ticketmaster had to license its software to a competitor. Via this way, the US Department of Justice attempted to maintain a competitive arena. The software license was bought by AEG, the largest competitor of Live Nation. AEG used the software license to develop AXS, AEG's ticket agency, to compete with Ticketmaster. Furthermore, the US Department of Justice took additional measures to prevent Live Nation from abusing its dominant market position. The live entertainment industry had to be monitored for 10 years and Live Nation was explicitly prohibited to retaliate against venues who had chosen to use a ticket agency other than Ticketmaster. As the merged company had a strong position in both the concert promotion industry as well as the ticketing industry, the hazard of foreclosure did exist. Live Nation could retaliate against venues by only choosing venues that used Ticketmaster to distribute the tickets. In 2015, Songkick, a ticketing company based in New York, sued Ticketmaster for violating antitrust laws (Sisario, 2015). Songkick claimed that Live Nation "*had attempted to destroy competition in the artist presale ticketing service market"* and had threatened unnamed artists not to work with Songkick. The lawsuit never made it to court though.

In the live entertainment industry, promoters can use various pricing strategies. Prices can differ, based on the quality of the seats; tickets closer to the stage are usually more expensive. The promoter can also charge lower prices to those who decide to buy early. Fans are heterogeneous; some fans want to decide far in advance, while others want to decide last minute, but are willing to pay a premium. Promoters tend to incentivize fans to buy early by releasing cheaper "early bird" tickets. Michael Rapino, CEO of Live Nation, stated: "*We don't believe that true dynamic pricing is right for all fans. We want to make sure that the fan never get penalized for buying early."* (Cookson, 2016). Courty (2003) concludes that it is never optimal for an unintegrated promoter to price discriminate between these two groups, as scalpers are able to buy the cheaper tickets and sell these tickets on the secondary market at a later stage. In practice, price differentiation is used, but usually not for the high demand concerts for which tickets are resold with high profits in the secondary market. As this thesis focusses on these high demand concerts, this thesis assumes no price differentiation, which is consistent with Courty (2003).

Instead of using posted prices, promoters may also use auctions. Bhave and Budish (2017), who study the effects of Ticketmaster auctions, show that revenues are roughly doubled on average and rent-seeking opportunities can be eliminated. Bhave and Budish cannot provide a theory as to why auctions are not widely adopted. A possible reason is that auctions skim consumer surplus on the primary market and criticism which is now aimed at the secondary market could be directed to the ticket agency, promoter and artist (Nelson, 2003).

Although promoters do not want to be criticized for skimming consumer surplus and do not want to penalize fans for buying late, they do want to maximize their profit. Undercover operations from television station Channel 4 and TV show "Le Iene" have shown that concert promoters use secondary ticketing websites to sell their tickets in the United Kingdom and Italy directly to the fans (Channel 4, 2012, *The Great Ticket Scandal*; Italia1, 2016, *La Iene*). The concert promoter withholds the tickets from the primary market to sell it for a higher price on the secondary market. This strategy allows promoters to price discriminate without being criticized. Selling directly to fans at secondary ticketing websites is especially a profitable strategy for popular events. Willingness to pay for these events is often high and tickets for these events tend to be "underpriced": for high demand events, the price of the event is often set too low (Krueger, 2005). As the number of seats for an event is limited, a too low price will lead to excess demand. Not all the fans who are willing to pay the price of the ticket are able to attend the concert.

When tickets of popular events are underpriced, rent seeking opportunities arise. Ticket scalpers are able to purchase tickets for the face value on the primary market. These tickets can be resold to those fans who are willing to pay the most for it and were unable to buy the ticket on the primary market (Jolls et al., 1998). When fans with the highest willingness to pay are served, scalpers decrease their price so that tickets will be bought by fans with a slightly lower willingness to pay. This mechanism allows them to skim consumer surplus. Despite the criticism on the scalping activity, it is not necessarily bad for welfare. The tickets on the secondary market will be bought by those who are willing to pay the most for the tickets. Therefore, in case of excess demand, a secondary market will lead to a more efficient allocation (Swofford, 1999).

From the promoter's point of view, it is not necessarily irrational to underprice their shows. Swofford (1999) studies why concert promoters set prices below the expected market clearing level. Uncertainty with regard to the demand of an event could induce a promoter to set a price at which the event will surely sell out. A risk averse promoter will therefore set a lower price. Besides, higher attendance will result in more earnings on food, beverages and merchandise inside the venue (Black et al., 2007). In addition, being in a fuller crowd makes the experience more enjoyable, so positive externalities are at stake (Becker, 1991).

Bennett et al. (2015) distinguish two effects from the existence of a secondary market: the “option value effect” and “cannibalization effect”. The “option value effect” refers to the possibility for fans to sell their tickets in case they are not able to attend the event. Due to this effect the fan’s willingness to pay increases. Demand in the primary market is higher for a given price and promoters can set a higher price. On the other hand, the unintegrated event promoters have to compete with tickets sold in the secondary market, which is referred to as the “cannibalization effect”. Due to this effect, the demand on the primary market decreases at a given price and the promoter will set a lower price. While the net price effect remains ambiguous, Bennett et al. (2015) find that the promoter has an increased incentive to limit supply when a concert is not likely to sell out, e.g. by choosing smaller venues, to mitigate the cannibalization effect. The reason is that when there are less tickets available, it is more likely that the concert will sell out. When a concert is sold out, the cannibalization effect is no longer present.

3. Model

In this section we construct a simple model to analyze how pricing decisions for high demand events will change when a concert promoter acquires one or more secondary ticketing websites. Consider a single high demand concert of a well-known artist. As other gigs are assumed to be not close substitutes for the fans of the performing artist, the promoter is assumed to be a monopolist for this specific event. The promoter is also assumed to be risk-neutral. Inside the venue, there is a monopoly on merchandise, food and beverages. Given these rich opportunities for cross-selling, it is assumed that it is optimal for the promoter to sell out the concert by setting a sufficiently low primary market price. The profits of the event are divided between the concert promoter and the artist; the promoter receives γ, while the artist receives $1-\gamma$ and $\gamma \in (0,1)$. The ticket agency also sets a mark-up, which effectively leads to a lower share of profits for the artist and event promoter. For simplicity, it is assumed that the promoter sells these tickets through its own ticket agency and the mark-up of the ticket agency is included in γ.

The concert promoter sells the tickets on the primary ticket market at a fixed price. Total costs are equal to C. There are no variable costs. The number of available tickets (i.e. the number of seats in the venue) is denoted by Q_{max}. As the concert sells out by assumption, the number of sold tickets in the primary market is equal to the number of available tickets (Q_{max}). Demand (D) for the concert is assumed to be linear and decreasing in price (P). The inverse demand function is given by $P = a - bD$, with *a, b > 0*. Scalpers are not included in the demand function. The demand function refers to the demand for the concert itself and scalpers are only interested in reselling tickets. The event promoter is assumed to be able to estimate the demand accurately, due to statistics regarding previous concerts, downloads of tracks of the artists, activity on social media, fan base, etc.

The primary tickets will be sold both to fans and scalpers. Fans are assumed to receive $(1 - x)Q_{max}$ tickets and scalpers receive xQ_{max} tickets, where $x \in (0,1]$ can be considered as the proportion of scalpers in the total demand for tickets. The tickets bought by fans on the primary market are randomly distributed among all those who are willing to pay the price on the primary market. Scalpers will sell their tickets at secondary platforms. The model allows scalpers to sell their tickets for any price. Fans are also able to sell their ticket, but for simplicity, this is exempted from the model. The secondary platform receives a percentage $\tau \in (0,1)$ of the price paid on the secondary market. If the promoter is vertically integrated, then he does not share τ with the artist. The prices on the secondary market are characterized by first degree price discrimination. The tickets will be bought by fans who have the highest willingness to pay. Prices will initially be set at a high level, so that only fans with a high willingness to pay will buy these tickets. When tickets do not sell, scalpers will decrease their price to a level at which the tickets do sell. This mechanism will continue, until all tickets are bought by fans.

This thesis considers three models. In Model 1, the reference model, the concert promoter is not vertically integrated with a secondary platform. The proportion of tickets sold to scalpers in the primary market is x. The model shows what price a profit maximizing promoter sets in an unintegrated market. Profits of the promoter only depend upon the sales in the primary market.

Model 2 and 3 show the situation in which the promoter has been integrated with one or more secondary platforms. Profits of the promoter do therefore not only depend upon sales in the primary market, but also on sales in the secondary market. These two models show the mechanism by which the price level on the primary market affects the profits on the secondary market and how vertical integration changes the price on the primary market. In Model 2 we assume the number of tickets bought by scalpers to be independent of the price. Price is the only strategic variable of the promoter, which means that the amount of tickets bought by scalpers cannot be influenced by the promoter. In Model 3, in contrast, the share of tickets sold to scalpers (x) is decreasing in price ($\frac{dx}{dP} < 0$) on the interval $[0, P_{max}]$, where $P_{max} \equiv P(Q_{max})$, i.e. the price where the demand of the fans equals the supply of tickets. Thus, when the price in the primary market is higher, a lower proportion of the tickets will be bought by scalpers. The rationale of this is as follows. Scalpers will put most effort in the concerts that yield the highest expected profits and lowest risk. Therefore, an increase in price decreases the expected profits and increases the risk for scalpers, which could induce scalpers to divert their effort to scalping activities for other concerts, with a higher expected profit.

4. Analysis

This section analyzes the three models as specified in Section 3.

Model 1

This model analyzes the pricing decision of an *unintegrated* promoter. The model without integration is straightforward. The promoter only generates revenue from the ticket sales on the primary market. As the concert sells out by assumption, the profit function of the promoter is equal to Equation (1).

$$(1)\ \pi^p = \gamma(P^p Q_{max} - C) \quad \forall\ 0 \leq P^p \leq P_{max}.$$

The sup-index of π^p and P^p refers to the primary market. To maximize the profit, Equation (1) is derived w.r.t. P^p.

$$(2)\ \frac{d\pi^p}{dP^p} = \gamma Q_{max} > 0 \qquad \forall\ 0 \leq P^p \leq P_{max}.$$

Proposition 1. *Under the condition that the concert has to sell out, a profit-maximizing unintegrated promoter sets the ticket price equal to P_{max} in the primary market.*

Proposition 1 follows from Equation (2), which shows that profits are increasing in price. The highest valid price under the assumption that the concert should sell out is P_{max}. For all $0 \leq P^p < P_{max}$, there is excess demand, so an increase in price does not lead to less sales. At P_{max} the demand for tickets by fans equals exactly the total amount of tickets available. There are still fans willing to pay more than the face value of the ticket, so arbitrage opportunities for scalpers remain. Scalpers will sell their tickets to fans on the secondary market, so all tickets will eventually be purchased by fans with the highest willingness to pay.

Proposition 2. *Under the condition that the concert has to sell out, all tickets will be sold to fans with the highest willingness to pay.*

From Proposition 2 it follows that an unintegrated market leads to an efficient outcome.

Model 2

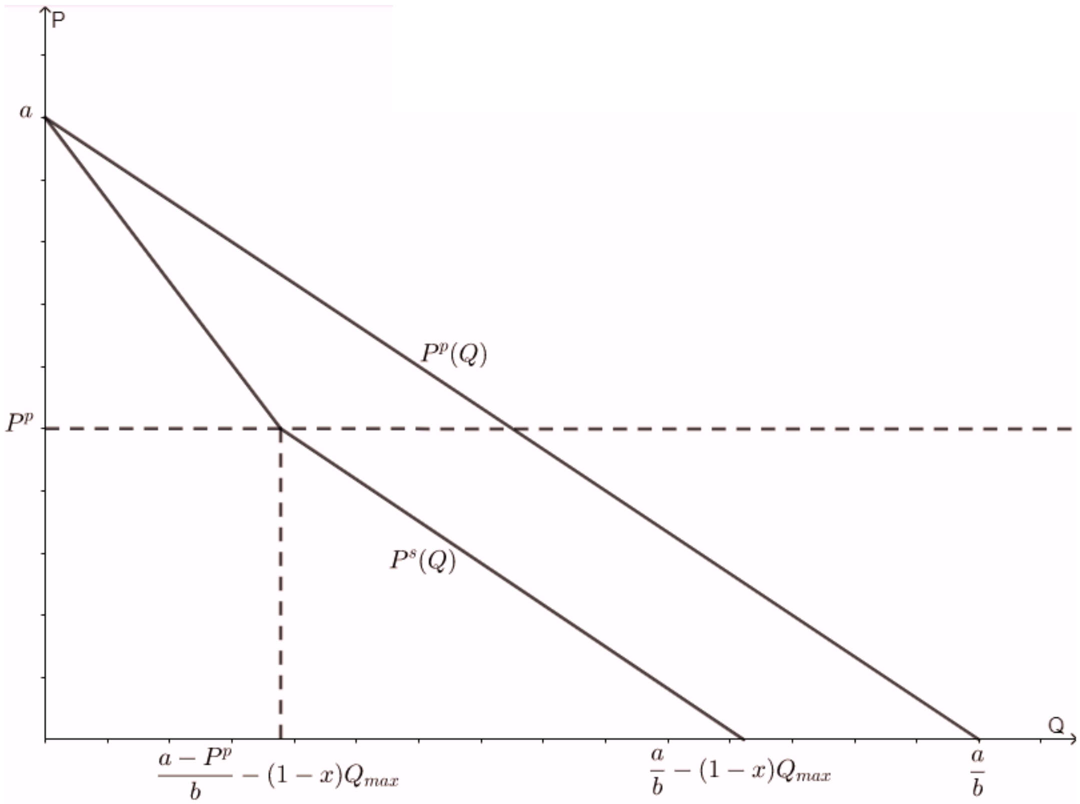
Model 2 and 3 analyze the pricing decision of an *integrated* promoter. The promoter generates profits from the tickets sold on the primary market and the tickets that are resold on the secondary market through his platform. To derive the profits generated on the secondary market, it is necessary to determine the demand for tickets on the secondary market first. The demand on the secondary market is equal to the amount of fans who were unable to buy a ticket on the primary market. The amount of tickets bought by fans on the primary market is equal to $(1-x)Q_{max}$, so the number of fans that are willing to pay P^P, but have not obtained a ticket on the primary market is equal to:

$$(3)\ \ D-(1-x)Q_{max} = \frac{a-P^P}{b} - (1-x)Q_{max}.$$

There will be no tickets sold to fans with a willingness to pay below P^p in the primary market, so the secondary market demand will be $\frac{a-P^S}{b} - (1-x)Q_{max}$ for $0 \leq P^S \leq P^P$, where P^S is the price on the secondary market. Thus when a ticket on the secondary market is offered for free (P^S = 0), there will be $\frac{a}{b} - (1-x)Q_{max}$ fans willing to buy the ticket. Because, according to the model assumptions, the tickets in the primary market are randomly distributed among all fans who have a willingness to pay higher than P^P, the inverse demand curve of the secondary market is a straight line through $(0, a)$ and $\left(\frac{a-P^P}{b} - (1-x)Q_{max}, P^P\right)$ $\forall\ a\ \geq P^S \geq P^P$ and a straight line through $\left(\frac{a-P^P}{b} - (1-x)Q_{max}, P^P\right)$ and $(\frac{a}{b} - (1-x)Q_{max}, 0)$ $\forall\ P^p > P^s \geq 0$. Equation (4) represents the inverse demand curve on the secondary market, which is visualized in Figure 1.

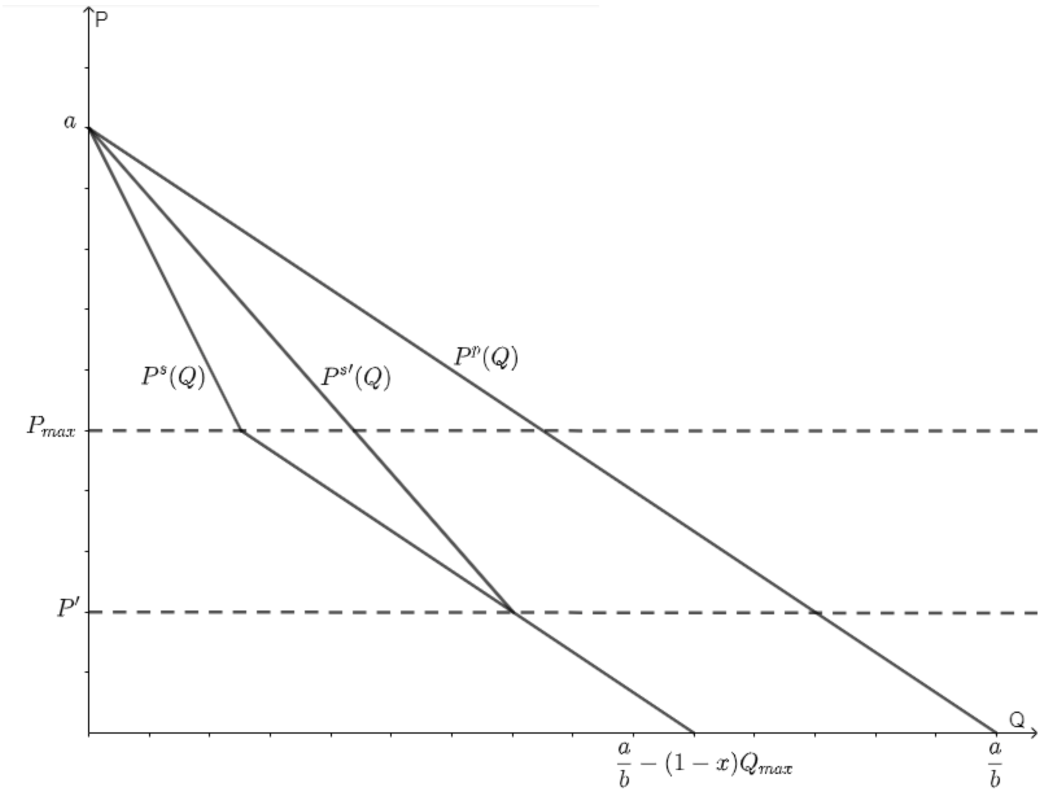
$$(4)\ P^s = \begin{cases} a - \frac{a-P^P}{\frac{a-P^P}{b}-(1-x)Q_{max}} Q^s & \forall\ a\ \geq P^S \geq P^P \\ \\ a - b(1-x)Q_{max} - bQ^s & \forall\ P^P \geq P^S \geq 0 \end{cases}.$$

Figure 2: graphical representation of demand curve on the secondary market (for $x = 0.5$ and $P^p = P_{max}$).



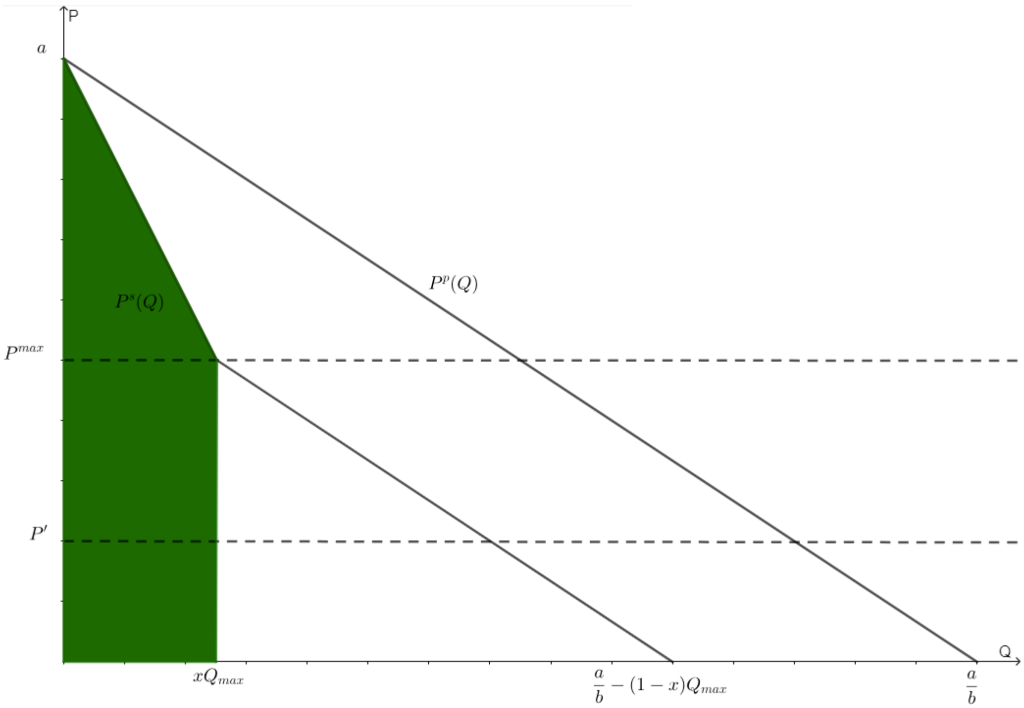
Equation (4) shows that the promoter is able to influence the demand on the secondary market by the price it sets on the primary market. If $P^P = 0$, then $P^S = a - \frac{a}{\frac{a}{b}-(1-x)Q_{max}}Q^S$, and if $P^P = P_{max}$, then $P^S = a - \frac{b}{x}Q^S \; \forall \; a \geq P^S \geq P^P$. Note that if $x = 1$ (i.e. all tickets on the primary market will be bought by scalpers), the demand curve of the secondary market is equal to the demand curve of the primary market, because no fan has obtained a ticket. If $x = 0$, then none of the tickets on the primary market will be bought by scalpers. Consequently, there will be no secondary market. Figure 3 shows the outward rotation of the demand curve on the secondary market when the primary market price decreases from P_{max} to P'.

Figure 3: shift of secondary demand curve when P^p decreases from P_{max} to P', with $x = \frac{1}{3}$.



The supply on the secondary market is fixed and equal to xQ_{max}. The secondary market is characterized by first degree price discrimination. Figure 4 shows the total revenue generated on the secondary market if P^P is set equal to P_{max}. The promoter receives τ of the revenue.

Figure 4: total revenue generated on the secondary market for $x = \frac{1}{3}$.



The promoter's profit on the secondary market π^S is equal to:

$$(5)\ \pi^S = \tau\left(\int_0^{xQ_{max}} [a - \frac{a-P^P}{\frac{a-P^P}{b}-(1-x)Q_{max}} Q^S]\, dQ^S\right) = \tau(axQ_{max} - \frac{1}{2}\frac{a-P^P}{\frac{a-P^P}{b}-(1-x)Q_{max}} x^2 Q_{max}{}^2)$$
$$\forall\ 0 \le P^P \le P_{max}.$$

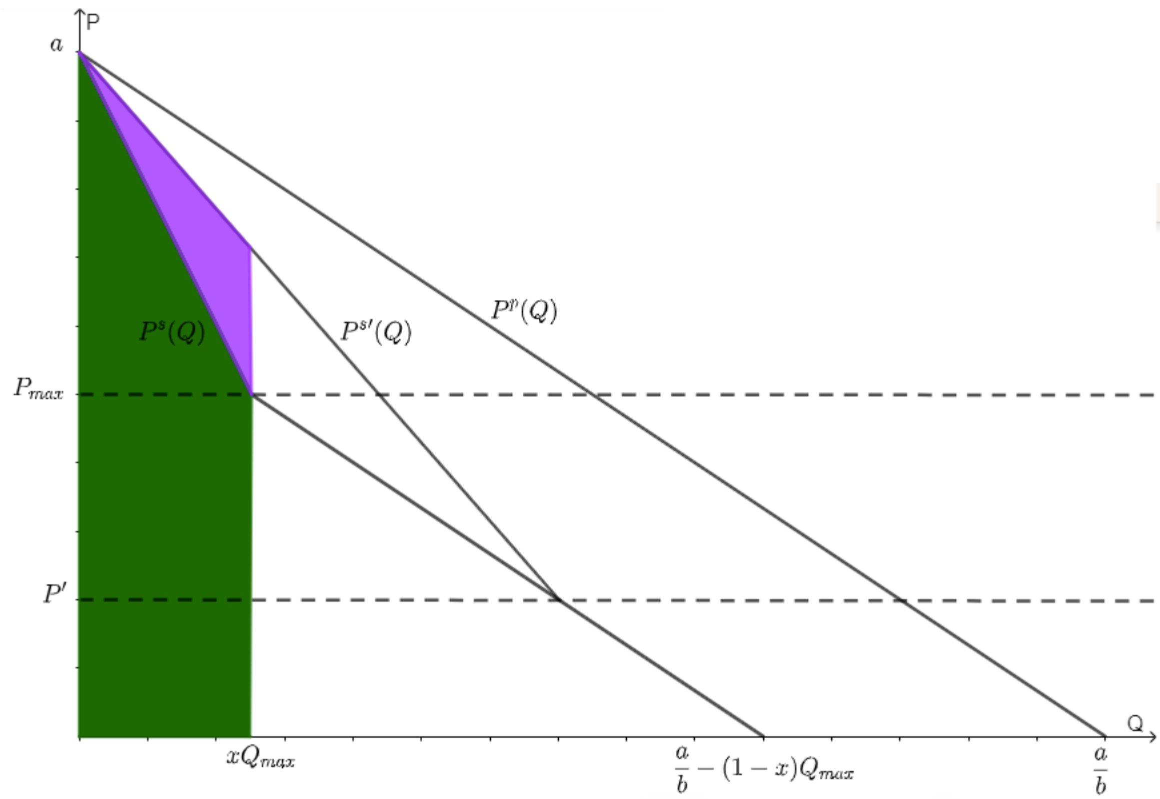
The total profits of the promoter is equal to the sum of the profits on the primary market π^P and the profits on the secondary market π^S.

$$(6)\ \pi = \pi^p + \pi^s = \gamma(P^P Q_{max} - C) + \tau(axQ_{max} - \frac{1}{2}\frac{a-P^P}{\frac{a-P^P}{b}-(1-x)Q_{max}} x^2 Q_{max}{}^2).$$

Proposition 3. *In Model 2, π^p strictly increases in P^P; π^S strictly decreases in P^P.*

As $\frac{d\pi^p}{dP^P} = \gamma Q_{max} > 0$ and $\frac{d\pi^s}{dP^P} = -\tau \frac{x^2(1-x)Q_{max}{}^3}{2\left(\frac{a-P^P}{b}-(1-x)Q_{max}\right)^2} < 0$, an increase in the primary market price will lead to higher profits in the primary market, but lower profits in the secondary market. The rationale for the former result is that for $0 \leq P^P < P_{max}$ there is excess demand on the primary market; an increase in P^P will not lead to less tickets sold, but increases the profit per ticket. The rationale for the latter result is the following. Increasing P^P will result in less demand by fans in the primary market. As the tickets are sold randomly among fans in the primary market, a larger share of the fans with a high willingness to pay are able to obtain a ticket in the primary market. This results in less demand in the secondary market by fans with a high willingness to pay given any $P^S \geq P^P$ and $x \neq 1$. This reduces the profits in the secondary market. This mechanism is visualized in Figure 5, where the purple area is the loss in profits in the secondary market, when the primary market price increases from P' to P_{max}.

Figure 5: change in secondary market profit when primary market price decreases.



As long as the increase in profits in the secondary market, as a result of a lower price in the primary market, exceeds the decrease in profits on the primary market, the promoter has an incentive to lower the price in the primary market. This is the case when $\frac{d\pi^S}{dP^P} > \frac{d\pi^P}{dP^P}$:

$$(7)\ \frac{x^2(1-x){Q_{max}}^3}{2(\frac{a-P^P}{b}-(1-x)Q_{max})^2} > \gamma Q_{max}.$$

To determine the optimal price on the primary market, the first order derivative of the profit function should be set equal to zero:

$$(8)\ \frac{d\pi}{dP^P} = \gamma Q_{max} - \tau \frac{x^2(1-x){Q_{max}}^3}{2\left(\frac{a-P^P}{b} - (1-x)Q_{max}\right)^2} = 0.$$

Rewriting leads to:

$$(9)\ {P^P}^2 - 2(a - b(1-x)Q_{max})P^P + a^2 - 2ab(1-x)Q_{max} + b^2(1-x)^2{Q_{max}}^2 - \frac{\tau b^2 x^2 (1-x){Q_{max}}^2}{2\gamma} = 0.$$

Solving for P^p:

$$(10)\quad P^p = a - b(1-x)Q_{max} \pm \frac{\sqrt{4(a-b(1-x)Q_{max})^2 - 4a^2 + 8ab(1-x)Q_{max} - 4b^2(1-x)^2{Q_{max}}^2 + \frac{2\tau b^2 x^2(1-x){Q_{max}}^2}{\gamma}}}{2}.$$

Simplifying the expression for P^p:

$$(11)\ P^p = a - \left((1-x) \pm \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}.$$

Only $P^p = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$ is valid as $P^p = a - \left((1-x) - \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max} = a - bQ_{max} + \left(x + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max} > a - bQ_{max} = P_{max}$.

The second order derivative of equation (6) is:

$$(12)\quad \frac{d^2\pi}{d{P^P}^2}(6) = \frac{d\pi}{dP^P}(8) = -\frac{\tau x^2(1-x){Q_{max}}^3}{b\left(\frac{a-P^P}{b} - (1-x)Q_{max}\right)^3}.$$

Filling in $P^p = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$ in the second order derivative in equation (12) leads to $-\frac{2\gamma\sqrt{2\gamma}}{bx\sqrt{\tau(1-x)}} < 0$. This means that $P^p = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$ is a relative maximum. P^p can be rewritten as $P^p = a - bQ_{max} + \left(x - \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max} = P_{max} + \left(x - \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$. Note that $\left(x - \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)$ is negative if $(1-x)\tau > 2\gamma$. Thus, if $(1-x)\tau > 2\gamma$, then the promoter will set

$P^p = \max\left(0, a - ((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}} x) bQ_{max}\right)$ and if $(1-x)\tau \leq 2\gamma$, then the promoter will set $P^p = P_{max}$. At $P^p = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}} x\right) bQ_{max}$ and $(1-x)\tau > 2\gamma$ the profit is equal to $\gamma\left\{a - ((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}} x) bQ_{max}\right\} + \tau\left\{ax - \frac{1}{2}\left((\frac{1}{x}\sqrt{\frac{2\gamma(1-x)}{\tau}} + 1) bx^2 Q_{max}\right)\right\} Q_{max} - \gamma C$. At $P^p = P_{max}$, the profit is equal to $\gamma(P_{max}Q_{max} - C) + \frac{\tau}{2}(a + P_{max})xQ_{max}$.

Proposition 4. *Under the condition that the concert has to sell out ($P^P \leq P_{max}$), a profit-maximizing integrated promoter sets the ticket price P^P in the primary market equal to*

$$P^P = \begin{cases} \max(0, a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}} x\right) bQ_{max}) & \text{if } (1-x)\tau > 2\gamma \\ P_{max} & \text{if } (1-x)\tau \leq 2\gamma \end{cases}.$$

The total profit is equal to

$$\pi = \pi^p + \pi^s$$
$$= \begin{cases} \gamma\left\{a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}} x\right) bQ_{max} - C\right\} + \tau x\left\{a - \frac{1}{2}\left(\left[\sqrt{\frac{2\gamma(1-x)}{\tau}} + x\right] bQ_{max}\right)\right\} Q_{max} & \text{if } (1-x)\tau > 2\gamma \\ \gamma(P_{max}Q_{max} - C) + \frac{\tau}{2}(a + P_{max})xQ_{max} & \text{if } (1-x)\tau \leq 2\gamma \end{cases}.$$

Corollary 1. *If $(1-x)\tau > 2\gamma$ holds, a profit-maximizing integrated promoter sets a lower ticket price in the primary market than an unintegrated promoter.*

Thus, if $(1-\mathrm{x})\tau > 2\gamma$ holds, a profit-maximizing integrated promoter sets a lower ticket price in the primary market than P_{max}, i.e. the price an unintegrated promoter would set. This condition holds when

γ and x are sufficiently small and τ is sufficiently large. The intuition is as follows. When γ is small, a promoter only keeps a small share of the primary market profits. When τ is large, the promoter receives a large share of the revenues of the secondary market. When x is small, i.e. when only a few scalpers buy tickets on the primary market, only a small amount of tickets will be sold on the secondary market. This may induce the promoter to extract more profits on the primary market by setting a high price. However, there is also an opposite incentive (to set a price lower than P_{max} in the primary market) when x is small. When x is small, the increase in demand in the secondary market, as a result of a lower price, is relatively large. The price decrease therefore leads to a relatively large outward rotation of the demand curve of the secondary market. When x is large, the increase in demand in the secondary market, as a result of a lower price, is relatively small. The price decrease therefore leads to a relatively small outward rotation of the demand curve of the secondary market. E.g., when $x = 1$, the demand curve of the secondary market does not depend on the price in the primary market. According to Corollary 1, a promoter is more inclined to set a price lower than P_{max} when x is small. The condition $(1-x)\tau > 2\gamma$ does not depend on *a, b,* and Q_{max}, because the incentive to decrease the price in the primary market does not change due a change in these parameters.

Proposition 5. *If* $(1-x)\tau > 2\gamma$ *and* $P^p \geq 0$, *then* $\frac{dP^p}{d\tau} < 0$, $\frac{dP^p}{d\gamma} > 0$, $\frac{dP^p}{da} > 0$, $\frac{dP^p}{db} < 0$, $\frac{dP^p}{dQ_{max}} < 0$, $\frac{dP^p}{dx} < 0$ for $x \in \left[0, \frac{2}{3} - \frac{4\gamma}{9\tau} - \sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2 + \frac{24}{81}\frac{\gamma}{\tau}}\right)$ and $\frac{dP^p}{dx} > 0$ for $x \in \left[\frac{2}{3} - \frac{4\gamma}{9\tau} - \sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2 + \frac{24}{81}\frac{\gamma}{\tau}}, 1\right]$.

Proof. The ceteris paribus effects of τ, γ, a, b, and Q_{max} are immediate from $P^p = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$. The effect of x follows from the first order condition:

$$(13)\quad \frac{dP^p}{dx} = \frac{d}{dx}\left[a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}\right] = \left(1 - \sqrt{\frac{\tau}{2\gamma}}\left(\sqrt{(1-x)} - \frac{x}{2\sqrt{(1-x)}}\right)\right)bQ_{max} = 0.$$

Solving for x leads to $x = \frac{2}{3} - \frac{4\gamma}{9\tau} - \sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2 + \frac{24}{81}\frac{\gamma}{\tau}}$.

The second order derivative is:

$$(14)\ \frac{d^2P^p}{dx^2}\left[a-\left((1-x)+\sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}\right]=\frac{4\sqrt{(1-x)}+\frac{x}{\sqrt{(1-x)}}}{4(1-x)}\sqrt{\frac{\tau}{2\gamma}}bQ_{max}>0\forall x\in[0,1].$$

Thus the value of x is a local minimum, which means that the effect of x on P^p is negative for $x \in [0,\frac{2}{3}-\frac{4\gamma}{9\tau}-\sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2+\frac{24}{81}\frac{\gamma}{\tau}})$ and positive for $x \in [\frac{2}{3}-\frac{4\gamma}{9\tau}-\sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2+\frac{24}{81}\frac{\gamma}{\tau}},1]$.

Q.E.D.

The rationale for these effects are as follows. If τ increases, the promoter receives a larger share of the profits in the secondary market and is therefore more inclined to set a lower price to increase profits on the secondary market. Contrary, when γ increases, the promoter receives a larger share of the profits on the primary market and sets a higher price to increase the profits on the primary market. If a increases, then the optimal price in the primary market increases, because demand for this event is higher. If b increases, then the optimal price in the primary market decreases, because P_{max} decreases and the incentive to decrease the price in the primary market does not change. If Q_{max} increases, then the price in the primary market decreases, because P_{max} decreases and the incentive to decrease the price in the primary market does not change. When x is sufficiently small, i.e. $x<\frac{2}{3}-\frac{4\gamma}{9\tau}-\sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2+\frac{24}{81}\frac{\gamma}{\tau}}$, an increase in x will lead to a lower optimal price for the promoter, because the increase in profits in the secondary market, as a result of a price decrease, is large, relative to the decrease in profits in the primary market. When x is sufficiently large, i.e. $x\geq\frac{2}{3}-\frac{4\gamma}{9\tau}-\sqrt{\frac{16}{81}\left(\frac{\gamma}{\tau}\right)^2+\frac{24}{81}\frac{\gamma}{\tau}}$, an increase in x will lead to a higher optimal price, because the increase in profits in the secondary market, as a result of a price decrease, is small, relative to the primary market.

Note that if $(1-x)\tau>2\gamma$ and $a-\left((1-x)+\sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}<0$, then $\frac{dP^p}{dx}=0$. The reason is that $P^p\geq 0$ by assumption. Furthermore note that $(1-x)\tau>2\gamma$ can be rewritten as $x<1-\frac{2\gamma}{\tau}$, implying that, if $1-\frac{2\gamma}{\tau}<x\leq 1$, the promoter sets $P^p=P_{max}$. Thus, if $\tau=2\gamma$, then $\frac{dP^p}{dx}=0\ \forall\ 0\leq x\leq 1$. The larger $\tau>2\gamma$, the smaller the interval for which $\frac{dP^p}{dx}=0$. If $x<1-\frac{2\gamma}{\tau}$ and $\tau>2\gamma$, then $P^p(x)$ will be a decreasing for small x and increasing for larger x (see above). The larger τ (relative to γ), the larger the critical value of x. If $x<1-\frac{2\gamma}{\tau}$ and $\tau\gg 2\gamma$, then $P^p(x)$ will be a decreasing for small x, constant (equal to zero) for intermediate values of x, and increasing for larger x. The reason is that for intermediate values of x, $a-\left((1-x)+\sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$ will become negative (which is not allowed by assumption).

Proposition 6. *Under the condition that the concert has to sell out, not all tickets will be sold to fans with the highest willingness to pay if* $(1-x)\tau > 2\gamma$.

Proposition 6 says that an integrated market may lead to an inefficient outcome. The reason is that for a price on the primary market lower than P_{max}, some fans with relatively low willingness to pay obtain tickets due to random allocation. As there are not enough tickets available to provide access to the concert for all the fans who are willing to pay the price, some fans with relatively high willingness to pay fail to win tickets in the secondary market.

Model 3

Contrary to Model 2, in Model 3 the proportion of tickets bought by scalpers (x) depends on the face value of the tickets (P^P). The function $x(P^P)$ is assumed to be decreasing in price ($\frac{dx(P^P)}{dP^P} < 0$) on the interval $[0, P_{max}]$. Additionally, this model assumes that the value of $x(P^P)$ is equal to x in Model 2 when $P^P = a-\left((1-x)+\sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$, which is the optimal price in Model 2 when $(1-x)\tau > 2\gamma$. This assumption is needed to be able to compare the results of Model 2 and Model 3. Because the share of tickets bought by scalpers is decreasing in price, the value x in Model 3 can only be equal to x in Model 2 for one value of P^P. This way, the model shows how the pricing decision changes when the promoter is not only capable of influencing demand, but also supply on the secondary market by its price on the primary market.

Equation (15) represents the inverse demand curve on the secondary market:

$$(15)\quad P^s = a - \frac{a-P^P}{\frac{a-P^P}{b}-(1-x(P^P))Q_{max}} Q^s \ \ \forall\, a \geq P^S \geq P^P.$$

The profit function is equal to:

$$(16)\quad \pi = \pi^p + \pi^s = \gamma(P^P Q_{max} - C) + \tau\left(\int_0^{x(P^P)Q_{max}} [a - \frac{a-P^P}{\frac{a-P^P}{b}-(1-x(P^P))Q_{max}} Q^s]\, dQ^s\right).$$

Rewriting leads to:

$$(17)\ \ \pi = \pi^p + \pi^s = \gamma(P^P Q_{max} - C) + \tau\left(ax(P^P)Q_{max} - \frac{1}{2}\frac{a-P^P}{\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}} x(P^P)^2 {Q_{max}}^2\right).$$

The relationship between the price on the primary market and the profit on the primary market is the same as in Model 1 and Model 2:

$$(18)\ \ \frac{d\pi^P}{dP^P} = \gamma Q_{max} > 0.$$

The relationship between the price on the primary market and the profit on the secondary market is (using the quotient rule):

$$(19)\ \ \frac{d\pi^s}{dP^P} = \tau Q_{max}\left(a\frac{dx(P^P)}{dP^P} - \left\{\frac{Q_{max}x(P^P)\left(2a\frac{dx(P^P)}{dP^P} - 2P^P\frac{dx(P^P)}{dP^P} - x(P^P)\right)\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right) - (a-P^P)x(P^P)^2 Q_{max}\left(Q_{max}\frac{dx(P^P)}{dP^P} - \frac{1}{b}\right)}{2\left(\frac{a-P^P}{b} - (1-x(P^P))Q_{max}\right)^2}\right\}\right).$$

Rewriting leads to:

$$(20)\ \ \frac{d\pi^s}{dP^P} = \tau\left(-\frac{\left(1-x(P^P)\right)x(P^P)^2 {Q_{max}}^3}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2}\right) + \tau\frac{dx(P^P)}{dP^P}Q_{max}\left(a - \frac{x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right]}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2}\right).$$

The first part of equation (20), $\tau\left(-\frac{\left(1-x(P^P)\right)x(P^P)^2 {Q_{max}}^3}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2}\right)$, is analogous to $\frac{d\pi^s}{dP^P}$ in Model 2, in which the promoter could only influence the demand in the secondary market. This will therefore be referred to as the demand effect. Note that the demand effect in Model 3 is not necessarily equal to the effect in Model 2, as equation (20) depends on the value of $x(P^P)$, which is only equal to value of x in Model 2 if $P^P = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}$. The second part of equation (20) is the effect of an increase in price on the promoters' profits in the secondary market, due to a decrease of supply, i.e. the number of available tickets, in the secondary market. This effect will therefore be referred to as the supply effect. This supply effect must have a negative effect on the profits, as it leads to less tickets sold in the secondary market. To prove this, the second part of Equation (20) should be negative:

$$(21)\quad \tau \frac{dx(P^P)}{dP^P} Q_{max} \left(a - \frac{x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right]}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2} \right) < 0.$$

As $\frac{dx(P^P)}{dP^P} < 0$ by assumption, the following should hold:

$$(22)\quad a - \frac{x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right]}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2} > 0.$$

Rewriting leads to:

$$(23)\quad \left(2a\frac{(a-P^P)^2}{b^2} - 4aQ_{max}\frac{a-P^P}{b} + 2aQ_{max}{}^2\right) + \left(2ax(P^P)Q_{max}\frac{a-P^P}{b} - 2ax(P^P)Q_{max}{}^2\right) +$$
$$\left(2P^P x(P^P)Q_{max}\frac{a-P^P}{b} - 2P^P x(P^P)Q_{max}{}^2\right) + (a+P^P)ax(P^P)^2 Q_{max}{}^2 > 0.$$

Equation (23) holds, as (24), (25), (26), (27) and (28) hold.

$$(24)\quad \frac{a-P^P}{b} \geq Q_{max}$$

$$(25)\quad 2a\frac{(a-P^P)^2}{b^2} - 4aQ_{max}\frac{a-P^P}{b} + 2aQ_{max}{}^2 = 2a\left(\frac{a-P^P}{b} - Q_{max}\right)^2 \geq 0$$

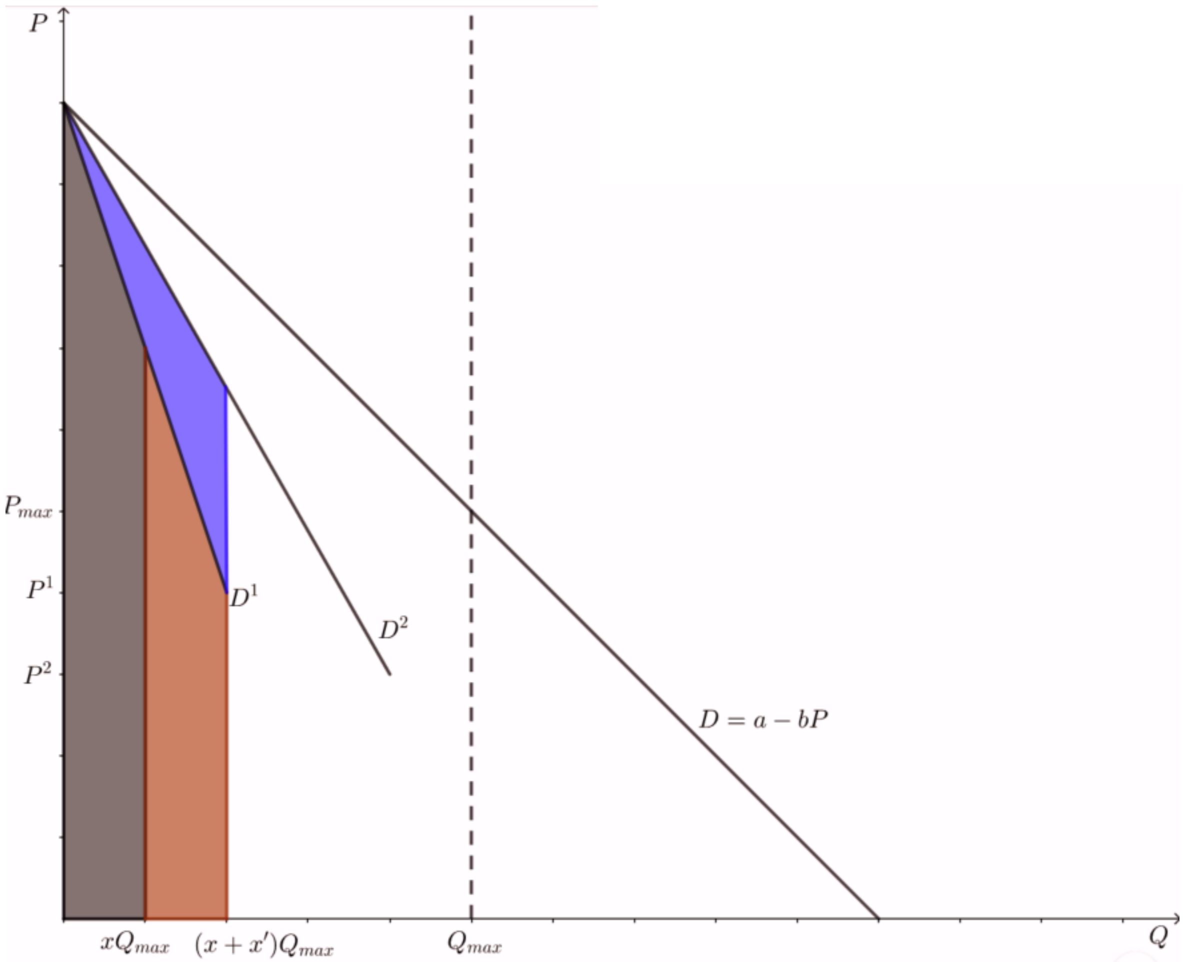
$$(26)\quad 2ax(P^P)Q_{max}\frac{a-P^P}{b} - 2ax(P^P)Q_{max}{}^2 \geq 0$$

$$(27)\quad 2P^P x(P^P)Q_{max}\frac{a-P^P}{b} - 2P^P x(P^P)Q_{max}{}^2 \geq 0$$

$$(28)\quad (a+P^P)ax(P^P)^2 Q_{max}{}^2 > 0.$$

Thus, the demand effect and the supply effect both have a negative influence on the profit on the secondary market. The demand effect and supply effect are depicted in Figure 6.

Figure 6: graphical representation of the demand effect (blue) and supply effect (red).



From the above, Proposition 7 follows.

Proposition 7. *In Model 3, like in Model 2, π^p strictly increases in P^P; π^S strictly decreases in P^P.*

Proposition 8 says that a promoter in Model 3 (thus when $\frac{dx(P^P)}{dP^P} < 0$) has an incentive to set a lower price on the primary market than a promoter in Model 2 (where *x* is assumed to be not dependent on price).

Proposition 8. *A profit-maximizing integrated promoter In Model 3 can increase its total profits by setting a lower price than the optimal price in Model 2:*

$$P^P < a - \left((1 - x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right)bQ_{max}.$$

Proof. To prove this, $\frac{d\pi^S}{dP^P}$ in Model 3 should be lower than $\frac{d\pi^S}{dP^P}$ in Model 2 when $P^P = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right) bQ_{max}$:

$$(29)\ a\frac{dx(P^P)}{dP^P}Q_{max} - \left\{\frac{Q_{max}{}^2 x(P^P)\left(2a\frac{dx(P^P)}{dP^P} - 2P^P\frac{dx(P^P)}{dP^P} - x(P^P)\right)\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right) - (a-P^P)x(P^P)^2 Q_{max}{}^2\left(Q_{max}\frac{dx(P^P)}{dP^P} - \frac{1}{b}\right)}{2\left(\frac{a-P^P}{b} - (1-x(P^P))Q_{max}\right)^2}\right\} \le -\frac{x^2(1-x)Q_{max}{}^3}{2\left(\frac{a-P^P}{b} - (1-x)Q_{max}\right)^2}.$$

Assume $x(P^P)$ to be equal to the value of x in Model 2 if P^P equals the optimal P^P in Model 2, i.e. if $P^P = a - \left((1-x) + \sqrt{\frac{\tau(1-x)}{2\gamma}}x\right) bQ_{max}$. Rewriting Equation (29) leads to:

$$(30)\ \left(-\frac{\left(1-x(P^P)\right)x(P^P)^2 Q_{max}{}^3}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2}\right) + \frac{dx(P^P)}{dP^P}Q_{max}\left(a - \frac{x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right]}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2}\right) \le -\frac{x^2(1-x)Q_{max}{}^3}{2\left(\frac{a-P^P}{b} - (1-x)Q_{max}\right)^2} \leftrightarrow$$

$$(31)\ a - \frac{x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right]}{2\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2} \ge 0 \leftrightarrow$$

$$(32)\ 2a\left(\frac{a-P^P}{b} - \left(1-x(P^P)\right)Q_{max}\right)^2 - x(P^P)Q_{max}\left[2(a-P^P)\frac{a-P^P}{b} - 2(a-P^P)Q_{max} + (a-P^P)x(P^P)Q_{max}\right] \ge 0 \leftrightarrow$$

$$(33)\ 2a\left(\frac{a-P^P}{b}\right)^2 - 4aQ_{max}\frac{a-P^P}{b} + 2axQ_{max}\frac{a-P^P}{b} + 2aQ_{max}{}^2 - 2axQ_{max}{}^2 + ax^2Q_{max}{}^2 + 2xP^PQ_{max}\frac{a-P^P}{b} - 2xP^PQ_{max}{}^2 + x^2P^PQ_{max}{}^2 \ge 0.$$

This condition holds, as (34), (35), (36) and (37) hold.

$$(34)\ 2a\left(\frac{a-P^P}{b}\right)^2 - 4aQ_{max}\frac{a-P^P}{b} + 2aQ_{max}{}^2 = 2a\left(\frac{a-P^P}{b} - Q_{max}\right)^2 \ge 0$$

$$(35)\ 2axQ_{max}\frac{a-P^P}{b} - 2axQ_{max}{}^2 = 2axQ_{max}\left(\frac{a-P^P}{b} - Q_{max}\right) \ge 0$$

$$(36)\ 2xP^P Q_{max}\frac{a-P^P}{b} - 2xP^P {Q_{max}}^2 = 2xP^P Q_{max}(\frac{a-P^P}{b} - Q_{max}) \geq 0$$

$$(37)\ ax^2 {Q_{max}}^2 + x^2 P^P {Q_{max}}^2 \geq 0.$$

Q.E.D.

Under what condition does a profit maximizing integrated promoter in Model 3 set a price below P_{max}? Because a promoter in Model 3 (in contrast to a promoter in Model 2) can influence the supply on the secondary market by its price setting on the primary market, a promoter in Model 3 can increase its profits (relative to Model 2) by decreasing its price. A promoter in Model 3 will set a price below P_{max} if at $P^P = P_{max}$ the increase in profits in the secondary market, as a result of a lower price, is larger than the decrease in profits in the primary market:

$$(38)\ \gamma Q_{max} < \tau\left(a\frac{dx(P^P)}{dP^P} Q_{max} - \left\{\frac{{Q_{max}}^3 x(P^P)^2\left(2(a-P_{max})\frac{dx(P^P)}{dP^P} - x(P^P)\right)(x(P^P)Q_{max}) - (a-P_{max})x(P^P)^2 {Q_{max}}^2 (Q_{max}\frac{dx(P^P)}{dP^P} - \frac{1}{b})}{2x(P^P)^2 {Q_{max}}^2}\right\}\right).$$

Recall, if $P^P = P_{max}$, then $\frac{a-P^P}{b} = Q_{max}$. Substituting:

$$(39)\ \gamma Q_{max} < \tau\left(a\frac{dx(P^P)}{dP^P} Q_{max} - \left\{\frac{\left(2(a-P^P)\frac{dx(P^P)}{dP^P} - x(P^P)\right)Q_{max} - (a-P_{max})Q_{max}\frac{dx(P^P)}{dP^P} + \frac{a-P_{max}}{b}}{2}\right\}\right) \leftrightarrow$$

$$(40)\ \gamma Q_{max} < \tau\left(a\frac{dx(P^P)}{dP^P} Q_{max} - \left\{\frac{\left(2(a-P^P)\frac{dx(P^P)}{dP^P} - x(P^P)\right)Q_{max} - (a-P_{max})Q_{max}\frac{dx(P^P)}{dP^P} + Q_{max}}{2}\right\}\right) \leftrightarrow$$

$$(41)\ \gamma < \tau\left(a\frac{dx(P^P)}{dP^P} - \left\{\frac{a\frac{dx(P^P)}{dP^P} - P^P\frac{dx(P^P)}{dP^P} - x(P^P) + 1}{2}\right\}\right) \leftrightarrow$$

$$(42)\ \tau\left(\frac{a\frac{dx(P^P)}{dP^P} + P^P\frac{dx(P^P)}{dP^P} + x(P^P) - 1}{2}\right) > \gamma \leftrightarrow$$

$$(43)\ \left(1 - (a + P_{max})\frac{dx(P^P)}{dP^P} - x(P^P)\right)\tau > 2\gamma.$$

Proposition 9 follows from the above.

Proposition 9. *In Model 3, a profit-maximizing integrated promoter will set* $P^P < P_{max}$ *if* $\left(1 - (a + P_{max}) \frac{dx(P^P)}{dP^P} - x(P^P)\right)\tau > 2\gamma.$

Recall from Proposition 4 that a promoter in Model 2 sets a price lower than P_{max} if $(1-x)\tau > 2\gamma$. Also recall that $x(P^P)$ is assumed to be equal to the value of x in Model 2 when P^P equals the optimal price in Model 2 if $(1-x)\tau > 2\gamma$. As $\left(1 - (a + P_{max}) \frac{dx(P^P)}{dP^P} - x(P^P)\right) > (1-x)$ a promoter in Model 3 is more inclined to set a lower price. Note that the more negative $\frac{dx(P^P)}{dP^P}$ is, the more likely it is that a promoter in Model 3 sets $P^P < P_{max}$.

5. Conclusion

This thesis studies the effect of vertical integration of concert promoters and secondary ticket platforms on the ticket price in the primary market under the condition that the concert sells out. At high demand events, the promoter has an incentive to sell out, because inside the venue there are opportunities for cross-selling, such as merchandise and food and beverages. By modeling the primary and secondary market of the live event industry with and without vertical integration, pricing decisions of integrated and unintegrated promoters can be compared. The situation is similar to the situation of Live Nation before and after acquiring secondary ticketing websites, such as Get Me In! and Seatwave. The thesis shows that an unintegrated promoter will set the price at a level at which demand equals the number of available tickets. This way the promoter will earn the maximum profits. Setting the price for tickets in the primary market at this level is also efficient, as the tickets will be allocated to those fans who have the highest willingness to pay.

However, in practice promoters can be limited in their ability to ask a market clearing price when this price is assumed to be high. For example, Barbra Streisand cancelled her concert in Rome in 2007, after various consumer organizations opposed to the high prices, ranging from € 150 to € 600. Even though the biggest fans were probably willing to pay this price, public opinion was negatively affected by the ticket prices. Thus promoters might not always be able to set a market clearing price in practice. In this case, vertical integration with the secondary market can be a solution, as the integrated promoter also generates profits in the secondary market. By setting a lower price, profit in the primary market is lower, but demand on the secondary market increases, leading to higher profits on the secondary market. The thesis shows that, when an integrated promoter earns a sufficiently small share of profits in the primary market, i.e. most of the profits goes to the artist, and earns a sufficiently large share of profits in the secondary market, i.e. a high percentage of the secondary market sale, the promoter has an incentive to decrease the ticket price in the primary market (relative to the market clearing price in an unintegrated market). A consequence of this price drop is that there will be excess demand in the primary market which in turn will lead to tickets be bought by fans who have a lower willingness to pay than fans who did not succeed to buy a ticket. The price setting therefore has a direct impact on the size and distribution of the consumer surplus over the fans.

In practice, does a concert promoter only earn a small share of the profits in the primary market (and vast majority of the profits go to the artist)? While concert promoting used to be a business with high margins and profits, this has not necessarily been the case in the past years anymore. While consumer organizations opposed to the Live Nation merger with Ticketmaster, the merged company has been struggling to record a profit ever since, as shown in Table 1. This leads to the impression that the bargaining power of the promoter against the artist is weak nowadays. As mentioned in Section 2, concerts used to serve as promotion of a new album, but illegal piracy diluted the margins on record sales (Yoshino, 2007). Therefore, artists rely more upon the revenues from concerts. Dick van Zuijlen, director of Mojo Concerts, the Dutch daughter company of Live Nation, stated in an interview in 2013 that margins are very small (Sisario et al., 2018). Managers of artists usually ask 85 percent of the profits; for the big gigs this can rise up to 97.5 percent (Haijtema, 2013). The margins in the primary market are small, so when the promoter earns a sufficiently high share of the profits in the secondary market, the results in this thesis show that it is optimal to set a lower price in the primary market. At this moment, the secondary market is a turbulent market with many players. Therefore, it is not expected that promoters can effectively earn high profits on the secondary market. Only if secondary markets become more stable and Live Nation or any other promoter is able to obtain a strong position in the secondary market, due to acquisition or organic growth, it becomes more likely that promoters will shift profits form the primary to the secondary market.

Table 1: profits of Live Nation Entertainment, Inc. since 2010 (Live Nation (2017); Live Nation (2016); Live Nation (2013)):

Year	Net income (x1000)
2011	-83,016
2012	-163,227
2013	-43,378
2014	-104,450
2015	-15,769
2016	20,297
2017	7,774

The thesis also shows that a promoter has an incentive to further decrease its price on the primary market if the number of scalpers is dependent on the price setting. The reason is that when the price on the primary market is lower, the expected profit for scalper is higher, which increases the number of scalpers. Thus the secondary market profit of an integrated promoter does not only increase due to higher demand but also due to higher supply.

There is scope for further research. Although this thesis considers pricing decisions, it has exempted the option of the promoter to use an auction on the primary market to maximize profits by applying first degree price discrimination. This is a strategy that Live Nation has used before, but never fully adopted. This thesis does not provide conditions under which it is optimal for a promoter to use an auction. However, this strategy will not be very effective when a large share of the surplus on the primary market is abstracted by the artist. In that case, selling directly through the secondary platform is likely to be a more suitable strategy. This strategy is used more often nowadays. Live Nation has recently been criticized for selling tickets directly via Seatwave and Viagogo in Italy and the UK (Channel 4, 2012, *The Great Ticket Scandal*; Italia1, 2016, *La Iene*).

Furthermore, competition among scalpers could be taken into account in follow-up studies. In this thesis it is assumed that scalpers in the secondary market set the price as high as possible at first and decrease the price when tickets do not sell. This mechanism leads to first degree price discrimination. Because all scalpers prefer to sell their tickets first (because then tickets are sold to the fans with the highest willingness to pay), it requires some coordination among scalpers to effectively apply first degree price discrimination. When scalpers offer their tickets simultaneously, they have an incentive to offer their ticket for a slightly lower price, leading to price competition among scalpers and less profits in the secondary market. According to the theory of Courty (2003) it can also be profitable to sell the tickets close to the date of the event, due to heterogeneous preferences of the fans; some fans want to buy their tickets early and some fans want to decide last minute but are willing to pay a premium. Because of these reasons, it remains unclear if, and to what extent, there truly is first degree price discrimination in the secondary market. The effect of a lower primary market price on the profits in the secondary market might therefore be less than the results in this thesis show.

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