The Pricing of Art and the Art of Pricing:

Pricing Styles in the Concert Industry

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Abstract: We document the existence of pricing styles in the concert industry. Artists differ in the extent to which they rely on second-and third-degree price discrimination and in the probability of their concerts selling out. Most strikingly, artists who use multiple seating categories are more likely to vary prices across markets and less likely to sell out concerts. These patterns are difficult to explain within a standard profit maximization paradigm. The hypothesis that artists differ in their willingness to exploit market power provides a plausible framework for explaining these patterns in artist pricing style.

JEL: D42, D45, L21, L82, Z11.

Keywords: Price discrimination, rationing, behavioral pricing, pricing style, exploitation of market power, fair pricing.

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Tickets to see musicians such as Bruce Springsteen, who insists that entry to his shows be cheap enough for working stiffs to afford, are particularly susceptible to what fans call "price gouging".
The Economist, Jan 20th, 2011

Bruce Springsteen, Pearl Jam, and Dave Matthews have never charged as much as they could for their tickets.
Ray Waddell, 2009

When Babs tried to charge up to Euro 900 for a Rome gig, Italian fans rebelled and urged the city's government to refuse the singer use of a stadium. After the public outcry, Streisand cancelled the concert.
The Sunday Times, August 2nd, 2008

1 Introduction

Why devote an entire chapter of the Handbook to studying how artists set prices for live concerts? One reason is the overwhelming popular interest in the topic. Ticket pricing receives a lot of attention in the press, and fans seem obsessed with the price and availability of tickets. Journalists howl when concert prices are perceived as outrageously high, and squawk when fans have to line up for hours for a much sought-after ticket unless they can afford to pay several times the face value on online resale markets. Newspapers also report on how difficult it is to get some or all types of seats when tickets are all sold at the same price. Artists, promoters, fans and commentators have different views on ticket pricing. So who should one listen to?

Ticket pricing is also interesting because of the unusual nature of the live event industry. The suppliers, typically individual artists or bands, are not the textbook profit-maximizing entrepreneurs. Many artists are also songwriters and composers who see higher meaning in their music. Some songs have strong emotional and political messages.

Music can raise spirits and aspirations. Artists are celebrities who often rely on their public image to sell their art. Some enjoy public adulation for the sake of it. Another unique feature of the concert business is that artists sometimes express personal views about who should attend their concerts and how much they should be expected to pay. Bruce Springsteen, for example, explains the low price of tickets to his concerts as an attempt to make them affordable to the working classes. One may question whether such statements are sincere. The debate goes on.

Concert-goers are not textbook consumers either. Many fans are loyal to specific bands, and develop emotional attachments to particular types of music and individual artists. The media reports on the lives of artists, thereby feeding fans with information that shape their perception of the artist. Some fans feel that concert attendees should not be selected on the basis of how much they are willing to pay but rather on the basis of their sincere understanding of, and commitment to, the art. Many artists are sympathetic to this view.[3]

These are just a few features of the live music industry that contribute to its uniqueness. While some have to do with the supply side of the market, others have to do with the demand side. The nature of the product and how it is distributed to consumers also raise interesting issues. Pricing is a salient issue because live bands have a tremendous amount of market power and sell highly differentiated products. Not all seats in a venue provide

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[3] Pearl Jam, for example, has always intentionally maintained relatively low prices (Ault, 2003).

the same experience. Moreover, live music is also often delivered to consumers through tours that stop in cities with sometimes widely different local demands. This raises complex pricing issues. Should an artist charge different prices for the same concert in two different markets? Should an artist charge different prices for two seats located in different areas of a venue? What determines the artists' willingness to use price discrimination?

While interesting questions are a good starting point for conducting worthy empirical research, they are not enough; one also needs reliable data to conduct statistical analysis. In this sense, concert pricing offers a unique laboratory for the researcher. Artists have to make a large number of choices when pricing tickets. Each time an artist launches a tour, which most artists do regularly, decisions must be made concerning the overall level of prices, how much prices should be differentiated across local markets, and how much prices should be differentiated within a venue. Artists set ticket prices in advance and rarely change them (although prices may vary widely in the resale market). Two trade publications cover the concert industry, *Pollstar* and *Billboard*, and maintain datasets that match artists, promoters, venues, and concert prices. Most importantly for the researcher, the concert industry lends itself to the use of statistical analysis because the econometrician can use repeated observations to control for many unobserved factors. Artists tour repeatedly, year in and year out, and give a large number of identical concerts within each tour. They may sing over and over again in the same city and venue as part of different tours. In addition, a fairly small number of promoters repeatedly promote concerts given by top artists.

A research topic is of particular interest if it offers outcomes that challenge conventional views. The live music industry is rich in such puzzles. First and foremost, one has to ask why rationing and resale markets are so common. *The Economist* (2011) claims that "Live music is one of the few businesses in which second-hand goods often sell for more than new ones."[4] This may be an overstatement, but it points outs the connections between the price level, the extent of price differentiation in the primary market, and the subsequent resale activities in secondary markets. Economists and others have produced many theories of under-pricing, rationing, and price rigidities. However, rigorous empirical evidence on rationing is almost non-existent. Overall, it is fair to say that there is no systematic understanding of the causes of rationing.

Another puzzling phenomenon is that price discrimination is not very common. Why are seats in the same venue often sold at the same price? Even when there are multiple seating categories, it seems that the number of categories is fairly small. The same is true if we consider the pricing of the same concert in two different cities. Why do so many artists set the same price for concerts that are part of the same tour?

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[4] This chapter focuses on prices in the primary market because they are controlled to a large extent by the artists. Tickets are also resold in secondary markets through brokers and on the Internet, but we do not discuss these issues here. See Courty (2003) , Leslie and Sorensen (2011), or Connolly and Krueger (2011) for a discussion of prices in the secondary market.

Connolly and Krueger (2006) highlight these puzzles in concluding their review of the 'Economics of popular music' in the first volume of the *Handbook of the Economics of Art and Culture*. Several areas they deem worthy of future research have to do with ticket pricing. They ask: "What determines the amount of price differentiation within concerts? Is there less regional variation in prices for the same concert than one would expect in an efficient market? If so, why? Why do tickets appear to be underpriced for many concerts?" This chapter takes on these questions. We study price discrimination and rationing in the concert industry.

We document new stylized facts from a large dataset that covers about 20,000 concerts offered by the top 100 artists in the period 1992-2005. Our initial focus is on the issue of the use of price discrimination (between seats within a venue and between venues that belong to the same tour). We document the existence of large differences across artists in the use of second- and third-degree price discrimination, even after controlling for a large number of sources of unobserved demand and product heterogeneity. Some artists vary prices to respond to demand conditions while others do not, suggesting that artists may have different pricing styles. Next, we develop a simple framework that is consistent with these stylized facts, and hypothesize that artists differ in their willingness to exploit market power. This assumption provides a plausible framework for explaining the observed patterns in artist pricing styles. First, it rationalizes the observed heterogeneity across artists. Second, it implies that artists who are more likely to vary prices within a venue will also vary prices across venues more and ration tickets more. These predictions, which are

unique to the hypothesis that artist pricing styles stem from differences in willingness to exploit market power, find remarkable support in the data.

Our evidence is drawn from one industry: concerts for live popular music. There are many reasons for this choice. As mentioned earlier, data on ticket prices are uniquely suitable for conducting statistical analysis. In addition, the industry is significant in value, global, and subject to market forces with little government interference, three features that distinguish it from many other performing arts.

The rest of this paper proceeds as follows. Section 2 presents background information about the live event industry, reviews the literature, and lists a number of open questions. Sections 3 to 5 present the data and establish stylized facts about the use of second and third-degree price discrimination. Sections 6 and 7 show that it is difficult to associate the differences in pricing practices to unobserved heterogeneity. Instead, heterogeneity in artist willingness to exploit market power can, in fact, rationalize a number of observed patterns in the data. Section 8 presents further evidence consistent with the hypothesis that artists differ in their pricing styles. Section 9 concludes and lists a number of questions for future research. This last section also discusses the broader relevance of our work and explains how the concept of pricing style could be applied elsewhere.

2 The live event industry: facts, literature review, and open questions

The economics of live events raises a number of interesting issues that cannot all be addressed in a single chapter. Here we focus on second- and third-degree price discrimination and rationing. To prevent confusion, discussion of the broader context and

of connections with other pricing issues is useful, although of course these issues are not directly addressed here.

This study focuses on the primary markets for concert tickets. Concerts are often sold out before the event date. Consumers who cannot purchase a ticket in the primary market can purchase one in resale markets. The most common ways to do so are through auction websites such as eBay, specialized resale websites or professional brokers. Although secondary markets are outside the scope of this study, we do investigate the issue of sold-out concerts, which is essential to understanding the economic rationale for secondary markets.

Typically, the price of tickets is fixed when a tour is announced, prices do not change over time, and tickets are distributed through the box office or national distributors. Although there have been some innovations in recent years (revenue management, distribution through artist websites, for example), this is still the dominant model for the industry. While we do not study these innovations in the core of this chapter, we shall touch on them again in the conclusion, when discussing areas for future research. Another consideration is that some artists offer many concerts each year and rarely take breaks, whereas others hardly ever give live performances. We leave aside the decisions of when to go on tour and which cities to visit, taking these decisions as given, and focus on the setting of prices for different seats in a venue and for different venues in a tour. Finally, the revenue from ticket sales is often supplemented by concessions revenues coming from the sale of food and drinks as well as CDs and a wide variety of souvenirs. Although these are important sources of revenue, they are not the focus of this work and are not discussed

at great length. The artists present in our sample make most of their income from touring. Connolly and Krueger (2006) discuss some of the connections between touring and other sources of income, recording in particular.

2.1 Industry background

We present the key characteristics of the concert industry that are relevant for this chapter. A more detailed review is available in Connolly and Krueger (2006) and Waddell et al. (2007). The modern touring industry was born in the late 1960s when a few bands such as the Rolling Stones and Led Zeppelin regularly started touring a variety of arenas and stadiums, using their own experienced crew to take care of the sound, staging and lighting. In the 1980s, advances in technology allowed bands to offer even more ambitious stage shows that were louder and brighter, and available to ever-larger audiences. By 2007, the North American concert industry had grown to $4 billion in revenue and 100 million in attendance.[5]

Although some artists give single concerts, the dominant model in the industry is that of tours. In brief, a concert tour is typically organized by an artist represented by his or her manager, a (booking) agent, and a promoter. The artist and the agent agree on an act and a tour plan. The agent then looks for promoters to organize the event in each city. The artist

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[5]   Part of the information on the touring industry presented in this section comes from interviews with concert promoters and with two professors teaching courses on concert promotion. Some of the information was also drawn from books and industry manuals on concert promotion, in particular Waddell et al. (2007).

comes to an agreement with each promoter on a pricing policy and on a revenue sharing

rule. Promoters are in charge of organizing the events. This involves booking venues,

advertising and collecting revenues. There are some variations on the theme. Most artists

use the same set of promoters to be in charge of the tour, but some also use local promoters

in certain cities to tap into the local expertise so crucial for success. A few artists even do

everything in-house and contact the venues directly. Although there are different types of

tours (e.g., promotional tours of new releases, seasonal tours, festival tours), all of the

concerts in a single tour usually include a common set of songs and similar staging, and are

marketed together.

2.2 What is specific about the pricing of live events? A review of the literature

Ticket prices of concerts are typically set jointly by the artist and the promoter(s) when the

tour is announced, and remain unchanged thereafter. Each event is unique and there is no

set formula for pricing a concert. There is no second chance if one gets the wrong number

of seating categories or prices. Events are sometimes added or cancelled, but prices or

category allocations typically remain the same.

The problem of pricing tickets for live events shares much in common with selling

perishable products such as tickets for air travel, booking hotel rooms, or handling

restaurant reservations. At the heart of the problem is the issue that the seller has a fixed

capacity, faces much demand uncertainty, and has a limited amount of time to sells tickets.

Many industries dealing with perishable products use techniques known as revenue

management, dynamic pricing or responsive pricing (Courty and Pagliero, 2008) to handle

these problems. But the live event industry does not think about pricing a seat for a concert

in the same way that a revenue manager thinks about pricing a seat for a flight or a hotel room. The concert industry is unique in its lack of sophistication. Although we have seen more experimentation with revenue management in recent years, it is still rare, and one has to ask why the concert industry does things differently.

Price discrimination

According to price discrimination theory, prices are expected to vary in response to differences in demand in different markets (third-degree price discrimination) or for different seats in the same venue (second-degree price discrimination, see Stole, 2007). Live events are peculiar in that the distribution of seat quality is given by the structure of the venue, and the artist decides only on the number and location of the different seating categories. Rosen and Rosenfield (1997) present a theory of second-degree price discrimination that deals with this specific problem.

Courty and Pagliero (2012) estimate (using the same dataset as the one herein) that the return from price discrimination relative to uniform pricing is about 5 percent of revenue. The magnitude is consistent with the results of Leslie (2004) in the context of a Broadway show. To put this number into context, assume that the artists' profits are 40 percent of revenue (LaFranco, 2003). Price discrimination increases the artist's take by 12.5 percent. Courty and Pagliero also show that the return to price discrimination increases in markets where demand is more heterogeneous, as predicted by price discrimination theory.

A preponderance of evidence indicates, however, that artists do not fully exploit the revenue potential of seat differentiation within a venue. The number of seating categories used in the concert industry appears to be relatively low. The majority of concerts in our

sample use two seating categories and the maximum number of seating categories is four. In the context of a Broadway show, Leslie (2004) reports a similar observation. More than three seating categories for a given show are never used. In contrast, the number of seating categories can be quite large for classical music events (Huntington, 1993).

Why do artists not increase the number of seating categories? One may argue that seat differentiation is not important in the concert industry. However, Leslie and Sorensen (2011) present evidence consistent with the fact that not all seats are alike within a seating category. For example, the best seats within a category are much more likely to be resold in secondary markets. Connolly and Krueger (2011) analysis of resale markets is consistent with these findings. Their survey reveals that the main reason for buying tickets on the secondary market was to get better seats.

Courty (2011) shows that a monopolist prefers to sell all the seats in a venue at the same price if low valuation buyers are more likely to obtain the better seats. Leslie and Sorensen (2011) make a similar point. They show that the existence of a secondary market influences the queuing game as well as the sales of each seating category in the primary market. Clearly, there are interactions between the primary and secondary markets

Courty and Pagliero (2012) estimate the return from adding seating categories. They find that although the return to price discrimination decreases with the number of categories, the return from adding a third and fourth category is significant (about half the return of introducing a second category). This suggests that some artists leave money on the table. Einav and Orbach (2007) address a similar puzzle in the context of the movie industry. They begin by observing that prices do not vary for different movies within a

theater, despite differences in theatrical potential and realized success. They consider a different dimension of product quality than we do (film quality rather than seat quality), but the puzzle is similar: firms sell differentiated products at the same price. Einav and Orbach rule out conventional explanations based on fairness, uncertainty and agency and conclude that history and industry conservatism must be at play. A similar explanation may also hold in the concert industry. For example, industry norms and resistance to innovation may explain why so many concerts use just two seating categories. Nevertheless, this type of argument is not useful in explaining the large differences across artists in pricing choices central to the present analysis.

There is a growing empirical literature in industrial organization on price discrimination (Verboven, 2010). Several studies investigate the relationship between second-degree price discrimination and market structure (e.g., Borenstein and Rose, 1994, and more recently, Busse and Rysman, 2005). The issue is relevant in markets with multiple firms selling products that are close substitutes. Market power in the concert industry differs because products are differentiated in two key dimensions. Artists have loyal fans who may not substitute even within a given musical genre. Even more importantly, few concerts are offered in any given local market on the same date. For these reasons, artists have a tremendous amount of market power.

Another line of research has tried to explain why service operators (e.g., telephone, electricity) offer only a few types of contracts (Wilson, 1996, Miravete, 2007). This literature shows that the gains of finely sorting consumers by providing many contracts that approximate the profit maximizing non-linear schedule are marginal. The issue is

slightly different in the case of concert pricing because the distribution of seats is given, and the only issue is whether to sell different seats at the same or at different prices. The return to price discrimination depends not only on the heterogeneity in consumer preferences but also in the (exogenously given) seating experience. Offering multiple ticket prices may raise profits even if all consumers are identical. This is not the case in the standard model of second degree price discrimination à la Mussa and Rosen (1978). As mentioned above, artists do not fully exploit the opportunities offered by second-degree price discrimination.

To our knowledge, no studies have been done on the use of third-degree price discrimination in the context of the concert tour industry or, in any market, on the joint use of second- and third-degree price discrimination. The literature on industrial organization has studied the two pricing questions independently (Stole, 2007). This is not because the issue has no empirical relevance. In fact, most firms that sell vertically differentiated products do so in multiple markets. Such firms apply second- and third-degree price discrimination simultaneously, charging different menus of prices in different markets. However, under the classical approach, there is no theoretical reason why the two decisions should be linked. Indeed, the second- and third-degree price discrimination literatures have no overlap.

A behavioral approach, however, can establish links between the two decisions. Kahneman et al. (1986) argue that community standards of fairness prevent sellers from increasing prices in response to positive demand shocks. Such a constraint on the sellers' ability to fine-tune pricing may apply to both second- and third-degree price

discrimination. Alternatively, sellers may be subject to biases or personal styles, as we argue shortly, and such biases may apply to all pricing choices. A novel aspect of our work is to show that second- and third-degree price discrimination are linked empirically and to suggest that they are linked through the identity of the sellers.

Rationing

Happel and Jennings (2010) list several explanations for the prevalence of rationing for live concerts. Broadly speaking, these explanations belong to one of two categories depending on whether the argument is based on classical economics or whether it also includes some psychological elements. Consider explanations based solely on classical economics. The main reason for rationing is that concert demand is subject to a great deal of uncertainty. Prices have to be set in advance before knowing many of the variables that influence demand.

Uncertainty alone, however, cannot explain why some artists *systematically* sell out the *first days* that tickets are offered for sale. It is possible that when artists first offer tickets for sale, they do not know what the demand for the concert will be on the event date. But how could they have such poor information about contemporaneous market demand and fail to learn from past mistakes? Classical economics has offered other explanations that address this fact. One is based on the observation that most performing artists care about their reputation. Empty seats may reveal negative information about the tour that could damage the artist's eminence and ability to sell tickets in the future. If concert-goers systematically substitute away from those artists who do not sell out, it may

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be rational for all artists to underprice because none of them wants to fall victim to a negative information spillover.

But there are other features that are specific to the industry. Producing a successful concert involves managing a coordination game between fans with important consumption externalities and informational asymmetries. Concert attendance is a joint consumption good and also an input of production (Busch and Curry, 2010). Becker (1992) has argued that due to consumer externalities, the demand for concerts may be upward sloping at least for some range of prices. DeSerpa and Faith (1996) refine the argument to explain excess demand for concerts. Another type of explanation is based on the relationship between ticket sales and other markets. Underpricing secures a full house, which increases ancillary sales on the premises. There are also complementarities between concert sales and the sales of recorded music that may justify keeping prices low (Krueger, 2006). Artists may therefore choose to subsidize tickets to increase consumption in other markets. However, while this explains selling below monopoly price, it does not offer a rationale against market clearing. It does not explain large excess demand for tickets that results in rationing and high prices on the secondary market.

A second class of explanations is based on the psychology of concert fans. One argument is based on the idea that ticket pricing is subject to norms of fairness. Kahneman et al. (1986) have argued that considerations of fairness play a large role in ticket markets to justify price compression. Fans have implicit contracts with artists that give entitlement to affordable prices. Artists who violate these norms may be subject to antagonism and withholding of demand. This view is consistent with the fact that high ticket prices receive

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ample coverage in the media. If the media is more likely to pick on unfair prices, charging

excessive amounts can backfire and trigger a consumer boycott (see Courty and Pagliero,

2010 for a discussion of these issues).

Happel and Jennings (2010) have argued that underpricing generates goodwill and that

consumers reciprocate in other markets (recordings, ancillary products, endorsement) as

they would in a gift exchange. They also propose another behavioral argument. Frenzies

associated with rationing may produce an aura of scarcity that drives the fear of rationing

and exclusion. Consumers want to be among the happy few who get tickets. Artists may

gain in the long run from creating such psychological pressure.

There is very little evidence in support of these explanations. In fact, there is not even

systematic evidence that rationing prevails in the concert industry. The underpricing debate

is fueled by anecdotal evidence and lacks systematic examination. There is little doubt that

some artists - Bruce Springsteen, for example - sell out most of their concerts. In addition,

these artists seem to underprice some concerts. Consumers have to line up (or wait on the

phone), tickets sell out very quickly, and some tickets are subsequently offered online at

much higher prices. These observations suggest that some artists leave surplus to

consumers (or resellers). The fact that brokers and scalpers make large profits in resale

markets is consistent with the underpricing hypothesis.

But there are also counter arguments to the hypothesis that tickets are systematically

underpriced. It could be that brokers enter the market because artists use very coarse

seating categories. Since consumers strictly prefer the best seats in a given category, these

seats have to be underpriced in order to sell the worst seats. This alternative hypothesis is

consistent with the fact that brokers trade in the best seats in each section (Leslie and Sorensen, 2011). In addition, rationing does not necessarily mean that artists leave money on the table. Courty (2003) has argued that artists may not be able to capture the profits from resale that are captured by brokers. More to the point, rationing is common but not at all pervasive. On the one hand, 40 percent of pop concert tickets were routinely unsold in 2011 (The Economist, 2011). On the other hand, our data reveals that 42 percent of concerts by the top 100 pop artists were sold out between 1992 and 2005. The debate on underpricing is still open. This is partly due to the challenging task of proving that artists charge prices that are substantially lower than the profit maximizing prices (Connolly and Krueger, 2006).

The artist's objective function

Sellers in the performing arts may have non-standard objective functions. They may not care solely about maximizing profits as in the standard classical framework. For example, artists may care about their fans out of altruism. Pro-social attitudes could play a role in explaining pricing decisions. Artists do not underprice out of fear of consumer retaliation, as in Kahnemnan et al. (1986), but because they may be willing to forego some profit to make sure that the event remains affordable to certain subgroups of fans. Obviously, both motives may be at play.

    As argued earlier, the assumption that artists have pro-social preferences is difficult to distinguish from the alternative hypothesis that artists are strategic. A strategic explanation typically assumes that fans' preferences have some behavioral component (e.g., consumers care about fairness, or are loss averse) and pricing is used to manipulate fans' willingness

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to pay. Most of the industrial organization literature on pricing has focused on behavioral consumers, and maintained the assumption that firms rationally maximize profits (Ellison, 2006, see also Spiegler, 2011, for a review). A strategic explanation, however, has difficulty explaining large differences in pricing choices across sellers.

An alternative approach is to assume that there is some heterogeneity in how sellers set prices. There are two main ways to proceed. Sellers may have behavioral preferences that influence pricing decisions (e.g., pro-social preferences as described above). Classical theory has traditionally not paid much attention to such a possibility. The argument against doing so is that market competition will eventually eradicate these differences because it will drive inefficient practices out. But this argument does not apply to the concert industry because sellers earn substantial rents and can afford to forgo some profit opportunities. In the concert industry, differences in seller preferences may explain some differences in pricing styles.

Another possibility is that decision makers are subject to behavioral biases. There is some recent evidence that support this assumption. Bertrand and Schoar (2003) and Malmendier et al. (2011) use datasets on top officers of large corporations and demonstrate the existence of manager styles. They show the existence of individual fixed effects that are correlated across a wide variety of financial decisions. They attribute these differences to individual specific life and career paths such as early life experience and MBA education. The interesting point is that seller heterogeneity survives in a context where one would assume that market selection is vigorous. If top managers influence management practices, it is not unreasonable that rock celebrities may also influence pricing decisions.

These two arguments suggest that the existence of pricing styles is not entirely implausible. Artists may form preferences over pricing decisions in the same way that managers have preferences over financial decisions. Moreover, artists have a tremendous control over prices and widely different views about their relations and responsibility toward fans and society. Some artists say that they care about fairness and affordability, but not all do. In addition, there is much heterogeneity in how much artists invest in their public image and care about their celebrity status.

2.3 Summary and questions to be addressed

The pricing of tickets offers an ideal case study to investigate standard questions in industrial organization (monopoly pricing, price discrimination) but with several twists due to the emotional nature of the product (musical performance), the special relationship between buyer and supplier (fan-idol), and the role played by the media in influencing the demand for top artists (celebrity status). The following questions are open:

1. How often do artists price discriminate? Do demand and product characteristics explain the use of price discrimination as standard theory predicts? Is the use of second- and third-degree price discrimination connected?

2. How often are concerts sold out? Do demand and product characteristics explain the use of rationing? Do artists leave money on the table by under pricing?

3. Do artists differ in pricing styles? What behavioral considerations influence artist pricing? Do artists have different objective functions?

The rest of this chapter presents a detailed analysis of price discrimination and rationing. We identify several puzzling features of the data and propose a unified framework based on the concept of artist pricing styles to explain these puzzles.

3 Data and summary statistics

This study focuses on the primary market for concert tickets, with data from two sources. The core of the data was collected by *Billboard*. It covers the same set of concerts and contains variables similar to those of Connolly and Krueger (2006), who used data from *Pollstar* instead. We supplemented this data with additional information on artists and tours from a wide range of sources.

3.1 Data

Our data identifies the main parties involved in organizing a concert (artists, venue, and promoter), with the exception of the agent, whose role is limited to putting artists and promoters in touch. For each concert defined by the date, venue, and artist(s), the *Billboard* dataset reports the promoter in charge, ticket prices, venue capacity, attendance, and the revenue realized. One main shortcoming is that we do not have information on tours. We gathered that information from band and fan websites. In addition, we gathered information on the characteristics of the bands from music websites, artist websites, and the *Rolling Stone Encyclopedia of Rock and Roll*.

Our resulting panel data is thus three dimensional. The first dimension describes the product, i.e., a concert, and can be aggregated by music genre, artist, or tour. The second dimension describes the local demand and can be aggregated at the level of city or state. In addition, knowledge of the venue where the concert takes place provides information about

both product (venue characteristics) and demand (through location) characteristics. The third dimension is time.

There are several differences with respect to the Connolly and Krueger (2006) dataset. In terms of depth, our data is richer in several dimensions. First, we observe all of the prices for each concert, rather than just the highest and lowest. Second, we know whether a concert is part of a tour and, if so, what tour it belongs to. This additional information allows us to provide a much more complete picture of the pricing strategies across seating categories and also across venues by comparing only concerts that belong to the same tour (with the same product offered in different local markets). In terms of breadth, our dataset covers fewer artists and fewer years. Still, we cover a large fraction of the industry measured in value terms for the years in our sample.

3.2 Scope and representativeness

Our sample includes all concerts collected by *Billboard* given by the top 100 grossing artists over the period 1992-2005. *Billboard* collects data on most concerts offered by our sample of artists in North America. We checked this by sampling a few tours, for which we collected the exact tour schedule from the artist website and matched it with the concerts reported in our database. In terms of breadth, our sample represents the majority of the industry in value terms. If we increased the sample to include the top 500 grossing artists over the same period, for example, the top 100 artists would represent 70 percent of the total revenue. Obviously, the sample covers only a small fraction of all performing artists. For our purpose, however, the pricing policies in our sample are representative, *in value terms*, of the average ticket sold in North America. That being said, our selection rule

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draws only from the superstars. The industry distinguishes between new performers and established artists. Established artists have more bargaining power over their promoters. They also probably have more market power to set prices.

A few entries in our sample include multiple artists who often tour together (e.g., Billy Joel and Elton John, Bob Dylan and Paul Simon). We treat each of these artists as one artist when they tour alone and as another when they tour together. Hence, we have a total of 122 different artists. In the rest of the paper, the term artist (or act) may refer to an individual, a band, or a set of these systematically touring together.

Table 1 presents some descriptive statistics. Our sample contains 122 artists, 779 tours, and 20,362 concerts. There are 1,561 concerts given on average each year.[6] Most concerts in our sample were given as part of a tour. The average number of artists performing in a given year is 57 and this number does not vary much across years (the minimum is 42 and the maximum 67). The average artist gives 7 tours and 167 concerts in our sample period with respective medians of 5 and 151. The majority (75 percent) of artists give at least two tours. The average tour has 24 concerts with a median of 18 and a standard deviation of 22. There is variability in the number of concerts per tour but half the tours have between 8 and 34 concerts.

<center>INSERT TABLE 1 HERE</center>

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[6]   The number of concerts per year rises from 1,020 in 1992 to 1,989 in 2003, and falls slightly thereafter.

Concerts are given in 579 different cities throughout the US. For half these cities, all the concerts are hosted in the same venue. For the other cities, there is much variation in the number of venues used. The overall average number of venues per city is 2.8 and the maximum is 25.

The tours in our sample are large multi-million dollar operations. Each concert is associated with a promoter. There are 464 promoters in our sample. Table 1 presents the distribution of the number of concerts organized by each promoter. The median promoter organizes 2 concerts and there is much variation across promoters. Clear Channel Entertainment dominates the market (it organizes a bit more than a quarter of the concerts in our sample) but it has many competitors. About 46 promoters organize 67 concerts or more.

4 Price discrimination: measurement issues

An act that goes on tour offers the same concert in different cities, with a variety of seating categories in each city. One possibility is to offer all the seats in every city at the same price. Selling all seats in a venue at the same price is called general admission, single price ticketing, or uniform pricing. Another possibility is to charge different prices for different seats in a given venue and/or different prices in different cities. The former corresponds to second-degree price discrimination: consumers face a menu of seating quality options with different prices. As long as ticket availability is not an issue, they can choose their favorite option. The latter corresponds to third-degree price discrimination, at least as long as arbitrage is not a viable option. This will be the case if fans do not travel to cities where

ticket prices are lower, a reasonable assumption if travel costs are much larger than price differences.

In this section, we present different measures of second- and third-degree price discrimination. We distinguish two types of measures that are inspired by past studies of price discrimination in the industrial organization literature (Verboven, 2008). One may measure whether an artist uses price discrimination instead of uniform pricing. In addition, conditional on using price discrimination, one may also measure the extent to which prices vary (Borenstein and Rose, 1994). This can be done both for second- and third-degree price discrimination.

There is a large body of empirical literature investigating whether price differences reflect differences in cost or differences in demand. In these studies, price differences among differentiated products might be due to variations in marginal cost, not just to price discrimination (Shepard 1991, Clerides 2004). In our application, however, matters are much simpler because most costs are fixed at the venue level, so cost considerations should not influence pricing decisions. Hence, one can interpret the absence of uniform pricing as price discrimination. This is obvious in the case of second-degree price discrimination: The seating capacity and the distribution of seat quality are given, and the only issue is whether to sell different seats at the same or at different prices.

5 Price discrimination at the concert level

5.1 Second-degree price discrimination

We identify concerts that use multiple seating categories with a dummy variable.

$$d_i=0 \text{ if } p^H_i=p^L_i \text{ and } 1 \text{ otherwise} \qquad (1)$$

where p^H_i (p^L_i) is the highest (lowest) price for a seat in concert i. Table 2 presents

summary statistics on price discrimination. In our sample, second-degree price

discrimination is used in 75 percent of the concerts. The dummy variable d_i measures the

existence of price discrimination but does not take into account the number of seating

categories or the price difference between seating categories. The number of seating

categories per concert ranges from 1 to 4 with an average of 1.99. Overall, 56 percent of

the concerts offer two price categories, 25 percent one, 15 percent three, and the remaining

4 percent four categories.

INSERT TABLE 2 HERE

We next report some statistics on the intensive margin of second-degree price

discrimination. We measure the maximum differences in price for seats in the same

concert. The average price range (p^H_i-p^L_i) is about \$25.74. After normalizing by the low

price, (p^H_i-p^L_i)/p^L_i, we get an average of .99. Top seats cost on average twice more than the

worst ones. This figure, however, hides much heterogeneity. As reported above, p^H_i-p^L_i is

equal to zero for 25 percent of the concerts. The price range p^H_i-p^L_i grows to \$34.43 for

concerts in which $p^H_i \neq p^L_i$. In addition, the quality premium is extremely high for a few

concerts.

The three measures of price discrimination (price discrimination dummy, number of

prices, relative price range) are positively correlated with very low p-values. In the rest of

this paper, we will often conduct the empirical work using the price discrimination dummy

because it is simpler to manipulate (than the number of prices, for example) and easier to

interpret (than the price range, for example, which has an arbitrary component to the extent

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that concerts may use different venue splits). However, the results still hold using alternative measures of price discrimination.

5.2 Third-degree price discrimination

We measure third-degree price discrimination at the tour level, since concerts in a tour are virtually identical (same stage, musicians, and set of songs). Rental and labor costs can vary from one city to the other. The largest fraction of these costs, however, is highly inflexible at the venue level since the only choice variable that is costly to adjust is the number of shows offered in a given venue. However, most tours offer a single show in most cities visited. For the sake of conciseness, we do not discuss in detail the case of multiple concerts given in the same city.[7]

Conditional on visiting a city, the price of tickets should depend only on demand factors (local public) and on venue characteristics and in particular total capacity. If price discrimination takes place, we would expect prices to vary from city to city as long as there are important variations in public demand across cities. The only reason for a lack of variation in prices is the implausible scenario that differences in audiences are exactly compensated for by differences in venue characteristics.

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[7] When this is the case, rental and labor costs could be correlated with the level of prices through the choice of total capacity. Holding total capacity constant (venue capacity time number of shows), however, pricing decisions should be independent of these costs.

To measure third-degree price discrimination, we define a concert pricing policy as the number of seating categories and the price for each seating category. For each tour, we record the pricing policy used in each city. We say that uniform pricing is used for a set of cities if the pricing policy does not vary across the cities in that set. The reader should keep in mind that the terminology 'uniform pricing' means different things for second and third-degree price discrimination. The correct interpretation, however, will be clear from the context.

There is no single method of measuring uniform pricing at the tour level. We propose two measures. The first computes the fraction of concerts within a tour that use the modal pricing policy, which is the pricing policy most frequently used within a tour. On average, 22 percent of the concerts use modal pricing (Table 2). This is the average across all tours, of the proportion of concerts that use the same pricing policy as the tour modal policy. This high figure could be driven by tours with few concerts. For these tours, a high proportion of concerts may use the modal policy even though the actual number of concerts with identical policies is low. This is not the case. For example, the proportion of concerts that use the tour modal pricing policies does not decrease when we restrict the sample to tours with at least 10 concerts.

The median number of concerts per tour is 18. If each concert within a tour were priced differently (a different number of seating categories or different price for at least one seating category) the fraction of concerts using the tour mode would be 5.5 percent. The much higher figure of 22 percent suggests that uniform pricing across cities plays a large role in the concert industry.

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Our second measure computes the Gini-Simpson homogeneity (or concentration) index for the set of pricing policies in a tour. This is the probability that two concerts drawn randomly from a tour use the same pricing policy. It can be written as:

$$G_t = \Sigma_i \, n_{i,t}(n_{i,t}-1) \, / \, N_t(N_t-1)$$

where t denotes a tour, i denotes a pricing policy within a tour, $n_{i,t}$ the number of concerts in tour t using pricing policy i, and N_t the number of concerts in tour t. Let N denote the total number of concerts in our sample. On average across all tours, the probability that two concerts in a tour use the same pricing policy,

$$G = \Sigma_t (N_t/N) G_t,$$

is 7.4 percent (Table 3). If all concerts in a tour sharing the same pricing policy used the modal policy, we would expect the Gini index to be around 4.8 percent (0.22 squared). The fact that it is much higher says that uniform pricing at the tour level is not just due to modal pricing.

<center>INSERT TABLE 3 HERE</center>

One concern with our measures of price discrimination is that some pricing policies may just happen to be the same by chance. A second concern is that identical pricing policies may be associated with venues or with promoters rather than tours. Table 3 reports the Gini-Simpson index for different partitions of our sample. Note that the Gini-Simpson index is at least three times higher for tour partitions than for any other partition (venue, artist, year, city or promoter). This indicates that uniform pricing occurs mainly at the tour level, confirming the validity of our measure of third-degree price discrimination.

<center>30</center>

There are many different measures of the extent of third-degree price discrimination. We compute the interquartile range of prices within a tour for the lowest, mean, and highest price. To illustrate these concepts, assume for the sake of argument that tours use a single seating category. The interquartile price range in tour t is $(p^{75}_t - p^{25}_t)$ where p^{75}_t is the price that corresponds to the 75th percentile of prices in tour t and similarly for p^{25}_t. This measure provides information on how much prices vary across cities within a tour. The interquartile range provides a more robust measure of variability of prices than standard deviation, for example, because there are outliers. On average across all tours, the interquartile range of the lowest price is \$7.5, of the mean price \$8.3, and of the highest price \$9.4. Table 2 shows that the interquartile range of the mean price is about 23 percent of the average price within a tour.[8]

Our measures of third-degree price discrimination are correlated, and the correlation is statistically significant at conventional levels. Most interestingly, the tours that use less modal pricing also vary prices less across cities. There is no clear reason why this should be the case. Something common to all concerts in a tour probably influences several pricing decisions. In Section 9, we will see that artist pricing styles can rationalize these correlations.

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[8] $E[(p^{75}_t - p^{25}_t)/p_t] = 0.23$ where p_t is the mean price in tour t and the expectation is taken over all tours in our sample.

5.3 Summary

We have defined two sets of measures for second- and third-degree price discrimination. The first set measures the existence of price discrimination. The second set measures the intensive margin of price discrimination (differences in price). We find that price discrimination is often but not always used. Uniform pricing is also common, although not as common as price discrimination. The next section shows that there is considerable variation in the use of price discrimination across artists.

6 Price discrimination at the artist level

Artists do not price concerts in the same way. Figure 1 and 2 illustrate the point with two tours by two different artists. The two figures describe ticket prices for Bruce Springsteen's "Solo Acoustic Tour" and Michael Bolton's "Fall Tour 1996". Both tours took place in 1996 and both artists are American rock singer-songwriters born around 1950. Figures 1 and 2 report the prices for different seats in a given venue (points on a vertical line), and for the different cities visited in a tour (different dates on the horizontal axis).

INCLUDE FIGURE 1 and 2 HERE

The use of price discrimination varies greatly across these two tours. Two patterns are worth noting. First, there is essentially only one seating category (on average 1.05) in the Bruce Springsteen tour (Figure 1), while there are typically multiple seating categories (on average 2.37) in the Michael Bolton tour (Figure 2), with significant variability in price within a venue (the highest price in a concert can be up to 200 percent higher than the lowest price). Bruce Springsteen rarely uses second-degree price discrimination while Michael Bolton often does so. Second, most prices are equal to one of two values ($30 or

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$33) across locations for Bruce Springsteen's tour, while they vary greatly for Michael Bolton's tour. Using our two measures of third-degree price discrimination, the fraction of concerts that use the modal pricing policy is 44 percent and 0.6 percent respectively (Table 4). The differences in pricing patterns for these two tours are remarkable.

INCLUDE TABLE 4 HERE

Why do Bruce Springsteen and Michael Bolton choose such different policies? Before we attempt to address this question we provide more systematic evidence that the use of price discrimination varies greatly across artists. In fact, Figures 1 and 2 report only one tour for each artist. To start, we should investigate if the patterns presented in Figure 1 and 2 are not specific to the two tours we selected. Table 4 also considers other concerts given by these two artists. We find that Bruce Springsteen uses fewer seating categories than Michael Bolton (1.53 against 2.44 on average across the 198 and 194 concerts in our sample period) and varies price less within a tour (on average 57 percent of Bruce Springsteen's concerts are identical to the tour modal pricing policy versus 7 percent for Michael Bolton). Bruce Springsteen and Michael Bolton seem to price concerts very differently. Is this typical just of these two artists?

The rest of this section documents the existence of differences in the use of price discrimination across artists. In Section 7, we will use a simple model to investigate candidate explanations for these differences.

6.1 Second-degree price discrimination

Table 5 reproduces Table 2, but at the artist level. To illustrate the difference between these two tables, consider our measure of second-degree price discrimination. Here, the

unit of observation is an artist. Denote $E(d_i|a)$ the mean value of d_i across all concerts

offered by artist a where d_i is defined by equation (1). This is a measure of an artist's

propensity to use second-degree price discrimination. Table 5 presents summary statistics

of the variable $E(d_i|a)$. On average, artists use second-degree price discrimination 77

percent of the time. This figure is similar to the same figure for the entire sample of

concerts (Table 2). The new information is found in the next columns of Table 5 which

report statistics on the variability across artists. These statistics differ greatly from Table 2,

which reported statistics for the entire sample.

<div align="center">INCLUDE TABLE 5 HERE</div>

There is a large standard deviation (26 percent) in artists' average use of price

discrimination. The range across artists is also very large. Billy Joel uses price

discrimination in 4 percent of his concerts, Garth Brooks in 8 percent and KORN in 22

percent. But Madonna, the Eagles and the Pink Floyd almost always price discriminate.

Figure 3 plots the distribution of $E(d_i|a)$ for our sample of 122 artists. The height of the

histogram corresponding to x on the horizontal axis, for example, measures the fraction of

artists who use uniform pricing about x percent of the time. The spread of the density mass

is distributed across the two extremes of zero (never use second degree price

discrimination) and one (always use it). This confirms that there is much variation across

artists in the use of price discrimination.

<div align="center">INCLUDE FIGURE 3 HERE</div>

Going back to Table 5, ten percent of the artists use price discrimination in at most 38

percent of their concerts. At the other extreme, one quarter of the artists almost always use

second-degree price discrimination (in 97 percent of their concerts or more). The same holds if we look at the average difference between the highest and lowest priced seats. Ten percent of the artists set an average price premium of 15 percent or less. At the other extreme ten percent of the artists set an average price premium of 214 percent or more.

6.2 Third-degree price discrimination

Table 5 also reports statistics on our measures of third-degree price discrimination averaged at the artist level. Again, the means do not change much. For example, artists use the modal pricing policy on average for 22 percent for their concerts (no change in the mean relative to Table 2). What is relevant for us are the statistics on the distribution across artists. The standard deviation across artists in the use of modal pricing is 15 percent. There are on average 80 tours per artist. If modal pricing were random across artists, the use of modal pricing would average out at the artist level around the sample value of 22 percent and we would expect to observe little variation across artists in the use of modal pricing. This is not the case.

This is confirmed by Figure 4 which reproduces Figure 3 for modal pricing. Again the density mass is spread across the zero-one interval. About 25 percent of the artists use modal pricing on average in less than 11 percent of concerts, while 10 percent use modal pricing in 47 percent of concerts or more. Table 5 presents some statistics on the distribution of Gini-Simpson coefficients across artists. There is a great deal of heterogeneity across artists in the chance that any two concerts in a tour are equally priced. The standard deviation across artists in the Gini-Simpson coefficients is .10 (recall that the average Gini-Simpson coefficient across all tours was .074). For ten percent of the artists,

the probability that two concerts in a tour use the same prices is 20 percent or higher. At the other extreme, ten percent of artists never set the same price for any two concerts in a tour.

INCLUDE FIGURE 4 HERE

The same conclusion holds when we look at the intensive measures of third-degree price discrimination. Ten percent of the artists have an interquartile range of the average price that is 11 percent of their average tour price; while at the other extreme, ten percent of the artists have an interquartile range that is 41 percent of the average tour price. The amount of price variation across cities within a tour varies greatly across artists.

6.3 Summary

There is much heterogeneity in the extent to which artists use second and third-degree price discrimination. This is true for our binary indicator for uniform pricing and also for the measures of price discrimination which take account of differences in prices.[9] This confirms that the difference between Bruce Springsteen and Michael Bolton is not specific to these two artists. In the next section, we investigate possible explanations for the observed differences in pricing across artists.

7 Identifying artists' pricing styles

Differences in pricing across artists may be due, for example, to the fact that artists play different music, in different venues, in different years, and in front of different audiences.

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[9]   The different measures of price discrimination are highly correlated, not only concert by concert, but also at the artist level.

Such heterogeneity could play through different channels. One channel considered in the industrial organization literature is that competition may vary across markets. As argued earlier, we do not believe this to be a major issue in the concert industry, but we can empirically investigate this possibility by controlling for city and year fixed effects. However, we believe that there are other channels that are more relevant in our application.

The return to price discrimination may vary from one concert to the other. To see how this could generate differences in our measures of price discrimination across artists, it helps to step back and ask the question of when price discrimination is expected to be used according to the existing theoretical literature. In a frictionless world, a profit maximizing artist always price discriminates, at least as long as consumers have preferences for seat quality (second-degree), or as long as the public differ across cities (third-degree). There is no obvious reason for why this should not be the case.

If there is a fixed cost associated with the implementation of price discrimination, however, some artists may find it more profitable to use uniform pricing. In practice, artists have to do some research to adjust ticket prices to local market conditions. In the case of second-degree price discrimination there are also costs associated with ticketing and enforcing that each attendee sits in the assigned seat. Hence, the return from implementing price discrimination may not always justify the costs. Variations in the return from price discrimination or in the implementation cost may explain why price discrimination is not always used.

We can now return to our interpretation of the finding that pricing practices vary across artists. To avoid confusion, in the rest of the paper we use the term *pricing practice* to say

that our measures of price discrimination vary across artists. We use the terminology *pricing style* to say that individual artists deliberately price concerts differently, as a result of, for example, differences in objective functions or individual skill endowments.[10]

Evidence of differences in pricing practices does not necessarily imply the existence of pricing styles. It is also consistent with the existence of unobserved demand and product heterogeneity correlated with artist unobserved characteristics. To clarify the distinction, consider a simple thought experiment. Say one observes differences in pricing decisions across sellers and wants to find out whether these differences are due to individual pricing styles. The dream experiment for testing this hypothesis would be to ask each seller to set prices for the same set of goods. Doing so, one would hold constant demand and product characteristics; hence the variability in pricing practices would have to be attributed to individual styles. Unfortunately, in our dataset each concert is a unique pricing problem. We can, however, try to hold constant concert characteristics as much as possible, in an attempt to investigate the role of individual pricing styles.

This section presents a simple theoretical framework to show that under fairly general assumptions on the structure of demand, we can interpret differences in pricing practices

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[10] There are other interpretations of artist pricing styles. Artists' fans may differ in how much they expect pricing to be fair. Consumers who care about fairness may sort with artists who are willing to offer fair pricing. Dynamic issues may also be at play. Fair pricing today by a given artist fuels expectations for fair pricing in the future. These issues are beyond the scope of this chapter.

(after controlling for demand and product characteristics) as evidence of artist pricing styles. To be clear, field data cannot provide definite evidence of artist pricing styles as in our thought experiment. This is because one cannot fully rule out the possibility of unobserved demand or product heterogeneity that is correlated with artist-specific characteristics. Still, in Section 8 we go a long way towards decomposing the variations in pricing choices that can be attributed to demand heterogeneity and individual pricing styles.

In Section 9, we follow a second approach to demonstrate the existence of pricing styles. We investigate whether artists are biased in a systematic way for different pricing choices. We argue that any systematic artist-specific bias is consistent only with individual pricing styles. The case is convincing if the decisions that are found to be associated have no reason to be connected according to classical theory. This delivers a powerful test in our application because there is no reason for which the decision to second- and third-degree price discriminate should be correlated across artists.

7.1 Theoretical framework: When should artists use price discrimination?

Assume an artist sells tickets to two different audiences. The tickets could be for the same concert in two different venues, or for two different seats for the same concert. Accordingly, the public could live in two different towns or buy two different types of seating categories. In this latter interpretation, we make the simplifying assumption that consumers are interested in only one seating category. Allowing for the possibility of substitution across seating categories adds realism, but does not change our main conclusions.

The inverse demand by consumer c=1,2 for seat category c and for artist a is $P(q|c,a)=\alpha_{c,a}-\beta q$. The marginal cost is χ (typically small or zero in the concert industry). We assume that differences across consumers and artists can only influence the intercept $\alpha_{c,a}$. This is to establish a benchmark; later we will revisit this assumption.

Under price discrimination, the artist chooses prices in order to maximize $q(\alpha_{c,a}-\beta q-\chi)$ in each market. Profits from audience c are $(1/4\beta)(\alpha_{c,a}-\chi)^2$. Under uniform pricing, overall profits are $(1/8\beta)(\alpha_{1,a}+\alpha_{2,a}-2\chi)^2$. The increase in profits, or the return from price discrimination, is

$$R=(1/8\beta)(\alpha_{1,a}-\alpha_{2,a})^2-F$$

where F is the fixed cost of implementing price discrimination. Consider the benchmark case where the demand intercept for a concert performed by artist a in front of audience c is additively separable.

Additivity assumption: $\alpha_{c,a}=\alpha_a + \alpha_c$

The net profits from price discriminating simplify to $R=(1/8\beta)(\alpha_1-\alpha_2)^2-F$.

Proposition 1: If the additivity assumption holds, the return to price discrimination (a) increases with public heterogeneity ($\alpha_1-\alpha_2$), (b) is independent of the artist-specific demand intercept (α_a).

Proposition 1 is important for two reasons. First, artists are expected to use price discrimination when there is enough difference across audiences. For example, they should use second-degree discrimination when seating categories are perceived to be sufficiently different. This could stem from physical differences in seating categories within a venue, or heterogeneity in willingness to pay for seats of different quality. Similarly, they should

use third-degree price discrimination if the local audiences where the tour stops are sufficiently different or if the venues are sufficiently different. Second, the decision to price discriminate does not depend on the characteristics of the artist that equally affect all consumers. Proposition 1 says that we should control for demand shifters that influence quality differences or difference in willingness to pay for quality. After controlling for product and demand shifters, the decision to price discriminate should not depend on the artist's identity as long as the additivity assumption holds.

7.2 Summary

Proposition 1 helps interpret the results presented in the previous section. For example, the differences across artists in the use of second-degree price discrimination could be rationalized if artists perform in front of different audiences with different willingness to pay for seating quality. The differences in the use of third-degree price discrimination could be rationalized if artists tour different subsets of cities. Coming back to Figure 1 and 2, it could be that Michael Bolton visits very different cities and performs in venues with very heterogeneous seating experiences while Bruce Springsteen tours similar cities and books venues where all seats are similar.

The next section initially assumes that the additivity assumption holds, and investigates whether the variations in the use of price discrimination can be explained by demand and product characteristics. In the rest of the section, we relax the additivity assumption and consider a number of other explanations for the variations in artist pricing practices.

8 Candidate explanation for the use of price discrimination

8.1 Second-degree price discrimination

We propose to explain the decision to price discriminate with controls for demand, product heterogeneity, and artist fixed effects. Assuming that the additivity assumption holds, we follow the empirical methodology proposed by Bertrand and Schoar (2003) to identify the existence of managing styles. In a nutshell, we estimate artist fixed effects θ_{artist} from model

$$\Pr(d_i=1)= \theta_{artist}+ \theta_{city} + \theta_{year} + \theta_{venue} + \gamma_1 \text{Popularity}_{a,y} + \varepsilon_i \qquad (2)$$

where θ_{city} denotes city fixed effects that control for differences in local audiences and for differences in venue characteristics for all the cities where there is a single venue (more than half the cities in our sample); θ_{venue} denotes venue fixed effects that control for venue characteristics more precisely than city fixed effects do; θ_{year} denotes year fixed effects that control for changes over time in public taste, public preferences for seating quality, or in the cost of implementing price discrimination; $\text{Popularity}_{a,y}$ controls for heterogeneity in artists popularity as we will explain shortly. City and year fixed effects control for unobserved differences in the level of competition across cities and over time.

We estimate equation (2) using a linear probability model, instead of a non-linear model (Logit or Probit). This is without loss of generality in a saturated model where all right hand side variables are dummies or categorical. The fitted probabilities are

simply the conditional probability of using second degree price discrimination within each cell defined by the different values of the dummy variables.[11]

Like Bertrand and Schoar (2003), we look at three sets of statistics: (a) changes in adjusted R^2 associated with the artist fixed effects, (b) F-tests that the artist fixed effects are equal to zero, (c) summary statistics on the distribution of the artist fixed effects.

We can answer several questions. (a) Do the controls increase the explained variation in the use of price discrimination? According to Proposition 1, the answer should be yes if the controls capture relevant variations in demand and product characteristics. (b) Does the addition of control variables decrease the explanatory power of artist fixed effects? This should be the case if the artist heterogeneity documented in Section 6 is caused by heterogeneity in demand or product

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[11] We use a linear probability model throughout the paper even though some specifications include two continuous explanatory variables (Artist's popularity is included in Column 6 and 7 and later in the paper and measures of experience are used in Table 10). For these specifications, the linear probability model is an approximation with little loss of generality because most of the variability in the dependent variable is explained by the dummy variables. The main results in Table 12, Panel A, are entirely based on saturated models that do not include artist popularity, hence these results cannot be affected by the approximation introduced by the linear probability model.

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characteristics. We can answer these two questions by looking at changes in adjusted R^2 and testing the significance of artist fixed effects. (c) After including the control variables, what fraction of the variation in price discrimination is attributed to the artist fixed effects (i.e., artist pricing styles)? The distribution of the artist fixed effects gives some information on the economic magnitude of heterogeneity across artists.

Table 6 reports the results. Column 1 shows that artist fixed effects explain 27 percent of the variations in the use of second-degree price discrimination. Column 2 shows that year and city fixed effects explain about 18 percent of the variations in the use of price discrimination. The adjusted R^2, however, goes from 18 to 40 percent as we add artists fixed effects (move from column 2 to column 3). This shows that the variations explained by city and year fixed effect are to a large measure orthogonal to the variations explained by artist fixed effect.

<div align="center">INSERT TABLE 6 HERE</div>

Note that artist fixed effects are economically highly significant in the sense that they explain a large fraction of the variations in price discrimination. This result will remain in all our specifications. In contrast, manager fixed effects in Bertrand and Schoar (2003) explain only 4 percent of the variations in corporate behavior.

The bottom of Table 6 shows statistics on the distribution of the artist fixed effects. The standard deviation (sd) of estimated artist fixed effect is 0.25, which is very close to the 0.26 figure in Table 5, as can be expected. The standard deviation corresponding to Table 6 Column 3 is only slightly lower than in Table 6 Column 1. The percentile estimates change very little.

We repeat the same exercise in Table 6, columns 4 and 5, with venue fixed effects instead of city fixed effects. The conclusion remains the same. The adjusted R^2 increases from 28 to 46 percent when we add artist fixed effect (compare columns 4 to 5). Interestingly, year and venue fixed effects explain about 10 percent more of the variations than year and city fixed effects (compare column 2 and 4). This suggests that venue fixed effects capture some variations in product characteristics.

We conclude that local market characteristics and venue characteristics explain a large portion of the variations in the decision to second-degree price discriminate, a finding consistent with Proposition 1. Still, even after controlling for these potential sources of unobserved heterogeneity, the proportion of variation in the use of price discrimination explained by artist fixed effects does not decrease much. In fact, Figure 5 reproduces Figure 3, but using the estimated fixed effects of the specification controlling for venue and year fixed effects. If local market and venue characteristics explained much of the variability across artists in the decision to price discriminate, then heterogeneity across artists, captured by the range of the distributions, would decrease after controlling for venue and year fixed effects. This is not the case. Heterogeneity in pricing styles still seems to play an important role.[12]

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[12] We do not comment on measures of the central location of the distribution (e.g., mean and median) of estimated fixed effects as they depend on an arbitrary normalization (i.e., the omitted category in fixed effects estimation). This applies to Figures 5, 6 and 9. However, this normalization does not affect the range or the

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INSERT FIGURE 5 HERE

8.2 Third-degree price discrimination

In the case of third-degree price discrimination, Proposition 1 says that we should control for the fact that different tours stop in different subsets of markets with possibly different venue characteristics and local audiences. Holding the set of cities within a tour constant should go a long way toward controlling for the mix of audience and venue characteristics. But there are 579 cities in our sample and no two tours visit the same set of cities. One option would be to focus on the set of most visited cities. But doing so would still leave many differences in the set of cities visited across tours.

We cannot use our measure of third-degree price discrimination computed at the tour level and also hold the set of cities visited constant. Therefore, we instead leverage the fact that there are many individual cities that are visited by a large fraction of tours. The nuance is that each city is visited by a slightly different subset of tours. Instead of measuring price discrimination at the tour level, we consider pairs of cities. For each pair, we can identify those artists who use the same pricing policy in the two cities and those who do not. We then aggregate this information across all pairs of cities and compute differences in pricing style across artists after holding city pairs constant.

The exact procedure is as follows. We first select the top 10 cities most visited and form the 45 possible city-pair combinations. For each pair, we construct an observation for

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standard deviation of the distribution, which provides measures of the heterogeneity across artists.

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each tour that visits that pair of cities. We construct a variable that is equal to one if the two pricing policies for that tour are identical, and equal to zero otherwise. This produces a dummy variable describing uniform pricing that assumes the value of zero or one each time one of the 779 tours in our sample stops in one of the 45 possible city pairs. The dummy variable for uniform pricing is equal to one in 16 percent of these observations. In In Table 7, we explain the variation in this dummy variable with artist fixed effects (column 1), with city-pair fixed effects (column 2), and both sets of fixed effects (column 3). The adjusted R^2 with artist fixed effect alone is 0.18 (Column 1), and with city fixed effect alone it is 0.14 (Column 2). The first result is consistent with our earlier finding that there is much heterogeneity across artists in the use of third-degree price discrimination. In fact, the standard deviation of the artist fixed effects is 0.19.[13] The second result is consistent with Proposition 1 stating that the use of third-degree price discrimination should depend on differences in local market characteristics. City-pair dummies control for differences in audience and venue characteristics. Price discrimination should be more likely to take place in pairs of heterogeneous cities. Most interestingly, the 18 percent

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[13]   In principle, the statistics reported here should be similar to the Gini-Simpson statistics reported in Table 2 and 3. In reality, these figures are higher than those in Table 2 and 3 (16 percent instead of 7.4 percent for the probability that two concerts have the same prices and 19 percent instead of 10 percent for the standard deviation across artists). This is because the measures here apply to a much smaller set of highly visited cities which are probably more similar than two random cities.

figure is identical to the increase in adjusted R^2 when we add in column 3 the artist fixed effect to the city fixed effects (0.32-0.14=0.18).

INSERT TABLE 7 HERE

Table 7 also presents summary statistics on the artist fixed effects. We find no decrease in the standard deviation of the artist fixed effects after controlling for differences in local market characteristics. The standard deviation of the artist fixed effect is 0.19 in columns 1 and 3. There is significant heterogeneity across artists. The probability that two concerts have the same pricing policy in the same pair of cities varies by 0.77 across all the artists in our sample. Figure 6 reproduces Figure 4, but by using the estimated artist fixed effects from Table 7, column 3. The spread of the distribution does not change much relative to Figure 4.

INSERT FIGURE 6 HERE

One possibility we have not discussed so far is that some artists may use a cost-based rule to set the price of tickets in each venue. They may charge a price equal to the rental and labor cost plus some fixed mark-up. Uniform pricing could result if subsets of venues have the same rental and labor costs. Table 7 rules out this possibility because we hold constant city pairs. Uniform pricing cannot be due only to the fact that some venues have the same costs.

We have made important progress. We started from Proposition 1. It says that after controlling for demand and product characteristics, artists should make the same price discrimination decisions. Instead, we find large differences across artists even after controlling for demand and product characteristics and this holds both for second- and

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third-degree price discrimination. What is the explanation for this? It could be that we have missed some dimensions of demand and product heterogeneity. The demand specification of the model behind Proposition 1 or other features of that model may be too simplistic. One could extend the model in several directions. Although a full treatment of the issue is beyond the scope of this work, we can rule out three candidate rationales that are particularly relevant to our application.

8.3 Other sources of heterogeneity in artist demands

The model assumes that artists influence the demand for tickets only through an additive component to the intercept. It could be that artists influence the demand in more complex ways. For example, the artist could influence the slope of the demand β or the overall demand in a multiplicative way, as in, $P(q|c,a)=k_a(\alpha_c-\beta q)$. The additivity assumption does not hold anymore. The return to price discrimination becomes $R=(k_a/8\beta)(\alpha_1-\alpha_2)^2-F$. It now depends on k_a. Both k_a here and α_a in the previous model are measures of artist popularity. The main difference is that they have a different impact on the return to price discrimination. Proposition 1 no longer holds when popularity is multiplicative. More popular artists, in the sense of an increase in k_a, are more likely to price discriminate. One could argue that some unobserved component of k_a explains the variations in pricing styles across artists. This possibility cannot be ruled out a priori.

The existence of non-additive demand heterogeneity across artists is not implausible. An increase in popularity then increases both the level of willingness to pay and also the difference in willingness to pay across audiences. In the case of second-degree price discrimination, an economic argument in support of this case goes as follows. The increase

in willingness to pay to upgrade seating category is related to the level of willingness to pay if, for example, artist quality and seating quality are complements in the utility function. Consumers are willing to pay more to upgrade their seating category when they are willing to pay more for the concert. One can make a similar case for third-degree price discrimination.

The possibility of heterogeneous demands deserves serious consideration. Table 6 controls for venue fixed effects. This should take care of the above problem if artists sort across venue by demand type (more popular artists play in larger venues, for example). Still, there may remain some heterogeneity in artist popularity that is unaccounted for.

We can make some progress toward showing that this is unlikely. We can measure many characteristics of the artists, but we can use as controls only those that vary over time. We check whether the variations in pricing style across artists remain after controlling for these time-varying characteristics. For those artist characteristics that do not vary over time, we follow a split-sample approach (see below). For the sake of conciseness, we conduct these robustness results only for second-degree price discrimination.

As our first control, we use a measure of artist popularity based on the success of musical recordings. We measure the number of albums and singles in the top charts up to a given year. If popularity is the main driving force of artist heterogeneity, then adding this variable should reduce the fraction of adjusted R^2 explained by adding the artist fixed effect. The last two columns of Table 6 control for artist popularity. The impact of popularity on the use of 2nd degree price discrimination is positive and significant. Having

one additional top single or album increases the likelihood of using second-degree discrimination by 1 percent. This is consistent with the earlier interpretation of k_a as a multiplicative impact of popularity. But the fraction of adjusted R^2 that is explained by artist fixed effects only decreases marginally. The distribution of artist fixed effects shows that the economic magnitude of differences in pricing styles does not change.

In the split-sample approach, we rank all the artists in our sample according to the average revenue per seat (average price of tickets sold) and then compute the mean across all artists. We split the sample into two categories, high and low average price artists, according to whether an artist's average price is above or below the average across artists. This controls for artist popularity under the reasonable assumption that average ticket price is a proxy for popularity. This approach directly addresses the concern that price discrimination could be correlated with the level of ticket price. Under that scenario, the explanatory power of artist fixed effects should decrease within the sub-samples of high and low average price artists. Table 8 reproduces selected specifications of Table 6 for our split sample.

<center>INSERT TABLE 8 HERE</center>

We first discuss the evidence on the F-test for the artist fixed effects. In all cases, we reject the null that all artist fixed effects are equal to zero. Adding artist fixed effects increases the adjusted R^2 although the magnitudes are smaller than before. For high price artists, the adjusted R^2 increases by 18 percent (difference between columns 3 and 1 in Table 8) when we control only for the cumulated number of hits. It increases by 14 percent when we control for year and venue fixed effects as well. The figures are a bit lower for

low price artists, but even in the lowest case, artist fixed effects still increase the adjusted R^2 by 10 percent. Again, the distribution of artist fixed effects does not change.

Heterogeneity in demand could also be due to differences in musical genres. There are several channels that could be at play. First and most importantly, demand may vary across musical genres. The return to price discrimination may be higher for rock artists because, for example, they sing to more diverse audiences. Alternatively, one may argue that the community standards of fairness vary by musical genre. The rock audience may respond more strongly to unfair and exploitative pricing.

The main musical genre in our sample is rock music, which represents a bit more than half of the artists. The remaining artists cover a wide range of music including country, jazz, and rap. We split the sample by rock versus non-rock music. Our main interest is to investigate what happens to the artist fixed effects when we focus on the rock subsample. If musical genre explains pricing decisions, we would expect that artist heterogeneity should matter less for the subsample of rock artists. Table 9 reproduces selected specifications of Table 6 for rock and non-rock artists. For the rock subsample, the increase in R^2 associated with the inclusion of artist fixed effects remains high around 17-24 percent. Similarly the standard deviation in artist fixed effect remains around 22 percent. Differences in musical styles do not explain the heterogeneity in the use of second-degree price discrimination across artists.

INSERT TABLE 9 HERE

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8.4 Cost of implementing price discrimination

Artists may have different access to information regarding the benefit of implementing price discrimination. Coming back to the model, the fixed cost of implementing price discrimination, F, could include information costs that are artist dependent. There is a related version of this argument. The model assumes that artists know the demand and can compute the profit maximizing prices. In practice, the return from price discrimination depends on the knowledge that an artist has about the demands for the differentiated product. Variations across artists in the use of price discrimination may be explained by differences in knowledge or expertise.

Many artists set prices jointly with promoters. If promoters have important information on how to set prices, we expect that promoter fixed effects should absorb some of the heterogeneity across artists in access to information. In Table 10, we add a set of fixed effects for promoters. The adjusted R^2 in Column 1 in Table 10 is .28 which is about .10 higher than the adjusted R^2 with city and year fixed effects alone. This large increase in the adjusted R^2 is consistent with several interpretations. It may be due to access to information as argued above. Another explanation is that promoters may specialize in different types of music. Promoter dummies may control to some extent for unobserved musical style.

INSERT TABLE 10 HERE

The important point for these additional results, however, is that even after controlling for promoter fixed effects, we still find that the adjusted R^2 increases by 16 percent. We also find that the distribution of artist fixed effects does not change even after controlling

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for promoter fixed effects. Again we find that access to information does explain some of the variations in the use of second-degree price discrimination, but these variations are largely orthogonal to the variations explained by artists fixed effects.

8-5 Learning

It may be difficult to find out whether it is profitable to adopt price discrimination in a city that was never visited before. However, even if they make mistakes early on, artists should learn over time, particularly when they repeatedly visit the same city or venue. This suggests controlling for the number of times an artist has performed in a given city or venue before.

We compute statistics on artist past experience for each concert in our sample. For a given concert, past experience is defined as the number of times an artist has previously given a concert in the same city. The value of past experience is equal to 0 for the early observations in our sample and increases up to 4 for the final years in our sample (the average experience is 1.26). Columns 3-6 in Table 10 report the regression results. The main result of this table is that the increase in adjusted R^2 explained by artist fixed effects does not change even when we control for past experience; this holds when we measure experience at the city or venue level.[14] In both cases, the increase in adjusted R^2 associated

[14]   Interestingly, experience is significant only when artist fixed effects are included and has the opposite sign as predicted under the learning hypothesis. It could be that artists are more likely to return to cities with a more loyal fan base. Those fans expect artists to use fair pricing (no price discrimination).

with artist fixed effects is around .19. The distribution of artist fixed effects does not change.

8.6 Summary: A price discrimination puzzle?

We have considered a number of explanations based on standard economic theory. We found some evidence in support of these explanations. This demonstrates that it is important to control for local demand, product characteristics, artist popularity, and access to information. Taken together, all our controls explain a bit less than half of the variations in the decision to second-degree price discriminate. Although some of the variation in the use of price discrimination can be explained by differences in demand and product characteristics or access to information, doing so does not decrease the amount of variation that is explained by artist fixed effects. We are left with a puzzle. What explains the variations in pricing across artist?

One could still argue that the variation in pricing practices across artists is due to unobserved demand heterogeneity. The return from price discrimination for a concert by Bruce Springsteen may not be the same as for one by Michael Bolton. Returning to Proposition 1, it could be that there are unobserved demand differences (that are not related to the controls we have tried) or other variables that influence the return to price discrimination. As argued before, it is not possible to fully exclude this possibility. But we think it is unlikely, because we would have expected that much of this heterogeneity should have been related to factors that vary across cities, venues, promoters, years, and our measures of popularity and musical styles. The finding that these controls did not reduce much the role of artist heterogeneity indicates that seeking new controls is unlikely

to resolve the issue. Keeping in mind that unobserved demand heterogeneity may contribute to some of the heterogeneity in pricing practices, in the next section we consider an alternative hypothesis, based on the assumption that artist pricing styles exist, to explain the variations in pricing practices across artists.

9 Exploitation of market power

Pop artists are the ultimate monopolists. They have tremendous market power and discretion over the pricing of concert tickets. But exploiting market power requires varying prices in response to demand conditions. Should artists take advantage of large differences in demand? Not necessarily. To start with, some artists make public statements that they want to set fair prices. They may have genuine preferences to be fair. In his discussion of the concert industry, Krueger (2005) argues that artists care about other things than profits. He writes: 'Some artists care about their customers' well-being as well as their own income.'

Most economists are suspicious of such statements. The concern is legitimate. One could explain almost anything by arbitrarily specifying decision makers' objective functions. But Krueger's view has more nuanced interpretations. Artists may act *as if* they cared about their fans and doing so may still be consistent with a long-term profit maximization hypothesis. The argument goes as follows: exploiting market power increases profits, but doing so is not without its downside.

Some pop music artists are notorious for participating in social and political debates. Not all artists are social activists, however. Let us focus for now on socially active artists. They take liberal positions supporting pro-social causes such as defending human rights,

fighting against poverty, and condemning inequalities. Outspoken pro-social artists face a dilemma when they go on tours. Using price discrimination may be perceived as opportunistic profit-seeking behavior that sends a dissonant message to many fans, one that is associated with the evil notion of the exploitation of market power. Pro-social artists may prefer to forgo the profit from price discrimination and not take the risk of being shamed as hypocrites in the media and on the Internet. Artists may not genuinely care about their fans. But they do care about maintaining their celebrity status, because it is marketable, and this may imply acting like they care about their fans.

In this section, we hypothesize that artists differ in their willingness to exploit market power. We do not attempt to distinguish the motive—sincere or strategic– for why this may be the case. Our goal is more modest. We investigate whether this simple hypothesis can shed new light on artists' pricing styles. This hypothesis is consistent with the evidence we have presented so far and, most importantly, has novel and unique implications regarding the pricing of tickets.

9.1 Hypothesis: willingness to exploit market power

Assume artists differ in their willingness to exploit market power. At one extreme, the pro-social artist does not want to leverage his market power. They use uniform pricing for all tickets in a tour. They charge the same price for all seats in a venue and for all venues in a tour. At the other extreme, the profit-maximizing artist charges the market clearing prices

for all seating categories and to all audiences.[15] These are two archetypes, but artists may also take intermediate positions. The evidence from the previous sections that there is much heterogeneity across artists in the use of second and third-degree price discrimination offers some support to our hypothesis. We derive two new implications.

Consider first the level of prices. Pro-social artists may keep prices low to make their concert affordable to all fans. This implies that some artists will systematically sell out. They will also refrain from responding to positive demand shocks by immediately increasing prices to the new equilibrium level. Instead, they may slowly increase prices and partially incorporate the demand shock. Krueger (2005) and others have documented dramatic increases in demand in our sample period. An implication is that pro-social artists should be more likely to sell out in this period. Because artists do not adjust prices by the same margins to match demand, we expect rationing probabilities to vary across artists.

- Hypothesis 1 (H1): The probability to sell out varies across artists even after controlling for demand and product characteristics.

H1 investigates a new feature of pricing. It does not consider differences in prices across products, as we have done so far, but instead tries to back up information on the artist's

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[15] We use the label 'profit maximizing' for those artists who maximize concert profits. This can be confusing since we have just argued that the pro-social artists could also be maximizing profits, but using an objective function that takes into account other considerations than just concert revenue. The meaning of 'profit maximizing' should be clear from the context.

choice of the level of prices from evidence on rationing. Those artists who refrain from exploiting market power will price tickets below market price. If this is the case, we would expect that they should be more likely to sell out their concerts. While all the evidence presented so far has been on price discrimination, H1 has to do with the level of prices. The main shortcoming of H1 is that it is subject to the same reservations as those made in regard to our analysis of price discrimination. Artist pricing styles is consistent with variations in rationing probabilities. But unobserved demand heterogeneity is an alternative candidate explanation.

The second implication presents a totally new way of looking at the evidence. It tackles the issue of exploitation of market power directly. If artists differ in their willingness to exploit market power, we should be able to predict how they will price tickets if we know where they stand between the two archetypes. Although we do not have this information, we can compare the different decisions each artist makes. Those artists who are willing to exploit market power should do so along all dimensions of pricing.

- Hypothesis 2 (H2): The decisions to use second- and third-degree price discrimination are positively correlated across artists and these two decisions are negatively correlated with sell-out probabilities.

It is more difficult to argue that H2 could be explained by unobserved heterogeneity across artists. The unobserved demand or cost factors that are picked up by artist fixed effects would have to be correlated across second- and third-degree price discrimination. This puts a much more demanding requirement on the set of candidate unobserved factors. The same

holds for why these two decisions should be correlated with the decision to ration.[16] But our simple framework based on exploitation of market power delivers a unique prediction about the relation between three decisions.

This new hypothesis is important for two reasons. Finding a non-zero correlation would add to the case that artist pricing styles matter. Bertrand and Shoar (2003) have argued that if fixed effects are caused by individual heterogeneity (instead of unobserved heterogeneity) one would hope that they are all caused by a common root factor. They argue that the correlation evidence is due to some overarching patterns in decision making. This conclusion rests on the implicit assumption that there is no theoretical argument for why any unobserved heterogeneity picked up by the fixed effects for different decisions should be correlated across decision makers. This is reasonable in our application. There is no economic theory that links second- and third-degree price discrimination (Stole, 2010). There is also no reason why the unobserved demand factors for second- and third-degree price discrimination should be correlated across artists.

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[16]   Different arguments can be made to explain why third-degree price discrimination and rationing should be related. When prices are not adjusted within a tour, one may argue that some concerts should be underpriced and others overpriced. The underpriced concerts should sell out more often. This prediction is the same as under the hypothesis of heterogeneity in willingness to exploit market power. This alternative explanation, however, cannot explain why some artists sell out most concerts.

But the assumption that pricing styles are due to different willingness to exploit market power allows us to go one step further. We can sign the correlations. This provides a unique test of our new hypothesis that the differences in pricing practices are due to differences in willingness to exploit market power.

9.2 Artists' rationing

It is reasonable to assume that there is excess demand for those concerts that are sold out. Sold out is a coarse measure of rationing, however, because we do not know how much excess demand there is. Table 2 reveals that 43 percent of the concerts in our sample are sold out. The last line in Table 5 shows that there is much variation in rationing probabilities across artists. For example, the Allman Brothers never sell out. Janet Jackson, Styx, Bob Dylan and Paul Simon sell out in less than 15 percent of the concerts. However, one quarter of the artists ration tickets in at least 57 percent of their concerts. For example, Madonna always sells out , while Billy Joel, Elton John and Garth Brooks sell out in more than in 85 percent of the cases. The interquartile difference across artists in rationing probability is 34 percent. This is a very large number considering that the sold out probabilities are fairly well estimated. In fact, the minimum number of observations per artists in our sample is 15 and the median across artists is 150. Figure 7 plots the distribution of sell out probabilities across artists. The range is striking. Even if we restrict the sample to artists with at least 100 concerts in the sample, the results are not much affected (Figure 8).

<center>INSERT FIGURE 7 AND 8 HERE</center>

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The fact that some concerts are sold out is not surprising. After all, demand is uncertain and prices have to be set in advance. A random component of the demand is realized only after tickets are offered for sale. By increasing the price of tickets, the artist increases the revenue per seat sold but also increases the risk of having unsold tickets. If demand is uncertain, the probability of rationing should be strictly positive. The profit maximizing level of rationing depends on the elasticity of demand, the amount of uncertainty, and the venue capacity.

Several stylized facts from the concert industry are difficult to rationalize within this simple profit maximization framework. As mentioned above, a large subset of artists sell out most of their concerts and they do so tour after tour. This cannot be profit maximizing. There is a high suspicion that these artists systematically underprice tickets (as illustrated by the large literature reviewed earlier that points towards systematic underpricing). For example, according to our initial quotes, there seems to be a widespread belief in the industry that Bruce Springsteen, Pearl Jam, and Dave Matthews have never charged as much as they could. In our sample, they sell out 70, 66, and 56 percent of their concerts respectively. If all artists perform in similar demand conditions, theory predicts that artists' rationing probabilities should be fairly close to one another. Returning to Figure 7, we see that this is not the case. Although there is a peak centered on 40 percent, there are large tails on both sides.

One concern with Figure 7 is that artists may not face similar demand conditions. We check that artist fixed effects are robust after controlling for demand and product heterogeneity by following a similar approach as we did for second-degree price

discrimination. Under a profit maximization hypothesis, rationing probabilities should depend on venue and demand characteristics that influence the uncertainty of demand and the shape of the demand curve. Assume, for example, that the population of concert fans varies from city to city and that this influences the local demand elasticity and/or the level of demand uncertainty. This could be due to differences in income, racial composition, age composition, or other variables. We would expect that the rationing probabilities should differ from city to city.

As with second-degree price discrimination, demand and product characteristics may explain variations in the probability that a concert sells out. We use a similar empirical model as before to extract artist fixed effects. The dummy variable r_i equals one if concert i is sold out and zero otherwise. We estimate the model

$$\Pr(r_i=1) = \theta_{artist} + \theta_{city} + \theta_{year} + \theta_{venue} + \gamma_1 Popularity_{a,y} + \varepsilon_i \qquad (3)$$

where the control variables were defined in Section 8. Table 11 reports the results with various sets of controls. Artist fixed effects alone explain 18 percent of the variability in concert sell out. Most interestingly, the amount of variations explained by artist fixed effects does not decrease by a large amount after controlling for year, venue or city fixed effects, and artist popularity. Artist fixed effects increase the adjusted R^2 by 15 percent when we control for year, city fixed effects, and artist popularity. This figure remains the same if instead we control for venue and year fixed effects. The F-test corresponding to the hypothesis that artist fixed effects are jointly equal to zero is rejected in all three specifications (Column 1, 3 and 5).

<center>INSERT TABLE 11 HERE</center>

<center>63</center>

Figure 9 reproduces Figure 7 but using the artist fixed effect estimated in Table 11. The distribution is again strikingly spread out. Table 11 also presents statistics on the distribution of artist fixed effects. The standard deviation does not change across the three specifications. The range of the distribution of artist fixed effects and the interquartile range are large. The finding that some artists almost never ration and others always do so holds even after controlling for a number of demand and product factors. Is this due to artist pricing styles?

INSERT FIGURE 9 HERE

In Section 2.2 we reviewed the main explanations for rationing that have been proposed in the literature. Most of these explanations (consumer demand for fairness, coordination game between consumers, publicity value of selling out, complementary products, and gift exchange) can explain the overall level of rationing in the concert industry but cannot on their own explain large variations across artists in rationing. To explain these variations, explanations would have to assume that some artists are subject to these forces while others are not. It is not clear, for example, why Bruce Springsteen's fans care about fairness while Michael Bolton's do not. In addition, specification (3) controls for a large number of variables associated with demand. Again, we doubt that the variations across artists in sell out probabilities are due only to unobserved demand or product heterogeneity across artists. Some of it is most likely caused by different pricing styles.

9.3 Artist pricing styles and exploitation of market power

Under the assumption that artists differ in the propensity to exploit market power, we should find that the decisions to second- and third-degree price discriminate are positively

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correlated and that these two decisions are negatively correlated with artist sell out probability. We start with evidence from the raw data based on artist averages. Figures 10-12 present the raw plots of the three variables of interest, second and third-degree price discrimination and sold out, taken two by two. Each point on the figures represents an artist. The three figures show correlations that are consistent with our hypotheses (and statistically significant at one percent confidence level). Artists who more frequently differentiate prices within a given venue are less likely to use the same pricing policy across concerts within a tour. Artists who are less likely to price discriminate are more likely to sell out concerts. These correlations are difficult to explain under the theory of price discrimination. However, they are consistent with our behavioral assumption that artists differ in their willingness to exploit market power.

INSERT FIGURES 10-12 HERE

We follow the approach of Bertrand and Schoar (2003) to address a shortcoming with these raw correlations. Each point of the graphs is computed by taking averages for an artist. But artists perform in different cities, venues, and years. Hence, it may be possible that it is the characteristics of the cities, venues, and years in which concerts take place that determine the choice to price discriminate and to sell out. We check whether the correlations across decisions are still present after controlling for these characteristics.

Like Bertrand and Schoar (2003), we construct a new artist dataset. For each artist, we collect the estimated fixed effects and standard errors from regressions (1) and (2) for second-degree price discrimination and rationing respectively (results in Tables 6 and 11),

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and from the regressions described in Table 7 for third-degree price discrimination. We then estimate the following equation

$$\text{F.E.}(y) = \alpha + \beta \, \text{F.E.}(z) + \varepsilon \qquad (4)$$

where F.E.(y) and F.E.(z) are any two of our three fixed effects. We can then test if the estimated coefficient β is significantly different from zero and has the predicted sign, keeping in mind that this coefficient has no causal interpretation. It is a measure of the association between the fixed effects. This is consistent with H2 which only says that the fixed effects should be associated in a systematic way. The right-hand side variable in equation (4) is itself an estimated coefficient which is noisy by definition. This will tend to bias the estimated coefficient β toward zero. Hence, the results will be biased towards rejecting the existence of pricing styles.

Since we know the precision with which the fixed effects were estimated, following Bertrand and Schoar we use a GLS technique to account for the measurement error in the right-hand side variables. We weigh each observation by the inverse of the standard error of the independent variable.

Table 12 reports the results of these regressions. The average R^2 of these regressions is 0.1. with a maximum of 0.38 and a minimum of 0.014.[17] Panel A in Table 12 computes the regression coefficients using the fixed effects from specifications that include only the artist fixed effects. All regression coefficients are significant and have the predicted sign.

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[17]   The R^2 are higher in Panel A 0.06, 0.17, 0.38, lower in Panel B 0.02, 0.06, 0.08 and even lower in Panel C 0.014, 0.054, 0.062.

Fixed effects for second and third-degree price discrimination are positively correlated, and

both are negatively correlated with rationing.[18]

<div align="center">INSERT TABLE 12 HERE</div>

Panels B and C in Table 12 address the issue of unobserved product and demand

characteristics. In both Panel B and C, we use the artist fixed effects for third-degree price

discrimination from Table 7, column 3, which holds constant city-pairs. Panel B takes the

artist fixed effects for second-degree price discrimination and rationing from a

specification that controls for city, year fixed effects, and artist popularity. Panel C is

similar, but controls for venue rather than city fixed effects. The signs of the regression

coefficients remain the same, although their statistical significance decreases. This is likely

due to the fact that artist fixed effects are less precisely estimated when more control

variables are included in (1) and (2). Similar results hold using alternative measures of

price discrimination. For example, if we use the number of seating categories instead of the

price discrimination dummy as a measure of second-degree price discrimination, the

results are again significant at the 10 percent level.

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[18] Note that artist effects on third degree price discrimination measure the propensity

to use modal pricing (see Table 7). Hence, a positive correlation between second and

third-degree price discrimination implies a negative coefficient in Table 12. Similarly,

a negative correlation between third degree price discrimination and rationing implies

a positive coefficient.

Overall, accounting for measurement error as well as demand and product characteristics does not change the main findings of the analysis described in Table 12, Panel A. The evidence is consistent with the hypothesis that there are differences across artists in willingness to exploit market power.

9.4 Summary

The hypothesis that artists vary in their willingness to exploit market power is consistent with the observed heterogeneity across artists in the use of second- and third- degree price discrimination, and the large differences in their propensities to ration tickets. Most importantly, this hypothesis implies that the propensity towards second- and third- degree price discrimination should be positively related and that both should be negatively related to the propensity to ration tickets. The empirical results are broadly consistent with these predictions.

10 Discussion

The industrial organization literature typically focuses on demand and cost primitives to explain firms' decisions. Consistent with this approach, we find, in the context of concerts for popular music, that a large portion of the variability in the use of price discrimination and rationing is explained by demand and product characteristics. The industrial organization literature has largely ignored supply side behavioral considerations (Ellison, 2006 and Spiegler, 2011). Surprisingly, we find that seller identity explains much of the variation in price discrimination and rationing. In the case of second-degree price discrimination, individual pricing styles explain about 20 percent of the total variations, or 40 percent of the explained variations. In the case of third-degree price discrimination and

rationing, artists' fixed effects explain about 14-15 percent of the total variation, or about half of the explained variations. These findings are consistent with the latest literature on corporate finance studying managerial styles (Bertrand and Schoar, 2003 and Malmendier et al., 2011). However, variations in artist pricing styles are much larger than observed variations in managerial style. Bertrand and Schoar, for example, find that managerial style explains only 4 percent of the variations in a firm's financial decisions.

A candidate explanation for differences in management practice across firms is moral hazard. This explanation, however, does not hold here because artists are the main residual claimants over concert revenues. Contracts between artists and promoters vary greatly, but top artists usually obtain the largest share of residual revenue, after covering all expenses. Accounts vary, but the artist's take of profits lies somewhere between 60 to 80 percent, with a few artists taking as much as 100 percent.

Artists may face a moral hazard problem when dealing with promoters. This will be the case if promoters bear most of the cost of implementing price discrimination. This argument, however, cannot explain the variations across artists, because all artists presumably face the same moral hazard problem when dealing with promoters. The extent of moral hazard may be promoter specific, but controlling for promoter fixed effects does not change the role played by artists fixed effects.

Variations in management practices are notoriously difficult to explain (Bloom and Van Reenen, 2003). Exposure to market competition is a usual suspect, but we can rule this

out as a candidate explanation for our findings.[19] Differences across artists remain even after controlling for city and year fixed effects, as well as for musical styles.

The hypothesis that artists vary in their willingness to exploit market power goes a long way toward explaining many patterns in artist pricing styles. But what ultimately explains these differences? Could it be sincere pro-social preferences to transfer surplus to consumers? For example, it has been argued that owners of sports teams are willing to lose money in order to increase their chances of winning important competitions. Artists may be willing to give up surplus on the principle of fairness, to fuel public adulation, or for other reasons associated to their preferences.

This is not the only explanation. Artists may also have strategic motives for pricing in pro-social ways. The literature on corporate social responsibility, for example, explains firm pro-social investment in public goods using strategic arguments (Kitzmuller and Shimshack, 2012). But how would a strategic argument explain differences in artist pricing styles? It may be due to the fact that artists vary in their revenue models. Some artists earn most of their revenues from music sales (concerts and recordings). These artists have a long-term horizon. They are household names who plan on performing indefinitely. Others are reunion bands or do not tour regularly, and hence have a shorter horizon. This is not the only source of heterogeneity. Some artists earn a significant portion of revenue from

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[19] Interestingly, the second key explanatory variable identified in Bloom and Van Reenen for explaining variations in firms' management practices is behavioral: reliance on primogeniture (the oldest male child) for management succession.

merchandizing, licensing, and endorsement (La Franco et al., 2002). These ancillary sources of revenues, particularly endorsement, depend to a large extent on the artist's public image. All these factors suggest that artists may have different interests in protecting their reputation, public image, and celebrity status. Those who need to maintain a good reputation to generate future revenue streams may refrain from exploiting market power in a way that is perceived as unfair. After all, concert pricing receives much publicity in the press and elsewhere and this contributes to the public's perception of the artist.

Our findings have important welfare implications. Artists leave surplus on the table, but may benefit from the publicity associated with selling out concerts. One may also argue that artist pricing style is an efficient way of generating publicity. However, such publicity also generates inefficiencies. The initial allocation of tickets is unlikely to be efficient for artists who ration rather than use price discrimination. Whether secondary markets can correct such distortions is debatable, given the costs associated with resale (Leslie and Sorensen, 2011).

11 Overview and future research

We document differences across artists in the use of second- and third-degree price discrimination and in the use of rationing. Much of this heterogeneity across artists remains, even after controlling for a number of variables that capture product and demand characteristics. We attribute this heterogeneity to individual pricing styles. We propose a simple framework to explain these differences based on the assumption that artists vary in their willingness to exploit market power. This assumption is consistent with the existence of artist fixed effects and delivers the unique prediction that artists who are less likely to

vary prices across seats within a venue are also less likely to vary prices for the same concert in different cities and are more likely to ration tickets. The evidence surprisingly supports these predictions.

Our results highlight the important role of individual style in explaining economic outcomes in the context of cultural economics. The possible existence of individual pricing styles is surprisingly absent from the industrial organization literature. Even the recent influence of behavioral economics has not yet explored the possibility that non-standard considerations may influence decision makers on the supply side. The only research we are aware of that has demonstrated the existence of individual styles is in the context of corporate finance.

We also contribute to the long-lasting questions of why brokers and scalpers actively resell tickets in secondary markets. Artists' objective functions may differ and some artists may prefer not to vary prices in response to market forces. This helps explain why some concerts are sold out, why quality and demand differences are not fully taken into account in ticket prices, and why tickets are often resold in secondary markets. However, a number of questions remain unanswered:

- What ultimately differentiates artists? Sincere preferences, strategic motives, or something else? Is there a relationship between an artist's 'exploitation of market power' and celebrity status? Are famous artists less likely to exploit market power? Are artist pricing styles fixed or is there a life cycle in pricing style?

- Our study can be generalized in several directions: (a) Do less popular artists (non top-100 artists) also have individual pricing styles? (b) Do the results generalize to

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other pricing decisions (e.g., the speed of response to demand shocks)? (c) Are pricing styles specific to live concerts for popular music? Do the results generalize to other performing arts? Is the notion of individual pricing style relevant in other markets where celebrity matters? How general is the notion of willingness to exploit market power?

- Some artists have started to experiment with more innovative pricing policies leveraging the distribution opportunities offered by the Internet (Halcoussis and Mathews, 2007). Our results suggest that not all artists may adopt these new opportunities to the same degree. Which ones are embracing these new possibilities?

- What is the welfare impact of heterogeneity in pricing style? Does consumer demand for fairness influence the overall level of prices?

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Tables

Table 1. Summary statistics: concerts, artists, tours, cities, venues and promoters.

	mean	s.d.	min	p10	p25	p50	p75	p90	Max
Number of concerts per artist	166.9	126.5	15	25	58	151.5	247	336	685
Number of tours per artist	7.1	7.2	1	1	2	5	9	16	38
Number of concerts per tour	24.1	21.9	1	4	8	18	34	54	230
Number of venues per city	2.9	3.7	1	1	1	1	3	7	25
Number of artists performing in a year	57.4	7.2	42	48	52	59	62	67	67
Revenue per concert (thousand $)	542	821	0.7	91	165	314	619	1,102	38,700
Revenue per tour (million $)	12.6	20.5	0.01	0.48	1.57	4.76	14.8	35.1	175
Number of concerts per promoter	44	227	1	1	1	2	12	67	4,265

Note: Statistics based on 20,362 concerts performed by 122 artists, in 579 cities, between 1992 and 2005; 18,798 concerts were part of one of the 779 tours. The total number of promoters is 464. The number of venues per city includes venues used at least once in each city.

Table 2. Summary statistics (price discrimination and rationing): concert level data.

	Obs.	mean	s.d.	min	p10	p25	p50	p75	p90	max
Second-degree price discrimination:										
2nd degree price discrimination (binary variable)	20,362	0.75	0.43	0	0	0	1	1	1	1
Number of prices	20,362	1.99	0.77	1	1	1	2	2	3	4
Price range (p^H-p^L)	20,362	25.74	61.15	0	0	0	12	29.75	50	1,225
Relative price range $(p^H-p^L)/ p^L$	20,362	0.99	4.08	0	0	0	0.43	1.04	2.00	211
Price range (p^H-p^L) if $p^H \neq p^L$	15,224	34.43	68.58	0.01	5	10	20	35	64	1,225
Third-degree price discrimination:										
Interquartile range of avg price within tour/ avg price in tour	18,798	0.23	0.152	0	0.07	0.13	0.19	0.29	0.41	1.08
Modal pricing policy in tour (binary variable)	18,798	0.22	0.412	0	0	0	0	0	1	1
Rationing:										
Sold out (binary variable)	20,362	0.43	0.50	0	0	0	0	1	1	1

Note: Statistics based on 20,362 concerts, of which 15,224 used more than one price category and 18,798 were part of a tour. The 2nd degree price discrimination binary variable is equal to one if a concert has more than one price category. The modal pricing policy binary indicator is equal to one if a concert uses the combination of prices that is most common within a tour. The sold out binary variable is equal to one if the concert is sold out.

Table 3. The concentration (or homogeneity) of pricing policies.

Partitioning the sample by	Gini-Simpson index
Tour	0.074
Artist	0.026
Promoter	0.021
Venue	0.015
City	0.008
Year	0.005
All data (no partitioning)	0.002

Note: the table reports the mean probability that two concerts selected randomly within a tour, artist, promoter, city, year, or in the whole sample have the same pricing policy (that is the same number of pricing categories and the same prices).

Table 4. Comparison of Bruce Springsteen and Michael Bolton.

	Number of concerts	Average frequency of modal pricing policy within a tour	Average number of prices within a concert
Bruce Springsteen, Solo Acoustic Tour 1996	39	0.44	1.05
Michael Bolton, Fall Tour 1996	16	0.006	2.37
Bruce Springsteen, 1992-2005	198	0.57	1.53
Michael Bolton, 1992-2005	194	0.07	2.44

Note: the frequency of modal pricing policy is the proportion of concerts by a given artist that uses the combination of prices that is most commonly used within a tour.

Table 5. Summary statistics (price discrimination and rationing): artist level data.

Variable	Obs.	Mean	s.d.	Min	p10	p25	p50	p75	p90	Max
Second-degree price discrimination:										
2nd-degree price discrimination	122	0.77	0.26	0.02	0.38	0.62	0.89	0.97	1	1
Number of prices	122	2.07	0.50	1.02	1.38	1.73	2.12	2.36	2.63	3.42
Price range (p^H-p^L)	122	33.06	44.94	0.22	3.87	9.95	19.87	31.71	82.03	271.1
Relative price range (p^H-p^L)/p^L	122	1.15	1.45	0.01	0.15	0.37	0.82	1.40	2.14	13.32
Price range (p^H-p^L) if $p^H \neq p^L$	122	39.44	51.36	2.74	10.16	15.03	22.43	37.32	82.88	288.0
Third-degree price discrimination:										
Interquartile range of avg price within tour/ avg price in tour	108	0.23	0.12	0.05	0.11	0.15	0.21	0.29	0.41	0.67
Frequency of modal pricing policy in tour	108	0.22	0.15	0	0.07	0.11	0.17	0.29	0.47	0.68
Rationing:										
Sold out	122	0.41	0.25	0	0.10	0.23	0.37	0.57	0.78	1

Note: The table reports the artists' average propensity to price discriminate and sell out. The statistics are based on 122 artist-specific mean values for second degree price discrimination and rationing, 108 for third degree price discrimination. The 2nd degree price discrimination variable is the proportion of concerts by a given artist with more than one pricing category. The frequency of modal pricing policy is the proportion of concerts by a given artist that uses the combination of prices that is most commonly used within a tour. The sold out variable is the proportion of sold out concerts by a given artist.

Table 6. Artist effects on second-degree price discrimination.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Artist's popularity	-	-	-	-	-	0.00870***	0.0390***
						(0.00257)	(0.0138)
Artist fixed effects?	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects?	No	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects?	No	Yes	Yes	No	No	No	No
Venue fixed effects?	No	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.268	0.185	0.398	0.284	0.461	0.294	0.452
Obs.	20,362	20,362	20,362	20,362	20,362	17,787	17,787
Number of artist fixed effects	121	121	121	121	121	87	87
F-test on artist fixed effects (p-value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
s.d. of artist fixed effects	0.251	-	0.228	-	0.216	-	0.231
min of artist fixed effects	-0.665	-	-0.481	-	-0.574	-	-0.811
25th percentile of artist fixed effects	-0.0611	-	0.0893	-	0.061	-	0.0877
75th percentile of artist fixed effects	0.282	-	0.37	-	0.298	-	0.30
max of artist fixed effects	0.32	-	0.496	-	0.408	-	0.57

Note: The table reports OLS estimation results. The dependent variable is the 2nd degree price discrimination binary variable, equal to one if a concert has more than one price category. Artist's popularity is the cumulative number of singles and albums in top charts in previous years (time varying for each artist). In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error. Robust standard errors in parentheses, clustered at the artist level. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Artist effects on third-degree price discrimination for city-pairs.

	(1)	(2)	(3)
City pair fixed effects?	No	Yes	Yes
Artist fixed effects?	Yes	No	Yes
Adjusted R^2	0.18	0.14	0.32
Obs.	3,237	3,237	3,237
Number of artist fixed effects	53	-	53
F-test on artist fixed effects (p-value)	0.00	-	0.00
s.d. of artist fixed effects	0.19	-	0.19
min of artist fixed effects	-0.45	-	-0.42
25th percentile of artist fixed effects	-0.361	-	-0.305
75th percentile of artist fixed effects	-0.115	-	-0.093
max of artist fixed effects	0.258	-	0.357

Note: The table reports OLS estimation results. An observation describes a pair of cities (among the top 10) in which an artist performed a concert within the same tour. The dependent variable is an indicator variable equal to one if the two concerts have identical pricing policy. The model identifies 53 artist fixed effects. In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error.

Table 8. Artists' effects on second-degree price discrimination (splitting the sample between artists with high and low average ticket price).

	High price artists (1)	Low price artists (2)	High price artists (3)	Low price artists (4)	High price artists (5)	Low price artists (6)	High price artists (7)	Low price artists (8)
Artist's popularity	0.0008	0.0240***	0.0462***	0.0667**	0.0002	0.0146*	0.0309**	0.0441
	(0.0026)	(0.0088)	(0.0168)	(0.0284)	(0.0018)	(0.0078)	(0.0118)	(0.0262)
Artist fixed effects?	No	No	Yes	Yes	No	No	yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	yes	Yes
City fixed effects?	No	No	No	No	No	No	No	No
Venue fixed effects?	No	No	No	No	Yes	Yes	Yes	Yes
Adjusted R2	0.081	0.066	0.266	0.238	0.302	0.335	0.437	0.439
Observations	9,582	8,205	9,582	8,205	9,582	8,205	9,582	8,205
Number of artist fixed effects	-	-	53	33	-	-	53	33
F-test on artist fixed effects (p-value)	-	-	0.00	0.00	-	-	0.00	0.00
s.d. of artist fixed effects	-	-	0.240	0.258	-	-	0.199	0.213
min of artist fixed effects	-	-	-0.947	-0.0617	-	-	-0.922	-0.0778
25th percentile of artist fixed effects	-	-	0.123	0.498	-	-	0.0534	0.295
75th percentile of artist fixed effects	-	-	0.364	0.784	-	-	0.246	0.573
max of artist fixed effects	-	-	0.595	1.05	-	-	0.412	0.782

Note: The table reports OLS estimation results. The dependent variable is the 2nd degree price discrimination binary variable, equal to one if a concert has more than one price category. We rank artists according to the average price of tickets sold and then classify an artist as "high price artist" if his/her average price is above the average. Popularity is the cumulative number of singles and albums in top charts in each year (time varying for each artist). In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error. Robust standard errors in parentheses, clustered at the artist level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9. Artist effects on second-degree price discrimination (splitting the sample between artists playing rock music and other types of music).

	Rock (1)	Other (2)	Rock (3)	Other (4)	Rock (5)	Other (6)	Rock (7)	Other (8)
Artist's popularity	0.0116***	0.00757	0.0584***	0.0373	0.0102***	0.00321	0.0468***	0.0239
	(0.00360)	(0.00743)	(0.0165)	(0.0258)	(0.00321)	(0.00506)	(0.0153)	(0.0180)
Artist fixed effects?	No	No	Yes	Yes	No	No	Yes	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects?	No	No	No	No	No	No	No	No
Venue fixed effects?	No	No	No	No	Yes	Yes	Yes	Yes
Observations	13,149	4,638	13,149	4,638	13,149	4,638	13,149	4,638
Number of artist fixed effects	-	-	66	20	-	-	66	20
Adjusted R-squared	0.064	0.153	0.301	0.311	0.282	0.439	0.451	0.520
F-test on artist fixed effects (p-value)	-	-	0.00	0.00	-	-	0.00	0.00
s.d. of artist fixed effects	-	-	0.266	0.284	-	-	0.228	0.214
min of artist fixed effects	-	-	-1.342	-0.337	-	-	-1.454	-0.307
25th percentile of artist fixed effects	-	-	0.0245	0.294	-	-	-0.446	0.215
75th percentile of artist fixed effects	-	-	0.293	0.568	-	-	-0.184	0.433
max of artist fixed effects	-	-	0.55	0.66	-	-	0.102	0.501

Note: The table reports OLS estimation results. The dependent variable is the 2nd degree price discrimination binary variable, equal to one if a concert has more than one price category. Popularity is the cumulative number of singles and albums in top charts in each year (time varying for each artist). In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error. Robust standard errors in parentheses, clustered at the artist level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 10. Artist effects on second-degree price discrimination (promoter fixed effects and experience in the same city or venue).

	(1)	(2)	(3)	(4)	(5)	(6)
Artist's popularity	0.00964***	0.0475***	0.0111***	0.0483***	0.0111***	0.0486***
	(0.00308)	(0.0134)	(0.0027)	(0.0148)	(0.00274)	(0.0148)
Experience in same venue	-	-	0.0010	-0.0032***	-	-
			(0.0007)	(0.0009)		
Experience in same city	-	-	-	-	-0.0004	-0.0043***
					(0.0014)	(0.0021)
Artist fixed effects?	No	Yes	No	Yes	No	Yes
Year fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes
Promoter fixed effects?	Yes	Yes	No	No	No	No
Adjusted R^2	0.284	0.444	0.201	0.389	0.201	0.390
Observations	17,787	17,787	17,787	17,787	17,787	17,787
Number of artist fixed effects	-	87	-	87	-	87
F-test on artist fixed effects (p-value)	-	0.00	-	0.00	-	0.00
s.d. of artist fixed effects	-	0.251	-	0.252	-	0.253
min of artist fixed effects	-	-0.835	-	-0.914	-	-0.917
25th percentile of artist fixed effects	-	0.13	-	0.13	-	0.136
75th percentile of artist fixed effects	-	0.383	-	0.362	-	0.366
max of artist fixed effects	-	0.643	-	0.675	-	0.684

Note: The table reports OLS estimation results. The dependent variable is the 2nd degree price discrimination binary variable, equal to one if a concert has more than one price category. Popularity is the cumulative number of singles and albums in top charts in each year (time varying for each artist). Experience is the cumulative number of previous concerts in the same venue or city. In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error. Robust standard errors in parentheses, clustered at the artist level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11. Artist effects on sell out probability.

	(1)	(2)	(3)	(4)	(5)
Artist's popularity	-	0.0065	-0.0054	0.0057	-0.0002
		(0.0044)	(0.0133)	(0.0047)	(0.0136)
Artist fixed effects?	Yes	No	Yes	No	Yes
Year fixed effects?	No	Yes	Yes	Yes	Yes
City fixed effects?	No	Yes	Yes	No	No
Venue fixed effects?	No	No	No	Yes	Yes
Adjusted R^2	0.179	0.127	0.272	0.166	0.314
Observations	20,362	17,787	17,787	17,787	17,787
Number of artist fixed effects	119	-	87	-	87
F-test on artist fixed effects (p-value)	0.00	-	0.00	-	0.00
s.d. of artist fixed effects	0.245		0.224		0.235
min of artist fixed effects	-0.38		-0.551		-0.464
25th percentile of artist fixed effects	-0.134		-0.259		-0.195
75th percentile of artist fixed effects	0.195		0.09		0.152
max of artist fixed effects	0.62		0.481		0.563

Note: The table reports OLS estimation results. The dependent variable is an indicator variable equal to one if a concert is sold out. Popularity is the cumulative number of singles and albums in top charts in previous years (time varying for each artist). In computing the statistics for the estimated artist fixed effects, each artist fixed effect is weighted by the inverse of its standard error to account for estimation error. Robust standard errors in parentheses, clustered at the artist level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12. Correlation between propensity to use second- and third-degree price discrimination and to sell out.

Panel A. Relationship between estimated artists' mean pricing characteristics.

VARIABLES	Artist effects on second- degree price discrimination	Artist effects on sell out probability
Artist effects on sell out probability	-0.254***	-
	(0.0910)	
Artist effects on third-degree price discrimination	-0.679***	0.981***
	(0.144)	(0.121)

Panel B: Relationship between estimated artist fixed effects (controlling for artist, city, year fixed effects, for second-degree price discrimination and sold out; city pair for third-degree price discrimination).

VARIABLES	Artist effects on second-degree price discrimination	Artist effects on sell out probability
Artist effects on sell out probability	-0.132	-
	(0.0923)	
Artist effects on third degree- price discrimination	-0.278*	0.279**
	(0.153)	(0.130)

Panel C: Relationship between estimated artist fixed effects (controlling for artist, venue, year fixed effects, for second-degree price discrimination and sold out; city pair for third-degree price discrimination).

VARIABLES	Artist effects on second- degree price discrimination	Artist effects on sell out probability
Artist effects on sell out probability	-0.109	-
	(0.0838)	
Artist effects on third-degree price discrimination	-0.287**	0.313**
	(0.142)	(0.138)

Note: Coefficients from a weighted OLS regression where the dependent variable is the column variable and the independent variable is the row variable. Observations are weighted by the inverse of the standard error on the independent variable. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figures

Figure 1. Concert prices for Bruce Springsteen, Solo Acoustic Tour.
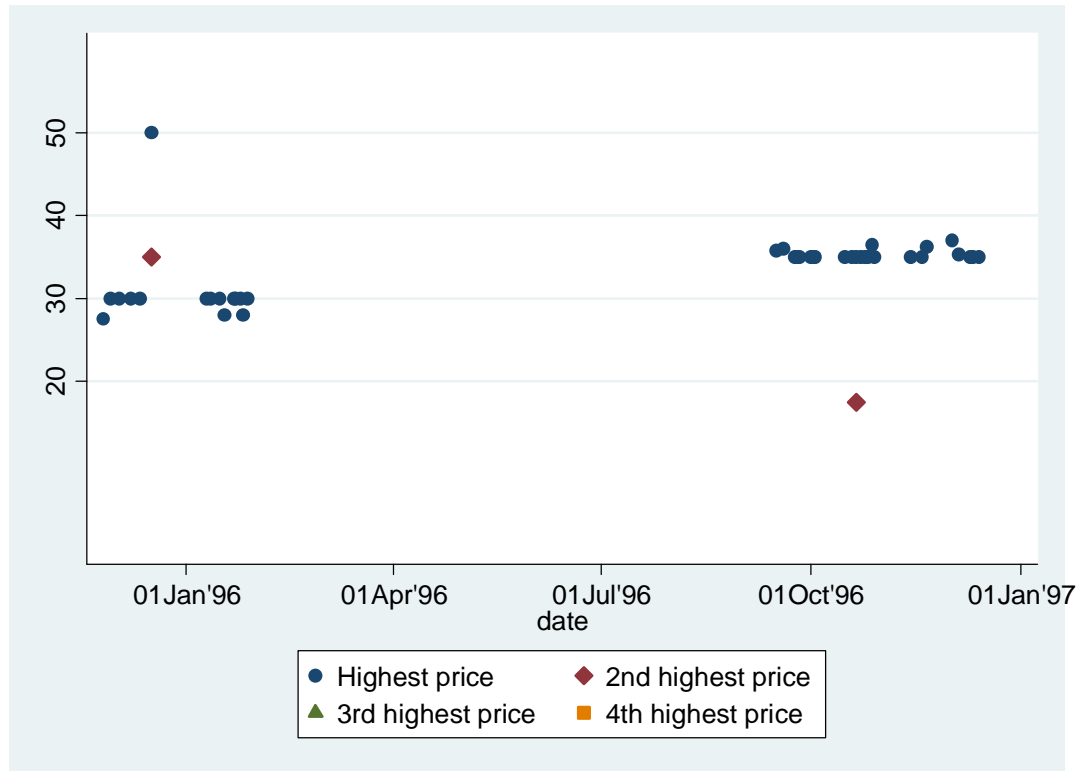
Figure 2. Concert prices for Michael Bolton, Fall Tour 1996.

Figure 3. The distribution of artist-specific average use of second-degree price discrimination.
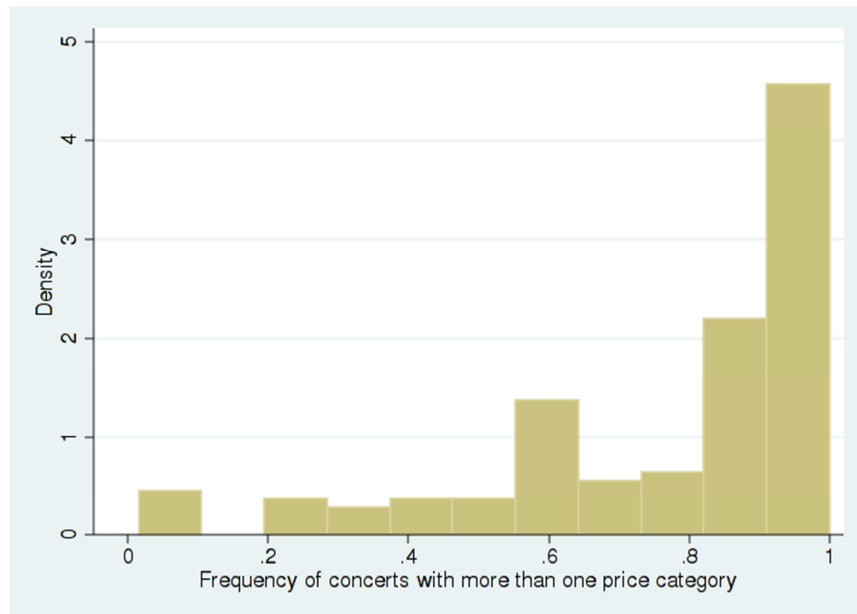
Figure 4. Third-degree price discrimination: the distribution of artist-specific average proportion of concerts with modal pricing policy.
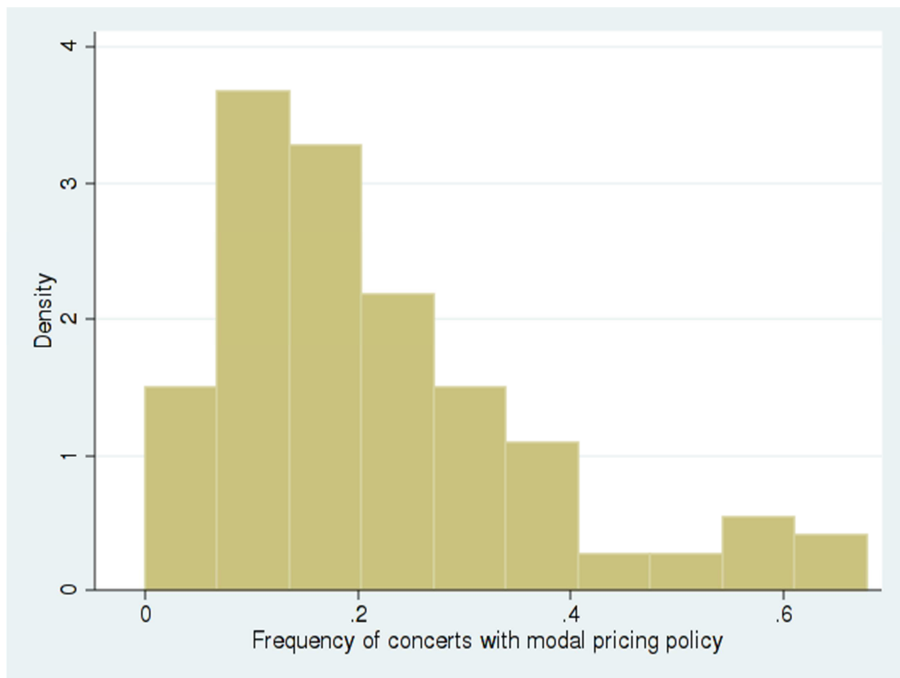
Figure 5. Second-degree price discrimination: distribution of estimated artist fixed effects in regression with artist fixed effects, venue fixed effects, year fixed effects.
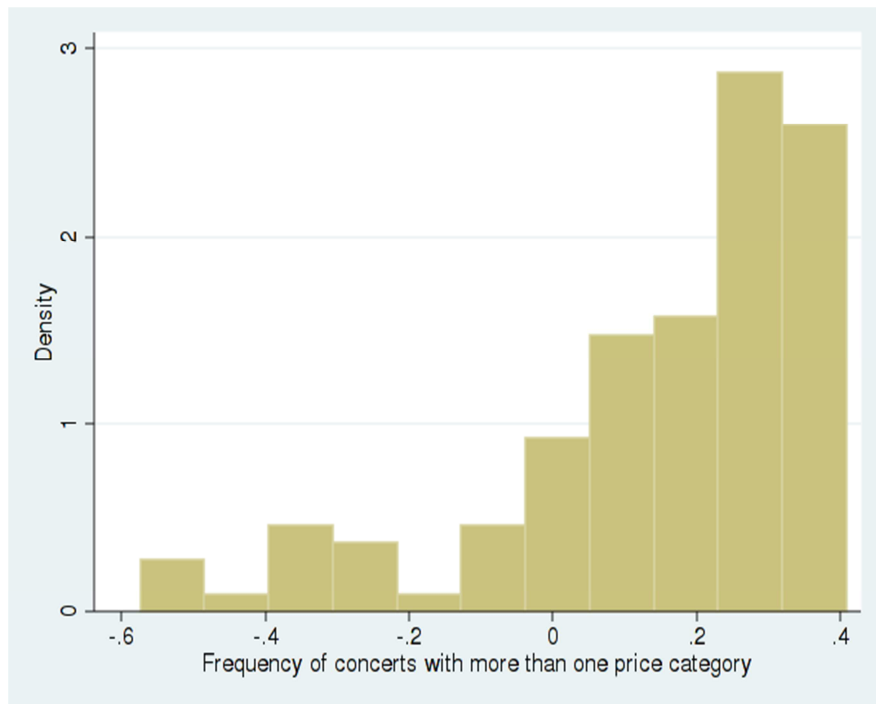
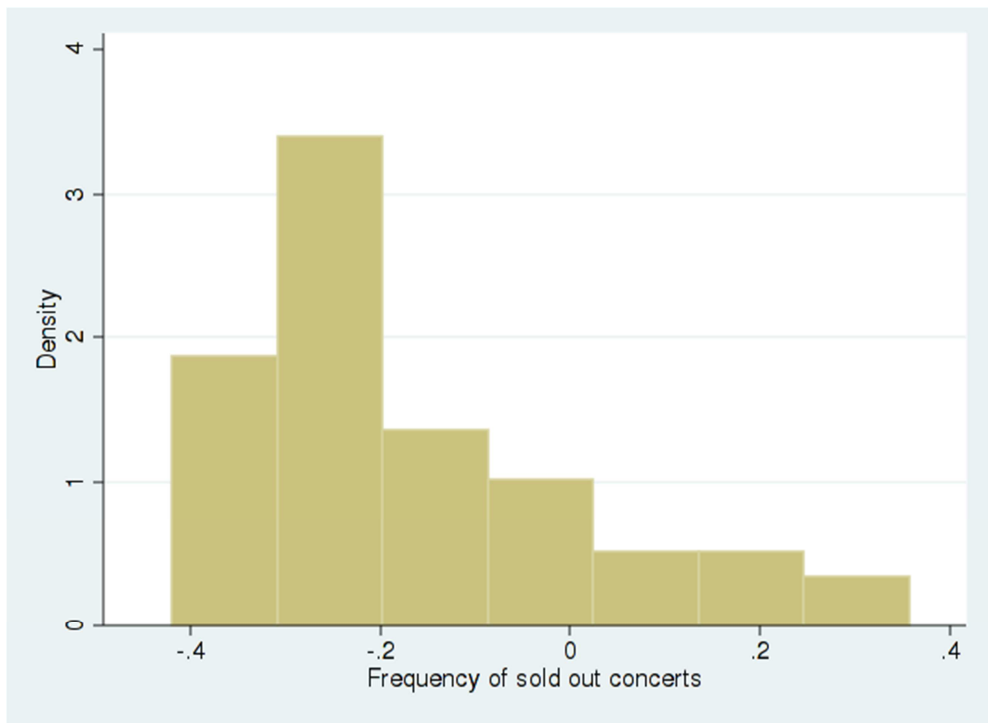Figure 6. Third-degree price discrimination: distribution of estimated artist fixed effects in regression with city-pair fixed effects.
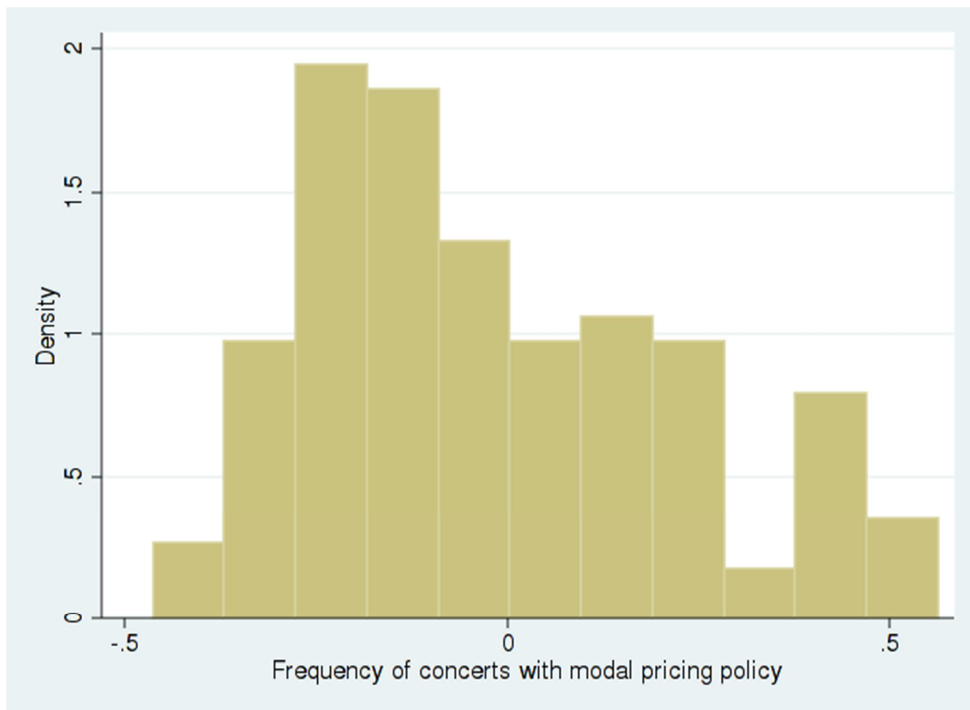
Figure 7. Rationing: the distribution of artist-specific propensity to sell out.
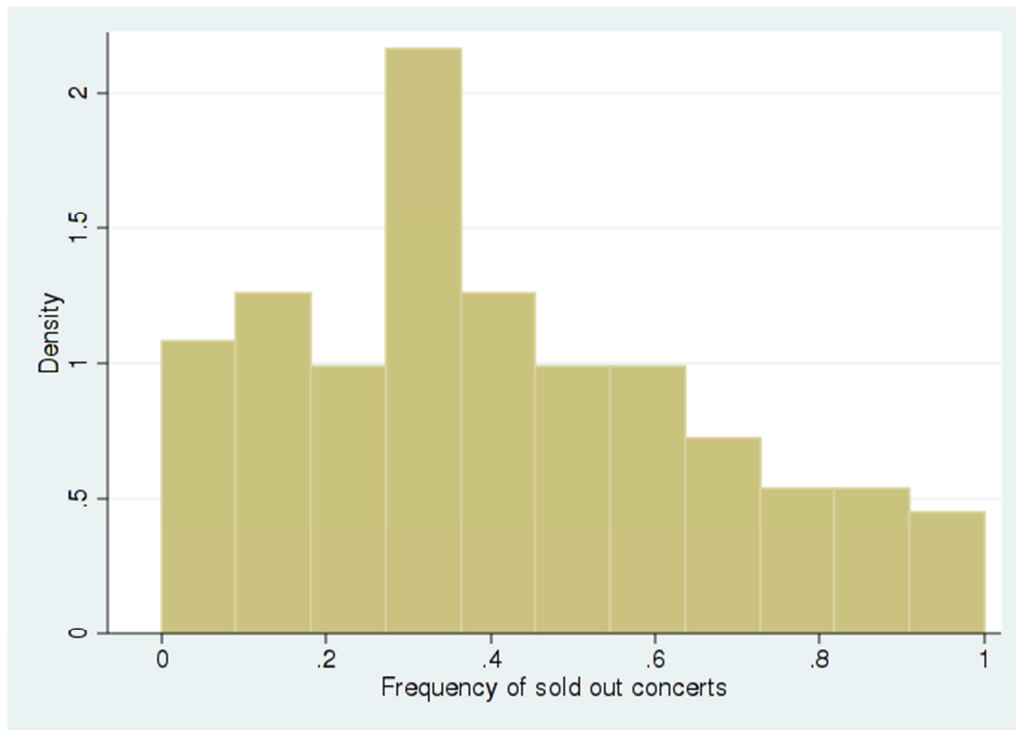
Figure 8. Rationing: the distribution of artist-specific propensity to sell out (artists with more than 100 concerts).
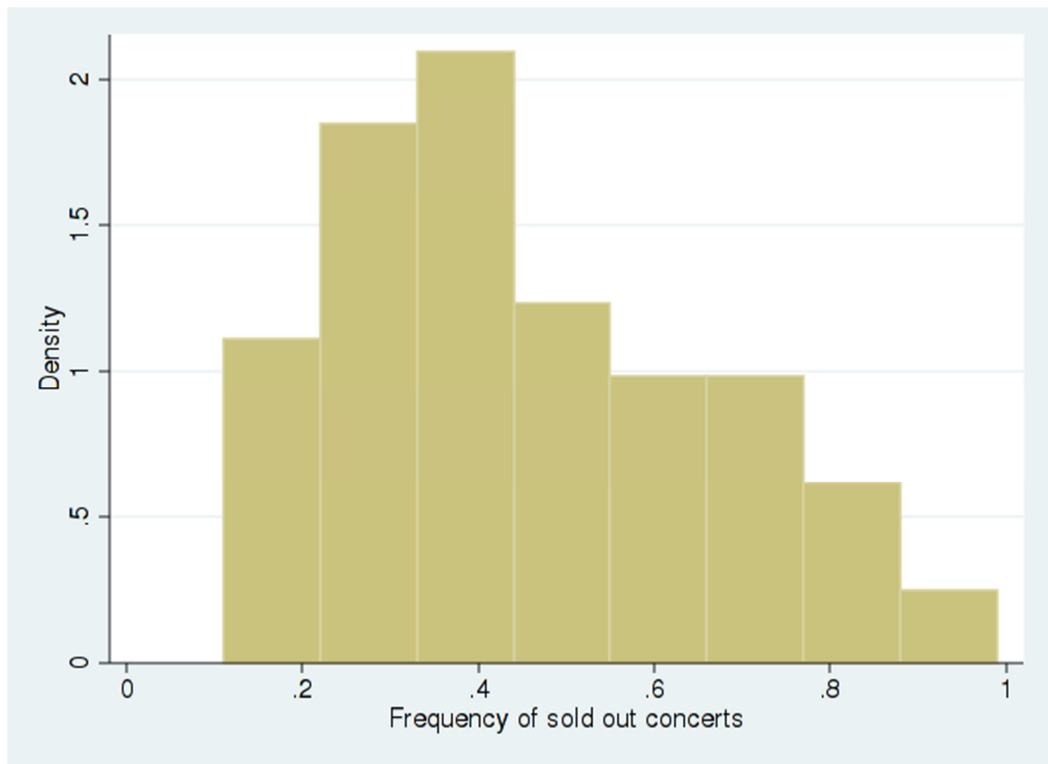
Figure 9. Rationing: distribution of estimated artist fixed effects in regression with artist fixed effects, venue fixed effects, year fixed effects.
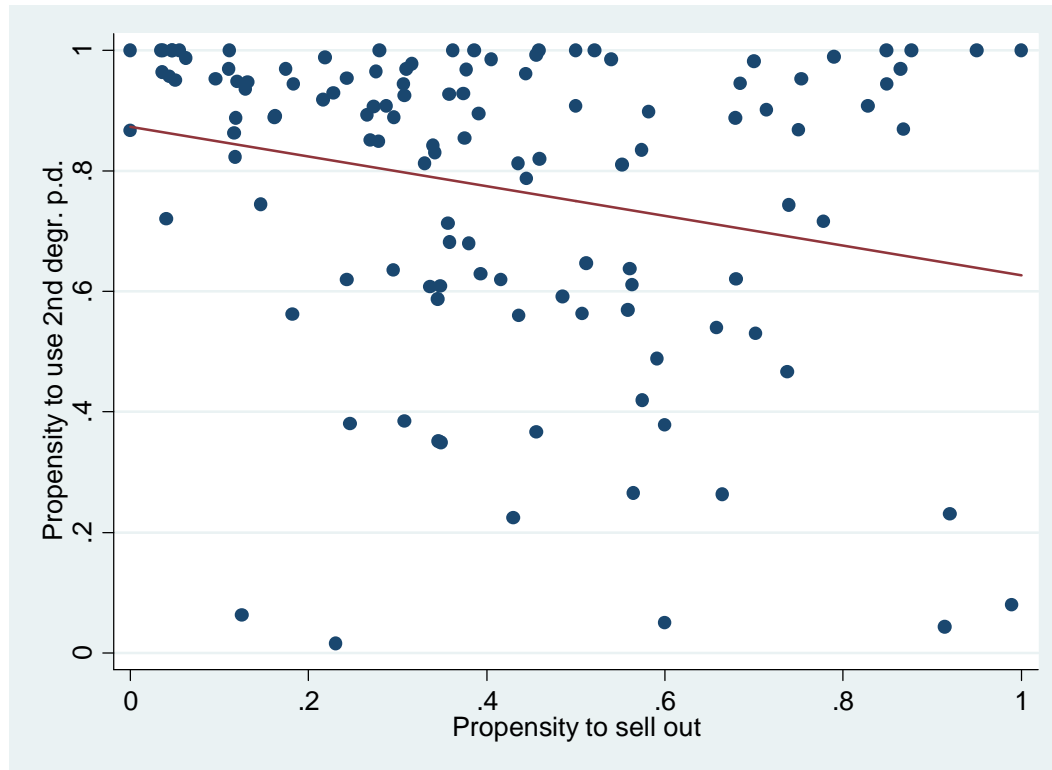
Figure 10. Correlation between artist propensity to sell out and use third degree price discrimination.
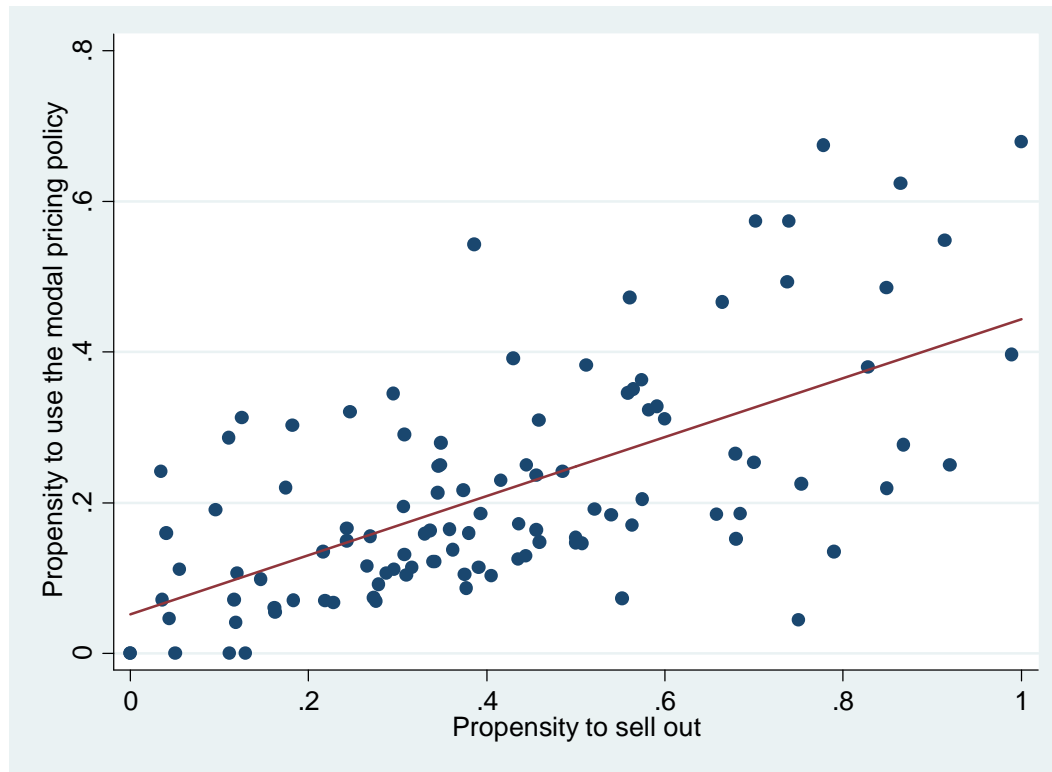
Note: Each dot represents an artist. The vertical axis measures the average proportion of concerts that use the modal pricing policy within a tour (i.e., the most common combination of prices within a tour). The figure also reports OLS fitted values, with 108 observations. The slope coefficient is 0.39 (s.e. 0.05).

Figure 11. The correlation between artists' propensity to use second degree price discrimination and to sell out.

Note: Each dot represents an artist. The figure reports OLS fitted values, with 122 observations. The slope coefficient is -0.25 (s.e. 0.09).

Figure 12. The correlation between artists' propensity to use second- and third-degree price discrimination.
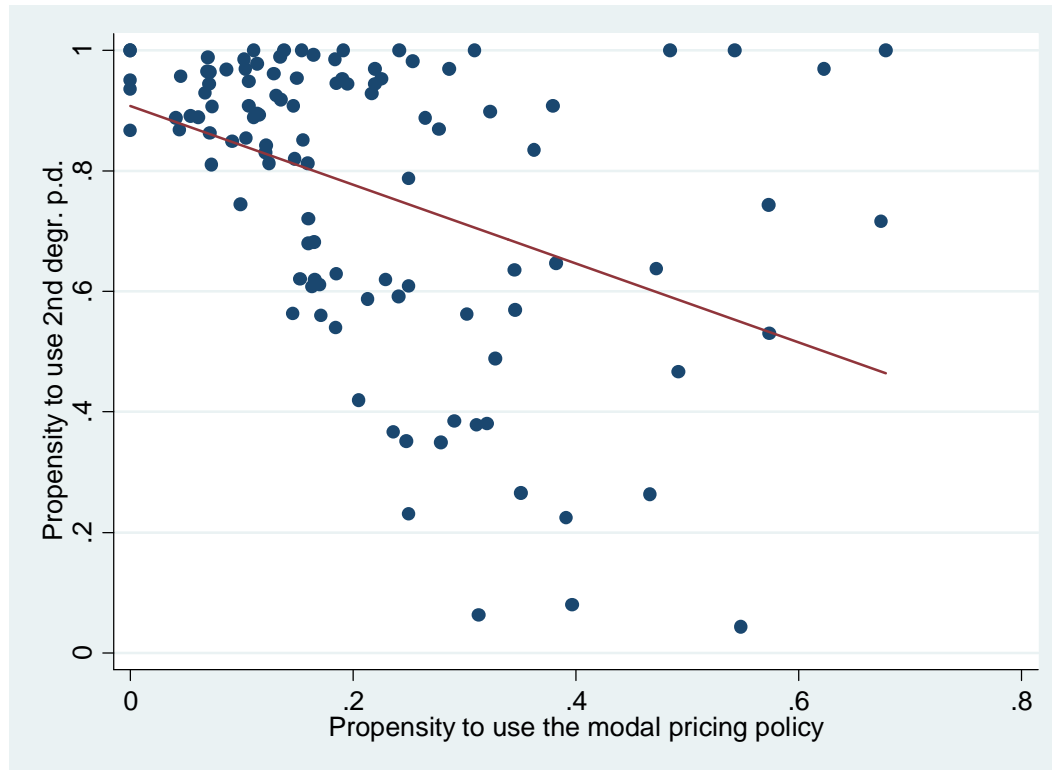
Note: Each dot represents an artist. The horizontal axis measures the average proportion of concerts that use the modal pricing policy within a tour (i.e., the most common combination of prices within a tour). The figure also reports OLS fitted values, with 108 observations. The slope coefficient is -0.65 (s.e. 0.14).