Title

Intermediaries in Two-Sided Markets: An Empirical Analysis of the US Cable Television Industry

Journal

American Economic Journal Microeconomics, 8(1)

ISSN

1945-7669

Author

Boik, Andre

Publication Date

2016-02-01

DOI

10.1257/mic.20140167

Peer reviewed

American Economic Journal: Microeconomics 2016, 8(1): 256–282
http://dx.doi.org/10.1257/mic.20140167

Intermediaries in Two-Sided Markets: An Empirical Analysis of the US Cable Television Industry†

By Andre Boik*

Local television stations are platforms in a two-sided market connecting advertisers and viewers. This paper explicitly examines the effect that important intermediaries (*such as cable*, *telephone*, *and satellite distributors*) *may have on a platform's pricing behavior in a two-sided market. I find that stations raise their fees to cable distributors because stations prefer that viewers access their content through satellite distributors with whom they do not compete in the local advertising market*, *and that station mergers lower stations' fees to distributors by partially internalizing a pricing externality that results from the mandatory bundling of local content.* (*JEL* C78, D12, G34, L11, L82, M37)

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 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.[1] Intermediaries exist anytime a platform does not interact directly with one or both sides of the market. Though the existing

* Department of Economics, University of California at Davis, One Shields Avenue, Davis, CA 95616 (e-mail: aboik@ucdavis.edu). This is a revised version of Chapter 1 of my doctoral dissertation. I am very grateful to Kenneth S. Corts, Mara Lederman, and Rahul Deb for their guidance in helping me to complete this paper. I would also like to thank Heski Bar-Isaac, Joshua Gans, Frank Mathewson, Sean May, Robert McMillan, Doug Miller, Matthew Mitchell, Erich Muehlegger, Eric Rasmusen, Marc Rysman, Christopher Snyder, Junichi Suzuki, Hidenori Takahashi, two anonymous referees, as well as seminar participants at the University of Toronto, University of Californa at Davis, Kelley School of Business, Bates White, and CRA Boston for helpful comments and suggestions.

† Go to http://dx.doi.org/10.1257/mic.20140167 to visit the article page for additional materials and author disclosure statement or to comment in the online discussion forum.

[1] Unfortunately, it is common in the two-sided market literature to refer to platforms as intermediaries. Here, the intermediary exists between the platform and end users just as a retailer exists between a manufacturer and consumers. See Figure 1 for further clarification.

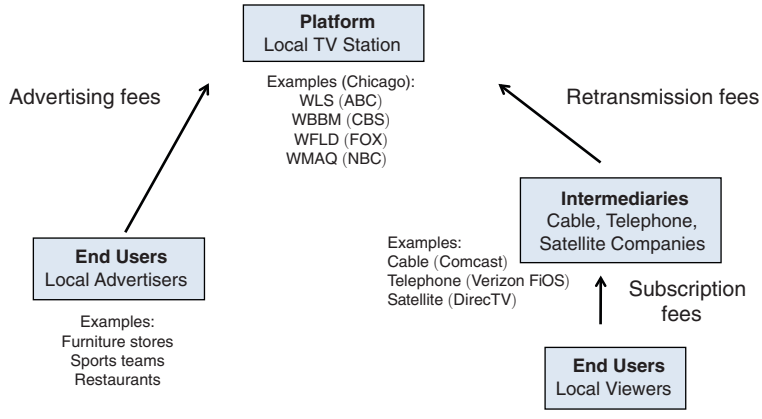

FIGURE 1. LOCAL TELEVISION AS A TWO-SIDED MARKET

Note: Arrows represent dollar flows.

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.[2] 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 percent 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).

My empirical analysis investigates the extent to which intermediaries affect how stations price compared to how they would in the absence of intermediaries. To do

[2] See, for example: Ambrus, Calvano, and Reisinger (2015); Anderson and Gabszewicz (2006); Anderson and Coate (2005); Armstrong (2006); Wilbur (2008); and Wright (2004).

so, I exploit provisions of the 1992 Cable Act and the entry of technologically heterogeneous distributors, satellite and telephone. However, 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 4,500 manually collected zip code-level distributor prices that I have paired with additional zip code and market-level data obtained from multiple media research firms. Since distributor competition varies at the zip code 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. A 1 percent increase in per-household ad rates in a market corresponds to as much as a 7 percent decrease in basic cable prices attributed to decreases in retransmission fees. 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. In particular, a 10 percent increase in overlap between Comcast and Verizon's infrastructure in a given market corresponds to a decrease in basic cable prices of between $0.37 and $0.78 (or between 1.8 percent and 3.8 percent) that is attributed only to changes in retransmission fees, and not due to the direct effect of competition. 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). Instead, 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. The broad implication for the two-sided market literature is 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, which in turn affects platform pricing to that side of the market.

By examining three types of station mergers that occur under different circumstances, I find evidence that station mergers lower retransmission fees. For the most plausibly exogenous set of mergers, a merger between two top-four stations in a market corresponds to basic prices that are on average $3.87 (or 18.9 percent) lower. 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 joint ownership because higher retransmission fees can only be passed through in the form of a higher bundled price for all 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. To my knowledge, there exist only two previous empirical studies of the price effects of platform mergers. The station merger findings here represent a considerable contribution not just because the existing empirical literature is scarce, but also because the station mergers occur under three separate circumstances: mergers strictly approved by the Federal Communications Commission, mergers carried out without such approval, and plausibly exogenous mergers resulting from the death of an owner of a large station conglomerate.

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. With regard to public policy implications, the evidence suggests local television markets warrant consideration as a two-sided market and that competition from technologically heterogeneous distributors may affect station pricing in different ways.

The paper is organized as follows. Section I provides a review of the literature. Section II contains institutional details. Section III describes the empirical approach. Section IV discusses the data. Section V contains the empirical results, and Section VI concludes.

I. 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 persistent 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 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, most importantly, considering an aspect of two-sided markets, which to my knowledge has not been considered before empirically: what effects intermediaries have on platform pricing in a two-sided market.

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 that has relatively elastic demand for the platform, and that prices should be higher for the group that has relatively inelastic demand for the platform. As this relates to the US cable television industry, it is natural to suppose that advertisers value viewers more than viewers value advertisers, a supposition that 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 2010; Chandra and Collard-Wexler 2009), but without clear predictions as of yet.

Empirical research has attempted to test these theories and in particular to identify whether relative prices to each side of the market are a function of each side's elasticity of demand for the platform. Researchers have turned to newspaper and magazine markets where advertising and circulation information has been made available (e.g., Kaiser and Wright 2006; Argentesi and Filistrucchi 2007; Van Cayseele and Vanormelingen 2009; Filistrucchi, Klein, and Thomas 2011). These papers find evidence of textbook two-sided behavior, and that in general advertisers value readers more than vice-versa. Chandra and Collard-Wexler (2009) study a series of mergers in local Canadian newspaper markets and find 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 (e.g., Anderson and Coate 2005 and Wilbur 2008).

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 (2014) provides an excellent example; he uses radio station mergers in the United States to structurally estimate various industry parameters that 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 (2014) 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 (2014), though almost the mirror image of it, because the number of ads and the content aired during "prime time" television hours 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, telephone, or satellite distributors that have the ability to exclude nonpaying viewers.

II. Industry Background

While this paper employs an entirely cross-sectional approach to documenting the ways in which distributors affect station pricing, many economic variables that might ordinarily be expected to vary cross-sectionally are in fact already held constant due to various institutional features of the cable television industry. This section lays out the relevant institutions and the implications of those institutional details for the empirical strategy employed in Section IV.

The US 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 telephone 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 telephone distributor. Cable and satellite distributors have been in the market for at least two decades, but telephone 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 that is negotiated. When distributors acquire the content of a national channel, they also receive 2–3 minutes worth of ad slots per hour for that channel that they can use to sell to advertisers or 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 at the time of writing. Because non-satellite 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), non-satellite distributors can offer advertisers the ability to sell ads that target a local audience. This contrasts with national satellite distributors who distribute their content from satellite and cannot feasibly target local audiences in the same way.[3] Instead, satellite providers sell national advertisements,

[3] Satellite distributors 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.

and so all DirecTV subscribers view the same advertisements on national channels at the same time. The economic implication of the different technologies used by different distributors is that cable and telephone distributors compete with local broadcast stations for local advertising revenues, but satellite distributors do not.

Distributors of all types negotiate with *local* channels (or "stations") to receive content in exchange for a linear fee per subscriber, known as a "retransmission fee." Unlike with national channels, distributors do not receive any local ad slots from stations. Although retransmission revenues are substantial, amounting to roughly $3 billion per year in 2013, stations derive most of their revenues from the sale of advertising slots during "prime time" hours provided by their parent network (e.g., ABC, CBS, FOX, NBC together known as the "Big Four"). The important economic implication here is that local stations have no control over the supply of ads during prime time hours and therefore need only to set their advertising rates at a level that clears their ad inventory.

Retransmission agreements are governed by the 1992 Cable Act, which offers stations the option every three years to demand "must carry" status from distributors. "Must carry" 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. From 1992 until 2005, all 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 2013 aggregate retransmission fees amounted to an estimated $3 billion. Unfortunately, retransmission fees agreed upon between stations and distributors are closely guarded secrets and so are unobserved to the researcher.

While retransmission fees are unobserved, 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 ownership groups (entities that own multiple stations *across* markets). At nearly $1 per subscriber per month, the magnitudes of retransmission fees may appear trivial, but these fees are well above what most national channels receive, many of which receive pennies per subscriber.

Distributors are required by FCC regulations to offer consumers a "basic" bundle of channels for sale that contains (at a minimum) all local channels. Roughly 9 percent of all subscribers subscribe to the basic package. In some areas, the price of basic remains regulated. In this paper, the cable distributor of interest is Comcast, and just under 50 percent of my sample of 4,621 zip code-level Comcast basic prices consists of deregulated prices.

FCC regulations enforce strict 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 ABC, CBS, FOX, and NBC stations in a market. Ownership of stations *across* markets is permitted, however. The economic implication of these ownership rules

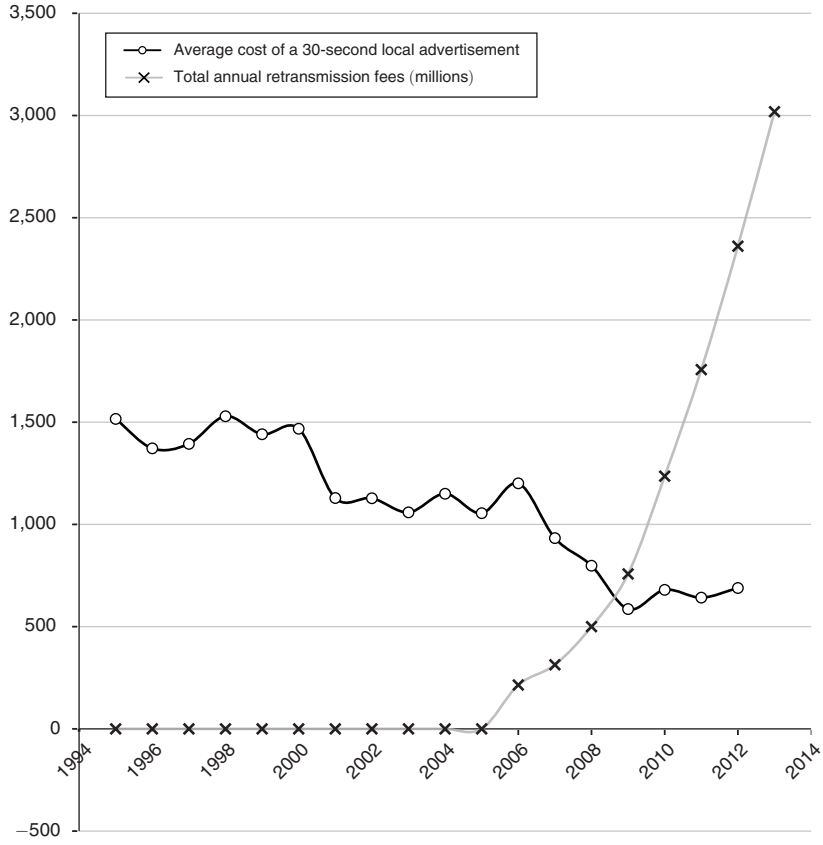

FIGURE 2. INDUSTRY RETRANSMISSION REVENUES AND THE COST OF A 30-SECOND ADVERTISEMENT DURING PRIMETIME HOURS (*averaged across all 210 DMAs*) BY YEAR

Source: SNL Kagan (2013) and Nielsen (2013)

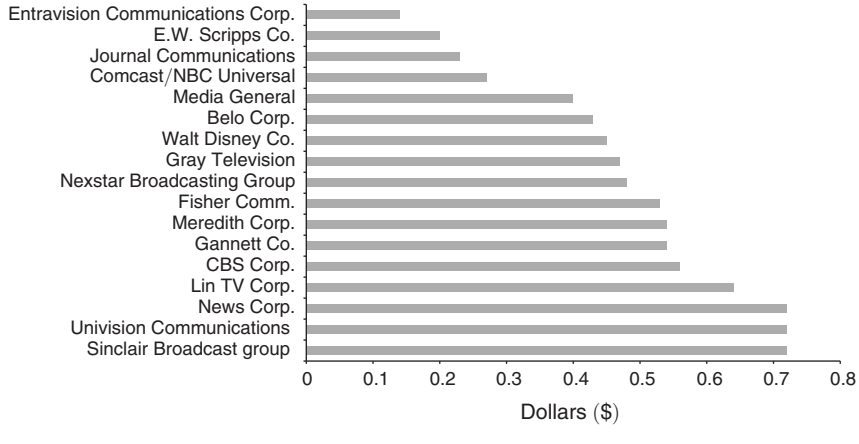

FIGURE 3. ESTIMATES OF RETRANSMISSION FEES PER SUBSCRIBER FOR VARIOUS STATION GROUPS IN 2012 (*Measured in dollars*)

Source: SNL Kagan (2012)

is that market structure among stations is already naturally fixed across markets. Though there are exceptions that occur (and which are later examined as examples of station mergers), each market consists of four Big Four stations with four separate owners. FCC regulations prevent distributors from importing signals from out of market, and so this allows even "small" local stations to be able to extract positive retransmission fees from large national distributors.[4]

III. Empirical Approach

The strategy to identify retransmission fees involves exploiting variation in distributor concentration (i.e., the presence of a telephone distributor) across markets and the fact that distributors do not earn advertising revenues from viewers who subscribe only to basic. It is important to note that by design of local television markets in the United States, this variation occurs while station concentration and content remains virtually fixed across markets. To this end, the main identifying assumptions are that distributor pricing in a given zip code is independent of competition in zip codes elsewhere in the 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).

First, however, I present an empirical model of the advertising market that will serve two key purposes: (i) to introduce notation that will be convenient throughout the rest of the paper, and (ii) to formalize the relevant comparative statics in the advertising market, especially how satellite viewership and geographic concentration affect equilibrium advertising rates, with the latter to eventually serve as an instrument *for* ad rates in the coming analysis of stations' setting of retransmission fees.

A. *The Advertising Market*

There is a large amount of variation in the number of television households across the 210 local television markets and of course larger markets generate larger advertising revenues. It is necessary to create a measure of how lucrative an ad market is in terms of the advertising marginal benefit of an additional subscriber. I define this measure as $AdRate_m = \frac{TotalAdvertisingRevenues_m}{TotalTelevisionHouseholds_m}$, a *per-household* ad rate in market $m \in \{1, \ldots, 210\}$. Ordinarily, pricing in two-sided markets is complicated because of the existence of cross-group externalities: for instance, a station may choose a strategy of reducing the number of ads to increase viewer demand, and then extract higher retransmission fees from distributors. However, the advantage of considering local television stations as platforms is that they do not control the supply of ads seen by viewers during prime time hours, and therefore they cannot pursue the aforementioned strategy. Without the ability to affect viewer demand by adjusting the supply of advertisements seen by viewers, the per-household ad rate chosen by

[4] See Chipty and Snyder (1999) for an analysis of distributor size and bargaining power.

the station is simply the highest one that clears its inventory of ad slots, and changes in *AdRate* across markets is going to be entirely driven by demand shifters that are hypothesized as follows:

$$(1)\quad AdRate_m = \alpha_0 + \alpha_1 FractionSatellite_m + \alpha_2 NumberOfDistributors_m + \alpha_3 NumberOfStations_m + \alpha_4 CitiesInDMA_m + \gamma X_m + \psi_m,$$

where $AdRate_m$ is the average per-household ad rate of the Big Four stations in market m, $FractionSatellite_m$ is the fraction of total paying subscribers (cable + telephone + satellite) that watch via satellite in market m, *NumberOfDistributors* is the number of distributors in the entire market m (the appropriate level of competition on the *advertising* side of the market), and $CitiesInDMA_m$ are the number of major cities in market m included in Neilsen's definition of each designated market area. To validate the two-sided theory of the local market in general, and in particular the effect of satellite viewership on ad rates, α_1 is predicted to be positive so that stations prefer viewership through satellite rather than cable or telephone. More distributors and more stations are expected to increase competition in the ad market, and so α_2 and α_3 are predicted to be negative. For the most part, however, the number of stations is fixed at four. Finally, the number of major cities in a market (as defined by Nielsen), $CitiesInDMA_m$, is expected to decrease per-household ad rates since these markets offer advertisers a less targeted audience, and so α_4 is predicted to be negative.

B. *The Subscription Market*

The first empirical test investigates whether increased distributor competition from telephone distributors results in higher or lower retransmission fees. Competition from telephone may eliminate the incentive stations may otherwise have to charge cable distributors higher retransmission fees since higher fees to cable result in higher cable prices, inducing viewer switching to satellite. Viewer switching to satellite benefits the station because it lessens competition in the advertising market.[5] I carry out a test of this theory that exploits variation in distributor concentration across markets. If cable faces greater competition from telephone downstream, and this affects stations' setting of retransmission fees, then the change in retransmission fees should not only affect zip codes downstream that are cable/telephone duopolies, but also those that remain cable monopolies. To investigate the relationship between distributor competition and retransmission fees, I estimate the following equation:

$$(2)\quad BasicPrice_{zm} = \beta_0 + \beta_1 Telephone_{zm} + \beta_2 ShareDuop_m + \beta_3 StationMerger_m + \gamma X_{zm} + \varepsilon_{zm},$$

[5] Ho and Lee (2013) study a similar tradeoff in an environment where bargaining occurs between hospital and insurers. More competition among insurers may actually lead to higher final prices if hospitals are able to play insurers off against each other to increase their input prices.

where $BasicPrice_{zm}$ is the cable distributor's price of its basic package in zip code z in market m, $Telephone_{zm}$ is a dummy for whether a telephone distributor competes with the cable distributor in zip code z, $ShareDuop_m$ is the fraction of zip codes in market m served by the cable distributor that are cable/telephone duopolies, $StationMerger_m$ controls for the existence of mergers among the Big Four stations in the market, and X_{zm} is a vector of zip code-level controls.[6] In my empirical setting, the only cable distributor considered is Comcast. The identification of the effect of distributor competition on retransmission fees comes through *ShareDuop*. *BasicPrice* is a function of *zip code* competitive and demand conditions, but *market*-level retransmission fees. While *BasicPrice* should be independent of the fraction of zip codes in the rest of the market that are cable/telephone duopolies, retransmission fees *are* affected by the fraction of cable/telephone duopolies in the market, and so retransmission fees in turn affect basic prices in all zip codes in the market.

The key ingredient for identification here is that competition varies at the zip code-level within a market, as otherwise the direct effect of telephone competition on the distributor's basic price could not be separated from the indirect effect of telephone competition on how stations determine their retransmission fees. Therefore by controlling for the direct effect of competition through *Telephone*, *ShareDuop* is an appropriate proxy for retransmission fees, and $\beta_2 < 0$ is evidence in support of a two-sided theory of station behavior: namely, that with a telephone presence in the market, stations have less of an incentive to charge high fees to cable to steer viewers toward satellite. *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 cable 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

$$BasicPrice_{zm} = \beta_0 + \beta_1 Telephone_{zm} + \beta_2 ShareDuop_m + \beta_3 StationMerger_m + \beta_4 AdRate_m + \gamma X_{zm} + \varepsilon_{zm}, \tag{3}$$

where $AdRate_m$ is the average per-household ad rate in market m, and $\beta_4 < 0$ is support in favor of a two-sided theory of station behavior since only a two-sided theory would suggest stations set lower retransmission fees in lucrative ad markets. There are two natural concerns with this estimation technique: endogeneity of $AdRate_m$, and the possibility for reverse causality. An endogeneity problem arises because both basic cable prices and prevailing advertising rates would be expected to be positively correlated with unobserved positive demand shocks. However, the resulting bias is expected to push the estimate of β_4 *upward*, while the purpose of this estimation is to test for the presence of a negative relationship; in other words, the bias makes it harder, not easier, to find a negative relationship between prevailing ad rates and retransmission fees. Nevertheless, an instrumental variables strategy is

[6] Technically, *ShareDuop* is the fraction of cable/telephone duopolies in the market *not including the given zip code*, but this does not affect the analysis since the markets considered all consist of a large number of zip codes.

also employed to tackle the endogeneity problem directly. The proposed instrument is *CitiesInDMA*, a variable that is correlated with advertiser demand but not correlated with demand factors that might affect basic cable prices. *CitiesInDMA* is a relatively arbitrary classification made by Nielsen of which cities should be part of which designated market area; being in a market that is highly segmented and consists of several major cities makes television advertising a relatively weak option for local advertising, yet says nothing about whether the market has positive or negative unobserved demand characteristics. Finally, the interpretation of β_4 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 β_4 is negative, then it could be that low prices are increasing viewership, which in turn is raising ad rates. However, by construction, *AdRate* is a *per-household* ad rate that is independent of the number of viewers and therefore unaffected by the price of basic unless there are strong second-order effects (i.e., that advertiser willingness to pay per-household is *increasing* in the level of viewership). As will be seen, if anything, there is only evidence pointing toward per-household ad rates *decreasing* in the level of viewing households.[7]

The final estimation involving zip code-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). *StationMerger* is broken down into three types of station mergers that can occur. $StationMerger^{FCC}$ are those that occur in name and are officially sanctioned by the FCC, whereas those arising from "local marketing agreements" are not officially approved and arguably violate the FCC's local ownership rules. Among the station mergers arising from local marketing agreements, nearly 25 percent arose as a result of the death of the owner of a large station ownership group, resulting in a purchase by Nexstar Broadcasting. $StationMerger^{NEX}$ represents such Nexstar station mergers, while $StationMerger^{NotNEX}$ represents the remaining station mergers arising from local marketing agreements.

It is well known that firms 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 mergers 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. FCC-approved mergers sometimes occur as a result of one station purchasing a failing station in a market. We may then expect that FCC-approved mergers occur in markets with weak demand characteristics, which will be negatively correlated with basic prices, biasing β_4 downwards.

Mergers that occur as a result of local marketing agreements may be conceived when those mergers are particularly profitable, or because it is the only option to remain viable. Therefore mergers arising from local marketing agreements may either positively or negatively bias the estimate of the true effect of the mergers on retransmission fees via final cable prices. The type of station merger that offers

[7] See Table A1 in the Appendix.

the most promising causal estimate of the effect of station mergers on retransmission fees are those arising from the death of the owner of Mission Broadcasting, and the resulting purchase by Nextstar. Anecdotal evidence suggests the widow was not interested in continuing to operate Mission, but had limited options to sell the group's sizable asset portfolio given FCC ownership restrictions. At the time of writing, Mission Broadcasting exists in name, but its station assets are managed by Nexstar, including retransmission fee negotiations.

IV. Data

A. *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 zip code-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 telephone competition from Verizon at the zip code-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 zip code-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.

B. *Construction of the Sample*

The sample period is January 2013. I restrict the advertising data only to include advertising revenues collected during prime time (8–11 PM) programming as this does not vary across stations with the same parent network. Duplicate Comcast price observations within the same zip code are omitted as the price data collected almost never varies within zip codes. The remaining number of zip code-level basic price observations is 4,621.

C. *Variables and Descriptive Statistics*

Variables and definitions are presented in Table 1, while summary statistics broken down by the level of observation are presented in Table 2. Comcast is the largest distributor in the US market with over 20 million subscribers and is the only distributor for which I have collected basic price data. The corresponding variable is *BasicPrice*.

Roughly 54 percent of Comcast's basic prices remain regulated by local municipalities and are therefore less likely to be responsive to changes in retransmission fees. Unfortunately, the FCC only provides data on regulated prices at the county level, whereas basic prices are collected at the zip code level. Because zip codes can cross county lines, it is necessary to construct a measure of the fraction of the zip

Table 1—Variable Names and Definitions

Zip code level	Definition	Source
BasicPrice	Comcast's price for its basic cable package	Web Scraping
Fraction Regulated	Fraction of zip code overlapping in counties with regulated prices	FCC
Verizon	= 1 if Verizon FiOS is available	SNL Kagan
Income	Median income (1,000s)	IRS
Market level	**Definition**	**Source**
ShareDuop	Fraction of zip codes in a market in which Verizon FiOS is available	Constructed
$StationMerger^{FCC}$	= 1 if Big Four station merger (FCC sanctioned)	SNL Kagan
$StationMerger^{NEX}$	= 1 if Big Four station merger (station owner's death)	ACA
$StationMerger^{NotNEX}$	= 1 if Big Four station merger (not station owner's death)	ACA
AdRate	Average Big Four stations' *per household* revenue for 30-second ad	KANTAR Media
Fraction Satellite	Fraction of satellite subscribers	SNL Kagan
Number of Distributors	Number of cable, telephone, and satellite companies available	SNL Kagan
DMA Density	DMA population density (1,000s) per square mile	SNL Kagan
DMA Income	DMA median income (1,000s)	SNL Kagan
Cities in DMA	Number of cities included in the DMA name	SNL Kagan
X Cities in DMA	= 1 if *Cities in DMA* = *X*, for *X* = 2, 3, 4	SNL Kagan

Note: ACA = American Cable Association, FCC = Federal Communications Commission, IRS = Internal Revenue Service

Table 2—Summary Statistics

Zip code level	Observations	Mean	SD	Min	Max	Markets
Basic Price	4,621	20.53	5.19	5.05	29.97	97
Fraction Regulated	4,621	0.54	0.38	0	1	97
Verizon	4,621	0.19	0.39	0	1	97
ShareDuop	4,621	0.20	0.33	0	0.90	97
$StationMerger^{FCC}$	4,621	0.03	0.19	0	2	97
$StationMerger^{NEX}$	4,621	0.01	0.11	0	1	97
$StationMerger^{NotNEX}$	4,621	0.05	0.25	0	2	97
Income (*median*, *1,000s*)	4,621	17.01	9.67	0	73.70	97
Market level	**Observations**	**Mean**	**SD**	**Min**	**Max**	**Markets**
AdRate (*per 1,000 households*)	210	1.67	0.82	0.75	7.04	210
DMA Income (*average*, *1,000s*)	210	44.39	8.31	26.62	78.09	210
Fraction Satellite	210	0.45	0.16	0.09	1	210
Number of Distributors	210	5.50	1.66	2	11	210
Number of Stations	210	3.62	0.82	1	4	210
DMA Density	210	0.14	0.18	0.00	1.47	210
Cities in DMA	210	1.59	0.78	1	4	210
Two Cities in DMA	210	0.30	0.46	0	1	210
Three Cities in DMA	210	0.11	0.31	0	1	210
Four Cities in DMA	210	0.02	0.15	0	1	210

code that exists in regulated counties. This variable is denoted *FractionRegulated*, and can take on any value between zero (entirely deregulated) and one (entirely regulated). For example, *FractionRegulated* is equal to 0.7 for a given zip code if 70 percent of the geographic area of the zip code is in counties that have regulated pricing.

The source of variation in distributor competition comes from the entry of telephone distributor Verizon FiOS that occurred over the period of 2006–2009. Verizon is the only telephone distributor that, conditional on being in a market, offers its

services in some zip codes 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 zip code in every market, and AT&T U-verse operates in virtually every zip code in markets where it has a presence because of its history as a home phone provider.[8] Verizon competes with Comcast in 13 markets, and in roughly 20 percent of all zip codes in the sample collected. Verizon does not vary its prices across zip codes or DMAs. *ShareDuop* represents the number of zip codes in a given market that are Comcast-Verizon duopolies. Conditional on Verizon being in a market, Verizon may compete with Comcast in as few as 9 percent of zip codes in the market, or as many as 90 percent. 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, *AdRate*. Each station's aggregate advertising revenues during the primetime hours (roughly 8–11 PM) 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 + telephone subscribers + satellite subscribers. 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 $1.67.[9]

V. Results

A. *The Estimated Effect of Satellite Viewership on Advertising Rates*

Table 3 presents the estimates corresponding to equation (1) and shows that satellite viewership has both a statistically and economically significant effect on per-household ad rates. Since the mean of $AdRate_m$ is $1.67, the estimated effect of a 1 percent increase in satellite viewership corresponds to a roughly 1.4 percent increase in average per-household advertising revenues for Big Four stations. Given the size of this estimate, the incentive for stations to increase satellite viewership relative to cable viewership is strong, and should be expected to affect how stations set their retransmission fees to cable distributors. While it is possible that there are unobserved factors in the market that are correlated with both satellite viewership and per-household advertising rates, density is not one of them as it appears as a control. Naturally, there may exist other unobservable factors that affect both per-household advertising rates and satellite penetration that drive the observed relationship. The purpose here is more modest: to present at a minimum unconditional empirical evidence in support of the intuitive claim that stations benefit from less competition in the advertising market.

[8] AT&T entered the television market by laying new fiber wires that connect to neighborhood 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 neighborhoods was very low and resulted in complete market coverage.

[9] In contrast to the common advertising metric cost-per-impression (CPM) that measures the cost of 1,000 actual impressions, typically 10–15 times larger than *AdRate*.

TABLE 3—COMPARATIVE STATICS ON THE ADVERTISING SIDE OF THE MARKET

Dependent variable	*AdRate*
Fraction Satellite	2.25***
	(0.36)
Number of Distributors	−0.12***
	(0.03)
Number of Stations	−0.12**
	(0.06)
Cities in DMA	−0.18***
	(0.06)
$StationMerger^{FCC}$	0.40***
	(0.12)
$StationMerger^{NEX}$	0.41**
	(0.20)
$StationMerger^{NotNEX}$	0.05
	(0.11)
DMA Income	0.02***
	(0.01)
DMA Density	0.47
	(0.33)
Constant	1.08***
	(0.37)
R^2	0.42
Observations	210

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Similar to satellite, the number of distributors in the market also has an effect on per-household ad rates, and while smaller than the effect that occurs through satellite viewership, a significant increase in the number of distributors operating in a market can quickly drive down per-household ad rates. The number of cities in a Nielsen-defined designated market area has a negative effect on per-household advertising rates: the less geographically concentrated a market is, the less likely it is that local advertisers (who may only operate in part of the market) will view local television advertising as a desirable option. When *CitiesInDMA* is broken down into dummies for when $CitiesInDMA = 2, 3, 4$, the expected decreasing pattern arises (see Table A2 in the Appendix). It is also worth noting that station mergers of various types are associated with higher per-household ad rates as expected: stations have no "two-sided" incentive to lower ad rates after a merger as ad rates have no effect on viewership.

B. *The Estimated Effects of Distributor Market Structure on Retransmission Fees*

Table 4 estimates the effect of distributor competition from Verizon on retransmission fees, proxied for by Comcast basic prices. The first column includes only basic prices in zip codes that lie in entirely deregulated jurisdictions so that the choice of basic price is guaranteed to be made by Comcast. The direct effect of Verizon's presence in a zip code is negative, significant, and associated with a $2 decrease in

Table 4—The Effect of Distributor Competition from Verizon on Stations' Setting of Retransmission Fees

Dependent variable	*BasicPrice* (1)	*BasicPrice* (2)	*BasicPrice* (3)
Verizon	−2.00*	0.49	0.49
	(1.14)	(1.62)	(1.82)
ShareDuop	−5.11**	−9.37***	−0.94
	(2.18)	(2.51)	(2.22)
Fraction Regulated		−4.54***	
		(1.38)	
Verizon × *Fraction Regulated*		−2.13	
		(2.29)	
ShareDuop × *Fraction Regulated*		7.15***	
		(2.02)	
Income	0.01	0.04*	0.05
	(0.06)	(0.02)	(0.05)
Constant	23.61***	23.48***	19.57***
	(1.11)	(1.01)	(0.80)
Regulated basic prices	None	Some	All
Four station markets only	Yes	Yes	Yes
R^2	0.41	0.22	0.01
Observations	225	3,872	536

Note: Standard errors are clustered at the DMA (market) level.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Comcast's basic price (a roughly 10 percent decrease in price as a result of direct competition). This variable, however, should be viewed as a necessary control and not as a direct variable of interest; Verizon's entry into certain zip codes is certainly endogenous, as Verizon likely entered zip codes that were particularly profitable for reasons not observed to the researcher, and as a result the negative estimate is likely biased *upward*.

While estimating the direct effect of competition from Verizon on Comcast's basic prices is interesting, the key estimate of interest is how the extent of competition in *other zip codes* in the market affects how retransmission fees are set by stations, which in turn affects all zip codes in the market, even those that were not entered by Verizon. A proxy for this effect is *ShareDuop*, which has a statistically and economically significant effect on Comcast's basic prices: a 10 percent increase in the number of Comcast-Verizon duopolies in a market decreases Comcast's basic prices *in zip codes without a change in competition* by roughly $0.50. Note that this estimate is not affected by the fact that Verizon's entry into certain zip codes is endogenous: the variable *Verizon* holds distributor market structure constant, so that Comcast monopoly prices are compared to other Comcast monopoly prices (as a function of how competitive the *rest* of the market is), and similarly, Comcast duopoly prices are compared to other Comcast duopoly prices. This result is robust to weighting zip codes by subscribers, since, of course, the total number of subscribers that exist under Comcast-Verizon duopolies is what is expected to affect stations' setting of

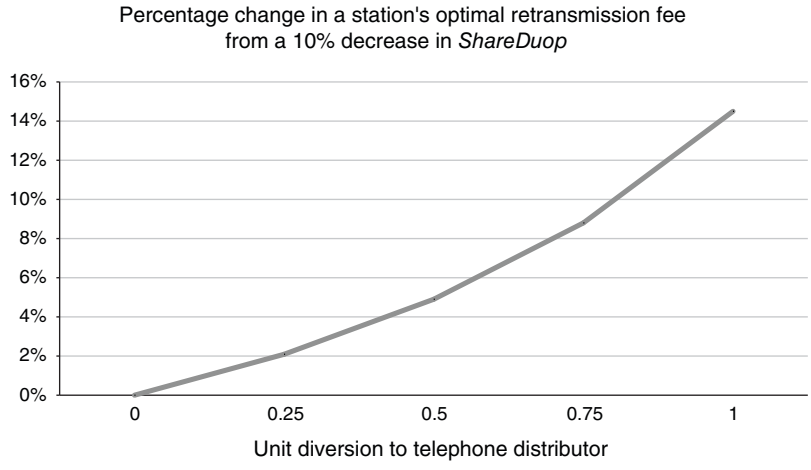

FIGURE 4. CALIBRATED ESTIMATES OF RETRANSMISSION FEE SENSITIVITY TO DISTRIBUTOR MARKET STRUCTURE

retransmission fees, and not just the number of zip codes. The subscriber-weighted estimates are presented in the Appendix in Table A3.

To get a better sense of the economic significance of a station's incentive to steer viewers toward satellite, and to examine whether the reduced form estimate of *ShareDuop* is robust, it is useful to consider a simple calibrated model of an abstract designated market area. While the details of this calibration are left to the Appendix, Figure 4 illustrates the predicted increase in a station's retransmission fee as a result of a hypothetical 10 percent decrease in *ShareDuop*. The effect is nonexistent if all cable subscribers view satellite as the next best alternative to cable, and largest when cable subscribers view telephone as the next best alternative to cable. The intuition is that if all substitution occurs to satellite even in the presence of telephone, then the existence of telephone is irrelevant, and so is *ShareDuop*. In contrast, if the presence of telephone entirely eliminates substitution from cable to satellite, then stations' ability to steer subscribers to satellite vanishes and the change in retransmission fees is most sensitive to *ShareDuop*. The calibrated model suggests a 10 percent decrease in *ShareDuop* can lead to as much as a 14.4 percent increase in retransmission fees. The corresponding reduced form estimate using the same pass-through rate as in the calibrated model is a 15.6 percent increase in retransmission fees. This suggests the calibrated estimate is more consistent with the lower subscriber-weighted estimate of *ShareDuop* presented in Table A3 in the Appendix. While telephone distributors are likely a better substitute for cable subscribers than satellite, some substitution would of course occur to satellite, and so these estimates should be viewed as upper bounds on the sensitivity of retransmission fees to the extent of telephone competition downstream.

The second specification of Table 4 interacts *ShareDuop* with *FractionRegulated* to include the rest of the sample, but recognizing that some zip codes are "more regulated" than others. A similar result emerges: more downstream competition from Verizon lowers prices even in zip codes unaffected by entry directly, but affected indirectly through changes in market-level retransmission fees. Finally, as a falsification

exercise, the third specification includes only zip codes which are entirely regulated, and as expected, the regulated prices are not responsive to competitive conditions.

One might wonder whether in fact Comcast sets its basic prices at the zip code-level, but at a more aggregate level, such as the headend facility (i.e., master distribution facility), cable "system," or county. If so, then *ShareDuop* might not be independent of the direct competition control *Verizon*, in which case the *ShareDuop* coefficient would be negative because it is absorbing part of the variation in prices caused directly from competition. However, in the raw basic price data, variation is prevalent in prices across zip codes contained within each of the more aggregate levels referenced above.[10] Since I observe no price variation within zip codes, these facts support the hypothesis that prices are set at the zip code level. In addition, the existence of regulated prices permits a "placebo test" that supports the theory presented: none of the relevant variables are significant when restricting the sample to consider only regulated prices out of the control of Comcast.

This finding suggests that when Comcast faces competition primarily from Verizon elsewhere in the market, retransmission fees are lower compared to a situation where Comcast faces competition primarily from satellite distributors. The explanation for this result is closely related to the 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 telephone 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 telephone 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 telephone). This explanation suggests stations care not only about the absolute number of viewers, but also the composition of viewers across different distributors, and highlights a channel through which final cable prices are affected by retransmission fees that cannot be explained without considering the connection between the advertising and subscription sides of the local television market.

An alternative explanation for this finding is 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 nontrivial process).

[10] There exist multiple headends per cable system or county, and for 51 percent of those headends, including those serving very few zip codes, there exists price variation across zip codes connected to the same headend.

TABLE 5—THE EFFECT OF PER HOUSEHOLD ADVERTISING RATES ON STATIONS' SETTING OF RETRANSMISSION FEES

Dependent variable	*BasicPrice* 2SLS (1)	*BasicPrice* 2SLS (2)
Verizon	0.19	−1.48
	(1.65)	(1.33)
ShareDuop	−4.39**	−4.98***
	(1.73)	(1.91)
AdRate	−11.79*	−3.52
	(6.66)	(2.88)
Income	−0.03	−0.00
	(0.07)	(0.05)
Constant	39.67***	28.59***
	(8.79)	(4.50)
Regulated basic prices	None	None
Four station markets only	Yes	No
R^2	0.09	0.16
Observations	225	309

Notes: Standard errors are clustered at the DMA (market) level. First stage regressions for IV estimates are provided in the Appendix in Table A2.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

C. *The Estimated Effect of Advertising Rates on Retransmission Fees*

Table 5 estimates the effect of advertising rates on retransmission fees (proxied for by Comcast basic prices) with the baseline specification carried forward from Table 4. Because advertising rates and cable prices are both expected to be correlated with unobserved demand characteristics, I instrument for *AdRate* using *CitiesInDMA* dummies. The first stage appears in Table A2 in the Appendix. Specification (1) considers only markets with four stations, while specification (2) allows for smaller markets that contain fewer than four stations. The results point toward a negative relationship between per-household ad rates and retransmission fees, though the point estimates vary significantly across the two specifications and so a reliable estimate is difficult to pin down. Despite imprecise estimates, the evidence suggests a negative relationship between ad rates and retransmission fees, amounting to additional (though unreliable) evidence that stations set retransmission fees to cable distributors as a function of conditions in the advertising market.

D. *The Estimated Effect of Station Mergers on Retransmission Fees*

Table 6 estimates the effect of three types of station mergers on retransmission fees, again proxied for by Comcast basic prices. The three types of mergers considered are those officially sanctioned by the FCC, $StationMerger^{FCC}$; and those conceived via local marketing agreements without the consent of the FCC and can be broken down into those involving Nexstar, $StationMerger^{NEX}$; and those not

Table 6—The Effect of Three Types of Station Mergers on Stations' Setting of Retransmission Fees

Dependent variable	*BasicPrice* 2SLS (1)	*BasicPrice* 2SLS (2)
Verizon	0.55	0.50
	(2.08)	(1.62)
ShareDuop	−3.81*	−9.43***
	(2.22)	(2.51)
Fraction Regulated		−4.51***
		(1.42)
Verizon × *Fraction Regulated*		−2.13
		(2.31)
ShareDuop × *Fraction Regulated*		7.12***
		(2.05)
AdRate	−14.46	0.24
	(9.29)	(3.84)
$StationMerger^{FCC}$	−2.08	0.92
	(1.55)	(2.11)
$StationMerger^{NEX}$	9.60	−3.87**
	(7.82)	(1.88)
$StationMerger^{NotNEX}$	0.00	−0.32
	(·)	(1.09)
Income	−0.02	0.04*
	(0.08)	(0.02)
Constant	42.80***	23.21***
	(12.08)	(5.56)
Regulated basic prices	None	Some
Four station markets only	Yes	Yes
R^2	0.06	0.23
Observations	225	3,872

Note: Standard errors are clustered at the DMA (market) level.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

involving Nexstar, $StationMerger^{NotNEX}$. No statistically significant relationship is found between FCC-approved mergers and basic cable prices across either specification. Too few Nexstar mergers appear in zip codes guaranteed to have deregulated prices, and so no effect of Nexstar mergers on basic cable prices appears in the first specification. Specification (2), however, considers the full set of Nexstar mergers and shows a strong statistically and economically significant negative effect of the Nexstar-Mission station mergers on cable prices. [11]

Station mergers resulting from the Nexstar-Mission agreement are those of most interest because they are the only mergers in the sample that are plausibly exogenous. Since exogenous mergers rarely occur, the Nexstar-Mission agreement is a

[11] There were nine instances of two mergers occurring in the same DMA. In this case, *StationMerger* takes on a value of two. Alternative specifications such as treating *StationMerger* as a dummy for the existence of any merger has a negligible effect on all relevant coefficient estimates and standard errors.

significant opportunity to examine the effect of station mergers on retransmission fees. Moreover, these mergers do not result in a change in quality or content during prime time hours since those decisions are made by the parent network, and so there are limited avenues through which station mergers can affect final cable prices other than through retransmission fees. I find that markets where Nexstar-Mission mergers have occurred have cable prices that are $3.87 lower on average. One natural explanation for this finding is that it mitigates the externality created by the forced bundling of local stations that causes stations to raise retransmission fees higher than they otherwise would since they do not internalize the effect that this has on rival stations in the market. Station mergers internalize this externality, and would be expected to unambiguously lower retransmission fees.[12]

VI. 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 United States, because it is a distributor that does vary the price of its basic package across markets and even zip codes. 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 moderate evidence 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. 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 telephone distributor such as

[12] 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 exist between a station and distributor in a single local market, the expected effect of local bundling on input prices (retransmission fees) is unambiguously positive.

Verizon FiOS. The explanation for this finding is that when a telephone 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 telephone distributor present, higher cable prices mostly induce switching to telephone (which has no effect on competition in the ad market). I find that this is the major mechanism through which two-sided pricing behavior is present in local television markets. The main implication of this finding for the study of two-sided markets is that, in general, platforms may have preferences over which intermediaries end users choose, and as a result may set different input prices to different intermediaries. Such variation in input prices in turn generates variation in final consumer prices, and that variation in final prices cannot be explained by a model that assumes platforms directly interact with both groups of end users.

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 when station mergers are not permitted. 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 thus retransmission fees are set too high from the joint perspective of stations. In examining three types of station mergers that occur in my sample, including a set of 11 station mergers induced by the death of a station group's private owner, I find evidence that station mergers lower retransmission fees, and in turn lower final cable prices. The implication of this finding for the study of two-sided markets is that non-price actions taken by intermediaries, such as bundling of rival platforms, also affects the pricing incentives of platforms which in turn affect the level of final consumer prices.

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 local television industry, which remains governed by the 1992 Cable Act. The empirical results of this paper suggest that the local television market warrants consideration as a two-sided market. Whether a market is two-sided or not is important since policy prescriptions in two-sided markets may differ substantially from those in standard "one-sided" markets. For example, even mergers among distributors that do not compete for subscription revenues, such as Comcast and Time Warner Cable, will increase ad rates in local markets (where they do compete), which may then induce stations to lower retransmission fees in those markets. If so, then final cable prices may *fall* as a result of the merger, despite no change in distributor concentration at the subscriber level.

Appendix

A. *First-Stage Results and Robustness Checks*

Table A1—Per Household Advertising Revenues (*AdRate*) Are Nonincreasing in Market Size

Dependent variable	*AdRate* (1)
Total Households (*100,000s*)	−0.02**
	(0.01)
R^2	0.03
Observations	210

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table A2—First-Stage Regressions Corresponding to Specifications (1) and (2) in Table 5

Dependent variable	*AdRate* (1)	*AdRate* (2)
Verizon	0.10**	0.25
	(0.05)	(0.23)
ShareDuop	0.08	−0.39
	(0.09)	(0.34)
Two Cities in DMA	−0.29***	−0.52**
	(0.09)	(0.18)
Three Cities in DMA	−0.23**	−0.56**
	(0.09)	(0.21)
Four Cities in DMA		−0.94***
		(0.20)
Income	−0.00	−0.00
	(0.00)	(0.00)
Constant	1.49***	1.81***
	(0.07)	(0.19)
Regulated basic prices	None	None
Four station markets only	Yes	No
R^2	0.43	0.34
Observations	225	309

Note: Standard errors are clustered at the DMA (market) level.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

TABLE A3—REPRODUCTION OF TABLE 6 WITH *ShareDuop* CONSTRUCTED USING SUBSCRIBER-WEIGHTED ZIP CODES

Dependent variable	*BasicPrice* 2SLS (1)	*BasicPrice* 2SLS (2)
Verizon	1.64	−0.96
	(3.41)	(1.60)
ShareDuop	−4.58***	−6.83***
	(1.45)	(2.57)
Fraction Regulated		−4.54***
		(1.40)
Verizon × *Fraction Regulated*		−0.81
		(2.39)
ShareDuop × *Fraction Regulated*		5.04***
		(1.72)
AdRate	−14.81	0.10
	(9.30)	(3.84)
$StationMerger^{FCC}$	−2.16	0.96
	(1.57)	(2.10)
$StationMerger^{NEX}$	9.84	−3.77**
	(7.81)	(1.89)
$StationMerger^{NotNEX}$	0.00	−0.31
	(·)	(1.10)
Income	−0.03	0.04
	(0.08)	(0.02)
Constant	43.30***	23.40***
	(12.12)	(5.56)
Regulated basic prices	None	Some
Four station markets only	Yes	Yes
R^2	0.05	0.22
Observations	225	3,872

Note: Standard errors are clustered at the DMA (market) level.
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

B. *Simple Calibration of an Abstract Designated Market Area*

Consider an abstract designated market area consisting of many otherwise identical zip codes that may be served by cable and satellite (CS) or cable, satellite, and telephone (CST). If $ShareDuop = 1$, then every zip code is CST and the profit function of a single upstream television station that must choose its retransmission fee is

$$\pi^{CST} = t_c q_c + t_s q_s + t_t q_t + AdRate(FractionSatellite)K,$$

where t represents the per-subscriber retransmission fee for cable, satellite, and telephone, respectively; *AdRate* is the station's advertising rate per 1,000 subscribers for a single 30-second advertisement that depends on *FractionSatellite*; and

K is the station's exogenous total supply of monthly 30-second advertisements. If $ShareDuop = 0$, then every zip code is *CS* and the profit function is

$$\pi^{CS} = t_c q_c + t_s q_s + AdRate(FractionSatellite)K.$$

Assuming perfectly inelastic aggregate demand for television, and that $t_s = t_t$ are already chosen and fixed, the first-order conditions with respect to t_c are

$$\frac{d\pi^{CST}}{dt_c} = p_c + \varepsilon_c \frac{\partial p_c}{\partial t_c}(t_c - t_s) + \frac{dAdRate}{dFractionSatellite}\frac{K}{q_c + q_s + q_t}\frac{p_c}{q_c}\frac{dq_s}{dt_c} = 0$$

$$\frac{d\pi^{CS}}{dt_c} = p_c + \varepsilon_c \frac{\partial p_c}{\partial t_c}\left(t_c - t_s - \frac{dAdRate}{dFractionSatellite}\frac{K}{q_c + q_s + q_t}\right) = 0.$$

If *ShareDuop* is between zero and one, then the station will choose an average of each t_c implied by the two first-order conditions, weighted appropriately by *ShareDuop*. To calibrate the model, it is convenient to normalize $t_s = t_t = 1$ and total subscribers to 1,000 (since *AdRate* is interpreted per 1,000 subscribers). Crawford and Yurukoglu (2012) provide $\varepsilon_c = \frac{\partial q_c}{\partial p_c}\frac{p_c}{q_c} = -4.12$ as an estimate of the own price elasticity of basic cable with an implied pass through rate of $\frac{\partial p_c}{\partial t_c} = 0.80$ evaluated at a mean of $p_c = 13.49$ and $\frac{dAdRate}{dFractionSatellite} = 2.25$ from Table 3. Since retransmission fees accounted for 9 percent of total station revenues and $AdRate = 1.67$ on average, $K = 6{,}055$ is the value that matches that industry average target.[13] These estimates fully characterize the duopoly first order condition.

A hypothetical increase of *ShareDuop* by 10 percent depends critically on the unit diversion ratios of cable to satellite and cable to telephone in *CST* zip codes. In other words, if the price of cable were to rise such that the output of cable were to decrease by one, the unit diversion ratio measures what fraction of that unit of output would reappear as telephone versus satellite output. To my knowledge there are no industry estimates of the unit diversion ratio of cable to telephone. By the assumption of aggregate inelastic demand for television, the lost unit of cable output must be fully divided (according to some unknown fraction) between satellite and telephone. Under *CS*, the fraction allocated to telephone is zero because it is unavailable. Under *CST*, that fraction is the unknown unit diversion to the telephone distributor.

Figure 4 presents the calibrated model's predicted percentage increase in a station's retransmission fee arising from a 10 percent decrease in *ShareDuop*, evaluated at $ShareDuop = 0.67$ (the mean, conditional on Verizon entry in the market). The percentage change is zero when the telephone diversion ratio is zero because that implies all cable subscribers switch to satellite when the price of cable rises, even when telephone is available, and so *ShareDuop* is irrelevant. If, however, the

[13] Source: SNL Kagan (2012)

telephone diversion ratio is one, and all cable subscribers who switch choose to switch to telephone, then a 10 percent change in *ShareDuop* has a strong effect on the station's choice of retransmission fee. The intuition for this strong effect when cable subscribers prefer to switch to telephone over satellite is that the station fully loses its ability to steer subscribers to satellite in zip codes where telephone is available, and *ShareDuop* measures the fraction of such zip codes. Figure 4 shows that when cable subscribers mostly view telephone as the next best alternative to cable, a 10 percent decrease in *ShareDuop* can lead to as much as a 14.4 percent increase in retransmission fees.

REFERENCES

Ambrus, Attila, Emilio Calvano, and Markus Reisinger. 2015. "Either or Both Competition: A 'Two-Sided Theory' of Advertising with Overlapping Viewerships." http://www.dice.hhu.de/fileadmin/redaktion/Fakultaeten/Wirtschaftswissenschaftliche_Fakultaet/DICE/Konferenzen_und_Seminare/Konferenzen_und_Seminare/Forschungsseminar/Reisinger.pdf.

Anderson, Simon P., and Stephen Coate. 2005. "Market Provision of Broadcasting: A Welfare Analysis." *Review of Economic Studies* 72 (4): 947–72.

Anderson, Simon P., and Jean J. Gabszewicz. 2006. "The Media and Advertising: A Tale of Two-Sided Markets." In *Handbook of Cultural Studies*, edited by Victor Ginsburgh and David Throsby, 567–614. Amsterdam: North-Holland.

Argentesi, Elena, and Lapo Filistrucchi. 2007. "Estimating Market Power in a Two-Sided Market: The Case of Newspapers." *Journal of Applied Econometrics* 22 (7): 1247–66.

Armstrong, Mark. 2006. "Competition in Two-Sided Markets." *RAND Journal of Economics* 37 (3): 668–91.

Boik, Andre. 2016. "Intermediaries in Two-Sided Markets: An Empirical Analysis of the US Cable Television Industry: Dataset. *American Economic Journal: Microeconomics*. http://dx.doi.org/10.1257/mic.20140167.

Caillaud, Bernard, and Bruno Jullien. 2003. "Chicken and Egg: Competition among Intermediation Service Providers." *RAND Journal of Economics* 34 (2): 309–28.

Chandra, Ambarish, and Allan Collard-Wexler. 2009. "Mergers in Two-Sided Markets: An Application to the Canadian Newspaper Industry." *Journal of Economics and Management Strategy* 18 (4): 1045–70.

Chipty, Tasneem, and Christopher M. Snyder. 1999. "The Role of Firm Size in Bilateral Bargaining: A Study of the Cable Television Industry." *Review of Economics and Statistics* 81 (2): 326–40.

Crawford, Gregory S., and Ali Yurukoglu. 2012. "The Welfare Effects of Bundling in Multichannel Television Markets." *American Economic Review* 102 (2): 643–85.

Filistrucchi, Lapo, Tobias Klein, and Michielsen Thomas. 2011. "Assessing Unilateral Merger Effects in a Two-Sided Market: An Application to the Dutch Daily Newspaper Market." Università degli Studi di Firenze Dipartimento di Scienze Economiche Working Paper 15/2011.

Ho, Kate, and Robin S. Lee. 2013. "Insurer Competition and Negotiated Hospital Prices." National Bureau of Economic Research (NBER) Working Paper 19401.

Jeziorski, Przemysław. 2014. "Effects of Mergers in Two-Sided Markets: The US Radio Industry." *American Economic Journal: Microeconomics* 6 (4): 35–73.

Kaiser, Ulrich, and Julian Wright. 2006. "Price structure in two-sided markets: Evidence from the magazine industry?" *International Journal of Industrial Organization* 24: 1–28.

Rochet, Jean-Charles, and Jean Tirole. 2002. "Cooperation among competitors: Some economics of payment card associations." *RAND Journal of Economics* 33 (4): 549–70.

Van Cayseele, Patrick, and Stijn Vanormelingen. 2009. "Prices and Network Effects in Two-Sided Markets: The Belgian Newspaper Industry." Hogeschool-Universiteit Brussel Working Paper 2009/06.

Weyl, E. Glen. 2010. "A Price Theory of Multi-Sided Platforms." *American Economic Review* 100 (4): 1642–72.

Wilbur, Kenneth C. 2008. "A Two-Sided, Empirical Model of Television Advertising and Viewing Markets." *Management Science* 27 (3): 356–78.

Wright, Julian. 2004. "One-sided Logic in Two-sided Markets." *Review of Network Economics* 3 (1): 44–64.