Essays on Uniform Pricing and Vertical Contracts in Two-Sided Markets

by

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Graduate Department of Economics
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Abstract

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This thesis is comprised of three chapters linked together by their economic analysis of uniform pricing and vertical contracts in two-sided markets. Various forms of uniform pricing and vertical contracts are present in the United States cable television market (Chapter 1), markets involving online purchasing platforms (Chapter 2), and in markets for health insurance (Chapter 3). These markets are common examples of two-sided markets since, for example, local television stations connect advertisers and viewers, online platforms connect buyers and sellers of various goods, and health insurers connect patients with medical providers. This thesis studies the economic consequences of vertical contracts and uniform pricing practices, which can arise through private contract or government regulation, in two-sided markets.

Chapter 1 examines how local television stations have responded to a regulation of the 1992 Cable Act mandating cable distributors offer consumers local content in the form of a bundle with a single price. In this chapter, I show that this form of government-mandated uniform pricing results in television stations setting their prices for content higher than they would absent this regulation.

In collaboration with Kenneth Corts, Chapter 2 examines the pricing incentives of sellers who reach potential buyers through platforms that may restrict sellers to offering a uniform price across all platforms. This contractual restriction is commonly referred to as a “most-favored-nation” clause. In this chapter, we show that platforms may find it privately profitable to adopt such a contractual restriction, and that the result is higher fees charged by platforms to sellers.
Chapter 3 studies the use of most-favored-nation clauses in markets for health insurance. A health insurer may find it privately profitable to restrict its participating medical providers from discounting their medical services to rival insurers, which amounts to uniform pricing of medical services to insurers. In this chapter, I show that such uniform pricing may lead to lower prices for health insurance as any discounts offered to one insurer must also be extended to all other insurers.
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Chapter 1

Intermediaries in Two-Sided Markets: 
an Empirical Analysis of the U.S. Cable Television Industry

1.1 Introduction

Two-sided markets consist of two distinct groups of users who interact with each other via a platform and whose utility depends on the number of users in the other group. Frequently cited examples of platforms that connect two such groups of users are credit cards (card holders and merchants), video game consoles (game players and game publishers), and newspapers and magazines (readers and advertisers). Two-sided markets have attracted significant attention from researchers in industrial organization economics in recent years. Theoretical and empirical work has demonstrated that pricing behavior, strategies and policy prescriptions can diverge considerably from those that prevail in a traditional one-sided market. This is because, in two-sided markets, platforms face a choice about which side of the market to charge higher prices to and which side of the market to subsidize in an effort to grow the number of transactions and value of the platform.
One thing this research has yet to consider is the potentially important role played by intermediaries in two-sided markets. Intermediaries exist anytime a platform does not interact directly with one or both sides of the market. Though the existing two-sided models typically assume that the platform interacts directly with both sides, it is clear that in some scenarios they interact via intermediaries (or a more complicated vertical structure) and the existence of such intermediaries may alter the behavior of a two-sided platform just as it would a traditional one-sided firm.

In this paper, I offer the first empirical study of two-sided markets in which the role of intermediaries is explicitly addressed. I study television stations, which are among the most frequently cited examples of platforms, connecting television viewers and advertisers. Though this was not always the case, today such stations charge prices to both sides of the market: ad rates to advertisers and retransmission fees to the cable, satellite and telephone distributors who rebroadcast (and effectively resell) stations' content to their subscribers. These distributors are important intermediaries (today, over 90% of viewers watch television through one of these three types of distributors) and their pricing, bundling, and other strategic decisions may have an impact on the nature of the optimal two-sided pricing strategy for the television station. Furthermore, in this particular setting, the intermediaries play a second role as well. Cable and telephone distributors themselves sell local advertising slots. Thus, in addition to being the downstream reseller of stations' content, they also compete with these stations in the local advertising market. This additional competition through the advertising market means that there are multiple channels through which these intermediaries may affect station behavior. Not only are such channels not explicitly considered in the existing literature but they were likely not foreseen when regulations affecting this industry were put into place in 1992 (at a time when roughly half of all television viewers accessed local content using an over-the-air antenna).

Currently in the United States, there are nearly 2,500 local broadcast channels (or “sta-

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tions”) that reach 115 million U.S. households. Historically, stations provided their content for free over-the-air as they lacked the technological capability to exclude viewers. As a result, stations derived revenues exclusively from advertising. The growth of content distribution through cable companies offered stations the option to monetize viewership since cable companies do have the ability to exclude viewers. The rise of cable distributors as monopolies drew the attention of regulators who introduced the 1992 Cable Television Consumer Protection and Competition Act. The 1992 Act introduced three main regulations: (i) “must carry” provisions which offered stations the option to force cable distributors to carry their content (but then forfeiting the right to charge for that content), (ii) mandatory bundling of local channels, and (iii) restrictions on joint ownership of stations within a market. At the outset, cable channel capacities were limited and so for cable companies, carrying local stations came with the high opportunity cost of foregone specialty programming. Realizing their limited ability to charge cable companies for content, stations elected “must carry” status and provided their content to cable companies free of charge. With stations choosing “must carry” status, the local television market was essentially segmented into an advertising market and a viewing market: prices on the viewer side of the market were determined simply by monopoly cable pricing (or regulated prices), and advertising rates were determined by competition among stations.

A number of technological changes have occurred since the implementation of the 1992 Act, one of which is the growth of cable channel capacity. It is now standard for capacity to reach up to 1,000 channels so that carrying local stations has a low opportunity cost. Beginning in 2005, stations ceased electing must carry status and began to seek payment from distributors for their content in the form of per-subscriber “retransmission fees”. Today, these fees amount to roughly $2.5 billion in revenues for broadcast television stations. The second significant change that has occurred is a move away from the free over-the-air model of television; today over 90% of viewers access the content of local stations through one of three distribution methods: cable (eg. Comcast, Time Warner), telephone or “telco” (eg. Verizon, AT&T), and satellite (eg. DirecTV, DISH). The growth of competition among such “distributors” has not only increased competi-
tion for paying viewers, but it has also increased competition in the local advertising market: along with stations, cable and telephone distributors also sell local advertisements which air on specialty channels (e.g. ESPN, CNN). Satellite distributors also sell advertisements on specialty channels, however, they cannot feasibly target local audiences and so do not compete in the local advertising market. In light of these changes, we no longer observe segmented advertising and viewing markets. Instead, we observe an integrated two-sided market, illustrated in Figure 1, where retransmission fees affect final subscription prices, and subscription prices affect viewership which in turn determines advertising rates, and retransmission fees.

As a result of these two major changes in the industry since 1992, it is clear that the presence of distributors acting as intermediaries between stations and viewers may cause the stations to price in ways that are different from how stations would price if they interacted directly with viewers. My empirical analysis investigates the extent to which this is the case. To do so, there are two empirical challenges that need to be overcome. The first is that it is not possible to identify how intermediaries affect stations’ behavior by simply comparing stations operating with and without intermediaries (as all stations in all markets reach viewers through some form of distributor). Therefore, I develop an empirical strategy that identifies the effects of distributors on station behavior by exploiting variation in distributor market structure. While the variation I exploit is cross-sectional, my empirical approach takes advantage of the fact that institutional features of the industry mean that many of the characteristics that might otherwise vary across markets and might be problematic for a cross-sectional analysis are, by design, held constant here. The second empirical challenge is that retransmission fees (the fees that stations charge the distributors per subscriber) are not publicly disclosed. However, final prices charged to consumers are observed and thus the empirical strategy must be able to infer changes in retransmission fees from changes in final prices. To do this, I exploit a novel dataset including over 5,000 manually collected zipcode-level distributor prices that I have paired with additional zipcode and market-level data obtained from multiple media research firms. Since distributor competition varies at the zipcode but retransmission fees are set at the market level, I am able
to estimate the indirect effect of distributor competition on the negotiation of retransmission fees while still controlling for the direct effect of distributor competition on final prices.

Several key findings emerge. First, I find evidence that retransmission fees are lower in markets where ad revenues per household are high. This confirms that station behavior is consistent with a basic principle of two-sided market theory: since the marginal benefit of an additional subscriber in terms of advertising revenues is higher in markets with higher per-household ad rates, stations should set lower retransmission fees in these markets to increase viewership. My finding of evidence that retransmission fees are lower in lucrative ad markets suggests that platforms may still continue to pursue “two-sided” pricing strategies even through intermediaries. The remaining two results speak to how distributor intermediaries specifically affect station pricing incentives.

I find evidence that increased competition from telephone distributors lowers retransmission fees to cable distributors, while competition primarily from satellite raises retransmission fees to cable distributors. One explanation for this result is intimately tied to the advertising side of the market. Since satellite distributors cannot target local audiences, stations have an incentive to charge higher fees to cable distributors facing competition primarily from satellite as this induces higher cable prices and subscriber switching to satellite. Subscriber switching to satellite in turn lessens the effectiveness of competition from cable distributors in the ad market (since advertising via cable reaches fewer viewers). When cable distributors face competition primarily from telephone distributors, a station does not face an incentive to raise cable prices since higher cable prices induce switching to telephone distributors which has no effect on the local ad market. This suggests that platforms may not only care about the total number of users connecting to the platform, but they may also have strong preferences over which intermediary users choose to connect to the platform.

By examining two types of station mergers that occur under different circumstances, I find evidence that station mergers lower retransmission fees. One explanation for this finding is that bundling of local stations introduces a pricing externality among stations that causes them to
set retransmission fees higher than they would absent bundling. Because viewers only observe a single price for a bundle of all local stations, stations may seek higher retransmission fees than they would under a la carte pricing because higher retransmission fees can only be passed through in the form of a higher bundled price for all stations. Simply put, retransmission fees are determined by a transaction involving a single station and a distributor, but have an impact on other stations not involved in the transaction; higher retransmission fees impose a cost on other stations not involved in the transaction, and therefore fees are set too high from the joint perspective of stations. Station mergers partially resolve this externality because a station recognizes that higher retransmission fees impose a cost on partner stations, and for this reason, retransmission fees should fall under joint ownership of stations.

The empirical results of this paper have implications for the existing two-sided market literature as well as for public policy. The existing literature has largely ignored the role of intermediaries and the impact that they may have on the pricing decisions of platforms. This paper shows that intermediaries may cause platforms to price in a way that is different than if they connected directly to end users, and should not be ignored if there is a possibility that they may have a material impact on platforms’ pricing decisions. This is especially true if there is reason to believe that the platform may have a preference for which intermediaries end users choose; platforms’ preferences over intermediaries may create incentives that affect platform behavior but which cannot be captured by models assuming platforms connect directly to end users.

This paper also has implications for policy in the U.S. cable television industry which remains governed by the 1992 Cable Act. In particular, I find that markets where telephone distributors are present not only have lower cable prices because of competition, but also indirectly through lower retransmission fees because stations have less of an incentive to seek high retransmission fees in markets with telephone distribution downstream. This suggests that telephone distributors offer a greater restraint on the growth of retransmission fees than do satellite distributors. I also find evidence that mandatory bundling of local stations together with restrictions on joint
ownership of stations within a market combine to raise retransmission fees, and that this is an unintended consequence of the 1992 Cable Act which did not anticipate the current market structure. Allowing a la carte pricing of local stations would lessen a station’s incentive to raise retransmission fees because this would result in a higher final price for that station alone (and invite substitution to rival stations), whereas under bundling, higher retransmission fees result in higher prices for all local stations which does not permit substitution among stations contained in the bundle. I find evidence that joint ownership lessens a station’s incentive to seek higher retransmission fees under bundling because jointly owned stations are more reluctant to seek higher retransmission fees that impose costs (in the form of higher cable prices) on other stations in the same ownership portfolio. In general, the main policy implication of this paper is that the local television market warrants consideration as a two-sided market, where distributor intermediaries affect station behavior directly as a distributor of content but also indirectly as a rival seller of advertising.

The paper is organized as follows: Section 2 provides a review of the literature, Section 3 contains institutional details, Section 4 provides theoretical predictions, Section 5 describes the empirical approach, Section 6 discusses the data, Section 7 contains the empirical results, Section 8 presents preliminary evidence of two-sided behavior by distributors, and Section 9 concludes.

1.2 Existing literature

This paper contributes to several literatures. Broadly speaking, the main contribution is to the empirical literature which tests for the existence of two-sided behavior on the part of platforms. Since two-sided theory often predicts behavior that is inconsistent with predominantly one-sided theories of firm behavior (such as below cost pricing), the two-sided empirical literature tests whether any weight should be given to two-sided theories. After having found evidence of two-sided behavior, part of this literature has proceeded to examine the effect of platform mergers
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on the balance of prices to each side of the market. This paper contributes to the general empirical two-sided literature by testing for two-sided behavior on the part of stations, analyzing the effects of station mergers on prices to both sides of the market, and, mostly importantly, considering two aspects of two-sided markets which to my knowledge have not been considered before empirically: what effects intermediaries have on platform pricing in a two-sided market, and whether intermediaries themselves can be considered platforms. There is also a contribution to the study of the U.S. cable television industry itself, which as the industry evolves has had to re-evaluate certain policies such as forced distributor bundling of local channels and restrictions on joint ownership of stations. This paper directly speaks to the debate surrounding the regulatory framework imposed by the 1992 Cable Act because it examines the effects of station and distributor concentration on cable prices for consumers.

The earliest two-sided market theories (Rochet and Tirole 2002, Caillaud and Jullien 2003) examined optimal platform pricing and found that prices should be lower for the group of users which has relatively elastic demand for the platform, and that prices should be higher for the group which has relatively inelastic demand for the platform. As this relates to the U.S. cable television industry, it is natural to suppose that advertisers value viewers more than viewers value advertisers which is supported by the prevalence of ad-avoidance technologies. The predicted result is station “subsidization” of viewers and revenue extraction from advertisers. Since the original literature considered monopolist platforms, the theoretical literature has turned to predicting the effects of platform competition on the balance of prices (Armstrong 2006, Weyl 2006, Chandra and Collard-Wexler 2009), but without clear predictions as of yet.

Kind et. al (2011) provide a first step in the direction of developing an understanding of the role of intermediaries in two-sided markets. The authors develop a theory of the role of intermediaries in the cable television industry and find that the presence of distributors pushes channel pricing away from that which would exist under vertical integration of channels and distributors (to the detriment of both industry profits and consumer welfare). Unfortunately, the features of the model do not align with those of the U.S. cable television industry so the
predictions do not directly apply.

Several empirical challenges present themselves when attempting to test the theoretical predictions of two-sided market theory. The key empirical relationship this research attempts to identify is whether relative prices to each side of the market are a function of each side’s elasticity of demand for the platform. To estimate such a relationship, the researcher requires meaningful data on both sides of the market, such as price and quantity observations, as well as exogenous variation that will identify parameters of interest that drive the equilibrium decisions of platforms. As a result of these requirements, researchers have turned to newspaper and magazine markets where advertising and circulation information has been made available. The Dutch (Filistrucchi, 2011), Belgian (Van Cayseele and Vanormelingen, 2010), Italian (Argentesi and Filistrucchi, 2007), and Canadian (Chandra and Collard-Wexler, 2009) newspaper markets have been studied as two-sided markets but with different research questions. Kaiser and Wright (2006) study the German magazine market and find evidence of textbook two-sided behavior: advertisers value magazine readers more than readers value advertisers, and cover prices are “subsidized” as a result. Chandra and Collard-Wexler study a series of mergers in local Canadian newspaper markets and finds that prices fell to both advertisers and readers.

A related literature is concerned with how platforms determine the optimal mix of its products (such as newspaper or television content) along with advertising levels and subscription prices. This has proven a difficult problem to solve due to various cross-group effects or “chicken-and-egg” effects. For example, Anderson and Coate (2005) model the effects of platform (television station) concentration on the numbers of ads and programs under the assumption that stations price directly to viewers, but with unclear predictions over which level of concentration is more socially desirable. Wilbur (2008) serves as both a theoretical and empirical example of this literature; he presents a theoretical model of network behavior in the U.S. cable industry followed by an estimation of various cross-group elasticities and their effects on networks’ program choices. Among other results, Wilbur finds that the preferences of advertisers affect networks’ programming choices more than viewers’ preferences.
Due to the difficulties in estimating a number of parameters simultaneously, it has been helpful to examine industries where the problem is simplified because, either for technological or regulatory reasons, one of the platform’s choice variables is held constant. Jeziorski (2012) provides an excellent example; he uses radio station mergers in the U.S. to structurally estimate various industry parameters which are then used to perform a welfare analysis of radio station mergers. Because radio stations cannot charge listeners for their content, nor can they pay listeners to tune in, the estimation problem is greatly simplified and Jeziorski is able to focus on the effects of station mergers on advertising levels, content variety, and listener welfare. The approach taken in this paper is very similar to Jeziorski, though almost the mirror image of it, because the number of ads and the content aired during prime time are variables that are out of the control of a local television station. But unlike radio stations, television stations are restrained in choice of content but flexible in prices to viewers because most viewers access their content through cable, telco, or satellite distributors that have the ability to exclude non-paying viewers.

1.3 Industry background

The U.S. cable television industry is broken down into 210 Designated Market Areas (DMAs) that for simplicity will be referred to as markets. Households watch local and national channels either through a local cable distributor (Comcast, Time Warner Cable, Cox, etc.), a local telco distributor (Verizon FiOS, AT&T U-verse), or through a national satellite distributor (DirecTV, DISH Network). Virtually all households have access to a national satellite distributor. Almost all households in urban markets have access to a local cable distributor, and some of the larger markets have a third option of a telco distributor. Cable and satellite distributors have been in the market for at least two decades, but telco distributors are relatively new and began operations around 2005.

Households pay their distributor a monthly subscription fee to receive access to a certain
number of channels. In turn, distributors pay national and local channels a fee per subscriber for their content which is negotiated. When distributors receive the content of a national channel, they also receive 2-3 minutes worth of ad slots per hour for that channel which they can use to sell to advertisers or which they can use to advertise themselves. While they amount to less than subscription revenues, ad revenues derived from these slots are substantial, amounting to roughly $2 billion per year for the largest distributor Comcast, and $1 billion per year for Time Warner Cable. Because distributors distribute their content to households from a local headend facility (essentially the origin of the cable or fibre lines that reach out to households), local distributors can offer advertisers the ability to sell ads that target a local audience. Therefore Comcast subscribers in different markets may see different ads on national channels (such as ESPN) for 2-3 minutes per hour, and neighbours in the same market but who separately subscribe to Comcast and Verizon may also see different ads on the same channel at the same time. This contrasts with national satellite distributors who distribute their content from satellite and cannot feasibly target local audiences in the same way. Instead, satellite providers sell national advertisements and so all DirecTV subscribers view the same advertisements on national channels at the same time.

When distributors negotiate to receive content from local channels (or “stations”) the distributors do not typically receive any ad slots, at least not for free. For this reason, the linear fees per subscriber that distributors pay local stations are lower than what they pay for national channels of comparable popularity. These linear fees in the context of agreements between distributors and stations are known as “retransmission fees”, as local distributors historically served to extend the broadcast signals of these stations to neighbourhoods too distant to receive those signals with over-the-air antennas. Although retransmission revenues are substantial, stations derive most of their revenues from the sale of advertising slots provided by their parent network.

\footnote{They would need to increase their satellite transponder capacity by 210 times to have this capability for all markets. Transponder space on a satellite is very expensive, roughly $2 million per transponder per year. The satellite distributors, however, are slowly beginning to offer local advertising capabilities by preloading their digital receivers with thousands of ads to be played based upon household-level characteristics, which could ultimately provide advertisers with the ability to target audiences even further.}
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(e.g. ABC, CBS, FOX, NBC). A given parent network provides all of its affiliate stations with the same number of ad slots, but this allotment varies across networks.

Retransmission agreements are governed by the 1992 Cable Act which offers stations the option every three years to demand “must carry” status from distributors. This requires distributors to carry the station, but the station relinquishes the right to charge the distributor for content. If a station does not elect must carry status, then the station retains the option to charge a positive retransmission fee, but the distributor has the option not to carry the station. These agreements are re-negotiated every three years, though the length of contracts can extend further. From 1992 until 2005, stations elected must carry status and so aggregate retransmission revenues were zero. As illustrated in Figure 2, since 2005, stations have sought payment for their content from distributors and in 2012 aggregate retransmission fees amounted to an estimated $2.5 billion. Unfortunately, retransmission fees agreed upon between specific stations and distributors are closely guarded secrets and so are unobserved.

While retransmission fees are not observed, some aggregate retransmission revenue data is available which can be overlapped with subscriber information to calculate average retransmission fees. Retransmission fees are climbing, and there is evidence of substantial variation in fees across stations. Figure 3 presents SNL Kagan estimates of average retransmission fees per subscriber for a selection of station groups (entities that own multiple stations across markets).\(^3\) The magnitudes of the retransmission fees may appear trivial, but these fees are well above what most national channels receive (some earn pennies per subscriber), not to mention that national channels provide distributors with free ad time whereas stations do not.

Distributors are required by FCC regulations to offer consumers a “Basic” bundle of channels for sale which contain (at a minimum) all local channels. Roughly 9% of all subscribers subscribe to the Basic package. Historically, the price of this bundle was regulated by local municipalities as part of a Local Franchise Agreement that distributors sought in exchange for the right to

\(^3\)Many station groups do not report any information regarding its retransmission revenues. The estimates presented are sometimes based only upon comments made by a station group’s CEO regarding the neighbourhood of its aggregate retransmission revenues.
distribute in the area. With the entry of satellite and telco providers, very few municipalities still regulate the price of distributors’ Basic package, with one distributor indicating that less than 1% of its municipalities are subject to price regulation.\(^4\)

Another important FCC regulation relates to ownership rules, which limit a single entity to owning up to two stations in a single market, and not more than one of the top four stations in a market. Essentially this prevents a group from owning two or more of the Big Four stations in a market. Ownership of stations across markets is permitted, however, though a group’s ownership of stations cannot exceed 39% of the national audience. Ownership of stations across markets is common; station groups exist that own dozens of Big Four stations across markets. Many stations are owned and operated by their parent network, known as “O&O” stations, but the extent of ownership is again limited by the 39% rule.

FCC regulations prevent distributors from importing signals from out of market, and so if negotiations break down between, say, FOX Chicago and Comcast, Comcast cannot import FOX Detroit. Instead, a blackout arises and Comcast subscribers will no longer be able to view any FOX programming. Since the primetime content aired on FOX Chicago and FOX Detroit is identical, Chicago-area subscribers would view it as a reasonably good substitute; the only difference would be seeing Detroit-area advertisements and Detroit-area news. As a result, this FCC regulation grants local stations substantial bargaining power as blackouts may lead some subscribers to cancel their subscription with their distributor.\(^5\)

There are a number of industry concerns regarding these rules. For one, if a station is struggling financially, local ownership rules are often waived in order to preserve local programming diversity. One such example is the San Antonio market where Sinclair Broadcast Group owns both the FOX and NBC stations. Another circumvention of these rules occurs through “Lo-

\(^4\)Technically, distributors must file to the FCC stating effective competition, but most municipalities do not want the administrative burden of regulating.

\(^5\)The costs of a blackout to a station are mostly reduced advertising revenues from lower viewership. The cost to a distributor is that some subscribers will switch to a rival distributor to regain access to the blacked out channel. For this reason, stations often find it beneficial to renegotiate retransmission agreements ahead of television events that subscribers are most likely to switch distributors to see, such as the Superbowl.
cal Marketing Agreements" (LMAs) where a station delegates its entire operations, including retransmission negotiations, to another station in the market. These agreements amount to virtual mergers among stations; as of this writing there are 46 known LMAs in existence.

While all markets have access to the content of the Big Four, there are a few markets where the content is not supplied from a local station. For example, the Juneau market does not have a local FOX station and instead distributors in Juneau are permitted import FOX Anchorage for their subscribers. ABC, CBS, and NBC each have 192 locally-represented stations while FOX has 185. Despite these occasional exceptions, the number and concentration of stations is mostly fixed across the 210 markets.

1.4 Theoretical predictions

My objective is to lay out a simple theoretical framework that can generate a series of predictions about how platform behavior is affected by the presence of intermediaries. To be specific, the main objective is to identify (from final cable prices) how distributor competition affects the setting of retransmission fees. I then proceed to examine how ad rates and joint ownership of stations are predicted to affect retransmission fees.

To do this, I first introduce some notation and then formalize the objectives of stations and distributors. I derive a measure of how lucrative the ad market is by introducing the concept of a per-household ad rate that serves as a measure of the marginal benefit of an additional viewer in terms of advertising revenues. I then examine how distributor concentration might affect stations’ retransmission fees under two competing hypotheses: a “one-sided” hypothesis that retransmission fees are determined in isolation of conditions in the ad market, and a “two-sided” hypothesis that retransmission fees are a function of conditions in the ad market, and in particular, per-household ad rates. The final item is a discussion of how station mergers might remedy an externality created by a provision of the 1992 Cable Act that mandates bundling of

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6 Less of a concern, at least from a market power standpoint but not a diversity standpoint, are Joint Service Agreements where stations agree to share production equipment, news crews, etc.
local stations.

1.4.1 Local ad market

The primary determinant of advertising rates is the number of viewers. It is helpful to create a measure of ad rates which is independent of the viewing population so that differences in ad rates across markets are not determined by market size. Such a per-household ad rate will serve as the measure of the marginal benefit of a viewer in terms of advertising revenues.

In the cable television industry, the unit of viewership is the household. Each market has a set of television households which are defined as any household that has a television (but which is not necessarily watched). Reachable households in market $m$, $H_m$, is the subset of television households that watches television either over-the-air using an antenna, through a cable subscription, telco subscription, or satellite subscription. Let $R_{sm}$ be the average non-household adjusted ad rate station $s$ receives for a 30-second ad. Then $r_{sm} = (R_{sm}/H_m)$ is the per-household ad rate of station $s$.\(^7\)

Each station $s$ has a fixed allotment of ad slots $a_m$ to sell. This allotment is determined by the parent network, such as ABC, CBS, FOX or NBC. While $a$ varies across stations within a market, it does not vary across stations in different markets with the same parent.\(^8\) Since station ad output is fixed at $a$, supply is vertical and the non-household adjusted ad rate $R^*_{sm}$ that will just clear this ad inventory is determined by the intersection of that vertical supply curve with the demand to advertise on the station. The determinants of $R^*$ are therefore entirely driven by local demand factors such as market-specific viewership of the station, the price of substitute advertising such as rival local stations but also newspaper and radio. Most importantly, $R^*$ is also a function of how viewers are distributed across cable, telco, and satellite distributors. Ideally, stations would prefer that all viewers connect to the station through a satellite distributor.

\(^7\)Note that this is not the same as the commonly used viewing metric CPM (cost per 1000 impressions) which measures the cost to an advertiser of actually reaching 1000 viewers. Here, $r_{sm}$ measures the cost of potentially reaching a single household. That household may not actually see the advertisement.

\(^8\)For example, the ABC affiliate in San Francisco has the same allotment as the ABC affiliate in Los Angeles.
so that they would not face local ad competition from cable or telco distributors. Therefore $R^*$ is most importantly a function of “satellite penetration” so that $R^* = R\left(\frac{\text{SatelliteSubscribers}}{\text{TotalViewers}}\right)$. Once divided by the number of reachable households, $R^*$ provides an appropriate measure of the advertising marginal benefit of a subscriber and is given by $r^*_{sm} = \left(\frac{R^*_{sm}}{H_m}\right)$.

It is important to emphasize that a given station has no control over the total number of advertisements seen by its viewers. For example, stations cannot pursue a strategy of reducing the number of ads seen by viewers to increase viewership, and then increasing subscription prices via retransmission fees. While stations do have the option to advertise their own programming so that they can move up their demand curve and extract a higher ad rate from paying advertisers, this does not affect the number of advertisements seen by viewers.

1.4.2 Distributor market structure

A key ingredient for identifying the effect of distributor competition on retransmission fees is to note that distributors do not earn any advertising revenue when viewers subscribe to its Basic package. An implicit assumption is that the distributor’s profit-maximizing choice of price for its Basic package is not materially impacted by the prices of its better-than-Basic packages. A theory of multi-product price discrimination is beyond the scope of this paper, but this theme is explored later in the paper when testing for two-sided behavior by distributors themselves.

Distributor competition varies at the zipcode-level. The price set by a distributor is therefore a function of zipcode demand characteristics, costs, and the number of competing distributors in that zipcode. The existence of rival distributors in the rest of the market does not directly impact the pricing decision of a distributor in a given zipcode. When setting the price of its

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9Recall that satellite distributors cannot sell local ads.

10It is natural to assume that viewers are indifferent between seeing advertisements for local programming and advertisements for local car dealerships, restaurants, or even a blank screen. While a station may move up its demand curve to increase $R^*$, since this does not affect viewership, $R^*$ (once adjusted for number of reachable households) still represents the marginal benefit of an additional viewer.

11The exceptions are the satellite providers whose cheapest offering is a form of “expanded Basic” and does include national channels.
Basic package in zipcode $z$ in market $m$, distributor $d$ chooses $p_{dzm}$ to maximize

$$(p_{dzm} - RT_{dm})q_{dzm}(p_{dzm}, p_{dzm})$$

where $p_{-dzm}$ represents the prices of rival distributors in zipcode $z$, $RT_{dm}$ is the sum of the retransmission fees the distributor $d$ must pay to all local stations in market $m$ and is the distributor’s constant marginal cost of a subscriber. Note that because this is the price for the Basic package, the distributor’s local ad sales do not enter the objective function. Out of this maximization problem is assumed to arrive an equilibrium price $p_{dzm}^*$ and a corresponding equilibrium number of subscribers $q_{dzm}^*$. The equilibrium price is expected to be increasing in retransmission fees and decreasing in the number of rival distributors in the zipcode.

### 1.4.3 Retransmission fee setting

Retransmission fees are negotiated between distributors and stations. This paper does not develop a formal model of the bargaining game that occurs between a distributor and a station. Instead, it is useful to consider as a benchmark the take-it-or-leave-it retransmission fee that would prevail if the station had full bargaining power in a negotiation. Since a station does not have full bargaining power, the station is not able to achieve that level of retransmission fee. However, as distributor competition increases, a station’s bargaining position clearly increases and a station behaving in a one-sided manner will always choose to exercise that bargaining power to increase retransmission fees.

In contrast, a station behaving in a two-sided manner may respond to an increase in distributor competition differently depending on who the competing distributors are. For example, when cable distributors face competition only from satellite, stations have an incentive to raise retransmission fees to cable distributors because higher cable prices result in switching to satellite which lessens the effectiveness of cable as a competitor in the ad market (meanwhile satellite distributors do not compete in the ad market). However, when cable distributors face compe-
tition mostly from a telco distributor, stations have less of an incentive to raise retransmission fees to cable distributors because higher cable prices result in switching to telco which has no effect on the local ad market (since both cable and telco participate in the ad market). The key institutional details to keep in mind are that satellite distributors do not compete in the local ad market, so that stations have a preference for viewers to access their content through satellite rather than cable or telco. This preference only matters, however, if stations are behaving in a two-sided manner and consider the ad market when negotiating retransmission fees.

The effects of distributor competition on retransmission fees

Consider a single market consisting of a single zipcode which before entry contains only one cable distributor, Comcast (C), and one satellite provider DirecTV (D). Before entry and under take-it-or-leave-it offers, a station $s$ behaving in a one-sided manner only interested in maximizing retransmission revenues would choose in its negotiation with Comcast a retransmission fee $t_{sc}^*$ according to

$$t_{sc}^* = \arg\max_{t_{sc}} t_{sc} q_c(p_c^*, p_d^*) + t_{sd} q_d(p_c^*, p_d^*)$$

(1.1)

where $p_c^* = p_c^*(RT)$ is Comcast’s downstream price and a function of its marginal cost $RT = \sum_s t_{sc}$ (of which $t_{sc}$ is a component), $q_c$ is Comcast’s demand which without competition from telco is a function of its own price and the satellite distributor’s price. The satellite distributor’s demand is given by $q_d$, and $t_{sd}$ is the already agreed upon retransmission fee paid by the satellite distributor to the station. In practice, the satellite provider’s price $p_d^*$ is fixed across all markets. Since a breakdown in negotiations harms the station, it does not have full bargaining power and will have to settle for a retransmission fee that is lower than $t_{sc}^*$. If there is greater distributor competition because of the entry of a telco distributor (Verizon), the station would choose its

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12For simplicity only one satellite provider is considered though in practice both DirecTV and DISH Network operate in every market. Further, only one zipcode is considered when in practice markets consist of many zipcodes. The results that follow easily generalize to any number of zipcodes and these simplifications are only made for ease of exposition.
retransmission fee according to

\[ t^*_sc = \text{argmax} \quad t_{sc}q_c(p_c^*, p_d^*, p_v^*) + t_{sd}q_d(p_c^*, p_d^*, p_v^*) + t_{sv}q_d(p_c^*, p_d^*, p_v^*) \] (1.2)

where the \( v \) subscripts indicate Verizon. Standard models of competition suggest that the \( t^*_sc \) in (1) is identical to that in (2), so that all that has changed for the station is the cost of a breakdown in negotiations.\(^{13}\) This cost decreases because any subscribers who cancel their Comcast subscription are more likely to re-appear as subscribers of either Verizon or DirecTV (compared to a situation where DirecTV is the only alternative). Standard bargaining models suggest that because of this increase in the station’s “outside option”, the station’s realized retransmission fee will be closer to \( t^*_sc \).

I now re-examine how the entry of a telco distributor under the assumption that stations behave in a two-sided manner. Before entry of a telco distributor and under take-it-or-leave-it offers, a station \( s \) behaving in a two-sided manner recognizes that higher retransmission revenues risk reducing viewership which negatively impacts advertising revenues. A two-sided station would choose \( t^*_sc \) according to

\[ t^*_sc = \text{argmax} \quad (t_{sc} + r^*)q_c(p_c^*, p_d^*) + (t_{sd} + r^*)q_d(p_c^*, p_d^*) \] (1.3)

Station profits consist of retransmission revenues plus advertising revenues from both distributors. Recall that \( r^* \) is an increasing function of satellite penetration so that \( r^* = r^* \left( \frac{q_d}{q_d + q_c} \right) \).

\(^{13}\)For example, with a single manufacturer upstream who has zero costs of production and retailers downstream with final demand \( q = 100 - p \), the take-it-or-leave-it wholesale price is \( w = 50 \) whether the retail sector is monopolized or perfectly competitive. If the wholesale price is negotiated, Nash Bargaining suggests \( w = 25 \) when retail is monopolized and \( w = 50 \) if retail is perfectly competitive.
The first order condition is\footnote{To recover the first order conditions under one-sided station behavior, simply set \( r^* = 0 \) in the following first order conditions.}:

\[ q_c(p_c^*, p_d^*) + (t_{sc} + r^*) \frac{\partial q_c(p_c^*, p_d^*)}{\partial p_c^*} \frac{dp_c^*}{dt_{sc}} + (t_{sd} + r^*) \frac{\partial q_d(p_c^*, p_d^*)}{\partial p_c^*} \frac{dp_c^*}{dt_{sc}} + \frac{dr^*}{dt_{sc}} (q_c(p_c^*, p_d^*) + q_d(p_c^*, p_d^*)) = 0 \]  

(1.4)

where \( \frac{dp_c^*}{dt_{sc}} = \frac{\partial p_c^*}{\partial RT} \frac{\partial RT}{dt_{sc}} > 0 \) and \( \frac{dr^*}{dt_{sc}} = \frac{\partial r^*}{\partial q_c} \frac{\partial q_c}{\partial p_c^*} \frac{dp_c^*}{dt_{sc}} + \frac{\partial r^*}{\partial q_d} \frac{\partial q_d}{\partial p_c^*} \frac{dp_c^*}{dt_{sc}} > 0 \). All terms are positive except the second. The second term represents the foregone revenue from viewers exiting the market as a result of higher retransmission fees being passed through. However, some re-appear as satellite subscribers (the third term), and this creates an additional benefit through the ad rate which is increasing in satellite viewership.

If there is greater downstream competition because, for example, Verizon has entered the market, the retransmission fee chosen by the station under take-it-or-leave-it offers is

\[ t_{sc}^* = \text{argmax} \ (t_{sc} + r^*)q_c(p_c^*, p_d^*, p_v^*) + (t_{sd} + r^*)q_d(p_c^*, p_d^*, p_v^*) + (t_{sv} + r^*)q_v(p_c^*, p_d^*, p_v^*) \]  

(1.5)

where the terms with subscript \( v \) represent Verizon. Without Verizon entry, a marginal increase in \( t_{sc} \) raised Comcast’s downstream prices \( p_c^* \) which caused viewers to either switch to satellite or exit the market entirely. Now, a marginal increase in \( t_{sc} \) will result in fewer exiting the market because subscribers have an additional option in Verizon, but it also means fewer will switch to
satellite. The first order condition is:

\[ q_c(p^*_c, p^*_d, p^*_v) + (t_{sc} + r^*) \frac{\partial q_c(p^*_c, p^*_d, p^*_v)}{\partial p^*_c} \frac{dp^*_c}{dt_{sc}} + (t_{sd} + r^*) \frac{\partial q_d(p^*_c, p^*_d, p^*_v)}{\partial p^*_c} \frac{dp^*_c}{dt_{sc}} + (t_{sv} + r^*) \frac{\partial q_v(p^*_c, p^*_d, p^*_v)}{\partial p^*_c} \frac{dp^*_c}{dt_{sc}} + \frac{dr^*}{dt_{sc}} (q_c(p^*_c, p^*_d, p^*_v) + q_d(p^*_c, p^*_d, p^*_v) + q_v(p^*_c, p^*_d, p^*_v)) = 0 \] (1.6)

Without knowing Comcast subscribers’ substitution patterns to Verizon relative to satellite, the magnitude of this first order condition compared to that in (4) cannot be determined. If Comcast subscribers strongly prefer Verizon over satellite, then the \( t_{sc} \) chosen may be lower than when Verizon is not in the market because \( \frac{dr^*}{dt_{sc}} \) is small. If, however, Comcast subscribers continue to substitute strongly to satellite, then the \( t_{sc} \) chosen may be higher with Verizon in the market because the station is less concerned about subscribers exiting the market (which reduces aggregate viewership). In essence, the station faces a trade-off between higher aggregate viewership versus the distribution of viewership, and so the effect of Verizon entry on \( t^* \) cannot be signed.

To summarize, a one-sided theory of station behavior predicts that an increase in distributor competition results in higher retransmission fees, whereas a two-sided theory of station behavior suggests that retransmission fees could fall.

**Effect of higher per-household ad rates on retransmission fees**

A second prediction is that stations behaving in a two-sided manner should set lower retransmission fees in markets with higher per-household ad rates. Since the marginal benefit of an additional subscriber is higher in these markets, a marginal increase in retransmission fees comes with a greater opportunity cost than in markets with lower per-household ad rates. This follows directly from the first order condition. If stations behave in a one-sided manner, in contrast,
then prevailing ad rates should have no effect on retransmission fees.

**Station mergers**

An often discussed question in two-sided market theory is what effect platform mergers have on the balance of prices on each side of the market. As of yet there are no clear answers, mostly because the network effects present in two-sided markets result in complicated “chicken-and-egg” problems where a change in price affects demand on one side of the market, which in turn affects demand on the other side of the market, etc. (Weyl, 2006). In the context of the local cable television industry, platform mergers correspond to station mergers and for reasons explained in the theory of the local ad market, network effects do not exist in one direction: since stations do not control the number of ads seen by viewers, they cannot pursue a strategy of reducing ads to spur viewership and then recoup through higher subscription prices. Since stations cannot affect the number of ads seen by viewers, station mergers are predicted to unambiguously increase local ad rates through increased market power on the ad side of the market. In essence, this prediction is simply that if stations can clear their ad inventory at a higher price as a result of station mergers, they will choose to do so since there is no benefit from clearing their inventory at a lower price.

The effect of station mergers on retransmission fees is less clear because station mergers may increase or decrease their bargaining power (Chipty and Snyder, 1999), but there is one reason why station mergers may decrease retransmission fees. Whether stations are behaving in a one-sided or a two-sided manner, there exists a pricing externality through mandated distributor bundling of local stations. Stations unilaterally negotiate their retransmission fee, but consumers do not then observe a vector of a la carte prices for each station. Instead, they observe a single price for the entire bundle of local stations. This limits switching among local stations which would otherwise be substitutes for each other. Under a la carte pricing, a station is concerned that if it increases its retransmission fee, the price of its individual station will increase and subscribers will substitute to another local channel. Under bundling, the price of
all local stations must rise with that increase in retransmission fee, which reduces the station’s incentive to keep retransmission fees low. When stations merge, the externality created by bundling is mitigated because stations internalize the effect that higher retransmission fees have on the demand for their partner stations.\footnote{Crawford and Yurukoglu (2012) find that for national channels (which are owned by a handful of conglomerates), this pricing externality is outweighed by another effect whereby the conglomerates accept lower fees in exchange for the distributor carrying their other less popular programming. Since this effect does not occur between a station and distributor in a single local market, the effect of local bundling on prices is unambiguously positive.}

To summarize the theoretical predictions of this section, I find that (i) retransmission fees could fall in response to an increase in competition from telco distributors, but only if stations are pursuing a two-sided pricing strategy, (ii) retransmission fees should fall in response to increases in per-household ad rates, but only if stations are pursuing a two-sided pricing strategy, and (iii) station mergers should again reduce retransmission fees by mitigating an externality created by a provision of the 1992 Cable Act which mandates distributor bundling of local stations.

1.5 Empirical approach

The empirical objectives of this paper are to examine whether (i) stations continue to pursue two-sided pricing strategies in the presence of distributors, (ii) how exactly the pricing behavior of stations is affected by the presence of distributors, and (iii) to examine whether station mergers remedy an externality created by a provision of the 1992 Cable Act which mandates distributor bundling of local stations. It would be ideal to observe station retransmission fees with and without distributor intermediaries, but unfortunately, virtually all viewers connect to stations through distributors and a key price variable (retransmission fees) is unobserved. The main empirical challenge is therefore to infer how retransmission fees change in response to various market conditions (such as distributor competition, prevailing ad rates, and station concentration) from final subscriber prices.

The strategy to identify retransmission fees involves exploiting variation in distributor con-
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centration (i.e. the presence of a telco distributor) across markets and the fact that distributors do not earn advertising revenues from viewers who subscribe only to Basic. This variation occurs while station concentration and content remains fixed across markets. To this end, the main identifying assumptions are that distributor pricing in a given zipcode is independent of how competitive other zipcodes are in a given market, and that distributor pricing of Basic is only influenced by advertising rates *indirectly* through stations’ determination of retransmission fees (since distributors themselves do not earn ad revenues from Basic subscriptions).

1.5.1 The subscription market

The first empirical test investigates whether increased distributor competition from telco distributors results in higher or lower retransmission fees. The strategy to carry out this test involves exploiting variation in distributor concentration across markets. The theoretical prediction is that stations behaving in a one-sided manner will have higher retransmission fees in markets with more telco competition because their bargaining power is enhanced in retransmission fee negotiations. In contrast, stations behaving in a two-sided manner *may* have lower retransmission fees in markets with more telco competition because stations have less of an incentive to induce cable subscribers to switch to satellite through higher retransmission fees to cable. Identification of this effect comes from the fact that distributor pricing of Basic is only influenced through stations’ retransmission fees, and the relevant level of distributor competition is the zipcode, not the market. To investigate the relationship between distributor competition and retransmission fees, I estimate the following equation:

\[
BasicPrice_{dzm} = \beta_0 + \beta_1 Controls + \beta_2 Telco_{zm} + \beta_3 ShareDuop_{m} + \beta_4 StationMerger_{m} + \epsilon_{zm}
\]

where *BasicPrice*$_{dzm}$ is cable distributor *d’s* price of Basic in zipcode *z* in market *m*, *Telco*$_{zm}$ is a dummy for whether a telco distributor competes with the cable distributor in zipcode *z*,
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$ShareDuop_m$ is the fraction of zipcodes in market $m$ served by the cable distributor which are cable/telco duopolies, $StationMerger_m$ is a dummy for whether any of the top four stations in the market are jointly owned, and $Controls_z$ are zipcode-level market controls. The identification of the effect of distributor competition on retransmission fees comes through $ShareDuop$. $BasicPrice$ should only directly be a function of local competitive and demand conditions, and retransmission fees. $BasicPrice$ should be independent of the fraction of zipcodes in the rest of the market which are cable/telco duopolies, unless that fraction affects the determination of retransmission fees. The key ingredient for identification here is that competition varies at the zipcode-level within a market, as otherwise the direct effect of telco competition on the distributor’s Basic price could not be separated from the indirect effect of telco competition on the station’s determination of its retransmission fee. Therefore by controlling for the direct effect of competition through $Telco$, $ShareDuop$ is an appropriate proxy for retransmission fees, and $\beta_3 < 0$ is evidence in support of a two-sided theory of station behavior. $StationMerger$ controls for the few cases of joint ownership of stations within a market and is discussed later in relation to examining the effects of mergers on prices.

The second test of two-sided behavior is more direct and tests whether stations lower retransmission fees in markets with higher ad rates. The estimated equation is

$$BasicPrice_{dzm} = \beta_0 + \beta_1 Controls_z + \beta_2 Telco_{zm} + \beta_3 ShareDuop_m + \beta_4 StationMerger_m + \beta_5 AdRate_m + \varepsilon_{zm} \quad (1.8)$$

where $AdRate$ is the average per-household ad rate in market $m$, and $\beta_5 < 0$ is support in favor of a two-sided theory of station behavior since only the two-sided theory suggests stations set lower retransmission fees in lucrative ad markets. The interpretation of $\beta_5$ as a measure of how retransmission fees change in response to a marginal increase in the prevailing ad rate naturally leads to concerns of reverse causality, namely that if $\beta_5$ is negative then it could be that low prices are increasing viewership which in turn is raising ad rates. However, by construction,
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AdRate is a per-household ad rate that is independent of the number of viewers and therefore unaffected by the price of Basic. As will be seen, the validity of this argument is supported by the data since there is no evidence of per-household ad rates varying non-linearly with the number of viewing households.

The final estimation involving zipcode-level Basic prices is used to test whether station mergers decrease retransmission fees by mitigating an externality created by the 1992 Cable Act mandating that local stations be sold to potential subscribers as a bundle (which results in retransmission fees that are too high from the joint perspective of stations). The estimated equation is identical to (8) but where $\beta_4$ is the estimate of interest. StationMerger is broken down into two types of station mergers that can occur. “Natural mergers” are those which occur in name and are officially sanctioned by the FCC, whereas those arising from Local Marketing Agreements (LMAs) are not officially approved and arguably violate the FCC’s local ownership rules. NaturalMerger$_m$ is a dummy referring to the former type of merger, and LMA$_m$ a dummy for the latter type.

Stations self-select into mergers and it is unclear how the unobserved factors that cause stations to self select may bias the estimate of the true effect of the merger on retransmission fees. I do not propose a way to control for this selection bias, though there is anecdotal evidence of the direction of the bias. Natural mergers sometimes occur as a result of one station purchasing a failing station in a market. The FCC may permit joint ownership in these instances if the alternative is for the station to exit the market and for diversity in local content to decline. For this reason, we may expect that natural mergers occur in markets with weak demand characteristics which will be negatively correlated with Basic prices, biasing $\beta_4$ downwards.

Mergers that occur as a result of LMAs are plausibly exogenous since they occur between station groups (who own multiple stations across markets) and affect all stations in markets where the station groups’ assets overlap. The LMA in the sample that affects the largest number of stations is between Nexstar Broadcasting Group and Mission Broadcasting which is given special consideration in the estimation since their station mergers may be less correlated
with local demand conditions than mergers that occurred between ownership groups with few overlapping stations.\textsuperscript{16}

1.5.2 The advertising market

The effects of station mergers on ad rates are also considered in this paper, and while they are not of direct interest to the research questions at hand, they are included in a baseline estimation of factors that influence prevailing local ad rates. The purpose of examining comparative statics in the local ad market is to validate that per-household ad rates are responsive to market conditions, in particular that per-household ad rates are increasing in the fraction of viewers connecting to stations via satellite distributors. Motivated by the theory presented of the local ad market, the station-market level estimated equation is

\[ \text{StationAdRate}_{sm} = \alpha_0 + \alpha_1 \text{Controls}_m + \alpha_2 \text{SatellitePenetration}_m \]
\[ + \alpha_3 \text{OverTheAirPenetration}_m + \alpha_4 \text{Distributors}_m \]
\[ + \alpha_5 \text{OwnMerger}_m + \alpha_6 \text{RivalMerger}_m + \]
\[ + \alpha_{7,...,10} \text{NetworkDummies}_m + \alpha_{11} \text{OtherStationDummies}_m + \psi_{sm} \]

(1.9)

where \text{StationAdRate} is the per-household ad rate of station \( s \) in market \( m \), \text{SatellitePenetration} is the fraction of viewers that watch via satellite, \text{OverTheAirPenetration} is the fraction of viewers that watch using an antenna, \text{Distributors} is the number of distributors in the entire market which is the appropriate level of competition in the local advertising market, and \text{OwnMerger} and \text{RivalMerger} are dummies for whether the given station \( s \) is part of a merger and whether a rival station in the market is involved in a merger. Both natural mergers and mergers through LMAs are again considered. \text{NetworkDummies} simply control for whether the given station is

\textsuperscript{16}As will be seen, this LMA was formed in response to the death of the owner of a station group (see section 7.3).
affiliated with ABC, CBS, FOX, or NBC, and OtherStationDummies control for the presence of other local stations such as TheCW, Univision, Telemundo, etc. To validate the theory of the local market in general, and in particular the effect of satellite penetration on ad rates, $\alpha_2$ is predicted to be positive so that stations prefer viewership through satellite rather than cable or telco.

1.6 Data

1.6.1 Sources of data

Most of the data used in this paper is original, and collected from a number of different sources. Household addresses at the zipcode-level were collected via web scraping from the website Realtor.com and then over a two-week period in January 2013 were used as an input into Comcast’s website to obtain package and price quotes. Data identifying the presence of telco competition from Verizon at the zipcode-level was obtained from Mediacensus. Market-level data was obtained from SNL Kagan, including the composition of viewership across distributors, the number and identity of stations in each market, station ownership information, and various market-level controls. Median income at the zipcode level was collected from IRS filings data. Advertising data at the station level were obtained from KANTAR Media. The list of known Local Marketing Agreements between stations was provided by the American Cable Association.

1.6.2 Construction of the sample

The sample period is January, 2013. I restrict the advertising data only to include advertising revenues collected during prime time (8-11PM) programming as this does not vary across stations with the same parent network. Duplicate Comcast price observations within the same zipcode are omitted as the price data collected never varies within zipcodes. The remaining number of zipcode-level Basic price observations is roughly 5,300.
1.6.3 Variables and descriptive statistics

Summary statistics of the data broken down by the level of observation are presented in Table 1. Comcast is the largest distributor in the U.S. market with over 20 million subscribers and is the only distributor for which I have collected Basic price data. The corresponding variable is BasicPrice. The second and third largest distributors are DirecTV and the Dish Network, neither of whom offer a Basic package (the cheapest package includes some national channels) nor vary the price of that package across markets. Other large cable distributors such as Time Warner Cable and Charter do not vary their prices across markets, at least not from information available on their websites.\footnote{It is possible that there are sales or special offers directed to viewers in some markets but not others, however, this information is difficult to collect.} Cox is a cable distributor that does vary its Basic price across markets, but the number of markets is relatively small and not considered in the analysis. Neither AT&T nor Verizon vary their prices across markets.

The source of variation in distributor competition comes from the entry of telco distributor Verizon FiOS that occurred over the period of 2006-2009. Verizon is the only distributor that conditional on being in a market, offers its services in some zipcodes in that market but not others. This within-market variation is critical in carrying out the identification strategy described in the previous section. Other distributors are not appropriate because cable distributors rarely overlap, satellite distributors operate in every zipcode in every market, and AT&T U-verse operates in virtually every zipcode in markets where it has a presence because of its history as a home phone provider.\footnote{AT&T entered the television market by laying new fibre wires that connect to neighbourhood telephone “nodes”, but the decades-old wires that connect from those nodes to the viewer’s home are copper. Therefore, conditional on entry into a market occurring, the marginal cost of entering additional neighbourhoods was very low and resulted in complete market coverage.} Verizon presence in a market is captured by the dummy VerizonInMarket. Verizon competes with Comcast in 13 markets, and in roughly a third of all zipcodes in the sample collected. ShareDuop represents the number of zipcodes in a given market which are Comcast-Verizon duopolies. Conditional on Verizon being in a market, Verizon may compete with Comcast in as few as 9% of zipcodes in the market, or as many as 84%. This
within-market variation in competition among Comcast and Verizon is important for identifying the effect of Verizon competition on retransmission fees.

An important variable in this paper is the per-household ad rate in a market, $\text{AdRate}$, and is constructed using data obtained from KANTAR Media. Each station’s aggregate advertising revenues during the primetime hours (roughly 8-11PM) of January 2013 are divided by the number of 30 second ad spots sold by that station, then further divided by the number of viewers in the market: cable subscribers + telco subscribers + satellite subscribers + over-the-air subscribers (as estimated by SNL Kagan). Since this number is very small, it is multiplied by 1,000 for ease of interpretation. In the sample, the cost to an advertiser of potentially reaching 1,000 viewers is almost two dollars. Figures 4 and 5 plot this per-household ad rate across markets which are ordered from largest (New York, NY) to smallest (Glendive, MT).

One of the benefits of studying local television stations is that the number of stations, their content, and their ownership concentration is mostly fixed across markets. Table 2 shows the frequency distribution of the number of local Big Four stations in a market and how often joint ownership of stations occurs within a market. For much of the empirical analysis, the sample is restricted to markets where all Big Four stations have a local presence (rather than being imported from elsewhere) and there is no joint ownership of stations, though the exceptions of joint ownership that occur are returned to the sample when testing for the price effects of mergers.

There are limitations of the data collected. Despite over 5,000 zipcode-level price observations and over 600 station-market level ad rate observations, the appropriate calculation of standard errors involves clustering at the market level, which reduces the statistical significance of the estimates presented because both the price and ad rate data are strongly correlated within markets. Since retransmission fees are negotiated only once every three years, it is expected that the relationship in the data between Basic prices and retransmission fees will not be strong. However, while retransmission fees are negotiated once every few years, they do include provisions for annual escalators so that retransmission fees in terms of absolute size are roughly
in line with the overall trend across markets and not strongly determined by the date of the most recent agreement. A final caution is that while a number of key cross-market variables are held constant due to technological or regulatory features of the industry, the empirical results presented below are subject to the usual caveats of cross-sectional estimation.

1.7 Results

In this section I present the estimation results corresponding to the empirical approach section. The main objective is to determine how stations’ retransmission fees are affected by the presence of distributors, and whether stations pursue two-sided pricing strategies in the presence of distributors. I also present estimates of the effects of station mergers on retransmission fees, and conclude with a discussion of the estimates corresponding to the baseline specification of the ad market.

1.7.1 The estimated effects of distributor market structure on retransmission fees

Table 3 estimates the effect of distributor competition from Verizon on retransmission fees, proxied for by Comcast Basic prices. The first column includes the entire sample of Basic prices, even those in markets with fewer than four stations which are subsequently excluded. The direct effect of Verizon’s presence in a zipcode is negative, significant, and associated with an almost $2 decrease in Comcast’s Basic price (a roughly 10% decrease in price as a result of direct competition). The measure of downstream competition in other zipcodes in the market, ShareDuop, is the main variable of interest and is negative and significant at the 5% level, indicating that when the rest of the market is in general more competitive, retransmission fees are lower. To be precise, I estimate that a 10% increase in the number of Comcast-Verizon duopolies decreases Comcast’s Basic prices by roughly $0.45. Since the actual retransmission fees are unobserved, only certain bounds can be placed on how exactly stations react to more competition down-
Chapter 1. Intermediaries in Two-Sided Markets: U.S. Cable TV

stream: assuming a Comcast pass through rate between 0.5 (for monopoly downstream) or 1 (for perfect competition), and that only the Top Four stations charge meaningful retransmission fees, I estimate that a 10% increase in Comcast-Verizon duopolies decreases a single station’s retransmission fee by between roughly $0.11 and $0.22, or approximately 10-20% since the average retransmission fee in 2013 was roughly $1.00. These estimates suggest an economically significant response by stations to the presence of telephone competition downstream.

This negative relationship persists when the sample only includes markets with all Big Four stations represented, with almost no change in the coefficient estimates. Specification (2) will remain as the baseline specification for subsequent estimations that include AdRate and different controls for mergers. Specifications (3) and (4) appear for robustness, with VerizonInMarket being a simple dummy for whether Verizon has a presence in any Comcast zipcode in the market. Since there is no a priori way to know how market structure across zipcodes aggregates to a market-level measure of “downstream competition”, the final specification acknowledges that the effect of distributor competition on retransmission fees may not be linear, and may instead affect retransmission fees only if distributor competition is “high” or “low”. There is no effect of distributor competition when the extent of entry into the market is less than 25%, but a negative relationship is found at higher levels. The estimated effect of median income in the zipcode is positive as expected, and NaturalMerger is included for now as a control but will be the focus of discussion when station mergers are examined. The relationship is also robust to alternative specifications of ShareDuop.

The finding of a negative relationship between Comcast’s Basic prices and the extent of competition from Verizon suggests that when Comcast faces competition primarily from Verizon, retransmission fees are lower compared to a situation where Comcast faces competition primarily from satellite distributors. One explanation for this result is closely related to the

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19 The upper and lower bounds are calculated by dividing $0.45 by the number of stations (4) and the pass through rate.
20 For example, not all zipcodes have the same population, so that ShareDuop would overestimate the amount of downstream competition if duopoly zipcodes tend to have few television households. The estimated relationship between ShareDuop and Comcast’s Basic prices persists after appropriately weighting zipcodes by population.
advertising market. Since satellite distributors cannot target local audiences, stations have an incentive to charge higher fees to cable distributors since higher cable prices result in switching to satellite (and which lessens ad market competition from cable). However, when cable distributors face competition primarily from a telco distributor such as Verizon, stations have less of an incentive to charge higher fees to cable distributors since higher cable prices result in relatively more substitution to telco distributors (and which has no effect on the local ad market since less ad market competition from cable is replaced with more effective ad market competition from telco). This explanation suggests stations care not only about the absolute number of viewers, but also the composition of viewers across different distributors.

There are naturally alternative explanations for this finding. For example, it could be that Verizon specifically entered markets where retransmission fees were already low for unobserved reasons so that the extent of entry (and therefore distributor competition) is driven by already low retransmission fees and not the other way around. Fortunately, the bulk of Verizon’s entry occurred between 2006 and 2009 at a time when stations mostly elected “must carry” status and were not receiving positive retransmission fees for their content, or if they were, the amounts were negligible. Moreover, the period of 2006 to 2009 corresponds to the actual expansion of the network; the entry decisions preceded that period since Verizon first had to complete local franchise agreements with the relevant municipalities (a non-trivial process). While there are unobserved demand characteristics that caused Verizon to enter some markets and not others, these demand characteristics should be positively correlated with entry as well as positively correlated with Comcast’s Basic prices. Therefore any bias in the estimate of the effect of \( \text{ShareDuop} \) is expected to be positive rather than negative, indicating the true effect may even be stronger.

1.7.2 The estimated effect of advertising rates on retransmission fees

Table 4 estimates the effect of advertising rates on retransmission fees, proxied for by Comcast Basic prices, with the baseline specification carried forward from Table 3. The first specification
considers the continuous measure of the average per-household ad rate in a market, $AdRate$, which has a negative point estimate but is not statistically significant. However, high levels of local ad rates have a strong negative and economically meaningful effect on Basic prices that is statistically significant at the 1% level. While in markets with all Big Four stations represented there does not appear to be a strong linear effect of ad rates on Basic prices, when ad rates are substantially higher, Basic prices are indeed found to be lower.

Restricting the sample only to consider markets where all four networks have a local station allows station market structure to remain fixed across markets, however, this also restricts the amount of variation in ad rates. Much of the variation in ad rates occurs across markets that have fewer than four locally represented stations. Therefore, it is worthwhile to re-include these markets into the sample to test whether large differences in ad rates result in significantly lower cable prices. The cost of including these markets, unfortunately, is that market structure is no longer held constant across markets and it is possible that this may affect an unbiased estimation of the effects of ad rates on retransmission fees. Specifications (4) and (5) re-include these markets into the sample, and the negative relationship between ad rates and Basic prices persists and is statistically significant. Overall, the evidence supports the claim that stations behave in a manner consistent with two-sided market theory by lowering retransmission fees in markets with higher potential for advertising revenues.

There may again be concerns that these results are driven by reverse causality or endogeneity resulting from unobserved demand characteristics, namely that the negative relationship between prices and ad rates is driven by low cable prices increasing viewership which increase ad rates. However, by construction, $AdRate$ is a per-household ad rate so that it is independent of total viewership. Therefore changes in the per-household ad rate may affect prices through stations’ retransmission fees, but prices do not in turn affect per-household ad rates. Figures 4 and 5 show that per-household ad rates are almost perfectly linear in viewership. Further, unobserved market characteristics that are positively correlated with advertiser demand (and therefore ad rates) would generally be expected to be positively correlated with demand for cable television
so that any bias in the estimate of the effect of ad rates on retransmission fees would be expected to be positive. However, it is possible that demand specifically for the Basic package may be negatively correlated with advertiser demand since the Basic package could be considered an inferior good. In this case, the bias would affect the estimate negatively and be a cause of concern.

1.7.3 The estimated effect of station mergers on retransmission fees

Table 5 estimates the effect of two types of station mergers on retransmission fees, again proxied for by Comcast Basic prices. Natural mergers were previously included as a control but are now part of the focus when examining the effect of mergers on Basic prices. The first specification also includes a dummy for whether two or more stations are merged in the market as a result of a local marketing agreement (LMA). The estimate of the effects of both types of mergers is negative, but neither is statistically significant. The second specification breaks the LMAs into those that were a result of the Nexstar LMA with Mission Broadcasting or not. The Nexstar LMA is of particular interest because it affected the most markets, and also because there is anecdotal evidence that it was formed as a result of the death of the founder of Mission Broadcasting.\footnote{Anecdotal evidence suggests the surviving family was not interested in managing Mission Broadcasting, but rather than sell its station assets, maintained ownership in name and permitted Nexstar to handle all Mission operations in exchange for a 70% royalty.} While both Nexstar and Non-Nexstar LMAs are associated with lower Basic prices, that negative relationship is only significant in markets affected by the Nexstar LMA. Specifications (3) and (4) repeat the analysis with an alternative measure of prevailing ad rates and the estimates remain the same, though the effect of natural mergers becomes marginally significant. While the estimates do not indicate a definitively negative relationship between station mergers and Basic prices, there is certainly no evidence that station mergers result in higher Basic prices. However, the usual caveats of empirical estimates of mergers apply as the bias introduced by self-selection into mergers cannot typically be controlled for.
1.7.4 The effect of station mergers on advertising rates

Table 6 presents the estimates of how station concentration affects per-household advertising rates. Instead of examining the effects of station mergers on Basic prices, the estimates are of the effect of station mergers on per-household ad rates. The merger estimates are the primary focus of the estimation, though it is important to first discuss the controls. Across all specifications, the number of distributors in the entire market, Distributors, negatively impacts per-household ad rates which is consistent with the theory of the local ad market presented earlier. Distributors also sell local advertisements and so this variable captures the number of competitors in the ad market. The positive and statistically significant effect of SatellitePenetration is also predicted by the theory; the more viewers that connect to stations’ content via satellite, the higher are per-household ad rates because the effectiveness of competition from cable and telco distributors in the ad market is greatly reduced. The effects of Distributors and SatellitePenetration are also economically significant. The addition of just a single distributor to the market has an estimated 10% negative effect on per-household ad rates. Moreover, if one were to consider a market where all viewers subscribe to a cable or telco distributor and then have all subscribers switch to satellite, ad rates are estimated to increase by roughly 60%. Of course the coefficient estimates only apply locally but they illustrate that the composition of viewership within a market greatly affects ad rates. The negative effect of OverTheAirPenetration on ad rates is curious since from the perspective of a station, a viewer connecting over-the-air is equally beneficial as one connecting through a satellite subscription. One likely explanation for the effect is through the construction of SNL Kagan’s measure of the number of over-the-air viewers; over-the-air viewers are assumed to be a subsample of households that identify themselves as having a television but not a paying subscription. As a result, OverTheAirPenetration is correlated with the number of households that have a low intensity of viewing and so advertisers have a low willingness to pay to reach them.\textsuperscript{22}

\textsuperscript{22}Anecdotal evidence suggests such viewers are not priced into advertising packages sold to advertisers for this reason.
Turning to the estimates of how mergers affect per-household ad rates, the first specification considers only a dummy variable $\text{NaturalMerger}$ that indicates whether any stations are jointly owned in the market. The second specification breaks these down into whether the station considered is part of the merger or it is rival stations in the market that have merged. Specifications (3) and (4) follow the same theme, but for mergers resulting from local marketing agreements. While the estimates are all positive, indicating both natural mergers and mergers arising from LMAs raise local ad rates, the estimates are either not statistically significant or marginally significant. Curiously, for both natural mergers and LMAs, the positive effect on a station’s ad rate (if any) comes through mergers which the station itself was not involved in. Standard models of competition typically predict the effect in reverse. The difficulty in identifying an effect of station mergers on ad rates arises because most of the variation in ad rates comes from smaller markets, as shown in the right tail of Figures 4 and 5. A common approach to treating outliers is to consider a logged form of the variable; Table 7 follows the same specifications as in Table 6 but the dependent variable is transformed into $\log(\text{StationAdRate}_m)$. The effects of both types of mergers remain positive, with a stronger effect coming from the LMAs than the natural mergers. Table 8 follows the same approach with a threshold form of the ad rate, $(\text{StationAdRate}_{sm} < 2.00)$, and is estimated as a probit model. Once again the mergers appear to increase ad rates, but stations’ own ad rates appear to be more influenced by rivals’ mergers than mergers in which they are directly involved.

Though the effects of mergers on both Basic prices and ad rates are only marginally statistically significant, the direction of the effects is consistent with the theory provided. Since stations cannot control the number of ads seen by viewers, they cannot influence viewer demand. As a result, the local ad market is “one-sided” in the sense that stations need only to consider a typical marginal revenue versus marginal cost trade-off contained within the ad market. These trade-offs are well understood and increased seller concentration is expected to raise ad rates. On the subscriber side of the market, forced bundling of local stations creates a pricing externality among stations that increases their marginal incentive to raise retransmission fees. Station
mergers are found to lower cable prices, and the reason could be that station mergers mitigate the externality created by bundling because stations will be reluctant to raise retransmission fees if it harms partner stations.

1.8 Distributors as platforms

A final issue I consider is whether intermediaries (i.e. distributors in this setting) may themselves behave in a two-sided manner. Since distributors also connect local advertisers to local viewers, and derive meaningful revenues from both advertisers and viewers, it is possible that distributors themselves may be considered platforms operating in a two-sided manner. The key institutional feature here that is relevant is that distributors sell local advertisements using ad slots provided to them by national channels such as ESPN. Therefore, distributors only earn advertising revenues by being able to connect local advertisers to viewers who have access to national channels. A distributor with exclusively Basic subscribers earns no advertising revenues. It is possible that distributors themselves may behave in a two-sided manner by carefully balancing subscription and advertising rates – markets with particularly high local advertising rates imply that the marginal advertising benefit of a “better-than-Basic” subscriber are higher and so the distributor should lower the price of better-than-Basic channels. Since distributors offer multiple package tiers, it is not only the absolute price of better-than-Basic packages that matter but also those prices relative to Basic: in a lucrative ad market, the distributor could lower the price of better-than-Basic, raise the price of Basic, or both. The empirical challenge is to identify evidence of distributors “steering” subscribers towards better-than-Basic.

While not the primary focus of this paper, I briefly explore whether there is evidence of distributor intermediaries themselves behaving in a two-sided manner, though a full exploration is reserved for future work. The first thing to note is that the marginal advertising benefit for a distributor from inducing a subscriber to upgrade from Basic to better-than-Basic is much greater than the benefit from a subscriber upgrading from one better-than-Basic package to
another. The reason is that a viewer upgrading from Basic to better-than-Basic moves from being completely unreachable by the distributor’s ads to reachable. This viewer is likely to substitute meaningfully away from local channels towards national channels. A viewer with access to a large number of national channels upgrading to a package with even more national channels is likely spending a similar number of hours watching national channels. In terms of advertising revenues, a distributor is indifferent between a subscriber spending 8 hours a day watching ESPN and a subscriber spending 4 hours on each of ESPN and ESPN2. Therefore unless the upgrade within better-than-Basic induces a substantial increase in overall viewership, the distributor does not stand to gain much in terms of additional advertising revenue. For Comcast, the preference relation over the packages it offers is given by

\[ \text{Basic} \prec \text{Digital Economy} \prec \text{Digital Starter} \prec \text{Digital Preferred} \prec \text{Digital Premier} \]

A two-sided analysis suggests, all else equal, that in markets with high ad rates, Comcast should especially steer subscribers away from Basic towards Economy. There are a number of ways to measure the extent to which Comcast is attempting to induce subscribers to choose Economy (or better) over Basic. Natural examples are price differences and ratios. The empirical difficulty with these measures is that the price of better-than-Basic does not take on multiple values. In contrast with Basic prices which vary continuously, Economy is either offered at a price of $29.95, $34.95, or not offered as an option at all.

To explore this, I construct three variables that measure whether the distributor may be steering subscribers away from Basic towards better-than-Basic packages. The first measure of steering is \( \text{EconomyI} \) which is a dummy for whether or not Digital Economy was offered to the potential subscriber, \( \text{EconomyII} \) takes a value of 0 for Economy not being offered, 1 for being offered at $34.95, and 2 for being offered at $29.95. \( \text{Difference} \) is the price difference between the cheapest better-than-Basic package offered and the price of Basic, and finally \( \text{Ratio} \) is the ratio of the cheapest better-than-Basic package to the price of Basic. For the first two measures,
larger numbers represent a greater probability of Economy being offered.

Table 9 presents the various measures of steering by prevailing ad rates. There is little evidence of steering between per-household ad rates of 1 and 3, but the likelihood of Economy being offered increases dramatically when ad rates are substantially higher. For Difference and Ratio, lower numbers are evidence of steering, but there is not much change across different thresholds of ad rates. Note that in this table AdRate refers to station ad rates, as distributor ad rates at the local level are not observed. While distributor ad rates should be positively correlated with station ad rates in the same market, this remains a limitation of the analysis.

Overall there is some evidence of distributors behaving in a two-sided manner, however this finding is preliminary and remains an avenue for future research. That distributors sell local ads is likely a curiosity of the U.S. cable television market, but meaningful intermediaries in other two-sided markets may also have this property which only serves to strengthen their relevance in the analysis of two-sided markets.

1.9 Conclusion

This paper examined the role of intermediaries in two-sided markets by considering the case of cable distributors that act as intermediaries between local television stations and viewers. Because distributors are required by the 1992 Cable Act to bundle local stations, and because many distributors do not vary the price of this bundle across markets, it is unclear to what extent stations can affect the final prices paid by viewers. This paper followed Comcast, the largest distributor in the U.S., because it is a distributor that does vary the price of its Basic package across markets and even zipcodes. Since station concentration scarcely varies across markets, but because Comcast faces different competitive constraints in different markets, the effect of distributor concentration on station price setting behavior can be examined.

This paper has three key findings. The first is that retransmission fees that stations charge Comcast are lower in markets where per-household advertising revenues are high. This is a
basic test for whether stations price in accordance with two-sided market theory. When per-
household advertising rates are high, the marginal benefit of an additional subscriber is higher
and so stations should set lower fees in these markets. Generally speaking, this suggests that
platforms may continue to pursue two-sided pricing strategies in the presence of intermediaries.

I also examine two ways in which intermediaries (distributors) in this industry affect platform
(station) behavior. The first is that because stations have a preference for how viewers access
their content, stations have an incentive to charge different retransmission fees to different
distributors. Because satellite distributors do not participate in the local ad market, stations
strictly prefer that viewers access their content through satellite distributors rather than cable
or telephone distributors that do participate in the local ad market. I find evidence that stations
charge higher retransmission fees to cable distributors when viewers’ next-best substitute to cable
is satellite, but that stations charge relatively lower retransmission fees to cable distributors when
viewers’ next-best substitute is a telco distributor such as Verizon FiOS. The explanation for
this finding is that when a telco distributor is absent, stations recognize that higher cable prices
induce viewer switching to satellite (which lessens competition from cable in the ad market),
whereas with a telco distributor present, higher cable prices mostly induce switching to telco
(which has no effect on competition in the ad market). The main implication of this finding
is that in general platforms may have preferences over which intermediaries end users choose,
and may therefore set different input prices to different intermediaries. Such variation in input
prices cannot be explained by a model that assumes platforms directly interact with both groups
of end users. This is important to our understanding of two-sided markets because final prices
observed by both groups of end users will be a function of these input prices.

The second way in which intermediaries affect platform pricing in this industry is through
distributor bundling of local stations as mandated by the 1992 Cable Act. Forced bundling of
local stations is predicted to raise retransmission fees relative to a situation where distributors
price stations a la carte. The reason is that bundling creates a pricing externality among stations
that pushes retransmission fees higher than they otherwise would be; a higher retransmission
fee charged by one station increases the final price of all local stations, and hence retransmission fees are set too high from the joint perspective of stations. In examining two types of station mergers that occur in my sample, I find evidence that station mergers lower retransmission fees, which suggests stations are reluctant to impose the cost of higher retransmission fees on partner stations. The implication of this finding is that non-price actions taken by intermediaries, such as bundling of rival platforms, may also affect the pricing incentives of platforms.

The findings of this paper not only have implications for our understanding of two-sided markets, but they also have implications for policy in the U.S. cable television industry which remains governed by the 1992 Cable Act. This Act was introduced at a time when the viewing and advertising sides of the market were essentially segmented. Today, the two sides of the market are closely linked by retransmission fees; these fees affect viewership, and viewership in turn affects advertising rates, and so on. The first result of this paper, that retransmission fees are lower in markets with higher per-household advertising revenues, suggests that the local television market warrants consideration as a two-sided market. Whether a market is two-sided or not is important policy prescriptions in these markets may differ substantially from those in standard “one-sided” markets. The final result of the paper highlights this point by examining an example of a policy introduced to the industry at a time when it was essentially “one-sided”. Bundling of local stations, originally intended to ensure access to local television content, now creates a pricing externality among stations that raises retransmission fees and cable prices, reducing access to local television content. The finding that bundling of local stations raises cable prices suggests that either station mergers within markets should be permitted (since they mitigate this externality) or that regulators should reconsider forcing distributors to bundle local stations.
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Figure 1.1: Revenue flows in a local television market. Cable, telephone, and satellite distributors receive monthly subscription revenues from viewers. Local television stations receive per-subscriber fees “retransmission fees” for their content. Stations, as well as cable and telephone distributors, receive local advertising revenues, however satellite distributors do not participate in the local advertising market.
## Table 1.1: Summary Statistics

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<td>0.78</td>
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<td>NaturalMerger(_m)</td>
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<td>Distributors(_m)</td>
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<td>SatellitePenetration(_m)</td>
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Table 1.2: Frequency distribution of number of stations and number of owners in a market

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<td>21</td>
<td>40</td>
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<tr>
<td>4</td>
<td>0</td>
<td>2</td>
<td>22</td>
<td>143</td>
<td>167</td>
<td>210</td>
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</table>
Figure 1.2: Aggregate retransmission revenues and number of television households (in millions of dollars and millions, respectively), by year. Retransmission revenues are steadily increasing and predicted to continue upwards, whereas the number of television households has remained virtually unchanged. Source: SNL Kagan and Nielsen.

Figure 1.3: Estimated retransmission fees per subscriber for various station groups in 2012 (measured in dollars). Source: SNL Kagan.
Figure 1.4: Per-household ad rates across all 210 markets sorted from largest number of households to smallest. Diamonds represent markets with all Big Four stations present, and squares represent markets where at least one Big Four station is imported from out of market.

Figure 1.5: Per-household ad rates across the 100 Comcast markets sorted from largest number of households to smallest. Diamonds represent markets with all Big Four stations present, and squares represent markets where at least one Big Four station is imported from out of market.
Table 1.3: Estimated Effect of Downstream Competition on Retransmission Fees (proxied by Comcast’s Basic Prices). Dependent variable is Comcast’s BasicPrice_{zm}

<table>
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<th>(5)</th>
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<td>-1.84***</td>
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<td>(0.81)</td>
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<td>-3.99</td>
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<tr>
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<td>(2.12)</td>
<td>(2.14)</td>
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<tr>
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<td>0.04*</td>
<td>0.03*</td>
<td>0.03*</td>
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<tr>
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<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
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<td>-5.71</td>
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<td>(3.51)</td>
<td>(3.52)</td>
<td>(3.52)</td>
<td>(3.51)</td>
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<td>FourStations_{m}</td>
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<td>(0.63)</td>
<td>(0.63)</td>
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<td>Four Stations Only</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>0.17</td>
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* p < 0.10, ** p < 0.05, *** p < 0.01

Standard errors are clustered at the market level
Table 1.4: Estimated Effect of Local Advertising Rates on Retransmission Fees (proxied by Comcast’s Basic Prices). Dependent variable is Comcast’s BasicPrice<sub>zm</sub>

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<th>(4)</th>
<th>(5)</th>
</tr>
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<td>-1.86**</td>
<td>-1.84**</td>
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<td>-1.87***</td>
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<td>(0.69)</td>
<td>(0.68)</td>
<td>(0.67)</td>
<td>(0.66)</td>
</tr>
<tr>
<td>ShareDuop&lt;sub&gt;m&lt;/sub&gt;</td>
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<td></td>
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* p < 0.10, ** p < 0.05, *** p < 0.01

Standard errors are clustered at the market level
## Table 1.5: Estimated Effect of Local Marketing Agreements on Retransmission Fees (proxied by Comcast’s Basic Prices). Dependent variable is Comcast’s $BasicPrice_{zm}$

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<td>(0.63)</td>
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<tr>
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* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the market level
Table 1.6: Effect of “Natural Mergers” and Local Marketing Agreements on Advertising Rates. Dependent variable is StationAdRate_{sm}  

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<td>0.17</td>
<td>(0.21)</td>
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<td>(0.16)</td>
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<td>0.25*</td>
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<td>FourStations_{m}</td>
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<td>-0.09***</td>
<td>-0.08***</td>
<td>-0.08***</td>
<td>-0.15***</td>
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<td>1.10**</td>
<td>1.04**</td>
<td>1.05**</td>
<td>2.81***</td>
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<tr>
<td>OverTheAirPenetration_{m}</td>
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<td>-1.89*</td>
<td>-1.78*</td>
<td>-1.79*</td>
<td>-5.28***</td>
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<td>N</td>
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<td>0.21</td>
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* p < 0.10, ** p < 0.05, *** p < 0.01
Standard errors are clustered at the market level
Table 1.7: Effect of “Natural Mergers” and Local Marketing Agreements on Advertising Rates. Dependent variable is log(StationAdRate<sub>sm</sub>)

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<th>(3)</th>
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<th>(5)</th>
</tr>
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<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>N</td>
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<tr>
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<td>N</td>
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<td>Observations</td>
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<td>661</td>
<td>661</td>
<td>661</td>
<td>761</td>
</tr>
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</table>

* p < 0.10, ** p < 0.05, *** p < 0.01
Standard errors are clustered at the market level
Table 1.8: Effect of “Natural Mergers” and Local Marketing Agreements on Advertising Rates. Dependent variable is $(StationAdRate_{sm} > 2.00)$

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<td></td>
<td></td>
<td>0.60**</td>
</tr>
<tr>
<td>Distributors$_m$</td>
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<td>-0.15***</td>
<td>-0.16***</td>
<td>-0.16***</td>
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<td>Four Stations Only</td>
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<td>0.19</td>
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<tr>
<td>Observations</td>
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<td>649</td>
<td>649</td>
<td>649</td>
</tr>
</tbody>
</table>

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard errors are clustered at the market level.
Table 1.9: Various measures of Comcast steering subscribers away from Basic towards better-than-Basic in lucrative ad markets

<table>
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<tr>
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<th>$AdRate_m &lt; 1$</th>
<th>$(1 &lt; AdRate_m \leq 2)$</th>
<th>$(2 &lt; AdRate_m \leq 3)$</th>
<th>$(3 &lt; AdRate_m)$</th>
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<td>25.3</td>
<td>29.3</td>
<td>19.5</td>
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<tr>
<td>Ratio</td>
<td>2.26</td>
<td>2.38</td>
<td>2.58</td>
<td>2.25</td>
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</table>
Chapter 2

The Effects of Platform MFNs on Competition and Entry (with Kenneth S. Corts)

2.1 Introduction

Recent interest from competition authorities in contracts that reference rivals has dovetailed with interest in platforms and two-sided markets to draw significant attention to the effects of a type of contract known variously as a platform parity agreement or platform most-favored nation agreement. In settings in which a seller sets a price and transacts with a buyer through an intermediary platform (which may charge a fee or a commission to the seller), such contracts restrict the seller not to sell through any alternative platform at a lower price. Most-favored-nation contracts and other contracts that reference rivals have recently been the subject of a US Department of Justice Antitrust Division workshop (Baker and Chevalier, 2013), a UK Office of Fair Trading report (Lear, 2012), and a speech by the Deputy Assistant Attorney General of the US DOJ Antitrust Division (Scott Morton, 2012). Platform MFN agreements in particular have played a key role in recent antitrust cases involving credit cards, ebooks, and health care
networks (see Salop and Scott Morton (2013) for an overview). The policy-oriented literature conjectures that these agreements can raise prices for consumers and profits for platforms, and also that they may limit entry of low-cost business models. However, there exists little theoretical work to support or qualify these assertions. Analyzing these agreements in an explicit model, we find support for some of these claims, but with important caveats.

To fix ideas, consider two examples of such a platform MFN policy. First, Apple facilitates the sale of ebooks through its online platform, where publishers set retail prices and pay a fraction of their revenue to Apple. Apple has in place agreements that require publishers not to sell the same ebooks through other channels at lower prices. Second, a bank that issues VISA cards processes transactions between retailers and consumers at prices determined by the retailer, with the retailer paying a fee to the card-issuing bank. VISA has in place contractual provisions that limit the ability of the retailer to offer lower retail prices for purchases made through other payment mechanisms. The conventional wisdom about these agreements, which appears with varying degrees of clarity or explicitness in Schuh, Shy, Stavins, and Triest (2012), Salop and Scott Morton (2013) and in chapter 6 of the Lear (2012) report for the OFT, among other places, is simple.\(^1\) These policies create an incentive for the platform to raise fees in attempt to squeeze the retailer, since the platform MFN limits the ability of the platform to pass through higher fees in the form of higher retail prices. These higher fees in turn lead in equilibrium to higher retail prices and potentially higher fees and profits for platforms. In addition, such policies disadvantage potential platform entrants with low-end business models by eliminating the entrant’s ability to win customers away from the incumbent through lower prices.

However, we find that the effects of these policies are not quite that simple. With respect to price and profit effects, we find that platform MFN agreements do tend to raise prices, but also that they may raise prices so much that they hurt industry profits. Whether this is the case depends on the substitutability of the platforms. With respect to effects on entry, we find that a platform MFN agreement may encourage or discourage entry when the entrant’s competitive

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\(^1\)One of the authors of the present paper (Corts) was retained by Lear to coauthor the cited report.
position is exogenous, depending on how different from the incumbent the entrant is. When
the entrant’s competitive position is endogenous, a platform MFN agreement may distort the
entrant’s choice toward a lower-end business model even when it fails to deter entry. Our results
therefore support some aspects of the conventional wisdom, but add important nuance and
qualification that aid in understanding the effects of these platform MFN policies.

The most relevant theoretical paper is Johnson (2013), which studies an environment in
which multiple sellers sell through multiple platforms under either the “wholesale” model (in
which sellers set wholesale prices and platforms set retail prices, as in traditional bricks-and-
mortar retailing) or the “agency” model (in which sellers set retail prices and platforms set
commissions paid by the retailer, as in many online marketplaces such as Amazon Marketplace,
eBay’s fixed price auctions, and the market for ebooks). That paper is primarily concerned with
the comparison between these two models; however, one section addresses the effect of platform
MFN agreements on the equilibrium under the agency model. That paper finds, as do we, that
platform MFNs raise platform fees and retail prices; however, it also shows, in contrast to our
results, that platform MFNs always raise industry profits and are always adopted by platforms
in equilibrium. These differences arise because of a difference in the way demand is modeled,
which is discussed in more detail in the text. Johnson does not consider asymmetric firms and
only tangentially considers effects on entry incentives, noting that in some circumstances the
price-increasing power of platform MFNs might induce socially desirable entry.

In a paper on the dissemination of mobile applications, Gans (2012) studies a model in
which the firm controlling the mobile platform can offer direct access to app purchases within
the platform, while app developers can also sell directly to consumers. He is primarily focused
on the difficulties platforms have in charging for the platform in the presence of hold-up by
apps developers, and he shows that a platform MFN policy can help solve this problem. The
literature on payment processing arrangements in credit card markets largely either ignores
the no-surcharge rule (which is arguably tantamount to a platform MFN in this setting) or
takes it for granted. A notable exception is Rochet and Tirole (2002), which briefly discusses the
ambiguous welfare effects of abolishing the no-surcharge rule in their model. Thus, the literature is quite limited; in this context, we make a significant contribution by explicitly considering the effects of platform MFN policies in a fairly general setting, including effects on the potential entry of a differentiated firm.

Section 2 lays out the model. Section 3 considers the effects of platform MFN agreements on competition between two symmetric incumbent platforms. Section 4 considers the equilibrium adoption of such agreements. Section 5 analyzes the effect of such policies on incentives for entry and endogenous choice of competitive position for an entrant platform. Section 6 concludes by relating this paper to recent antitrust activity in the credit card, ebook, and health insurance markets.

2.2 Model

A single seller $S$ sells its products to buyers through one or both of two platforms (or “marketplaces”) $M_i$, $i = \{1, 2\}$. The seller incurs three kinds of costs: fixed cost $K_S$, constant marginal and average production cost $c_S$, and a per-unit transaction fee $f_i$ charged by each platform $i$. The seller sets a price $p_i$ on each platform $i$. Buyer demand through a particular platform $i$ is given by $\hat{q}_i(p)$. Each platform $i$ incurs a fixed cost $K_i$ and a constant marginal and average production cost $c_i$.

The timing is as follows. The platforms simultaneously choose whether to require platform MFN policies. They then simultaneously choose transaction fees $f_i$. The seller then sets prices $p_i$, abiding by the terms of any platform MFN policies in place. The seller earns profits $\pi_S = \sum_{i=1,2} [p_i - f_i - c_S] \hat{q}_i(p)$; each platform $i$ earns profit of $\pi_i = [f_i - c_i] \hat{q}_i(p)$. For the analysis of competition between incumbent platforms (sections 3 and 4), we ignore any fixed costs, which

\[2\] In many applications, platforms charge a commission proportional to retail price rather than a fixed per-unit fee. We expect that our qualitative results would apply to both types of fees. In general, in these kinds of models, a proportional commission has the effect of raising the seller’s “perceived marginal cost” (as in Johnson (2013)) because of the divergence between the taxed revenue and the maximized profit, whereas in our model the fixed unit fee directly raises that marginal cost.
will not affect pricing or fee-setting incentives. Fixed costs are introduced in section 5, in which we focus on the effect of platform MFN policies on entry decisions.

Because the final stage involves only the single seller’s pricing decision, it is convenient to suppress this stage of the game in the analysis by writing platform-level demand functions as a function of the transaction fees $f_i$ rather than prices $p_i$, where these demand functions indicate demand at the seller’s optimal prices given the transaction fees. Note that the seller is effectively a simple multi-product monopolist (where the underlying product sold through each of the platforms is thought of as a distinct product) facing demand $\hat{q}_i(p)$ and with potentially different marginal costs $(c_S + f_1)$ and $(c_S + f_2)$ for its two “products”. However, the seller may also face a constraint imposed by the presence of one or more platform MFN agreements. Therefore, this implied demand function varies with the platform MFN regime. We denote this implied demand function $q^k_i(f)$, where $k = 0, 2$ denotes how many platform MFN agreements are present. The case of a single platform MFN agreement is analyzed separately and does not require its own implied demand functions for reasons that will become apparent later.

We analyze this model under two different scenarios for demand: “general” and “linear”. We first assume that an unspecified underlying general demand function induces a unique optimal pricing rule for the single multi-product seller, yielding a differentiable and well-behaved implied demand function on transaction fees, $q^k_i(f)$. We later assume that the underlying demand function is a familiar linear differentiated-products demand function, which we show satisfies all of the assumptions we maintain in the general demand case.

### 2.2.1 General Demand

In the general demand case, we assume that the multi-product seller’s optimal pricing, given underlying demand and a given set of transaction fees, is well-behaved, yielding an implied demand function $q^k_i(f)$ with the following properties.

(A1) Implied demand is a differentiable function $q^k_i(f)$.

(A2) Implied demand is not too nonlinear; in particular, second-order effects do not over-
whelm first-order effects in signing second-order conditions or the slopes of best-response functions.

(A3) Implied demand for each platform is downsloping in that platform’s own fee, \( \frac{\partial q_k^i}{\partial f_i} < 0 \), and aggregate demand is downsloping in a common fee (for \( f_1 = f_2 = \bar{f} \), \( \frac{\partial q_k}{\partial f} < 0 \)).

(A4) Quantity demanded is more responsive to one’s own fee when there are no platform MFN agreements than when there are two platform MFN agreements: \( \frac{\partial q^0_i}{\partial f_i} < \frac{\partial q^2_i}{\partial f_i} < 0 \).

(A5) Quantity demanded is increasing in the rival’s fee if and only if there are no platform MFN agreements: \( \frac{\partial q^0_i}{\partial f_j} > 0 > \frac{\partial q^2_i}{\partial f_j} \).

Again, each of these properties will subsequently be shown to hold for a linear differentiated products demand model. In addition, the appendix will (eventually) show that they hold for general (non-linear) demand functions satisfying typical regularity conditions (these properties can be derived by applying the implicit function theorem to the seller’s multi-product pricing first-order conditions). Conditions (A4) and (A5) should be intuitive, but they merit further discussion because they lie at the heart of the strategic effects of platform MFN agreements (hereafter, PMFNs).

First consider (A4). When there are no PMFNs in effect, the multi-product seller reacts to a fee increase by one platform by raising that platform’s price, which diverts demand to the other, now relatively higher-margin, platform. When there are two PMFNs in effect, the seller is constrained to set a uniform prices across platforms. As a result, it has reduced flexibility in diverting sales to the other platform. Raising price on one platform means raising price on both platforms. While the higher fee on one platform does induce the seller to raise price on that platform (and on the other platform), this is now more costly in lost demand on both platforms, and the seller optimally chooses to raise price on the fee-raising platform less than it would have absent the PMFN agreements. Now consider (A5). Absent PMFNs, the seller’s price increase for a platform in response to a fee increase on that platform increases demand for the non-fee-raising platform. But, with two PMFNs, the seller’s uniform price increase reduces demand for both platforms.
2.2.2 Linear Demand

We show that all of the above assumptions for general demand do in fact hold when the underlying demand takes the familiar linear differentiated products form: \( \hat{q}_i(p) = a - bp_i + dp_j \), where \( a, b, d > 0 \) and \( b > d \). In this case we also assume \( c_i + c_s < \frac{a}{b-d} \), where this quantity is the symmetric choke price. It is in fact straightforward to determine the optimal pricing rule for the two-product monopoly seller under both the 0-PMFN and 2-PMFN regimes. Maximizing the seller’s profit yields optimal prices that are linear in the platform fees. These optimal pricing rules give non-negative quantities as long as the seller’s total effective marginal cost is less than the symmetric choke price—that is, \( c_S + f_i < \frac{a}{b-d} \), which can be shown to hold for all profit-maximizing \( f_i \) under the assumption on \( c_S + c_i \) above.

Substituting the optimal pricing rules into the demand function yields implied demand as a function of transaction fees:

\[
\begin{align*}
q_0^i(f) &= \frac{[a - b(c_s + f_i) + d(c_s + f_j)]}{2} \\
q_2^i(f) &= \frac{[2a - (b - d)(2c_s + f_i + f_j)]}{4}.
\end{align*}
\]

It is easy to check that these implied demand functions immediately satisfy conditions (A1)-(A5).

2.3 Competitive effects of platform MFNs

This section analyzes a model with two symmetric incumbent platforms: the platforms have the same cost structure and demand is symmetric (\( \hat{q}_i(p_i = y, p_j = z) = \hat{q}_j(p_j = y, p_i = z) \)). In this section, we analyze the best-response functions and equilibrium transaction fees that arise in the stage 2 subgame in which platforms simultaneously set fees. This allows us to characterize the impact of PMFN policies on competition, comparing the cases with and without PMFN policies present.
2.3.1 General Demand

Platform $i$’s profit is given by $\pi_i = (f_i - c_i)q^k_i(f)$, which yields a first-order condition of

$$\frac{\partial \pi_i}{\partial f_i} = (f_i - c_i)\frac{\partial q^k_i(f)}{\partial f_i} + q^k_i(f) = 0.$$ 

This yields a second-order condition of

$$\frac{\partial^2 \pi_i}{\partial f_i^2} = (f_i - c_i)\frac{\partial^2 q^k_i(f)}{\partial f_i^2} + 2\frac{\partial q^k_i(f)}{\partial f_i}.$$ 

The last term is negative by (A3); the second-order condition therefore holds by (A2).

Totally differentiating the FOC gives the slope of the best-response function in the fee-setting game:

$$\frac{df^k_i}{df_j} = -\frac{\partial q^k_i(f)}{\partial f_j} + (f_i - c_i)\frac{\partial^2 q^k_i(f)}{\partial f_i\partial f_j}$$

The denominator is exactly the second-order condition; therefore, the slope of the best-response function has the same sign as the numerator. By (A2), the best-response function therefore has the same sign as the first-order cross-partial $\frac{\partial q^k_i(f)}{\partial f_j}$. By (A5), this implies a game of strategic substitutes with 0 PMFNs and a game of strategic complements with two PMFNs. Assume the existence of a symmetric equilibrium under both 0 PMFNs and 2 PMFNs. Each of these equilibria must be unique by the monotonicity of the best-response functions. Denote these equilibrium fees $f^k_i$.

The first result of interest arises from comparing these equilibria. In fact, as the conventional wisdom suggests, fees and prices are higher when both firms adopt PMFN policies. To see this, note that by (A4) the FOC for 2 PMFNs evaluated at the 0 PMFN equilibrium fees is positive. Thus, the symmetric equilibrium fees must be higher under 2 PMFNs than under 0 PMFNs. Moreover, (A3) implies that these higher fees also lead to higher prices. Specifically, the fact that quantity falls as both fees rise implies that the seller’s prices are rising along with fees. These results can be summarized in the following proposition.
Proposition 1. Assume that (A1)-(A5) hold. Then there exists a unique symmetric equilibrium in transaction fees if no platforms have PMFN agreements or if both platforms have PMFN agreements. Equilibrium fees and prices are higher when both platforms have PMFN agreements.

The intuition for this result should be quite clear. Consider the case in which both platforms have PMFN agreements and consider hypothetical fees equal to the 0 PMFN equilibrium fees. These are best-response fees absent PMFN agreements. They weigh off the increased margin of a higher fee against the reduction in quantity that results from the multi-product seller raising one’s price and diverting demand to the other platform. When PMFNs are present and the seller is constrained in its price-setting, this trade-off is altered. The increase in margin of a higher fee is no longer offset by the same reduction in demand. Rather, the reduction in demand is smaller because the constrained seller must raise the fee-raising platform’s price and also the other platform’s price, which has a positive impact on quantity at the fee-raising firm. This effects leads to higher equilibrium fees and prices and is at the heart of the competitive effects of PMFN agreements.

We can also compare the 2PMFN equilibrium fees and prices to those that would arise under collusive platform fee-setting absent PMFNs. Perhaps surprisingly, PMFNs necessarily lead to fees and prices even higher than those chosen by perfectly colluding platforms. To see this, note first that under either symmetric collusive fees or symmetric 2PMFN equilibrium, the seller optimally chooses a symmetric price. In the 0PMFN equilibrium the seller’s variable profit following collusive symmetric fee-setting reduces to \( \sum_{i=1,2}^2 [p - c_S - f_i] \hat{q}_i(p) = 2[p - c_S - f] \hat{q}(p) \). In the 2PMFN equilibrium, the seller variable profit reduces to \( \sum_{i=1,2}^2 [p - c_S - f_i] \hat{q}(p) = 2[p - c_S - (f_1 + f_2)/2] \hat{q}(p) \). Importantly, in both of these cases (and unlike the non-collusive 0PMFN case) the seller’s optimal pricing rule can be reduced to a function of the average fee \( \bar{f} = (f_1 + f_2)/2 \). Therefore, both situations generate the same implied demand function, which can be denoted \( q^{SYM}(\bar{f}) \). Now compare the collusive fee-setting FOC with the 2PMFN equilibrium fee-setting FOC. The former yields \( \frac{\partial q^{SYM}}{\partial \bar{f}} (f - c_i) + q^{SYM}(\bar{f}) = 0 \), while the latter yields \( \frac{1}{2} \frac{\partial q^{SYM}}{\partial \bar{f}} (f_i - c_i) + q^{SYM}(\bar{f}) = 0 \). The latter is clearly positive at the solution to the former,
implying that the 2PMFN fees (and therefore prices) must be higher than the collusive fees and prices absent PMFNs.

**Proposition 2.** Assume that (A1)-(A5) hold. Then the unique symmetric equilibrium fees and prices when both platforms have PMFN agreements are higher than the symmetric equilibrium fees and prices that would arise under collusive fee-setting by platforms absent PMFNs.

This is the point at which the stark contrast with the results on platform MFN agreements in Johnson (2013) is most evident. That paper shows that platform MFNs lead to equilibrium pricing that maximizes industry profits (defined as the sum of seller and platform profits). This is clearly not the case in the present paper, where retail prices under platform MFNs are higher than those under collusive fee-setting, which are themselves already higher than those that would maximize industry profits, given the inefficiencies involved in the double markup problem associated with higher-than-cost platform fees. This result in turn drives the difference between Johnson’s adoption results (in which platform MFN adoption is always part of an equilibrium with appropriate beliefs) and ours (in which adoption is far from certain because the resulting equilibrium may not be very attractive). These differences arise because of differences in the way demand is modeled. In particular, Johnson employs a unit demand model and maintains an assumption of market coverage. This implies that there is no aggregate demand effect—i.e., that increases in symmetric prices never reduce quantity sold or industry profit. This is not the case in either the general or linear version of our model. In our model, even at the fees that maximize joint platform profits, an individual platform has an incentive under PMFNs to raise its fee (this is exactly Proposition 2): it raises its unit revenue without losing its share of sales, with the aggregate demand effect being shared across all firms (that is, imposing an externality through reduction of demand for the platforms that did not raise their fee but nonetheless faced retail price increases). In Johnson’s model, aggregate demand is fixed (by the unit demand and market coverage assumptions); therefore, only shares of sales matter. Since these shares are themselves fixed under PMFNs, an individual platform does not have an incentive to raise fees beyond the point at which joint platform profits are maximized, and PMFNs necessarily
increase profits.\(^3\)

### 2.3.2 Linear demand

The linear model allows us to explore some aspects of the model for which we do not have general results. Proposition 2 suggests the possibility that 2-PMFN profits might actually fall below the 0-PMFN profits, since fees and prices are higher than in the case of collusive fee-setting. The linear model allows us to examine under what conditions this may arise; the following pair of results demonstrate that which case prevails depends on the own- and cross-price elasticities of demand.

**Proposition 3.** In the linear model, 2-PMFN profits are higher than 0-PMFN profits if platforms are sufficiently close substitutes—that is, if \(b - d\) is sufficiently small. Specifically, for any \(b > 0\), there exists a \(d < b\) such that 2-PMFN equilibrium profits are higher than the 0-PMFN profits for all \(d > d\).

**Proposition 4.** In the linear model, 0-PMFN profits are higher than 2-PMFN profits if platforms are sufficiently independent and demand is sufficiently inelastic in own price. Specifically, if \(d = \alpha b\), then for \(b\) sufficiently small there exists an \(\bar{\alpha} > 0\) such that 0-PMFN profits are higher than 2-PMFN profits for all \(\alpha < \bar{\alpha}\).

Both propositions are proved algebraically by analyzing \(\pi^{2*} - \pi^{0*}\). While the individual profit expressions are complex, the sign of this difference can be shown to be of the same sign as \((2b - d)^2 - 9(b - d)\). Since this is continuous, increasing in \(d\), and strictly positive at \(d = b\), the expression must be positive for all \(d < b\) sufficiently close to \(b\), as in the first of these propositions. Similarly, substituting \(d = \alpha b\) in this expression, the expression is negative if \(b < \frac{9(1 - \alpha)}{2(2 - \alpha)^2}\), which holds in the limit as \(\alpha \to 0\) if \(b < \frac{9}{2}\). The result then follows by continuity of the expression.

\(^3\)Put differently, in Johnson’s model the discrete drop in demand encountered when the buyer’s utility hits that of the outside option limits the incentive of the platform to raise fees. Once fees are high enough to create a retail price such that the buyer’s outside option binds (which is also the price that maximizes industry profits) and the platforms capture all the available surplus, there is no incentive to raise fees further because sales will fall to zero. This discrete drop in demand never arises in our model.
It is important to develop some intuition for why the higher prices that result under 2PMFN pricing are more likely to be profitable for platforms the more substitutable they are. One can think of the effects on the platform in the 2PMFN regime as having two effects: a “squeezing the seller” effect and a “softening competition” effect. The “squeezing the seller” effect exists regardless of the interdependence of demand. This captures the idea that each platform knows that the seller is constrained in its pricing, making the seller (optimally) less responsive to a unilateral increase in fee. This leads each platform to raise fees even beyond the collusive fee solution (this is the effect used in proving Proposition 2). Moreover, note that this effect exists without any regard to the substitutability of the products. Even if the two platforms served entirely distinct markets, it would remain true that the constraint to equal pricing would reduce the seller’s pass-through of a unilateral fee increase (thus, “squeezing the seller”), leading to higher-than-collusive pricing. The fact that profits fall once fees pass the collusive fees indicates that the firms reach a point where each suffers more from the rival’s excessive incentive to raise fees than each gains from its own ability to squeeze the seller directly.

In contrast, the “softening competition” effect exists only when platform demand is interdependent, and its strength increases with the interdependence of demand. Since each platform’s implied demand is increasing in the other platform’s price, each platform effectively faces less elastic demand when the seller is constrained to symmetric pricing. Any unilateral increase in fee is passed through (equally) in both platform prices, and that increase in the rival platform’s price increases the fee-raising platform’s demand, mitigating the direct effect of its own higher price. Since this effect serves to raise profits (i.e., the same increase in joint fees has a less negative impact on profits when demand is more interrelated because of the positive effect of a higher rival’s price on one’s own demand), conditions are more favorable for PMFNs to raise equilibrium profits when it is at work.
2.4 Endogenous adoption of PMFN policies

This section considers stage 1 of the full game, in which firms simultaneously decide whether to endogenously adopt PMFN policies. The above results on whether PMFNs raise profits for the platforms do not suffice to demonstrate whether PMFNs will be adopted in equilibrium when chosen by the platforms simultaneously; rather, we must characterize the outcome when only one firm adopts a PMFN and compare the profits under that equilibrium to 0PMFN and 2PMFN profits. This section continues to employ the symmetric duopoly model.

2.4.1 General Demand

The results on equilibrium fees and best-response functions can be graphed to develop further intuition about competition under PMFNs and, in particular, about incentives to adopt PMFNs in the first stage of the full game. Figure 1 lays out two sets of best-response functions—those that prevail under 0PMFN and 2PMFN—in a single graph in $f_1 \times f_2$ space. We denote platform $i$’s best-response curve under a scenario with $k$ PMFNs by $b^k_i$. Best-response functions are for simplicity portrayed as linear, as they are under the linear differentiated product demand model. The two points along the 45-degree line at which $b^1_1$ and $b^2_2$ cross define the 0PMFN and 2PMFN equilibria. The primary value in this figure is in the analysis of competition in the scenario in which only one platform (which we assume to be platform 1) has a PMFN in place. We therefore proceed to construct the best-response functions in this scenario, using bold solid and dashed lines to denote these best-response functions, as indicated in Figure 1.

First, note that for a particular platform, pricing incentives are determined under either the 0PMFN best-response calculation (there is no PMFN binding and $q^0(f)$ is relevant) or the 2PMFN best-response calculation (there is a PMFN binding and $q^2(f)$ is relevant). Which of these calculations is relevant depends on the relative prices of the two platforms. In particular, the PMFN is irrelevant if $f_1 < f_2$, and the 0PMFN incentives apply. Alternatively, when $f_1 > f_2$, the PMFN binds; the fact that platform 2 does not have a PMFN is irrelevant; and the 2PMFN
incentives apply.

Consider platform 2, the platform without the PMFN agreement. At low \( f_1 \), platform 2 prices off its \( b_2^0 \) curve; since this calls for overpricing the platform with the PMFN, the presence of the PMFN is irrelevant. Once that \( b_2^0 \) curve falls below the 45-degree line (at the 0-PMFN equilibrium fee), however, this best-response curve is no longer relevant as the price it dictates will trigger 2PMFN pricing by the seller. Considering this, platform 2 prefers to price off its \( b_2^2 \) curve. However, any price above the 45-degree line renders the PMFN not binding, triggering 0PMFN pricing by the seller. As a result, the best response by the non-adopting platform 2 is to match platform 1’s fee for all fees between the 0PMFN equilibrium and 2PMFN equilibrium fees. (Put another way, over this range of \( f_1 \), profits under the PMFN-binding regime are increasing in \( f_2 \) below \( f_2^0 \) and profits under the PMFN-not-binding regime are decreasing in \( f_2 \) above \( f_2^0 \).) Once \( f_1 \) exceeds the 2-MFN equilibrium fee, platform 2’s \( b_2^2 \) is relevant since it prescribes undercutting platform 1, triggering the PMFN policy and making the 2PMFN best-response the relevant curve.

Now consider platform 1. At any \( f_2 \) equal to or below the 0-PMFN equilibrium fee, platform 1’s best-response is given by \( b_2^0 \), which prescribes overpricing platform 2, making the PMFN bind. Since even its 0-PMFN best-response involves overpricing platform 2, the PMFN will certainly be binding; given this, \( b_2^2 \) reflects the correct incentives. For any fee equal to or above the 2-PMFN equilibrium fee, platform 1’s best-response is given by \( b_1^0 \). Since even the PMFN-binding incentives (reflected in the 2-PMFN best-response) imply a best-response fee at which the PMFN is not binding (i.e., lie above the 45-degree line), the PMFN will not be binding and \( b_1^0 \) gives the correct best-response. Somewhere between the 0- and 2-PMFN equilibrium fees there lies a fee \( \hat{f}_2 \) at which firm 1 is indifferent between undercutting and overpricing platform 2’s fee. Since firm 1 is indifferent between these two strategies, it is part of a mixed strategy equilibrium for firm 1 to randomize between \( b_1^0(\hat{f}_2) \) and \( b_2^2(\hat{f}_2) \) with any probabilities \( \sigma \) and \( 1 - \sigma \), respectively. In addition, there is a unique \( \hat{\sigma} \) for which \( \hat{f}_2 \) is the best response of platform 2 to platform 1’s mixing strategy; more formally, there exists a \( \hat{\sigma} \) such that \( \hat{f}_2 = \arg \max_{f_2} \hat{\sigma}\pi_2(b_1^0(f_2), f_2) + (1 - \hat{\sigma})\pi_2(b_2^2(f_2), f_2) \).
This follows from the continuity of the profit function. If $\hat{\sigma} = 0$ then the argmax is $f_2^2$, and if $\hat{\sigma} = 1$ then the argmax is $f_2^0$. There is some $\tilde{f}_2$ in between that is the best response of platform 2 to platform 1’s mixing strategy $\hat{\sigma}$. This $\tilde{f}_2$ and $\hat{\sigma}$ constitute a mixed strategy equilibrium to the simultaneous pricing subgame when only platform 1 has adopted a PMFN policy. This yields the figure as drawn (for an arbitrary and illustrative $\tilde{f}_2$ between the two equilibrium fees). The following proposition follows from this analysis.

**Proposition 5.** Assume (A1)-(A5) hold. Then (1) there can be no pure-strategy equilibrium in fees when exactly one firm has a PMFN agreement, and (2) there is a mixed-strategy equilibrium in which firm 2 sets $\tilde{f}_2$ (such that $f_i^{0*} < \tilde{f}_2 < f_i^{2*}$) and firm 1 randomizes with appropriate probabilities between $b_1^0(\tilde{f}_2)$ and $b_1^2(\tilde{f}_2)$.

Without further structure on demand, it is impossible to evaluate $\tilde{f}_2$ or the profits in this mixed strategy equilibrium. It is therefore not possible to assess in general the profitability of the unilateral adoption of a PMFN policy as required to characterize the equilibrium of the full game with adoption of PMFN policies preceding price-setting. However, this analysis is sufficient to characterize the pure strategy equilibria of the related game in which PMFNs are adopted or not simultaneously with the setting of transaction fees.

**Proposition 6.** Consider a game with the alternative timing in which platforms simultaneously set fees and adopt PMFNs in the same stage. Then there are exactly two pure strategy equilibria; one in which both firms adopt PMFNs and set fees $f_i^{2*}$ and one in which both firms do not adopt PMFNs and set fees $f_i^{0*}$.

PMFNs may or may not be adopted in this game depending on the equilibrium selection mechanism. It remains true as in the earlier propositions that either of these equilibria may be the more profitable one for the platforms, depending on the substitutability of the products and other characteristics of demand. Note that this implies that in this game with alternative timing it is possible to experience a coordination trap in two forms: firms might fail to adopt
PMFNs when it is profitable and firms might also adopt PMFNs when they raise prices so high as to lower profits.

2.4.2 Linear Demand

Focusing on the linear demand model does allow us to more fully characterize incentives for PMFN adoption. First, it allows a straightforward corollary to the last proposition, combining it with the earlier result on the relative profitability of 0PMFN and 2PMFN equilibria.

**Corollary 7.** Consider a game with the alternative timing in which platforms simultaneously set fees and adopt PMFNs in the same stage, and assume an equilibrium selection rule that eliminates equilibria that are Pareto-dominated from the point of view of the platforms. Then in the unique Pareto-undominated pure strategy equilibrium both platforms adopt PMFNs if the two platforms are sufficiently close substitutes.

Moreover, focusing on the linear demand model allows us to characterize equilibrium adoption in the full game, with simultaneous adoption of PMFN policies preceding simultaneous fee-setting by the platforms. What is required to characterize the conditions for equilibrium mutual adoption of PMFN policies is an understanding of the 1PMFN equilibrium profits. In what follows, asterisks indicate profits in under the fees that arise in equilibrium of the ensuing fee-setting subgame, the superscript indicates the number of platform with PMFN policies, and the subscript indicates the platform, where platform 1 is the adopter in the 1PMFN subgame.

If \( \pi_{1}^{0*} < \pi_{1}^{1*} \) (a single PMFN adopter finds the policy profitable) and \( \pi_{2}^{1*} < \pi_{i}^{2*} \) (a single PMFN non-adopter finds it profitable also to adopt the policy), then mutual adoption is the unique equilibrium in the full game. We proceed by showing that both of these are true in the linear model when platforms are close enough substitutes.

That the first inequality holds is easy to see. The sole adopter’s profit is \( \pi_{1}^{1*} = \pi_{1}^{0}(b_{1}(\hat{f}_{2}), \hat{f}_{1}) > \pi_{1}^{0}(f^{1*}) \). That is, the sole adopter’s 1PMFN equilibrium profit is the profit at that firm’s best response to a rival’s higher price, compared to the 0PMFN equilibrium. This is clearly higher.
since higher rival’s prices directly raise profits under 0PMFN pricing by the seller.

The second inequality is much more complicated to assess, as it requires the non-adopter’s profit under 1PMFN, which is a weighted average of being undercut and overpriced by the adopting firm while maintaining the price \( \hat{f}_2 \). First, note that being overpriced in the mixed strategy equilibrium is always worse than being in the 2PMFN equilibrium. To see this, note that

\[
\pi_2^2(b_1^2(\hat{f}_2), \hat{f}_2) < \pi_2^2(b_1^2(\hat{f}_2), b_2^2(b_1^2(\hat{f}_2))) < \pi_2^2(f_2^*)
\]

The first of these inequalities follows from the fact that platform 2 would certainly rather be best-responding to the adopter’s price (in the figure, platform 2 would rather be on \( b_2^* \), directly above the point at which platform 1 overprices against \( \hat{f}_2 \)). The second inequality follows from the fact that profits under the 2PMFN equilibrium are decreasing in the rival’s fee (in the figure, platform 2 would rather be at the 2PMFN equilibrium than down the \( b_2^* \) curve at a higher \( f_1 \)).

Now, in addition we show, as a sufficient condition, that platform 2 also prefers the 2PMFN equilibrium to being undercut.\(^4\) This seems natural, in the sense that the situation in which platform 1 is able to best-respond to \( \hat{f}_2 \) with an undercutting fee, and in which the seller, in turn, is unconstrained by any PMFNs in altering prices to reflect these relative prices, seems very grim indeed for the non-adopting platform 2. However, it does not immediately follow that the non-adopter prefers the 2PMFN equilibrium to this since it is at least conceptually possible that the 2PMFN pricing is so high that it is preferable to be undercut at some price intermediate to the 0PMFN and 2PMFN equilibrium pricing. The earlier results suggest that this will not be the case when platforms are close substitutes, so that the 2PMFN fee equilibrium is not so high as to be terribly destructive of platform profits. This is true, although the algebra to prove the result is extremely tedious; it is therefore reserved for the Appendix.

**Proposition 8.** Consider the full game, in which platforms simultaneously adopt PMFNs prior to simultaneously setting fees. Then if platforms are sufficiently close substitutes, both firms adopt PMFN policies.

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\(^4\)Note that this condition is sufficient but not necessary. What is necessary is that the weighted average of the nonadopter’s 1PMFN profits under the mixed strategy equilibrium is lower than its 2PMFN profit. For tractability, we focus instead on conditions for which each component of that weighted average is smaller.
2.5 The effects of PMFNs on entry incentives

This section explores the effects of PMFNs on entry incentives. Obviously, for symmetric firms, whether PMFNs induce additional entry or curtail entry depends on how they affect equilibrium profits. This follows directly from the results proved earlier on when adoption of PMFNs raises equilibrium platform profits. What is of interest in this section, therefore, is the effect that PMFNs might have on the entry of firms with different characteristics in demand or cost, or on the endogenous selection of those characteristics. We will consider the sequential entry of a firm facing different demand or cost parameters against an incumbent firm with a PMFN in place. Given that PMFNs explicitly rule out a low-price entry strategy for an entrant, and given that such a strategy is likely to be especially important for an entrant who has a lower cost or a lower-value platform, it is natural to assume (as in the conventional wisdom described in the introduction) that a PMFN policy by an incumbent inhibits entry by lower-cost, lower-value platforms. For example, one might expect that adoption of a PMFN by a full-service platform would make entry by platform with a bare-bones, low-cost (and potentially) low-price business model much more difficult, given the constraint it places on the seller’s ability to pass through those lower costs or to offer a discount price for transactions through the lower-quality platform. Similarly, one could argue that these same forces would lead an entrant endogenously determining its cost and value characteristics to choose a higher-cost, higher-value position or business model than it might have done otherwise.

To analyze these questions we focus on the linear demand model but allow two kinds of asymmetry. Specifically, we allow \( c_2 < c_1 \), where firm 1 refers to the incumbent throughout this section. We also permit the possibility that the entrant has a lower value offering, resulting in a reduction in demand of \( x > 0 \) for any given prices: \( \hat{q}_1(p) = a - bp_1 + dp_2 \) and \( \hat{q}_2(p) = a - x - bp_2 + dp_1 \). Note that lower \( x \) need not reflect an “inferior” platform in a general sense;
it is a platform that faces lower demand at given prices, but this may be accompanied by lower variable or fixed costs that make the entrant quite a viable competitor and a potential contributor to total welfare. Similarly, a lower cost need not make a firm a superior creator of value if it is accompanied by a demand disadvantage.

Given the results on equilibrium PMFN adoption above, we assume that the 2PMFN regime will prevail post-entry. This is basically an assumption that either the entrant adopts a PMFN along with the incumbent, or the entrant is asymmetric enough that the fee-setting equilibrium behaves as if there are 2 PMFNs. It is evident in Figure 1 that if the non-adopting platform has a much lower best-response function, there will come to be an intersection of the bolded 1PMFN best-responses where both firms are on their 2PMFN portions of the best-responses; in this case, the (incumbent’s) single PMFN is binding because platform 2 is undercutting platform 1 and whether platform 1 (the entrant) in fact has adopted a PMFN policy is irrelevant.

2.5.1 The effects on implied demand

The basic logic of this argument that PMFNs skew entry away from lower-cost, lower-value business models and toward higher-cost, higher-value business models can be seen directly from the implied demand functions. Again, the basic intuition is that a firm seeking to compete on the basis of low-price (typically, a demand-disadvantaged or marginal cost-advantaged firm) has a hard time competing when the possibility of undercutting the higher-value, or higher-cost incumbent is precluded.

For the case of \( x \) this is evident in the implied demand functions if \( \frac{\partial q_2^*}{\partial x} < \frac{\partial q_0^*}{\partial x} < 0 \) that is, if increases in \( x \) lowers demand more quickly in the presence of 2PMFNs. This reflects the seller’s inability to discount the lower-value platform in order to attract customers to it. It is easy to check from the (linear) implied demand functions that this is true: \( \frac{\partial q_2^*}{\partial x} = \frac{3}{4} < -\frac{1}{2} = \frac{\partial q_0^*}{\partial x} < 0 \).

For the case of \( c_2 < c_1 \) this is evident in the implied demand functions if \( \frac{\partial q_2^*}{\partial f_2} < \frac{\partial q_2^*}{\partial f_2} < 0 \)-that is, if lowering one’s fees in response to one’s lower marginal cost has a smaller effect on one’s sales in the presence of 2PMFN. It is easy to check from the (linear) implied demand functions
that this is true: $\frac{\partial q^*}{\partial f_2} = -\frac{b}{2} < -\frac{b-d}{4} = \frac{\partial q^*}{\partial f_2} < 0$.

Thus, with respect to choices in both willingness-to-pay and marginal cost, the entrant’s residual demand more quickly diminishes as its position deviates from the incumbent’s (toward lower costs or lower value) when the incumbent has adopted a PMFN policy. In this sense, the incumbent’s PMFN can be said to skew incentives for choice of business model or inhibit entry of low-cost, low-value business models.

### 2.5.2 The effects on profits

Of course, a full analysis of the incentives for entry are more complex. The analysis in previous sections suggests that PMFNs may raise levels of profits, even as they increase the absolute value of the slope of profits in quality or costs (that is, making profits fall more quickly as a platform becomes more downward differentiated). It seems entirely possible that the former effect might outweigh the latter, causing PMFNs to encourage the entry of competing platforms even as they skew incentives for competitive positioning. To make progress in understanding these competing effects, we need to characterize the relationship of profits to competitive position across regimes both with and without PMFNs. For tractability, we pursue this for the case of differentiated products ($x > 0$) with zero costs throughout the model ($c_1 = c_2 = c_S = 0$). We are interested in the entrant’s profits as a function of $x$ and as a function of whether the incumbent has adopted a PMFN policy. Because we are interested in entry, we are interested in net profits, accounting for fixed entry costs, which we allow to vary with $x$. The entrant will enter if $\pi_k^*(x) - f_2(x) \geq 0$, where $k = 0, 2$ indicates whether PMFN policies are adopted. (Recall that we assume that the outcome is as if the entrant follows suit, if the incumbent has already adopted a PMFN policy.)

We can establish three facts about the relationship between $\pi_2^0*(x)$ and $\pi_2^2*(x)$, which form the basis for this analysis.

First, from the results proved in the earlier sections, we know that as $x \to 0$ and $d \to b$, $\pi_2^2*(x) > \pi_2^0*(x)$. Second, for $x$ not too large relative to $a$ (specifically, $x < 2a/7$), both profit functions are downsloping in $x$ ($\frac{\partial \pi_k^*(x)}{\partial x} < 0$, for $k = 0, 2$). This follows from straightforward
algebraic manipulation of the derivatives of $\pi^{k^*}_2(x)$ with respect to $x$. This condition is the one that ensures negativity of $\frac{\partial \pi^{k^*}_2(x)}{\partial x}$, which is the stronger of the two conditions. Third, for small $x$, PMFNs make profits diminish more rapidly in the demand disadvantage ($\frac{\partial \pi^{k^*}_2(x)}{\partial x} < \frac{\partial \pi^{0^*}_2(x)}{\partial x} < 0$). This is intuitive given the earlier result that PMFNs make implied demand decrease more rapidly in the demand disadvantage. This follows from the straightforward comparison of the derivatives of $\pi^{k^*}_2(x)$; the desired inequality can be show to hold if and only if $\frac{1-\gamma^2}{(4-\gamma^2)^2} < \frac{7}{36}$, which can be shown to hold for all $\gamma \in [0, 1]$.

2.5.3 The effects on entry when entrant’s quality is exogenous

Together, these facts yield the scenario captured in Figure 2. For small demand disadvantages, PMFN policies raise equilibrium post-entry profits. However, because PMFNs also make profits more sensitive to the demand disadvantage, this relationship may reverse for large enough $x$. As the demand disadvantage increases, the presence of PMFNs causes the entrant’s profit to fall more quickly, implying that the ordering of profits $\pi^{0^*}_2(x)$ and $\pi^{k^*}_2(x)$ may potentially reverse. As a result, whether the incumbent’s PMFN policy encourages or discourages entry depends on the exogenous demand disadvantage $x$ of the entrant and its associated fixed cost $f_2(x)$.

Figure 2 depicts the effect of PMFNs on entry for any pair of exogenous $x$ and $f_2(x)$. At the top of the figure, fixed entry costs are so high that the entrant does not enter regardless of whether the incumbent adopts a PMFN policy. At the bottom, fixed entry costs are so low that the entrant enters regardless of whether the incumbent adopts a PMFN policy. At left is a region in which the profit-increasing effects of PMFNs encourage the entry of the relatively similar entrant. To be clear, here the entrant would not enter absent a PMFN policy, but does enter when the incumbent adopts PMFN. At right is a region in which the augmentation of the demand disadvantage by the PMFN policy is so strong that it outweighs the profit-increasing effects of PMFNs, and entry of the more demand-disadvantaged entrant is deterred. Again,

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5It is easy to graph a numerical example corresponding to this graph. For example, for $a = 10$, $b = 4$, $d = 3$, and $x \in [0, 1]$, the figure looks much like this, with a slight convexity to both profit curves and an intersection at about $\frac{1}{2}$. 
in this region the entrant would have entered absent the incumbent’s PMFN policy but is deterred by that policy. This figure clearly demonstrates both the legitimacy and the limits to the conventional wisdom that PMFNs curtail entry by low-end platforms. The conventional wisdom applies in the shaded region, but only there, when the entrant contemplates entry with an exogenous competitive position. These arguments are summarized in the following proposition (which, in addition, relies only on continuity arguments).

**Proposition 9.** Assume that all costs are approximately zero \((c_1, c_2, c_S \approx 0)\) and that a potential entrant has an exogenous differentiated position \((x > 0)\). Then the incumbent’s adoption of a PMFN policy encourages entry (raises post-entry profits relative to those that arise absent PMFNs) if the entrant is not too differentiated; if the policy discourages entry (lowers post-entry profits relative to those that arise absent PMFNs), it is only for entrants with a sufficiently large difference in position.

### 2.5.4 The effects on entry when entrant’s quality is endogenous

We can also consider the effect on entry by an entrant that endogenously chooses its competitive position \(x\), by evaluating \(\pi^*_2(x) - f_2(x) \geq 0\) for an endogenously chosen \(x^*_2 = \max_x \pi^*_2(x) - f_2(x)\). For \(f_2(x)\) convex enough, the net profit will be concave for \(k = 0, 2\), and we maintain this assumption throughout this section. We also restrict \(x\) to some compact interval, \(x \in X\).

Because increases in \(x\) correspond to lower quality, it is natural to model \(f_2\) as decreasing. Convexity of \(f_2(x)\) then implies that the largest cost savings come from the first departures from symmetry \((x = 0)\), with these cost savings becoming smaller at the margin as the platform becomes more downward-differentiated \((x\) increases). Note that the third fact above (that the slope of profit in \(x\) is greater under PMFNs) means that PMFNs will bias the entrant’s optimal \(x\) down (toward more similar platforms). This is most easily seen by considering the fact that the first-order condition under PMFNs at the no-PMFN optimal \(x\) must be negative. As a result, if there is an interior optimal \(x\) under either regime, then \(x^*_{2} < x^0_{2}\) (i.e., regardless of whether the other regime has an interior or corner optimum).
Chapter 2. Platform MFNs, Competition and Entry

Proposition 10. Assume that a potential entrant chooses its position \( x \in X \) after observing the incumbent’s PMFN adoption decision, and that the entrant’s optimal \( x \) is interior to \( X \) either with or without PMFNs (or both). Then if entry occurs regardless of PMFN adoption, the entrant chooses a less differentiated position (strictly smaller \( x \)) when the incumbent adopts a PMFN policy.

Whether entry is encouraged or deterred due to the incumbent’s PMFN now rests on the profit that is obtainable by the entrant at its optimal competitive position, which may vary with the incumbent’s PMFN decision. We must separately determine \( x^{k\ast}_2 \), and then evaluate \( \pi^{k\ast}_2(x^{k\ast}_2) - f_2(x^{k\ast}_2) \) for each \( k \).

Two possibilities arise. It may be that the optimized net profit \( \pi^{k\ast}_2(x^{k\ast}_2) - f_2(x^{k\ast}_2) \) is higher under 0PMFN or 2PMFN. When it is higher under 0PMFN this indicates that the incumbent’s PMFN policy may deter entry, in the sense that it is reducing the maximal profit available to the entrant. When it is higher under 2PMFN then the incumbent’s PMFN policy may encourage entry, in the sense that it is increasing the maximal profit available to the entrant. Given the analysis of the exogenous-\( x \) case, it seems natural that the former (entry-deterring) scenario is more likely when the optimal \( x \) absent PMFNs is high, which will be the case when cost savings associated with higher \( x \) are significant. Similarly, the latter (entry-encouraging) scenario is more likely when the optimal \( x \) absent PMFNs is low, as when cost savings are relatively small.

It is possible to use numerical examples to illustrate these possibilities. For simplicity, assume that \( f_2(x) = F - w\sqrt{x} \), which is convex as assumed. Fixing \( w \), one can then find the optimal \( x \) (which will not depend on the fixed component of cost \( F \)), and the profits at that optimal \( x \), net of all costs except \( F \). This then yields the threshold \( F^k \) at which entry is realized under the various scenarios. Comparison of this \( F^k \) under the 0PMFN and 2PMFN scenarios then determines whether entry is encouraged or discouraged (or unaffected) by the incumbent’s PMFN policy. In both of the following examples, \( a = 10, b = 4, d = 3, \) and \( x \in [0,1] \).

First consider a case in which cost savings are significant enough to create an interior \( x^{0\ast}_2 \) but still relatively small: \( w = 1 \). Here, \( x^{0\ast}_2 = 0.2 \) and \( x^{2\ast}_2 = 0 \). The threshold fixed costs are \( F^0 = 8.2 \).
and $F^2 = 11.1$. Thus, for low fixed costs ($F < 8.2$), there is entry regardless of the incumbent’s adoption of a PMFN policy, and the chosen $x$ is reduced by the incumbent’s PMFN policy. For intermediate entry costs ($F \in (8.2, 11.1)$), entry occurs only if the entrant incumbent adopts a PMFN policy. For high entry costs ($F > 11.1$), there is no entry regardless of the incumbent’s PMFN adoption decision.

Now consider a case with more significant cost savings: $w = 7$. Now, $x^0_2 = 1.0$ and $x^2_2 = 0.25$. The threshold fixed costs are $F^0 = 13.85$ and $F^2 = 12.75$. For low entry costs ($F < 12.75$), there is entry regardless of the incumbent’s adoption of a PMFN policy, and the chosen $x$ is reduced by the incumbent’s PMFN policy. For intermediate entry costs ($F \in (12.75, 13.85)$), entry occurs only if the entrant incumbent does not adopt a PMFN policy. For high entry costs ($F > 13.85$), there is no entry regardless of the incumbent’s PMFN adoption decision. This case is depicted in Figure 3.

This case, in which cost savings are sufficiently high that an entrant would choose a substantially different position from the incumbent absent PMFN policies, illustrates precisely the conventional wisdom. Here, for low fixed costs, there is entry regardless of the PMFN policy, but the presence of the policy distorts the entrant’s choice of position and leads the entrant to choose a less differentiated and higher-end business model. For intermediate fixed costs, the PMFN deters entry that would have occurred absent the policies, because the entrant would have maximized its profits by choosing a very differentiated position that is penalized too heavily by the PMFN. This illuminates the potential for both deterrence of low-cost business model entry and the distortion of business model choice when entry does occur.

Comparing this case with the prior case, in which cost savings were more modest, also demonstrates the limitations of the conventional wisdom. When an entrant would not choose a very differentiated position absent the incumbent’s PMFN policy, the skewing of that position by the PMFN is unlikely to deter entry; in fact, it is quite possible that the price-raising effects of the PMFN will encourage entry that would not have occurred absent the PMFN. Obviously, a full analysis of whether the encouragement, deterrence, or skewing of entry increases or decreases
social welfare requires much more structure on both demand and costs, and is beyond the scope of this paper.

2.6 Conclusion

We study the effects on pricing and entry of platform MFN policies—a type of policy not widely studied in the extant literature, but one that is of increasing interest and importance in antitrust enforcement. It is worth reemphasizing that these platform MFN policies are not the same as traditional MFN policies, which have been the subject of considerable theoretical inquiry (see, for example, Cooper (1986) and Besanko and Lyon (1993)). In our main model, in which one supplier (our “seller”) sells through two symmetric intermediary retailers (our “platforms”), a traditional MFN policy is of no consequence. Consider adapting our model to the alternative contracting arrangement in which the supplier sets wholesale prices for the retailers, with the retailers subsequently (and simultaneously) setting retail prices (which is the arrangement to which a traditional MFN applies). A traditional MFN policy would then consist of contractual provisions that ensure uniform wholesale prices (that is, the supplier cannot sell to any retailer at a price lower than the price at which it sells to the other retailer). Absent MFN policies, the supplier optimally chooses symmetric wholesale prices to maximize its profit given the anticipated markups of its retailers. Constraining the supplier to set uniform wholesale prices through an MFN policy therefore has no effect.\(^6\) Similarly, traditional MFN policies would have a less dramatic effect on the incentives of low-end business model entrants. While a traditional MFN policy would prevent the upstream producer from favoring a low-end entrant with a lower wholesale price (and might therefore reduce the entrant’s post-entry profits somewhat), it would not prevent the low-end entrant from competing on price altogether, as is the case with a platform MFN. Thus, the effects of platform MFN policies are different from those of traditional

\(^6\)A long literature in this field considers more complex contracting games, including the scenario in which there is secret bilateral contracting rather than simple posting of wholesale prices (see, for example, O’Brien and Shaffer (1992)). Even in such a model, an MFN policy (if enforceable despite the secret recontracting) simply restores the outcome achieved with posted wholesale prices, by eliminating the possibility of secret price cuts.
MFN policies and warrant careful theoretical examination.

We show that platform MFN agreements tend to raise fees charged by platforms and prices charged by sellers, and that these policies are adopted in equilibrium and increase platform profits when the platforms are close substitutes. However, when platforms are not close substitutes platform MFNs may raise prices so high that industry profits fall. We also show that the adoption of a platform MFN agreement by an incumbent platform can discourage entry by an entrant if it is sufficiently downward-differentiated; however, when the potential entrant has a business model relatively similar to the incumbent’s, platform MFNs actually work to encourage entry through their price-raising effects. Moreover, when entry occurs regardless of the incumbent’s adoption of a platform MFN policy, platform MFNs have the effect of distorting the entrant’s choice of business model towards a model more similar to that of the incumbent. These results have important implications for ongoing antitrust scrutiny of these policies in ebook, credit card, and health care markets.

2.7 Appendix

With linear demand, platform 2’s profits at the 2MFN fee equilibrium are:

$$\pi_2^* = \pi_2^2(f_1^2, f_2^2) = \frac{1}{36(b - d)} (2a - (b - d)(c_1 + c_2 + 2c_s))$$

and platform 2’s profits in the 1MFN mixed-strategy fee equilibrium when undercut by platform 1 are:

$$\pi_2^0(b_1^0(\hat{f}_2), \hat{f}_2) = (1/2)(\hat{f}_2) - c_2)(a + dc_s - b(\hat{f}_2 + c_s) + (1/2b) \left(d(a + b(c_1 - cs) + d(\hat{f}_2 + c_s)\right)$$

where \(\hat{f}_2\) is given by:

$$\hat{f}_2 = \frac{b - d}{b^2 - 3bd + 2d^2} \left(2(a - (b - d)c_s) - bc_1\right) \mp \sqrt{2} \sqrt{b(a - (c_1 + c_s)(b - d))^2(b - d)}$$
Substituting \( \hat{f}_2 \) into \( \pi_2^0(b_1^0(\hat{f}_2), \hat{f}_2) \) and defining \( Z = \pi_2^0(f_1^0, f_2^0) - \pi_2^0(b_1^0(\hat{f}_2), \hat{f}_2) \), any parameter values for which \( Z \geq 0 \) support PMFN adoption by platform 2. It is helpful to define \( h = \frac{d}{b} \in (0, 1) \) as a measure of substitutability between the platforms; by substituting \( d = hb \), this simplifies the expressions greatly. Under the maintained assumption of symmetry \((c_1 = c_2)\), it can be shown that

\[
\text{sign}(Z) = \text{sign}(2 \left(38 + h - 28h^2\right) \pm 9\sqrt{2 - 2h \left(-6 - 3h + 2h^2\right)}).
\]

For any \( h \), \( (38 + h - 28h^2) > 0 \) and \( (-6 - 3h + 2h^2) < 0 \). Therefore the negative root guarantees \( Z \geq 0 \). For the positive root, it can be shown that \( Z \geq 0 \) for \( h \) larger than the value of a complex expression that can be shown numerically to be approximately 0.303.
Figure 2.1: Best-responses with asymmetric PMFN adoption
Figure 2.2: The effects of PMFNs on entry with exogenous position
Figure 2.3: The effects of PMFNs on entry with endogenous position

F in REGION A: incumbent’s PMFN has no effect; no entry
F in REGION B: incumbent’s PMFN deters entry
F in REGION C: incumbent’s PMFN does not deter entry, but does distort entrant’s position
Chapter 3

MFN Clauses in Health Care Provider Contracts

3.1 Introduction

A most-favored-nation (MFN) clause is a promise made from a seller to a buyer that that buyer will receive at least as favorable a price as any other buyer.\(^1\) The U.S. Department of Justice has recently increased the number of challenges against the use of MFNs, alleging that MFNs have the effect of discouraging discounting, leading to higher prices for consumers (Department of Justice, 2012). These challenges have been particularly targeted towards the health insurance industry, the latest of which involves Blue Cross & Blue Shield of Michigan. The Department of Justice has alleged that Blue Cross & Blue Shield’s MFNs in its contracts with Michigan hospitals “inhibit competitive entry and expansion from other insurers and likely raise insurance rates” (Department of Justice, 2012). The origin of the alleged harm is that hospitals will be reluctant to give discounts to smaller insurers if they must also extend those discounts to the larger insurer Blue Cross & Blue Shield. While in this case the suppliers of medical services are

\(^1\)MFN clauses are sometimes referred to as most-favored-customer clauses, prudent buyer clauses, non-discrimination clauses, etc.
hospitals, antitrust challenges involving the use of MFNs have previously involved physicians, dentists, optometrists, and pharmacists.\(^2\)

Despite the existence of a substantial literature on MFNs and price matching guarantees in general, there has yet to be a formal welfare analysis of MFNs in a vertical supply relationship. Instead, previous studies have typically focused on the effects of MFNs in a horizontal setting, such as facilitating collusion and solving the durable good monopolist’s problem by acting as a commitment not to lower price. A standard vertical setting usually features a manufacturer upstream and retailer downstream, and the health insurance market can be viewed in the same way. Medical providers such as hospitals can be thought of as supplying medical services to health insurers who re-sell them to consumers. Figure 1 illustrates the basic mechanics of an MFN in the health insurance market for an arbitrary medical service.

This paper is the first to examine theoretically the antitrust implications of MFNs in a vertical supply relationship. The main result of the paper is that an MFN can enhance welfare because while it decreases the magnitude of discounting by providers, discounting still occurs and extends across more insurers. The focus has typically been on the first effect of discouraging discounting, but less attention has been paid to the fact that the insurer with the MFN now pays less for medical services, and that these cost savings are partially passed through to consumers. The theory presented suggests the welfare effects of MFNs depend upon demand curvature, but that they are welfare enhancing under most typical models of demand.

To ensure this result is not isolated to particular assumptions on competition, I directly consider a general form of equilibrium output function which depends only on input prices. A sufficient but not necessary condition for an MFN to increase consumer welfare is that this equilibrium output function be weakly concave in input prices. Since an MFN is a commitment not to price discriminate, this result is consistent with the general price discrimination literature which finds uniform pricing improves welfare if demand is concave in price.\(^3\) In contrast to this

\(^2\)See Figure 2 for a summary of these cases.

\(^3\)The seminal references are Schmalensee (1981) and Varian (1983). More recently, Cowan (2007) finds that the conditions for price discrimination to enhance welfare are strict and so the presumption is that uniform
literature, however, the case of linear demand leads to an MFN strictly improving welfare rather than having a neutral effect. Since the condition for an MFN to reduce welfare is stringent, this paper suggests a more lenient view of MFNs in contrast to the general perception that MFNs are anti-competitive.

While the main result is that MFNs are presumptively welfare enhancing, welfare unambiguously falls when an MFN is implemented by a provider-controlled insurer whose objective is to coordinate a provider cartel. In this case the MFN can be used to discourage discounting by providers who have a private incentive to support the entry of a rival low-cost insurer because they do not internalize the cost that entry has on other providers. In this case the MFN reduces welfare because the cost-savings generated by the MFN are passed upstream to other providers who The antitrust implication of this paper is that a rule of reason approach should be taken towards the use of MFNs. When applying this rule of reason, the antitrust authority should recognize the beneficial cost savings that accrue to the insurer implementing the MFN and the lower prices that result for consumers. Antitrust enforcement should instead pay special attention to MFNs implemented by insurers that have an interest in the welfare of their providers. *RxCare of Tennessee* offers a clear example of when this applies: here the insurer had a publicly stated mandate to promote compensation for its participating providers.

The paper is organized as follows. Section 2 provides a review of the economic and legal literature concerning MFNs as well as a case summary. Section 3 introduces a model that shows in a very simple environment that an MFN can improve consumer welfare, while section 4 illustrates how an MFN used by a provider-controlled insurer to coordinate a provider cartel reduces consumer welfare. Section 5 concludes.
3.2 Literature Review

3.2.1 Economic

The economic literature on MFNs has not explicitly considered the type of vertical market setting discussed above. Instead, it has focused on the ability of MFNs to facilitate horizontal collusion (Cooper 1986, Neilon and Winter 1993, Besanko and Lyon 1993), to solve the durable good monopolist’s problem (Butz, 1990), to reduce investment uncertainty (Crocker and Lyon, 1994), and to speed up litigation in cases with multiple plaintiffs (Spier 2003, Daughety and Reinganum 2004). The papers most closely related to an examination of MFNs in the health insurance market are DeGraba and Postlewaite (1992), McAfee and Schwartz (1994), and O’Brien and Shaffer (1993) who examine an input monopolist deciding which prices to charge competing downstream firms.

Cooper (1986) shows that an MFN can act as a pre-commitment not to lower price in the future because it would involve giving a rebate to consumers who purchased previously at a higher price, and therefore allows duopolists to maintain a price higher than the competitive level. Butz (1990) shows that a durable goods monopolist can achieve the regular monopoly outcome with an MFN because consumers know the monopolist will not lower price in the future as it would trigger rebates to purchasers in previous periods.

The previous two uses for an MFN indicate they do not benefit consumers, but Crocker and Lyon (1994) show an MFN can be welfare enhancing when it solves investment uncertainty problems in gas supplier/pipeline relationships. A gas supplier may not commit to drilling in a specific location at an agreed-upon tariff with the pipeline if he thinks gas suppliers entering in the future may get a more favorable tariff from the pipeline. An MFN gives the gas supplier a guarantee that he will not be at a permanent cost disadvantage in the future. Spier (2003) shows an MFN can speed up litigation with multiple plaintiffs because early plaintiffs have an incentive to settle early - they know if later plaintiffs receive a more favorable settlement that they are entitled to receive it as well.
Examining MFNs in a horizontal context has recently come back into focus. Klibanoff and Kundu (2009) characterize the solution to a monopolist’s price discrimination problem where the monopolist sells both to Medicaid patients and to those with private insurance. The novelty of the problem arises from the fact that Medicaid patients have an MFN in their contract with the monopolist, a feature that is motivated by Medicaid’s adoption of an MFN in 1991. The theory developed by Klibanoff and Kundu (2009) complements Morton (1997)’s empirical study of the 1991 Medicaid rule adoption which finds that the MFN resulted in higher prices for non-Medicaid consumers. Chen and Liu (2011) find that an MFN implemented by Best Buy led to lower retail prices for electronics. Since the Best Buy MFN was both contemporaneous (Cooper, 1986) and retroactive (Butz, 1990), Chen and Liu’s finding contradicts the theory that predicts the MFN should have increased prices by facilitating collusion.

DeGraba and Postlewaite (1992), McAfee and Schwartz (1994), and O’Brien and Shaffer (1993) are the most relevant to the study of MFNs in a health insurance setting. Each studies a setting where an input monopolist supplies several competing retailers downstream. The authors show that the input monopolist may not want to offer a uniform price to all of the retailers. Instead, the input monopolist may have an incentive to offer a retailer a lower price, giving it a competitive advantage over its rivals; the extra profits derived from this cost advantage are then divided between that retailer and the input monopolist. However, the outside retailers realize they may be put at such a disadvantage before entering the retail market and therefore their willingness to pay a franchise fee falls. DeGraba and Postlewaite show an MFN clause in this context can act as a commitment mechanism to assure retailers they will not be at a cost disadvantage in the future, similar to the analysis of Crocker and Lyon. However, McAfee and Schwartz, and O’Brien and Shaffer show that if the retailers do not observe the contracts of their rivals, an MFN may not be sufficient to re-assure retailers that they will receive at least as favorable a price.4

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4The empirical literature has similarly mixed conclusions. For example, Villas-Boas (2009) studies the German coffee market and finds wholesale price discrimination distorts productive efficiency so that uniform pricing increases welfare, while Grennan (2012) studies the market for medical devices and suggests a move towards
While the preceding studies focus on the use of MFNs to re-assure retailers about relative wholesale prices post-entry, this paper is concerned with the price effects of MFNs conditional on acceptance. Further, this paper allows for the asymmetric welfare effects we would expect when moving away from price discrimination towards uniform pricing, which are not present in the preceding studies featuring symmetric retailers.

### 3.2.2 Legal

The remaining literature involves legal commentary on the antitrust implications of MFNs in health care providers’ contracts. Baker (1988) was one of the first to outline the potentially anti-competitive effects of MFNs. Although he focuses more generally on vertical restraints in the health insurance industry, Baker considers MFN clauses as a device with which a dominant insurer can raise its rivals’ costs (see Salop and Scheffman, 1983). He discusses one case of particular interest: *Ocean State Physicians Health Plan, Inc. v. Blue Cross and Blue Shield of Rhode Island*.

*Ocean State* saw Blue Cross implement an MFN clause among its physicians in response to the entry and growth of Ocean State (a competing health insurer) in the Rhode Island health insurance market. Ocean State claimed the clause was intended to exclude competition in the insurance market. Blue Cross had at least 57% market share while Ocean State possessed approximately 10%.

Ocean State entered into “risk sharing” agreements with its physicians, whereby physicians would be paid only 80% of their fees unless Ocean State made a profit that year. If it did, the other 20% would be returned to physicians. In its three years of operation, however, Ocean State never earned a profit - physicians working for Ocean State were essentially doing so at a 20% discount. Observing that some of its physicians were working for lower fees, Blue Cross implemented an MFN clause requiring physicians to extend any Ocean State discounts to Blue Cross as well. Of the 1200 physicians participating with Ocean State, 350

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5Blue Cross claimed its market share was 57%, while Ocean State asserted it was actually 80%. Nevertheless, Blue Cross did not deny that it had substantial market power.
left the plan with many citing the MFN clause as the reason. The 350 physicians decided they could not “afford” to extend the 20% discount to their sizeable base of Blue Cross patients.

Blue Cross claimed its only intent was to minimize its costs and to avoid being taken advantage of by physicians. Baker seems skeptical of Blue Cross’s motives, reasoning that “it is curious that [Blue Cross] limited its attention to those doctors who were affiliated with both [Blue Cross and Ocean State] plans” (Baker, 1988, p. 161). Baker insinuates that if Blue Cross were actually interested in lowering its costs, it would have also aggressively pursued discounts from physicians not in Ocean State’s network. In fact, Baker (1988) is the only analysis to address the question of why Ocean State was able to elicit discounting from providers but Blue Cross was not despite its position as a monopsonist.

Baker hypothesizes that Blue Cross was

controlled by doctors who in effect employed the insurer to coordinate a physician cartel ... The most favored nations clause may have deterred cheating on a physician cartel, thereby facilitating collusion among doctors, by making it uneconomic for physicians to lower their fees to those patients participating in the HMO. Unfortunately, it is difficult to evaluate whether this plausible explanation for the anticompetitive effect of a most favored nations clause applied to the facts of Ocean State because no evidence was presented from which it would be possible to determine whether [Blue Cross] in effect acted to manage a physician cartel in Rhode Island (Baker, 1988, p. 167-168).

Even before Baker (1988) there has been empirical support for the hypothesis that provider control of an insurer raises reimbursement rates for physicians. A 1979 FTC staff report cites medical society involvement in board member selection and physician presence on these boards as having a significant positive effect on physician reimbursement rates (Kass and Pautler, 1979).

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This positive relationship between physician control and reimbursement fees has also been found in another study, though it exists only for insurers that enjoy a federal tax advantage such as Blue Cross & Blue Shield (Arnault and Eisenstadt, 1980).

### 3.2.3 Case history and empirical facts

*Ocean State* was only one of many cases featuring the use of an MFN. Figure 2 summarizes all American federal and state cases whose central issue was the use of an MFN clause in contracts between health insurers and medical providers. All private cases from 1986-1989 were ruled in favor of MFNs, but in the mid-1990s the Department of Justice brought several challenges, all of which ended in consent decrees; the insurer implementing the MFN agreed to remove the clause from its contracts with providers. While the market shares have varied across these cases, the basic facts are the same.

Physicians are not permitted to organize themselves to negotiate collectively with an insurer regarding fees. In *Ocean State* for example, Blue Cross alleged that Ocean State and its participating physicians “violated Section One of the Sherman Act by conspiring to collectively negotiate with Blue Cross”. The court ruled that there was no evidence that “the Physicians and Surgeon Association of Rhode Island negotiated or attempted to negotiate collectively with Blue Cross concerning physicians’ fees.”

In both the cases brought privately and by the Department of Justice, there has been little evidence regarding whether the MFN implementing insurer was acting on behalf of its providers. The one exception is *U.S. v. RxCare of Tennessee*. RxCare is a pharmacy network that at the time of the complaint had 95% of Tennessee’s pharmacies in its network, and served more than 50% of those with third-party pharmacy benefits. The difference between *RxCare* and the other

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8. Some often cited but less relevant cases include *Blue Cross & Blue Shield (Wisconsin) v. Marshfield Clinic*; *Reazin v. Blue Cross & Blue Shield of Kansas*; *Kartell v. Blue Shield of Massachusetts*.

9. *Willamette Dental Group v. Oregon Dental Service* originally had Willamette as the complainant but the Department of Justice took up the case.


cases is that RxCare had as its sole shareholder the Tennessee Pharmacists Association which sought to “define and promote appropriate compensation to pharmacists for patient care”. Instead of seeking cost-savings, it appears RxCare used the MFN to discourage discounting by its providers which was allowing rivals to undercut RxCare in the insurance market. The fact that the MFN discourages discounting likely makes providers better off in aggregate. Supporting a rival insurer erodes the market position of the incumbent insurer, which in turn reduces the number of desirable incumbent customers. This cost, however, is borne by the entire network of pharmacists. In this way, an MFN can mitigate a horizontal externality among pharmacists by discouraging discounting.

While the magnitude of the discounting in RxCare is not known, in other cases it has been substantial. In Vision Services Plan, physicians granted 20-40% discounts to non-VSP insurers (Doherty and Ras, 2005). And Delta Dental of Rhode Island calculated that its dentists were accepting fees 14% lower than what they were paying.

The following model aims to capture the main features of the cases above, and to show that in a very simple setting an MFN can improve consumer welfare because the cost savings it generates for the implementing insurer are partially passed through to consumers. On the other hand, the model also shows that when an insurer is interested in maximizing provider welfare, an MFN can be used by an insurer to facilitate coordinating a provider cartel. This claim regarding provider control is supported by the fact that in the case of a single provider, a provider-controlled insurer has no use for an MFN because there is no coordination problem.

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13 Sometimes those opposed to MFNs are not rival insurers, but the providers themselves. In Hawaii, the largest insurer (HDS) implemented an MFN after it discovered a rival insurer (HMSA) was obtaining discounts from dentists. One dentist stated that “HDS discriminates against HMSA providers by paying the lesser HMSA fee. Dentists who participate only with them and not with HMSA receive a higher fee – this is discriminatory.” (Jaworowski, 1997). This dentist believes it is discriminatory to prevent him from price discriminating.
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3.3 Model

3.3.1 Setup

The players are an incumbent insurer ($I$), a potential entrant insurer ($E$), and a single provider. Before potential entry, the incumbent agrees to pay the provider an exogenous wage $w_I > 0$ per patient seen.\textsuperscript{15} The timing of the game is as follows:

Stage 0  $I$ chooses MFN or No MFN

Stage 1  $E$ enters and offers the provider a wage $w_E$

Stage 2  The provider accepts or rejects the offer of $w_E$

Stage 3  The incumbent and entrant compete in the insurance market

If the entrant does not enter, or enters and has his offer rejected, the monopoly outcome ensues. The assumptions regarding the nature of competition are as follows.

The incumbent and entrant insurers maximize variable profits $\pi_i = \pi(w_i, w_j)$ with $i, j \in \{I, E\}$ and $i \neq j$ where $w_i$ is what insurer $i$ pays the provider per patient seen. The provider has a marginal cost of 0 and has an objective function given by $\pi_1 = w_E q_E + w_I q_I$, where $q_i$ is the amount of insurance sold by insurer $i$. Because the entrant’s only costs are wage payments to the provider (who has a marginal cost of 0) then depending on the $w_E$ that is determined, there is potential for the entrant to have a cost advantage over the incumbent. As is often the case in entry models, the incumbent’s positive cost per unit of insurance, $w_I$, is taken to be exogenous.\textsuperscript{16}

\textsuperscript{15}This assumption will be relaxed later.

\textsuperscript{16}There are a number of hypotheses regarding why $w_I$ is strictly positive. One is that a strictly positive $w_I$ is the result of a previous bargaining agreement between incumbent and provider; since in reality the provider has
One unit of insurance sold results in exactly one unit of medical services required. The insurers can therefore be thought of as retailers that provide no particular value added, and simply act as middlemen between provider and consumer. A comment on notation: \( q_i = q(w_i, w_j) \) is the \textit{stage 3 subgame equilibrium} output of firm \( i \neq j \) with own wage \( w_i \) and rival wage \( w_j \). This should not be confused with the equilibrium outputs of the incumbent and entrant for the entire game, given by \( (q^*_I, q^*_E) = (q(w_I, w_E^*), q(w_E^*, w_I)) \), where \( w_E^* \) is the entrant’s optimal choice of \( w_E \) in stage 1.\(^{17}\)

In order to solve the model, some structure is placed on the nature of competition in stage 3 but without imposing a particular demand system. The following assumptions are made:

\begin{align*}
\textbf{A1} & \quad q \text{ is continuous and symmetric: } q(w_i, w_j) = q(w_j, w_i) \iff w_i = w_j \\
\textbf{A2} & \quad q, \pi \text{ are decreasing in own wage, increasing in rival wage} \\
\textbf{A3} & \quad \pi(w_i, w_i) > \pi(w_j, w_j) \iff w_i < w_j \\
\textbf{A4} & \quad q(w_I, w_E) + q(w_E, w_I) > q^m_I(w_I) > q(w_I, w_E) > 0 \quad \forall \, w_E \in [0, w_I]
\end{align*}

The first assumption is that consumers view the incumbent and entrant’s products as having the same value so that in equilibrium if their costs are the same they will have the same level of output. The second assumption is that equilibrium outputs and variable profits are decreasing in own wage and increasing in rival wage. Assumption 3 is that if the insurers have the same costs, the insurers prefer to be low cost rather than high cost. Assumption 4 is that entry expands the market (so that \( q_I + q_E \) is greater than the monopoly level of output defined by \( q^m_I(w_I) \)) so long as the entrant is not of higher cost, and that the incumbent’s output falls in response to entry – but not to zero. Therefore there is symmetry but not homogeneity: consumers view the products of the insurers as differentiated but having the same inherent value. Since the fixed cost of operating a practice, a strictly positive wage is necessary for the provider to realize non-negative surplus. The model omits a fixed cost for the provider since it is effectively sunk by serving the incumbent. An alternative hypothesis is explored fully in Section 4 which examines the effects of an MFN when the incumbent is provider-controlled.

\(^{17}\)Note that this specification implicitly assumes there is always a unique \( q \) for any wages \( w_i, w_j \), which is consistent with many models of competition.
insurers’ products are symmetric, the measure of consumer welfare used is total output, and the equilibrium concept adopted is Subgame Perfect Nash Equilibrium.

This reduced form approach is useful because it focuses directly on the effect of the cost of medical services on output, while abstracting from the mechanics of insurer competition. That is not to say that insurer competition is ignored. The preceding assumptions are natural enough that they are satisfied by many well known models of price/quantity competition such as textbook Cournot or differentiated Bertrand competition, and so an advantage of this reduced form approach is that the welfare results are not confined to a particular competitive framework.

### 3.3.2 Solution without an MFN

The model is solved by backward induction. Consider a stage 3 history where the incumbent has chosen not to impose an MFN in its contract with the provider, and the entrant has already entered and had his wage offer accepted. The equilibrium outputs are \((q_I, q_E) = (q(w_I, w_E), q(w_E, w_I))\). Since the entrant’s profits are decreasing in \(w_E\), in stage 1 the entrant will offer the lowest \(w_E\) such that the provider accepts. The provider will accept an offer \(w_E\) in stage 2 if:

\[ w_E q(w_E, w_I) + w_I q(w_I, w_E) \geq w_I q_I^m(w_I) \tag{3.1} \]

The entrant will choose \(w_E\) such that this “participation constraint” binds, and so the wage offer chosen by the entrant, \(w_E^*\), is defined by:

\[ w_E^* q(w_E^*, w_I) + w_I q(w_I, w_E^*) = w_I q_I^m(w_I) \tag{3.2} \]

which leads to unique equilibrium outputs for the entire game given by \((q_I^*, q_E^*) = (q(w_I, w_E^*), q(w_E^*, w_I))\).\(^{18}\)

\(^{18}\)In equilibrium equation 1 must bind; if it does not then holding all else constant there exists a lower \(w_E\) that satisfies the participation constraint, violating profit maximization on the part of the entrant. I implicitly assume there exists a \(w_E^*\) that binds this equation as otherwise entry does not occur and the model is not interesting.
Chapter 3. MFN Clauses in Health Care Provider Contracts

3.3.3 Solution with an MFN

The previous section describes the equilibrium that occurs when the incumbent chooses not to include an MFN clause in its contract with the provider. Suppose now that the incumbent does impose an MFN clause on the provider in stage 0.\textsuperscript{19} The MFN states that should the provider see the patients of a rival insurer at a wage less than \(w_I\) that that lower wage be granted to the incumbent insurer as well. Therefore a wage offer \(w_E < w_I\) triggers the MFN clause and the incumbent’s effective marginal cost falls to \(w_E\).

In stage 1, the entrant will offer a wage \(w_E^M\) that again binds the provider’s participation constraint\textsuperscript{20}:

\[
\begin{align*}
    w_E^M (q(w_E^M, w_E^M) + q(w_E^M, w_E^M)) &= 2w_E^M q(w_E^M, w_E^M) = w_I q_I^m (w_I) \quad (3.3)
\end{align*}
\]

which leads to symmetric outputs since the MFN requires that the incumbent receive the lower \(w_E^M\) as well. Therefore the equilibrium quantities for the entire game are identical and given by \((q(w_E^M, w_E^M), q(w_E^M, w_E^M))\) which for notational convenience will be referred to as \((q_I^M, q_E^M)\). Under an MFN, the incumbent’s wage falls and the entrant’s wage increases compared to the no MFN case, so the incumbent always has an incentive to implement an MFN in stage 0. The incumbent’s preference for an MFN does not depend on the curvature of the equilibrium output function. Consumer welfare does, however.

\textsuperscript{19}From a modelling perspective, there is no benefit from allowing the provider to refuse the MFN clause as the provider will never choose to do so – such a refusal results in lost access to incumbent patients (and profits of \(w_I q_I\)) without any benefit in return. That said, the provider may seek to share in any benefits accruing to the incumbent from the MFN. This is a legitimate concern if providers are few, but if they are many then they are not in a strong position to refuse. The assumption here of a single provider is an abstraction that allows for cleaner exposition.

\textsuperscript{20}Equation (3) presumes that \(w_E \leq w_I\) so that the MFN is triggered. This is clearly the case as there is no incentive to offer a wage \(w_E > w_I\) since the entrant could do better by offering \(w_E = w_I\) and achieving profits of \(\pi_E(w_I, w_I) > \pi_E(w_E, w_I)\) by Assumption 3.
3.3.4 Consumer welfare

From the preceding participation constraints, it can be shown that with a reasonable assumption on the curvature of the equilibrium output function that the MFN increases consumer welfare. The first step involves recognizing that the entrant need not offer a wage as high as $w_I$, since this strictly satisfies the participation constraint of equation (3), so that the MFN will be triggered with $w^M_E < w_I$. The second step shows a wage offer of $w^M_E = \frac{w_E^* + w_I}{2}$ strictly satisfies the participation constraint, implying that the average wage falls and consumer welfare increases with an MFN if $q$ is not too convex. The following proposition is the first of two main results of the paper.

**Proposition 1:** If $q$ is concave in its arguments then the MFN strictly increases total output and consumer welfare increases.

Proof:
Let $w = [w_1, w_2]$ with $w_1, w_2 \geq 0$. Then $q : w \to \mathbb{R}_+$ is concave if for $t \in [0, 1]$

$$q(tw_1 + (1 - t)w_2) \geq tq(w_1) + (1 - t)q(w_2) \quad (3.4)$$

The purpose of this proof is to show that with concavity, the MFN strictly increases total output, or that in equilibrium $2q^M_E > q^*_E + q^*_I$. The approach taken is to show that if $w^M_E = \frac{w^*_E + w_I}{2}$ then total output weakly increases when $q$ is weakly concave, and then to show that $w^M_E$ is chosen to be strictly smaller than $\frac{w^*_E + w_I}{2}$ which establishes the strict inequality $2q^M_E > q^*_E + q^*_I$.

Letting $w_1 = [w^*_E, w_I], w_2 = [w_I, w^*_E]$, and $t = 0.5$, concavity implies

$$2q(w^M) \geq q(w_1) + q(w_2) = q^*_E + q^*_I \quad (3.5)$$
where $w^M = \left[ \frac{w^*E + w_I}{2}, \frac{w^*E + w_I}{2} \right]$. Continuing with the above inequality:

\[
2 \left( \frac{w^*E + w_I}{2} \right) q(w^M) \geq \left( \frac{w^*E + w_I}{2} \right) (q(w_1) + q(w_2))
\]

\[
2 \left( \frac{w^*E + w_I}{2} \right) q(w^M) \geq w^*_E q(w_1) + w_I q(w_2) + \left( \frac{w^*E - w_I}{2} \right) (q(w_2) - q(w_1))
\]

\[
2 \left( \frac{w^*E + w_I}{2} \right) q(w^M) \geq w^*_E q_E + w_I q_I + \left( \frac{w^*E - w_I}{2} \right) (q(w_2) - q(w_1)) \quad (3.6)
\]

\[
> w^*_E q_E + w_I q_I
\]

since $w^*_E < w_I \implies q(w_2) < q(w_1)$. But we know from the participation constraints in eq (2)-(3) that it must be in equilibrium that the provider earns the same level of profits given by

\[
2w^M q_E^M = w_I q_I^M = w^*_E q_E + w_I q_I^*
\]

(3.7)

Therefore choosing $w_E = \frac{w^*E + w_I}{2}$ under an MFN strictly satisfies the participation constraint; instead there exists a $w^M_E < \frac{w^*E + w_I}{2}$ that the entrant would choose instead. The following concludes the proof:

\[
2q^M_E = 2q(w^M_E, w^M_E) > 2q \left( \frac{w^*E + w_I}{2}, \frac{w^*E + w_I}{2} \right) = 2q(w^M) \geq q^*_E + q^*_I
\]

\[
2q^M_E > q^*_E + q^*_I \quad (3.8)
\]

Proposition 2: Strict convexity of $q$ is not sufficient to guarantee that total output falls and consumer welfare declines.

Proof: It can be seen intuitively that a strictly convex $q$ can still lead to a strict increase in total output. With linear $q$ and $w^M_E = \frac{w^*E + w_I}{2}$, total output strictly increases, but the entrant chooses a wage offer which is lower. If $q$ is slightly convex, then there should exist a wage offer slightly greater than the one chosen under linearity that satisfies the participation constraint.
and is still low enough to strictly increase total output. Examples can be constructed using specific functional forms such that \( q \) is strictly convex and output strictly increases with an MFN.\(^{21}\)

Therefore concavity is sufficient but not necessary for consumer welfare to increase. The result is illustrated in figure 3 with linear equilibrium output functions, and the intuition is as follows. Without an MFN, the provider receives many patients from the entrant but is paid a low wage \( w_E \), while the incumbent sends the provider few patients but pays the provider a high wage \( w_I \). A one unit decrease in the incumbent wage combined with a one unit increase in the entrant wage leads to a strict increase in provider profits despite neither the average wage nor total output from changing; the profits the provider loses on the lucrative but scarce incumbent patients are more than made up for by the unit wage increase earned over the larger patient base of the entrant.

An MFN mandates that this wage gap shrink to zero since both the incumbent and entrant pay the provider the same wage rate under the MFN. Holding the average wage constant, the provider strictly prefers this outcome, and as a result is willing to accept a decrease in the average wage in order to reduce the difference in wages. The entrant recognizes this, and offers that lower average wage of \( w^M_E < \frac{w_E^* + w_I}{2} \). Therefore, the magnitude of the discount offered to the entrant decreases with an MFN, but this discount now extends to the incumbent as well. Since the average wage strictly falls, total output strictly increases. When the equilibrium output function is linear, total output strictly increases, and this implies that the equilibrium output function can even be “slightly convex” for the MFN to increase total output. Since the MFN leads to \( w_E \) increasing and \( w_I \) decreasing, the incumbent always has an incentive to implement an MFN, especially when providers are numerous and not in a position to share in the incumbent’s increase in profits.

Note that the incumbent chooses to implement an MFN regardless of whether \( q \) is concave or

\(^{21}\)Let \( q(w_i, w_j) = A - (2w_i - w_j)^x \) which is linear in \( q \) when \( x = 1 \), concave when \( x > 1 \) and convex when \( x < 1 \). Letting \( A = 100, x = 0.999, w^*_E = 1, w_I = 2 \), it can be shown that \( w^M_E = 1.4925 \) satisfies the participation constraint, lowers the average wage, and yields total output greater with an MFN than without.
convex. Weak concavity of $q$ is sufficient to guarantee that the incentives of the incumbent and consumers are aligned: the incumbent strictly prefers to implement the MFN and consumers are strictly better off as a result. Below are the Cournot and Bertrand interpretations of the model, both of which satisfy assumptions A1-A4.²²

### 3.3.5 Cournot example

Consider a simple Cournot example with linear demand given by $P(Q) = A - bQ$ where $Q = q_I + q_E$. The equilibrium outputs in Cournot satisfy all of the assumptions A1-A4. As Cournot competitors the equilibrium outputs of the incumbent and entrant are $q_I = \frac{A-2w_I+w_E}{3b}$ and $q_E = \frac{A-2w_E+w_I}{3b}$, respectively. Total quantity is given by $\frac{2A-(w_I+w_E)}{3b}$ which is linear in the wages so that total output will increase if the average wage falls.

Before entry, the incumbent’s monopoly output is $\frac{A-w_I}{2b}$ and the provider’s rents are $w_I \left(\frac{A-w_I}{2b}\right)$. Without an MFN, the entrant offers $w^*_E$ that makes the provider just as well off as he was under an incumbent monopoly:

$$w^*_E \left(\frac{A-2w^*_E + w_I}{3b}\right) + w_I \left(\frac{A-2w_I + w^*_E}{3b}\right) = w_I \left(\frac{A-w_I}{2b}\right) \quad (3.9)$$

With an MFN, the entrant offers $w^M_E$ that satisfies

$$2w^M_E \left(\frac{A-w^M_E}{3b}\right) = w_I \left(\frac{A-w_I}{2b}\right) \quad (3.10)$$

²²A Hotelling model could also be considered, which typically assumes the entire market is covered so that $q_I + q_E = 1$. Johnson (2012) uses such a linear city representation to compare retail competition under a wholesale model of supply with that of an agency or sales model of supply. Johnson finds an MFN under the agency model is welfare neutral from the view of consumers, which reflects the assumption of total output being fixed.
which is simplified since under an MFN, the incumbent’s wage falls from \( w_I \) to \( w_I^M \). Since these participation constraints involve quadratics, at this point it is simplest to verify numerically that the average wage falls under an MFN (i.e. \( w_E^M < \frac{w_E^* + w_I}{2} \)). Let \( A = 100, b = 1 \) and \( w_I = 40 \). Then without an MFN, \( w_E^* = 20 \). With an MFN, offering \( w_E^M = 30 \) strictly satisfies the participation constraint. Instead, the entrant must only offer \( w_E^M = 23.53 \) which is much lower than the average wage. From this it can be seen that even if the equilibrium output function were “slightly convex” instead of linear, the wage offer under an MFN would still be low enough to strictly increase output and consumer welfare.

### 3.3.6 Differentiated Bertrand example

Consider a setting of differentiated Bertrand competition with linear demands given by \( q_i = v - p_i + \gamma p_j \) for \( i \neq j \in \{I, E\} \) and \( \gamma \in (0, 1) \). With marginal costs of \( w_I \) and \( w_E \), the equilibrium outputs of the incumbent and entrant are \( q_I = \frac{2(v - w_I) + \gamma(v + w_E) + \gamma^2 w_I}{4 - \gamma^2} \) and \( q_E = \frac{2(v - w_E) + \gamma(v + w_I) + \gamma^2 w_E}{4 - \gamma^2} \) with total output given by \( Q = \frac{(4 + 2\gamma)v - (2\gamma - \gamma^2)(w_E + w_I)}{4 - \gamma^2} \). Note that again total output depends linearly on the sum of marginal costs so that a fall in the average wage results in total output increasing.

The simplest way to illustrate that total output increases is to show that \( w_E^M < \frac{w_E^* + w_I}{2} \) so that the average wage falls. This can be done by showing that \( w_E^M = \frac{w_E^* + w_I}{2} \) is a wage that is higher than the entrant needs to offer to satisfy the participation constraints. Note that with linear equilibrium output functions, \( w_E^M = \frac{w_E^* + w_I}{2} \) results in the same level of output because the average wage is the same. But such a wage strictly satisfies the participation constraint

\[
\left( \frac{w_E^* + w_I}{2} \right) (q_E^M + q_I^M) = \left( \frac{w_E^* + w_I}{2} \right) (q_E^* + q_I^*) > w_E^* q_E^* + w_I q_I^* \tag{3.11}
\]
where the LHS is equal to the provider’s rents with an MFN and the RHS is equal to the provider’s rents without an MFN. Re-arranging,

\[
\frac{1}{2} (w_I - w_E^*) (q_E^* - q_I^*) > 0 \tag{3.12}
\]

because \( w_E^* < w_I \). Therefore there exists a \( w_E^M < \frac{w_E^* + w_I}{2} \) that satisfies the participation constraint, leading to an increase in output.

Since an MFN is a promise not to price discriminate, it is not surprising that the welfare effects of an MFN, like price discrimination, depend importantly on demand curvature (or in this case, equilibrium output curvature) (Aguierre et al., 2010). While the positive welfare result depends on the equilibrium output function not being too convex, it also relies upon the implicit assumption that the entrant has zero fixed cost of entry. If entrant variable profits are not sufficiently high to cover a fixed cost of entry under an MFN, then the MFN may have the effect of blocking entry and reducing welfare. This implicit assumption is the analog of that made in the price discrimination literature which typically assumes all markets continue to be served (e.g. Schmalensee (1981)).

Despite considering a wide class of competitive frameworks, such as Bertrand and Cournot, this positive welfare result is not meant to imply that an MFN is always welfare enhancing. Instead, the purpose is to illustrate that in a very basic framework an MFN can enhance welfare if it causes discounting to spread across insurers rather than being isolated to a single insurer. In particular, there has been no consideration of network effects which can be important if consumers have strong preferences for network size. In the next section, the assumption of a profit maximizing incumbent is relaxed to illustrate a relevant example of when an MFN can reduce welfare and to examine a hypothesis put forward by Baker (1988) as to why the entrant was able to acquire discounts but the incumbent was not.
3.4 Incumbent as a provider-controlled cartel manager

In the antitrust cases presented earlier, it is interesting to consider why the entrant was able to acquire discounts from providers but the incumbent insurer was not. Providers are typically numerous and dependent on the incumbent for patients; presumably the incumbent should have been able to get comparable discounts from providers even before the arrival of the entrant. In terms of the model presented, the question is why it was that \( w_I > 0 \) before the arrival of the entrant. One hypothesis regarding why the incumbent did not seek these discounts itself is that the incumbent acted as a provider-controlled cartel manager (Baker, 1988). The objective of such an incumbent would be to facilitate collusion among providers who would otherwise have an incentive to compete with each other, not to negotiate lower fees. There is strong evidence to suggest that in at least one antitrust case, this mechanism was at play.\(^{23}\)

In this section, rather than the incumbent maximizing its profits, the incumbent maximizes an alternative objective function which is equal to the welfare of its providers. When the incumbent maximizes this alternative objective function, an MFN improves provider welfare by mitigating a free-rider problem among providers. The free rider problem faced by providers is that they are better off in aggregate not serving the entrant insurer, but face a private incentive to do so.

This free rider problem should only exist if there are multiple providers. The alternative model presented below endogenizes the choice of \( w_I \) and shows that with a single provider, a provider-controlled incumbent has no incentive to impose an MFN, but as soon as a second provider is introduced, the incumbent will want to introduce an MFN. The purpose of this is to highlight that it is the provider-coordinating aspect of the MFN that drives the incumbent’s desire to use it, and is also the reason the MFN decreases consumer welfare under provider control.

\(^{23}\)RxCare of Tennessee provided pharmacy network services in Tennessee, and was owned exclusively by the Tennessee Pharmacists Associations which had as part of its mandate to “define and promote appropriate compensation to pharmacists for patient care”.

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The model presented above remains the same except that \( w_I \) is endogenized and chosen by the incumbent to maximize provider welfare subject to making non-negative profits in the insurance market. Without an entrant insurer in the market, the incumbent takes the true marginal cost of the provider of 0 as given, chooses a price in the insurance market that maximizes profits, then pays its provider that price. In this way, the profits earned in the insurance market are entirely transferred to the provider. I denote the associated output of the incumbent monopolist as \( q_I^m = q(0) \) since the incumbent acts based upon the provider’s marginal cost of 0. It follows that the profits earned by the provider are \( w_I^m q(0) \) where \( w_I^m \) is the price charged by the incumbent in the insurance market (and equals the wage paid to the provider).

3.4.1 Single provider’s welfare cannot be increased via an MFN

If the incumbent chooses No MFN in stage 0, then the entrant again offers the provider the lowest \( w_E \) such that the provider accepts. If the provider accepts this offer \( w_E^* \) the equilibrium outputs are \((q_I^*, q_E^*) = (q(0, w_E^*), q(w_E^*, 0))\).\(^{24}\) The provider earns profits of

\[
\frac{w_I q_I^* + w_E q_E^*}{w_I^m q(0)} \tag{3.13}
\]

where \( w_I \) is chosen by the incumbent and set equal to whatever price the incumbent commands in the insurance market.

If the incumbent chooses MFN in stage 0, the entrant again offers the lowest \( w_E \) such that the provider accepts. If the provider accepts this offer \( w_E^M \) the equilibrium outputs are \((q_I^M, q_E^M)\). The provider earns profits of

\[
\frac{w_E q_I^M + w_E q_E^M}{w_I^m q(0)} \tag{3.14}
\]

\(^{24}\)These should not be confused with the \( q_I^* \) and \( q_E^* \) from section 3.
assuming such a $w_E^M$ exists.\textsuperscript{25}

The provider’s profits are the same with the MFN as without it; as such, the provider-controlled incumbent has no reason to implement it. However, with the introduction of only a second provider, an MFN has a role to play because there exists a horizontal externality between the two providers that doesn’t exist with only one provider.

3.4.2 The MFN increases provider welfare with two providers

With a second provider, something must be said about consumers’ preferences for network size. To keep the model as simple as possible, assume that consumers do not care about network size, so that whether an insurer offers access to one provider or two providers makes no difference - all consumers desire is for the insurer to have at least one provider. The purpose of this unrealistic assumption is to highlight the externality faced by providers. Therefore if each insurer provides access to at least one provider, then the equilibrium output functions are exactly the same as before. Further, if both providers participate in an insurer’s network, then I assume patients coming from that insurer are split evenly between providers. In terms of the timing of the game, the incumbent still chooses $MFN$ or $No MFN$ in stage 0, the entrant still makes a uniform wage offer $w_E$ to both providers in stage 1, the providers then simultaneously accept/reject in stage 3, and in the final stage the incumbent and entrant compete.

Without an MFN, what wage will the entrant offer these providers? The entrant recognizes that he only needs one provider to sell insurance and chooses the lowest $w_E$ such that there exists an equilibrium where at least one provider accepts. Given an entrant offer of $w_E$, if both accept then the providers each earn profits of

\[
\frac{1}{2}(w_Iq(0, w_E) + w_Eq(w_E, 0)) \geq \frac{1}{2}w_Iq(0, w_E)
\]

\textsuperscript{25}If it does not exist, then the entrant cannot make an acceptable offer to the provider, and the monopoly outcome is maintained regardless.
which binds if $w_E = 0$. Therefore there exists an equilibrium with two providers where the entrant offers $w_E = 0$ and both accept. The reason is that if one of the two providers attempts to deviate by rejecting, he will earn exactly the same amount of profits since his leaving the entrant’s network has no effect on the entrant’s ability to sell insurance.

The providers have allowed entry to occur without receiving any compensation from the entrant, but have harmed themselves by reducing the incumbent’s ability to earn profits in the insurance market on their behalf. The providers would both be better off rejecting and each receiving half of $w_I^m q(0)$ rather than half of $w_I q(0, 0)$. Since (Reject, Reject) payoff-dominates (Accept, Accept), the providers face a coordination problem - they are both better off rejecting, however if one thinks the other is accepting then that provider may as well accept too.

The result of $w_E^* = 0$ takes this intuition to the extreme: in reality, the entrant just has to offer the providers a wage slightly above marginal cost. The providers as a whole are better off shunning the entrant to preserve the incumbent’s share of the market, but if one is going to accept and earn extra profits from the entrant, then the other provider may as well accept and share in those profits too since the damage to the incumbent has already been done. This is what some refer to as a “horizontal externality” among providers, with the classic reference being Rasmusen et al (1991). With a single provider, a wage offer of $w_E = 0$ is quickly rejected. With two providers, the entrant fully exploits the coordination problem, even though the two providers both recognize the effect their decisions have on the insurance market.

### 3.4.3 The MFN solves the coordination problem

With two providers, the no-MFN equilibrium is that the entrant exploits a coordination problem among providers to be able to pay them only $w_E = 0$, a wage offer that would not be accepted by a single provider that faces no coordination problem. A provider-controlled incumbent can use an MFN to mitigate this coordination problem. The following shows that despite the possibility of multiple equilibria, each equilibrium with an MFN strictly dominates the corresponding outcome without an MFN.
Since there is so little structure placed on demand, there are 3 types of Nash equilibria in the stage 2 subgame: (Accept, Accept), (Accept, Reject), and (Reject, Reject). For each \( w_E \) offer made in stage 1, there is a corresponding stage 2 Nash equilibrium. When the entrant makes his wage offer, his objective is to offer the lowest \( w_E \) such that at least one provider accepts. The following shows that regardless of which stage 2 Nash equilibrium we consider, provider welfare is higher with an MFN than without it.

Consider an (Accept, Accept) Nash equilibrium. For neither provider to want to deviate, it must be that their profits from both accepting are at least as high as their profits from unilaterally deviating to (Accept, Reject). For this to be an equilibrium, the entrant’s wage offer \( w^M_E \) must satisfy the following constraint for each provider:

\[
w^M_E \left( \frac{q(w^M_E, 0) + q(0, w^M_E)}{2} \right) \geq \frac{w_I^M q(0, w^M_E)}{2}
\] (3.16)

which increases each provider’s welfare because

\[
\frac{w_I^M q(0, w^M_E)}{2} > \frac{w_I q(0, 0)}{2}
\] (3.17)

where \( q_I(0, 0) < q_I(0, w^M_E) \). The intuition is simple. If the incumbent knows the providers are going to accept the entrant’s wage offer regardless of whether there’s an MFN or not, he may as well implement an MFN so as to force the entrant to increase his wage offer from \( w_E = 0 \) to \( w^M_E > 0 \).

Now consider an (Accept, Reject) Nash equilibrium. For neither provider to want to deviate, it must be that their profits from accepting are at least as high as their profits from unilaterally deviating to (Reject, Reject) [for the acceptor] or (Accept, Accept) [for the rejector]. The

\[26\] The equilibria (Accept, Reject) and (Reject, Accept) are treated as a single equilibrium.

\[27\] The wage \( w_I \) is equal to whatever price the incumbent charges in the insurance market when there is no MFN. The wage that the incumbent pays the rejecting provider, \( w^M_I \), is actually higher than the price the incumbent charges in the insurance market with an MFN, since it only has to pay the accepting provider \( w^M_E < p_I = \frac{q_I(w^M_E) + q_E(w^M_E, 0)}{2} \). Because with concavity \( q_I(0, w^M_E) + q_E(w^M_E, 0) < q_I(0, 0) + q_E(0, 0) \), prices are higher with the MFN assuming demand is decreasing in price.
acceptor’s profits must satisfy
\[ w^M_E \left( q(w^M_E, 0) + \frac{q(0, w^M_M)}{2} \right) \geq \frac{1}{2} w^m_I q(0) \] (3.18)
so that the acceptor does not want to reject and revert to the monopoly outcome. And the rejector’s profits must satisfy
\[ \frac{w^M_I q(0, w^M_E)}{2} \geq w^M_E \left( \frac{q(w^M_E, 0) + q(0, w^M_M)}{2} \right) \] (3.19)
so that the rejector does not want to also accept and receive \( w^M_E \), and then obtain patients from both insurers. Both constraints yield profits to the providers that exceed the profits of \( \frac{1}{2} w_I q_I(0, 0) \) that they receive without an MFN. 28

Note that since the MFN mandates that the incumbent pay the accepting provider \( w^M_E < w^m_I \), the incumbent is able to pay the rejecting provider even more than \( w^m_I \) with an MFN. The reason is that if the incumbent maintained a wage of \( w^m_I \) for the rejecting provider, the incumbent would earn positive profits in the insurance market because now it’s only paying the accepting provider \( w^M_E \). But since the incumbent has no incentive to earn profits in the insurance market, it can either transfer those profits to consumers by lowering price, or instead increase \( w^m_I \) and transfer them to the rejecting provider. Of course since the incumbent is maximizing provider profits, it will choose the latter. This can be interpreted as the incumbent rewarding the rejecting provider with a higher wage for not supporting the entrant, and punishing the accepting provider with a lower wage.

The final case is that of a (Reject, Reject) Nash equilibrium which means the entrant has offered a \( w_E \) that neither provider finds acceptable. In fact, it is possible there is no such \( w_E \) that a provider would accept. In this case the entrant is blocked from entering the market, and the MFN restores both providers to the monopoly outcome which again yields profits to the

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28Equation 14 shows the acceptor is made at least as well off as under monopoly, and equation 15 shows the rejector obtains utility \( \frac{w^M_I q(0, w^M_E)}{2} > \frac{w_I q_I(0, 0)}{2} \) as before in equation 13.
providers strictly greater than the no MFN case. Therefore in stage 0 it is weakly dominant for the incumbent to choose MFN over No MFN.

Unlike an insurer interested in its own profits, a provider-controlled insurer uses the MFN to discourage discounting by its providers. While the MFN can block entry entirely, the provider-controlled insurer still finds the MFN useful when entry cannot be blocked because it forces the entrant insurer to pay providers more. The following is the second main result of the paper.

**Proposition 3:** If \( q \) is concave in its arguments, an MFN implemented by a provider-controlled incumbent reduces consumer welfare.

Proof: it’s been shown above that a provider-controlled incumbent with two providers always has an incentive to implement an MFN, and that when this occurs the entrant must always offer a strictly positive wage. Without an MFN the entrant offers \( w_E = 0 \) and total output is \( q_E(0, 0) + q_I(0, 0) \), whereas with an MFN, \( w_E^M > 0 \) and total output is \( q_E(w_E^M, 0) + q_I(0, w_E^M) < q_E(0, 0) + q_I(0, 0) \).\(^{29}\)

The provider-controlled incumbent is not interested in the cost-savings earned through the MFN, since any “savings” come at the expense of provider welfare. Instead, the incumbent finds the MFN useful for coordinating a provider cartel; the MFN discourages discounting by providers because even though providers recognize the incumbent is operating in the insurance market on their behalf, providers have a private incentive to earn extra profits by supporting the entrant as half the cost of entry is borne by the other provider. The MFN not only punishes providers who continue to support the entrant, but also allows the incumbent to issue a higher wage as a reward to the provider who does not support the entrant. The MFN mitigates the horizontal externality between providers because it better aligns the private incentives of providers with the total welfare of providers.\(^{30}\)

\(^{29}\)A2 gives \( q(0, 0) > q(w_E^E, \frac{w_E}{2}) \) and concavity implies \( q(\frac{w_E}{2}, \frac{w_E}{2}) \geq q(w_E, 0) + q(0, w_E) \).

\(^{30}\)The positive welfare result of Section 3 continues to hold with two providers: an MFN implemented by a for-profit incumbent still increases welfare. It can be shown that the entrant will offer \( w_E = 0 \) without an
3.5 Conclusion

Recent statements made by members of the Department of Justice suggest a generally negative attitude towards the use of MFNs in vertical supply relationships. This paper shows that this view is not necessarily warranted, as the use of an MFN by a for-profit insurer may improve welfare in certain circumstances. The MFN generates cost savings for the insurer implementing it, and these cost savings may be passed through to the benefit of subscribers of that insurer. The MFN, however, also raises rival insurers’ costs of medical services which harms subscribers of those rival insurers. This paper suggests that antitrust authorities should be cognizant of these changes to the welfare of different consumers when designing policy.

That the MFN generates cost savings for the implementing insurer suggests that the intent of an MFN is not necessarily predatory even though it decreases the variable profits of rival insurers. As such, the theory implies an MFN-implementing insurer will always pass a test of predation since it does not incur any short-run losses.\(^3\)

If, however, there is evidence to suggest the MFN-implementing insurer is not interested in earning profits in the insurance market but instead is interested in the welfare of its providers upstream, then the MFN does not result in cost-savings to consumers. Here, the MFN reduces welfare because any cost-savings resulting from the MFN are transferred upstream to providers that did not join the entrant’s network, and not to consumers downstream. In this case the cost-savings rationale for the MFN should be viewed skeptically and for this reason it would be interesting for future analysis carried out by antitrust authorities to specifically investigate the objectives of the insurer imposing the MFN. This would be particularly prudent when the insurer has a publicly-stated mandate to protect provider welfare, as in RxCare. These con-

\[^{3}\]To be specific, the use of the MFN would easily pass the Brooke Group standard for establishing predation, which requires showing the plaintiff priced below an appropriate measure of cost and had a reasonable prospect of recouping the resulting losses in the future. This is likely the reason why Blue Cross & Blue Shield has argued that this is the standard that should apply to the evaluation of MFNs. See U.S. v. Blue Cross & Blue Shield of Michigan.
trasting uses of an MFN suggest the rule of reason approach currently taken by the Department of Justice towards MFNs is appropriate, but that the Department’s apparent presumption that MFNs reduce welfare is misguided.

A benefit of the simple model presented is that it captures features of many familiar markets. Instead of the market being for health insurance, the market could be for cable television, smartphones, operating systems, eBook readers, etc. Rather than providers upstream, these markets feature television programmers, software developers, and eBook publishers upstream, which consumers must typically access through a device downstream. The Department of Justice’s recent challenge of Apple’s use of an MFN in its contracts with eBook publishers suggests the use of price relationship agreements in vertical contracts will continue to be an important antitrust issue going forward.\(^{32}\)

Despite considering a wide class of competitive frameworks, including Bertrand and Cournot, the model presented makes a number of abstractions from a market that is known for its complexity. For example, network effects are considered in only a very simplistic way. Since the MFN causes reluctance on the part of providers to participate in the entrant insurer’s network, the entrant may find it more difficult to sell insurance due to its smaller network. A next step for future work involves generalizing the results of this reduced form approach to consider the role that network effects could play.

Figure 3.1: Health insurance as a vertical supply chain. Suppose insurer 2 negotiates a 20% discount from what insurer 1 pays a provider. If Insurer 1 has an MFN clause in its contract with the provider, that discount must also be granted to insurer 1.
**Figure 3.2: A summary of MFN cases.** The insurer implementing the MFN typically had substantial market size and virtually all providers participating in its network. Early cases were ruled in favor of MFNs, but later Department of Justice challenges result in settlements.

<table>
<thead>
<tr>
<th>Case</th>
<th>Year</th>
<th>Complainant</th>
<th>Provider Type</th>
<th>Incumbent Market Share</th>
<th>Incumbent Network Size</th>
<th>Ruling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madden v. California Dental Service</td>
<td>1986</td>
<td>Patient class action</td>
<td>Dentists</td>
<td>15%</td>
<td>-</td>
<td>Pro-MFN</td>
</tr>
<tr>
<td>Kitsap Physicians Service v. Washington Dental Service</td>
<td>1987</td>
<td>Kitsap</td>
<td>Dentists</td>
<td>13-22%</td>
<td>90%</td>
<td>Pro-MFN</td>
</tr>
<tr>
<td>Ocean State v. Blue Cross (Rhode Island)</td>
<td>1989</td>
<td>Ocean State</td>
<td>Physicians</td>
<td>57-80%</td>
<td>-</td>
<td>Pro-MFN</td>
</tr>
<tr>
<td>Willamette Dental Group v. Oregon Dental Service</td>
<td>1994</td>
<td>DoJ</td>
<td>Dentists</td>
<td>-</td>
<td>90%</td>
<td>Anti-MFN</td>
</tr>
<tr>
<td>U.S. v. Delta Dental of Rhode Island</td>
<td>1996</td>
<td>DoJ</td>
<td>Dentists</td>
<td>35-45%</td>
<td>90%</td>
<td>Anti-MFN</td>
</tr>
<tr>
<td>U.S. v. RxCare of Tennessee</td>
<td>1996</td>
<td>FTC</td>
<td>Pharmacies</td>
<td>50%</td>
<td>95%</td>
<td>Anti-MFN</td>
</tr>
<tr>
<td>U.S. v. Medical Mutual of Ohio</td>
<td>1998</td>
<td>DoJ</td>
<td>Hospitals</td>
<td>36%</td>
<td>100%</td>
<td>Anti-MFN</td>
</tr>
<tr>
<td>U.S. v. Blue Cross &amp; Blue Shield of Michigan</td>
<td>2010</td>
<td>DoJ</td>
<td>Hospitals</td>
<td>-</td>
<td>-</td>
<td>?</td>
</tr>
</tbody>
</table>
Figure 3.3: The provider strictly prefers uniform pricing by an amount equal to twice the shaded area, despite neither the average wage nor the average quantity changing. As such, the provider is willing to accept a decrease in the average wage to obtain uniform pricing which leads to the average wage falling, and total quantity along with consumer welfare increasing.
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