Clustered Acquisitions in the Cable Television Industry: Policy and Strategy

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Abstract

Since the passage of the Telecommunications Act of 1996, the U.S. cable television industry has consolidated. As of January 2013, the five largest cable operators have more than 80% market share. We document the growth of these five operators in the context of U.S. merger and anti-trust regulation – particularly the Hart-Scott-Rodino asset transfer reporting requirement. Using data from the Federal Communications Commission, the U.S. Census Bureau, and the Federal Trade Commission, we reconstruct the patterns of ownership from 2000 to the present, identifying 712 purchases made by the top firms. We show that companies have pursued a highly clustered acquisition policy and have successfully purchased many direct competitors. We provide suggestive evidence in the form of a reduced form model of the value of clustering and the costs of HSR compliance and propose a more robust structural model to study these benefits and costs in more detail in future work.

1 Introduction

In 2002, the top five cable providers[1] had 66% share in the national market for cable provision. Today, the top five providers[2] control almost 90% of the market.

This change in industry orientation, accomplished through a number of acquisitions of various sizes, provides an unusually large sample of similar acquisitions useful for studying

[1] In descending market share order: AT&T, Time Warner, Comcast, Charter, and Cox

[2] In descending market share order: Comcast, Time Warner, Cox, AT&T, and Charter

firm strategies and the impact of merger policy. For example, Comcast completed over 300 acquisitions in the period from 2000 to 2012. Most of these purchases brought Comcast into an area that it did not already serve, but in 5% of the communities involved in acquisitions, the acquired provider's infrastructure was *overbuild*; in other words it had directly competed with Comcast and Comcast's acquisition had increased its market power in the community. In economic terms we call the former a non-horizontal (or conglomerate) purchase and the latter a horizontal purchase. Due to the large fixed costs involved in laying cable in an area, cable markets are often thought of as natural monopolies and overbuild[3] is rare.[12]

This paper documents the patterns of acquisitions for the current top five cable operators, as well as Adelphia Communications Corporation, which declared bankruptcy in 2002 and was eventually acquired by Comcast and Time Warner in 2006. We use data from the Federal Communications Commission (FCC) and the U.S. Census Bureau to reconstruct the pattern of ownership for each "cable community" in the United States from 2000 to 2012 and identify 712 purchases made by these companies during this period. Furthermore, we use data from the Federal Trade Commission to examine the level of scrutiny devoted to each transaction. We show 10% of purchases involved some horizontal component. Additionally, we show many purchases are near-horizontal, or clustered, in the sense that they expand the reach of a cable provider in a local area. This follows intuitively from the idea that cable providers may be able to combine the capital and labor needed to administer the system and reduce fixed costs. Indeed, the number of cable "headends," facilities that replicate signals over an area, has decreased by a third since 1998 as shown in Figure 1.

While most of these near-horizontal purchases have little direct effect upon consumers (since they essentially are shifted from one monopoly to another), they may have large effects on other businesses. For example, on August 2, 2013, CBS stations in major markets across the country were pulled from Time Warner Cable systems after carriage fee negotiations broke down. This dispute is the latest in an escalating series of upstream-downstream disputes in the last several years, including conflicts between AT&T and Scripps, Time Warner and Disney, and Comcast and the National Football League. While comprehensive data on fees negotiations through time is not publicly available, industry watchdogs have identified a recent rise in the number and severity of these disputes.[4] One possible cause of this escalation

[3]Kelly and Ying (2003)[13] provide a more detailed analysis of fixed and marginal costs in cable and the feasibility of overbuild competition.

[4]http://webcache.googleusercontent.com/search?q=cache:GtAEzpakWtsJ:www.carseywolf.ucsb.edu/mip/blog/things-

is the increased power of individual cable providers[5] as the industry has consolidated.

We use the data to study the effect of merger regulation on not just the *volume* of acquisitions but the *types* of acquisitions in a quantitative way. In particular, given that the Federal Trade Commission (FTC) and the Department of Justice (DOJ) place increased scrutiny on large transactions, we hypothesize that cable providers may be less inclined to engage in large horizontal purchases.

To test our hypothesis, we construct a dataset of potential and actual purchase events and estimate both the benefits of clustering and the effects of merger policy. In particular, we focus on the reporting thresholds introduced by the Hart-Scott-Rodino Act (HSR). We find the HSR threshold only has a quelling effect on highly horizontal purchases and clustering plays a key role in the acquisition strategies of these large firms.

With those results in mind, we develop a structural model designed to identify the precise dollar impact of both the HSR disclosure rules and the costs associated with distances between disparate cable networks owned by the same firm. Our model focuses on the strategic, dynamic decision faced by firms considering alternative acquisition "baskets." Mathematically, our model combines elements from Goolsbee and Petrin (2004) and Holmes (2011).

The remainder of this paper proceeds as follows: In Section 2 we provide an industry and policy context with a short history of the cable industry focusing on the Telecommunications Act of 1996, followed by an explanation of the Hart-Scott-Rodino (HSR) Act of 1976. In Section 3 we describe the FCC, Census, and FTC data, highlighting the difficulty posed by limited information on former cable providers. Details on our data cleaning methods are left for an appendix. Section 4 describes the clustered purchase strategy of the various large players as well as the existence of true horizontal purchases. We estimate a reduced-form "potential acquisition" model in Section 5 to provide suggestive evidence of both the value of clustering to these firms and the impact of the HSR threshold. Section 6 introduces our structural model of the acquisition decision and discuss our identification strategy. Section 7 concludes and maps our future research program.

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[5]Throughout this paper, we focus on traditional coaxial cable provision and ignore other video transmission technologies such as direct broadcast satellite and fiber-to-the-home.

2 Industry and Policy Background

2.1 History of cable

Cable television began in the early 1950s as a way to improve the reception of over-the-air broadcast channels in remote communities. High demand for broadcast television coupled with the Federal Communications Commission's 1948 "freeze" on licenses to construct new stations led to the creation of Community Antenna Television (CATV) systems.[15] Instead of a separate antenna required for each household who wanted to receive broadcasts, a single, more sensitive antenna could be placed in a centralized location and connected to households through wiring.

Demand for cable systems spread rapidly, and by the 1970s even large metropolitan areas were wired for cable. Local governments executed ad-hoc franchise agreements with cable operators; in exchange for the (sometimes exclusive) right to provide cable services to the area, cable operators would guarantee certain benefits such as educational and governmental channels or special rates for particular segments of the population.[7]

Exclusive channels began appearing on cable systems starting with Home Box Office in 1972 and quickly became a large draw for subscribers. With the increased bandwidth available through wired technology, cable operators were able to offer a much wider variety to consumers than the broadcast alternative.[3, 7, 8]

Today, over 90% of households have access to cable television and over 60% of households are active subscribers.[2, 14] Cable operators, empowered by the Telecommunications Act of 1996 discussed below, have also used the two-way properties of the communication technology to offer internet and phone services.

Competition in the video space comes mainly from Direct Broadcast Satellite technology, a subject previously studied in detail by Goolsbee and Petrin (2004).[11] Competition in the market for data provision comes from Digital Subscriber Line and fiber-to-the-home technologies.

2.2 Telecommunications Act of 1996

The Telecommunications Act of 1996, which amended the Communications Act of 1934, is the primary law regulating cable operators (as well as the rest of the telecommunications industry) today. The law's main goal was to promote competition by removing entry restric-

tions in telecommunications markets. In essence, the law was designed "to let any communications business compete in any market against any other."[6] Additionally, the law sought to update the FCC's regulatory authority and framework to encompass the Internet.

The 1996 Act removed most price controls from the market and encouraged local franchise authorities to allow additional firms to construct physical capital and enter local service markets. It was believed these so-called "overbuilders," along with entry from telephone service providers, would provide effective competition in major markets.[16] These overbuilders are the source of the true horizontal purchase opportunities available to cable incumbents such as Comcast. Emmons and Prager (1997)[9] finds empirical evidence that this change in market structure created increased incentives for monopoly power in the cable industry while Kelly and Ying (2003) examined the feasibility of overbuild and concluded profitable opportunities were rare.

2.3 Hart-Scott-Rodino Anti-Trust Improvements Act

Modern merger policy is largely dictated by the Hart-Scott-Rodino Antitrust Improvements Act of 1976 (HSR), which consisted principally of a set of amendments to the Clayton Antitrust Act. Although Federal laws such as the Clayton Act had long empowered the Federal Trade Commission and Department of Justice to ensure the competitiveness of markets and had given regulators tools to punish or break up anticompetitive firms, the toolset was largely reactive. Enforcement agencies had difficulties challenging anticompetitive actions after they had occurred and often found restoring a market to competitive status a costly endeavor. The HSR Act was designed to allow the DOJ and FTC to become proactive participants in the marketplace by requiring parties to report certain asset transfers or purchases and obtain pre-clearance before the proposed transactions can be completed.[10] Additionally, HSR expanded the legal remedies available to authorities by allowing individual states to sue companies for violations of antitrust laws.

The primary effect of HSR was the creation of the FTC and DOJ's Merger Prenotification Program. Under the program, parties considering a sizeable transaction must file a "Notification and Report Form" and pay a substantial fee based upon the size of the proposed transaction. The parties must wait 30 days during which regulatory agencies may request additional information or time to review the transaction. If the reviewing agencies believe a proposed transaction violates antitrust laws, they may attempt to prohibit completion of

the transaction by filing for an injunction in federal district court. Information provided to regulators during this process, including the original filing, is not subject to public disclosure, though court filings are generally available.

If the parties are conducting routine transactions or have experience with the system, they may file a request for Early Termination of the waiting period. If the Early Termination is approved, the transaction is made public as part of the Federal Register. While this data can be used to give a flavor of the types of transactions generally seen by regulators as unlikely to have anticompetitive effects, it cannot be used to identify the entire universe of attempted or successful purchases, since not all transacting parties request Early Terminations and not all Early Terminations requests are approved.

Transaction reports are necessary when either the value of the assets or the size of the parties reaches certain thresholds. These rules are designed to take effect cumulatively, so a firm which slowly acquires the assets of a competitor through multiple transactions will be forced to report even if each individual transaction is small. Thresholds are adjusted periodically by the FTC and DOJ to reflect inflation. Figure 2 illustrates the various reporting thresholds based on the size of the parties and transaction denominated in dollars. As of 2013, reporting is required if the acquiring party will hold assets of $281 million or more, or if one party is worth at least $14.2 million, the other is worth at least $142 million, and the assets transferred are worth at least $71 million.[1] An additional set of reporting requirements exist based on the percentage of assets transferred: filing is required if the transaction involves $71 million in assets consisting of at least 50% of a company.

3 Data

In order to capture an accurate picture of the cable industry through time and understand the effect of merger policy on consolidation in the cable industry, we combine data on cable television systems from the FCC with market-level data on household counts from the Census and geographic location data from the United States Board on Geographic Names to create a novel dataset. We supplement this data with Annual Reports submitted to the FCC by cable providers, Early Termination Notices from the FTC, a series of letters Comcast wrote to the FCC informing the Commission of completed acquisitions, and a small number of public transaction size disclosures.

Our data on cable television systems was collected from FCC's internet-based Cable

Operations and Licensing System (COALS) using an automated process. For a given Community Unit (known as a CUID in FCC parlance), COALS lists the current and previous service providers. COALS also provides access to administrative or regulatory filings made by the system operator that relate to the cable system, including ownership change forms and annual reports.

Table 2 presents a summary of the CUID ownership file. Just under half of CUIDs undergo legal-entity changes at some point throughout the study period, and the average number of unique parent companies responsible for a CUID was 1.85.

We identified individual acquisition events by looking at groups of CUIDs that switched from (say) Owner A to Owner B within a short time period. We verified our purchase identification process using data collected from a series of public disclosures Comcast made to the FCC about its acquisitions from 2003 to 2008. We distinguish between horizontal and conglomerate purchases with a simple process: For each CUID involved in the event, we examined the list of the acquiring company's existing properties at the time of the event for an exact community name match. If a match is found, the CUID is flagged as a horizontal acquisition. The remaining purchases are considered conglomerate.

To understand the value of controlling any particular cable system, we obtained population and household count data from the U.S. Census at the Census Place level. To understand the value of geographic clustering, we collected data on the location of the various systems (i.e. latitude and longitude) from the Gazetteer created by the Board on Geographic Names. We matched these data to our FCC community information by community name and county.

Finally, to understand the effect of the HSR disclosure requirement, we needed to map the financial value requirement to the context of our community-level data. We used limited public disclosures on acquisition prices to estimate a value of $4000 per subscriber and use annual report and industry data to estimate subscription rates across years. On average, the estimated acquisition value per household was $2600. We then applied the monetary threshold of $71 million to arrive at a threshold value of 27,000 households. While the monetary thresholds change throughout the study period, they are tied to the rate of inflation, which should roughly track the rate of growth in the value of a single subscriber.

4 Acquisitions

Table 5 provides summary statistics for our final set of 712 purchases made by top firms, covering 15,357 communities (or CUIDs, in FCC parlance) during our study period. Most purchases covered a relatively small area; the median number of communities involved in a single transaction was 3 and the median population affected was 31,123.[6] Figure 3 shows the distribution of merger size as measured in households.

The existence of clustered purchases is immediately apparent: the average mean distance between CUIDs involved in an acquisition and the set of CUIDs already owned by the acquiring firm was 4.7 miles. Since distances are calculated using centroids, this suggests many purchases involved systems essentially adjacent to the acquiring firm's pre-existing properties.

Table 6 provides the same summary statistics for each large firm we study. Comcast had 43% of the acquisitions covering 45% of the total acquired CUIDs and 44% of the population transferred during the period. As such, the summary statistics for Comcast largely drive the overall numbers reported in table 5. That being said, the acquisition strategies for the other firms implied by the summary statistics are remarkably similar. The average number of CUIDs involved in a single event are almost identical, except for Adelphia which was impacted by its bankruptcy during the period.

The median number of households involved in purchases was below the threshold value of 27,000 for all firms except AT&T, suggesting a large amount of the consolidation in this industry was done without regulator scrutiny. Time Warner's significantly larger average purchase size was driven mostly by a few very large purchases in the New York and New England region.

Additionally, the average minimum distance between the acquired CUIDs and the firm's pre-existing CUIDs was also similar for all companies besides AT&T. Even AT&T's relatively large distance, 42.7 miles, equates to most acquisitions taking place within a space similar in size to the average US county.[7]

This clustering is apparent visually. Figure 4 shows Comcast's holdings by county in 2001. By 2003, shown in Figure 5, Comcast had not just consolidated its holdings in places

[6] Compare to the median population of all cities and towns of the U.S. of 41,994.

[7] In fact, this large distance is largely driven by a single acquisition 560 miles from the nearest AT&T-owned CUID.

such as Florida, it had also bought clustered operations in the Mountain West. Finally, by 2010 (Figure 6) Comcast had expanded to the market leadership position largely through additional regional purchases. In this way, as shown in Figure 7, Comcast has expanded its reach from roughly 10 million households to over 60 million by 2013. This implies that today, over 50% of households are in Comcast's territory (Figure 8).

4.1 Horizontal acquisitions

Of the 15,357 CUIDs that were acquired by one of the large firms during the study period, 190 were considered horizontal purchases. These 190 switches were part of 74 distinct acquisition events – 10% of the total number of events seen.

Within the 74 events that included a horizontal component, the median percentage of CUIDs involved in the purchase that were considered horizontal was 12.5%. The mean was 33.2%. Several small purchases that consisted of a completely horizontal takeover contributed significantly to this mean – these tended to be municipality-run networks that were sold.

Of the 23 acquisitions with more than 50% of the CUIDs considered horizontal, the median number of households involved was 24,504, implying that many of these purchases required disclosure and scrutiny under HSR.

5 Suggestive Evidence

The data presented in the previous section lend themselves to two clear hypotheses:

1. Outside of true horizontal purchases, Hart-Scott-Rodino has little effect on merger strategy.

2. Firms place a high value on "near-horizontal" or highly-clustered acquisitions.

Both of these hypotheses are testable. First, if HSR filing rules place a major burden on transactions over a certain size, large firms should be less willing to pursue those transactions, relative to the opportunities available in the marketplace. Second, if firms value clustered systems, they should be more willing to pursue those transactions relative to the available opportunities.

To test these hypotheses, we ran a simple exercise. For each year in our study period, we created a list of cable systems the large firms could have acquired based on the ownership records.

We then used a simple logistic regression to estimate the probability of a successful acquisition event based on the size of the acquisition and the percentage of the potential purchase's horizontality based upon the acquiring firm's presence in the communities involved at the time of the purchase. We added a dummy variable representing the necessity of Hart-Scott-Rodino disclosure, as well as year dummy variables to reflect changing macroeconomic conditions.

The most important decision in the execution of this exercise is the selection of the decision set available to the firms. The main decisions essentially boil down to the following questions:

1. Can firms partially acquire firms? How do we determine the possible subsets?

2. What level of horizontality is allowed?

3. Can firms acquire other large firms?

4. Should potential targets acquired by other large firms be included?

The first question essentially defines the cardinality of the set. Though partial acquisitions do occur, they are relatively rare. Additionally, many partial acquisitions lead to further transactions with the same target later in the study period – meaning the "cumulative size" portion of the HSR rules applies. For this reason, we opt to model acquisitions as absolute: you either buy the whole company, or you buy nothing.[8]

Since we observe several truly horizontal purchases in the data, we allow any level of horizontality in our potential purchase set. Additionally, since the only "purchase" of a large firm (Adelphia purchased by Comcast and Time Warner) was the result of a bankruptcy process, we do not allow the large firms to acquire each other.

The final question is also the most vexing. Unfortunately, we have no data covering behind-the-scenes overtures and negotiations, so we are unable to observe (for instance) targets of mutual interest, bidding wars, and other types of strategic activity. Therefore, we

[8]An alternative interpretation of this assumption is: you either execute a transaction with the firm or not.

estimate the model with several variants of the data representing alternative answers to this question.

The first variant treats all large firms as members of a hypothetical larger firm we call the "megafirm." In this variant, we calculate the distance variables according to the nearest distance to any cable system owned by any of the megafirm's "subsidiaries." In the second variant, we estimate separate models for the individual firms but exclude any company acquired by other firms from the set of potential purchases available to the firm in question. This assumes any negotiation process acts as a truth-telling device and large firms with the highest internal valuation always have the first option to purchase small concerns. In essence, if Firm B acquires Firm C, that event is viewed as evidence that Firm C was never truly an option for Firm A. In the third variant, we estimate separate models for each of the major firms and allow them the possibility of acquiring any other firm in the market. This assumes the negotiation process may break down and firms may end up acquiring a target despite a different firm's higher valuation. Furthermore, if Firm B acquires only some CUID operations of Firm C, then we reason that this subset of Firm C's CUID's was also a potential purchase by Firm A.

The results for the "megafirm" specification are shown in Table 7. Parameter estimates for the second and third variations are shown in Table 8 and Table 9 respectively. For clarity, we discuss the results related to each of the hypotheses in separate subsections.

5.1 Does Hart-Scott-Rodino have an effect?

Across our specifications, a couple of patterns emerge. First, the HSR disclosure flag on its own has a positive coefficient and is highly significant. This implies that firms aren't dissuaded from pursuing large acquisitions by the HSR rules alone. However, when interacted with the horizontal flag, HSR disclosure has a negative effect, though the effect is much less significant. While we refuse to believe regulators do not scrutinize large mergers with a strong horizontal component, this suggests such scrutiny is not particularly burdensome, particularly compared with the benefits of horizontality as measured by the horizontal flag on its own.

5.2 How important is clustering?

Though the minimum distance parameter is not significant in any estimation apart from for AT&T Broadband, the parameter is negative in every specification estimated. This suggests that while firms pursue purchases that are located close to their current holdings, it is not an overwhelming factor in their decision. Alternatively, given the relative crudity of our distance measure, it is possible our model is insufficiently nuanced to capture the true value. An ideal measure of distance would combine a concept of adjacency and the amount of right-of-way needed to combine physical systems.

6 Structural Model and Estimation

While the reduced form results presented in the previous section suggest firms place a higher value on acquisitions of systems geographically close to their current holdings, the model is not sufficiently structured to allow for precise dollar estimates of the cost of purchase scrutiny and the benefits of clustering. In this section, we introduce a structural model of acquisitions to bridge these gaps and estimate bounds on the value of clustering, the fixed cost of acquisitions, and the cost of scrutiny by the FTC and DOJ.

In each period, a large cable firm must answer the following questions:

1. What is our target number of additional subscribers?
2. Which firms will we acquire in order to achieve this target?

Our model follows the example of Holmes (2011). We take the answer to (1) as given, and use large firms' answers to (2) in order to estimate bounds on different kinds of costs (merging, scrutiny, geographic distance from nearest physical system) using Pakes, Porter, Ho and Ishii (2006) [17] (hereafter PPHI). We assume firms have symmetric costs and preferences and differ only in their initial endowment of cable systems and exogenous paths of subscriber acquisition targets. Potential acquisitions are valued according to a consumer demand model per Goolsbee and Petrin (2002).

6.1 Model

Since we take the target number of subscribers as given, we posit the existence of a decision maker concerned only with figuring out how to get to a target range: a Chief Acquisition

Officer who receives his acquisition goals exogenously to acquire and maximizes acquisition profits conditional on meeting those targets.

6.1.1 Environment

There is a set of J large firms (e.g. Comcast), denoted by j. There is a set N of small firms, denoted by n. Time is discrete, with a total of T periods denoted by t. Each small firm n has a *size* (e.g. the number of households), denoted by s_n. The distance between any small firm and any large firm's holdings at time t is $d_t(j, n)$. This notation emphasizes the idea that large firms change over time through acquisitions, while small firms are static. The function d_t embeds the initial geographic endowment of the various firms as well as the evolution of the geographic setting over time.

Each large firm has a period specific *target*, $B_{jt} \in \mathbb{R}^2_+$, interpreted as an interval on the positive real line. This represents bounds for the total size of all acquisitions made in the period.[9]

6.1.2 Actions and strategies

An *acquisition list* for firm j in period t is a list of firms $a_{jt} \in 2^N$. An *acquisition path* for firm j is $A_j = \{a_{jt}\}_{t=1}^T$, with the space of strategies for j denoted by $\mathcal{A}_j$. A *market path* combines the strategies of all firms: $A = \{A_j\}_{j=1}^J$ and $\mathcal{A} = \Pi_J \mathcal{A}_j$. A *competitor path* combines the strategies of all firms except for a particular firm j: $A_{-j} = \{A_k\}_{k \neq j}$. Denote the *firms available to* j by $N_{-j} = \{n \in N | n \notin A_{-j}\}$

A market path A is *feasible* if there are no conflicts between firms' individual acquisition paths and if the firm's acquisition lists are within their bounds:

1. $n \in a_{jt} \implies n \notin a_{kt}, \forall A_j \in A, a_{jt} \in A_j, j \in J, k \in J, k \neq j, t, t'$
2. $\sum_{n \in a_{jt}} s_n \in B_{jt}, \forall j, t$

6.1.3 Firm's problem

The firm's problem is to choose a strategy which maximizes profit given the initial endowment, the set of small firms, the bounds, and the other firms' strategies. That is:

[9] We use bounds instead of a fixed target to allow for small variations in acquisition totals during the execution of our estimation routine, detailed below.

$$\max_{A_j \in \mathcal{A}_j} E\left[\sum_{t=1}^{T} \sum_{n \in a_{jt}} \pi_{jt}(n)\right]$$

where the purchase-level profit function $\pi_{jt}(n)$ is:

$$\pi_{jt}(n) = r_t(n) - \left(\alpha + \lambda s_{nt} + \gamma * 1_{s_n > K} + \rho * 1_{s_n > K} * 1_{h(n,j)=1} + \phi d(n, j_t) + \epsilon_{njt}\right)$$

In this equation, $r_t(n)$ is the discounted sum of future profits for system n, α is the fixed cost of executing a purchase, λ is the marginal per-subscriber cost of the purchase, γ is the cost of HSR compliance, ρ is the additional cost of HSR compliance if the system is horizontal, with $h(n, j)$ capturing the horizontality, ϕ is the per-mile distance integration cost, and ϵ_{jt} is the acquisition specific error term.

6.1.4 Equilibrium

An equilibrium in this market is a market path A that is feasible and solves each large firm's problem taking the others' actions as given.

6.1.5 Selection

Given the random nature of the acquisition cost function, it is possible that multiple large firms may seek to acquire the same small firm. Our definition of equilibrium allows for any selection mechanism, as we take other firms' strategies as given when considering the problem of any individual firm. For the purposes of our exercise, we assume a simple selection mechanism: the large firm with the higher realized valuation (or lower cost-to-acquire) is always allowed to acquire the small firm. This is essentially equivalent to assuming competitive acquisitions are done using sealed-bids, or that the error term represents, at least in part, the negotiation process itself.

6.2 Estimation

The following section discusses future work. We have not completed estimating our structural model.

The first stage in our estimation strategy is to estimate the benefits, in the form of the profit stream, of owning any particular CUID. To do this, we estimate demand for cable following Goolsbee and Petrin (2002) with updated data from the Cable Factbook.

Given the number of items in any firm's decision set, it is computationally infeasible to calculate the dynamic value of every decision available. Therefore, following Holmes (2011), we identify parameters by focusing on potential deviations in the sequence of acquisitions.

The deviation strategy is simple. For each action the firm took, we consider other actions it may have taken instead. We can calculate the expected difference in firm profits under a given guess of model parameters. Optimality conditions imply the firms actual actions must provide a higher stream of profits than any of the deviations. These deviations therefore create a large set of inequalities. In the spirit of Holmes (2011), we define groups of moment inequalities to place the tightest possible bounds on model parameters.

We focus on three types of deviations in order to identify our parameters. First, we consider deviations in which two firms swap similarly sized purchases. For example, suppose in the data Comcast bought Hanson Cable and Time Warner bought Carlson Cable in 2008, which both had roughly 20,000 subscribers. A deviation would consist of Comcast purchasing Carlson Cable and Time Warner purchasing Hanson Cable. These deviations allow us to identify the benefits of clustering.

To identify the fixed cost of purchases, we also consider deviations in which one purchase is replaced with two smaller purchasers that combine to a similar size. For example, instead of Comcast purchasing a 40,000 subscriber system (over the HSR threshold), Comcast may have purchased two 20,000 subscriber systems (under the threshold).

To identify the cost of purchase scrutiny, we consider splitting up large purchases both above and below the HSR threshold.

7 Conclusion and future work

Although many have tried to measure the effectiveness of U.S. merger policy in an empirical way, these attempts have largely been stymied by the problem of sample size.[5, 4]. This project has attempted to cast the problem into the context of a specific industry, cable television service, in order to achieve enough variation to provide an empirically robust answer.

The results of our simple 'potential acquisition' exercise suggest policy may be too focused

on particular types of acquisitions without considering the industry at large. In particular, it is not difficult to imagine that regulators in 1999 may have rejected a proposal to combine the cable television access of 50% of U.S. households into a single company.[10] Yet this is precisely what has occurred.[11]

While this paper lays out the acquisition history and strategy of the largest players in the cable provider market, it cannot fully answer questions about the effectiveness of U.S. merger policy. To that end, we have developed a structural model of firm acquisition to produce a truly robust and coherent quantitative look at both the effect of HSR and the benefits of clustering without the cavalcade of assumptions we have used in our 'potential acquisition' exercise.

The next steps in the execution of this agenda include incorporating of Cable Factbook data into our acquisition dataset, followed by estimating our structural model using the techniques established in PPHI. With our structural model estimated, we can investigate several counterfactuals, including different regulatory regimes for acquisitions and alternative distance integration costs.

[10] If this thought experiment does not convince you, consider a proposal to combine cable television, internet, and voice services for 50% of American households into a single company that *also* controls a quarter of the broadcast television market.

[11] To be clear, we are not making any claims about consumer or firm welfare through this period of consolidation. Rather, we believe regulators may have opted for additional scrutiny.

8 Appendix: Data details

Our main sources of data are the U.S. Census Bureau and the Cable Operations and Licensing System (COALS), operated by the FCC. We also obtained information on Early Terminations from the Federal Trade Commission and supplemented our procedures with several additional sources. This appendix gives details of our various data collection and processing procedures.

8.1 Early Terminations

The Federal Trade Commission maintains lists of all early terminations granted each week under the Hart-Scott-Rodino Act.[12] We manually searched these lists for events that included the large firms we were concerned with.

8.2 Comcast Letters

As part of a public comment period on proposed ownership rules in the cable industry, Comcast voluntarily submitted quarterly letters detailing their acquisition activity to the FCC, which subsequently published them on their website. We collected all of the letters available.

8.3 Geographic Data

We obtained population data at the Census Place[13] level from the National Historical Geographic Information System for Census 2000 and 2010 and augmented this data with 2010 data directly from the Census Bureau. For a city that crosses county lines, population counts are available for each "county-part" of the city while household counts are only available for the city as a whole. We imputed 2010 household counts for multi-county cities by taking the city-wide ratio of households to population and multiplying it by the population of each "county-part." Population and household counts were also available for the balance of counties (or other civil divisions) that are unincorporated – similar to the FCC community classifications described below.

We estimated the 2010 household counts for unincorporated communities by using a simple linear regression of household count on total population interacted with state dummies

[12] Available at http://www.ftc.gov/bc/earlyterm

[13] This includes Census Designated Places

for all communities for which household data was available. We then used the growth rates of household counts by county from 2000-2010 to impute CUID household counts from 2000-2010.

Finally, we incorporated latitude and longitude data from the State Gazetteer prepared by the United States Board on Geographic Names,[14] matching by place name and the Census' internal unique identifiers. Where exact matches weren't available, we used the geographical centroid of the containing county or township.[15] Additionally, several manual links were made to account for changes in the definitions of certain political units (i.e. changes in county and city boundaries) throughout the country during our study period.

8.4 COALS

8.4.1 Overview of COALS and FCC identifiers

COALS consists of a database of cable system information, with a publicly accessible front end, as well as secured-access options for cable systems owners and administrators.[16]

Cable systems regulated by the FCC (and collected in COALS) are identified through Physical System Identification numbers (PSIDs) and the communities they service are identified through Community Unit Identification numbers (CUIDs). In towns where more than one physical system operates, multiple CUIDs are created. Additional CUIDs may also be created when towns cross county lines. For example, the city of Minneapolis, Minnesota, which is currently served by Comcast, is assigned a single CUID, MN0180. That CUID is "owned" by PSID 011339, which serves the greater Twin Cities area. On the other hand, Kansas City, Missouri, which spans four separate counties, is host to five separate CUIDs serviced by three PSIDs representing Comcast, Time Warner, and Surewest. The presence of two CUIDs with identical community names does not necessarily imply true overbuild; many of these cases occur in large geographic areas, such as the non-incorporated portions of counties.

CUIDs may also represent unincorporated areas and communities at a variety of scales. At the low end of the spectrum, a single CUID may represent a single 'private' settlement such as an apartment complex or hotel. A CUID may be created for an unincorporated

[14] Available at http://geonames.usgs.gov/domestic/fips55codedef.html

[15] This ensures every CUID can be included in distance calculations.

[16] COALS is available at https://apps.fcc.gov/coals/

community regardless of Census status. A single CUID may also be used to represent the 'balance' of a county: the total area of that county not included in any incorporated city contained within that county. Table 1 shows the distribution of CUIDs by FCC community type classification.

8.4.2 Data Collection

Our data collection process begins with a exhaustive list of every CUID in the United States, taken from an FCC-provided current-status digest.[17] This CUID list is used as the input to a Python script which opens the public COALS page, parses the source HTML, and saves relevant information on providers and filings.[18] The primary output of this script is a dataset of every CUID/provider combination in the COALS system.

8.4.3 Merging COALS and Census Data

With our geographic data and CUID data collected at the finest levels possible, we use a "specific-to-general" process to combine the data. We map the Census Place classifications to the FCC CUID classifications according to table 4. We then match the community type and the community, county, and state names as closely as possible. An overview of the match quality is tabulated in Table 3. Of the 45,146 CUIDs in the FCC file, we match 31,598 to Census locations. Of those 31,598 matches, 5,517 are unincorporated communities and therefore use imputed household data. Though all major cities match successfully, the CUID file contains many unmatched entries. While some of the unmatched CUIDs consist of individual housing developments or government facilities, most are unincorporated communities or areas which do not qualify as a Census Designated Place.

8.5 Data cleaning

The first step in our analysis is a manual cleaning process focusing on the 9,506 unique legal entities that control CUIDs at various points in time throughout our raw dataset. The vast majority of the changes come from either missing address information or typographical errors in the legal name or address.[19] Many additional changes are made through the identification

[17] Available at http://www.fcc.gov/mb/vax/registeredcuid.xls

[18] See figure 9 for an example CUID shown in COALS.

[19] See figure 10 for examples of these two cases.

of franchised or otherwise split legal entities which are in fact owned by a single corporation. These entities were identified either through analysis of their names or publicly available business databases maintained by Business Week and Funding Universe.[20] The result of this process is a mapping that links each of the 9,506 "raw" legal entities to one of "cleaned" 3,889 entities. These cleaned entities are then merged back into the original providers dataset.

With the legal entities cleaned, it is now the case that several "switches" in a single CUID may now actually be multiple entries of the same parent company. We perform a sifting procedure on the dataset to identify the earliest date a CUID was controlled by each of the legal entities which ever controlled the community during the period covered by COALS data. The result is a pared-down list of unique legal entities controlling CUIDs at different points in time.

We refactor this list into a set of switches, by combining multiple observations in our source data into a single observation for each switch containing information on the prior owner, the new owner, and the date of the switch. We group these switches by the two owners in question and the calendar quarter of the switch to identify mergers. These so-called "switch groups" represent the universe of possible merger events in our data.

These groups require additional manual cleaning. Although FCC rules require cable providers to inform the FCC of changes in the legal status of a CUID or cable system within 30 days of such a change,[21] we find several instances where the bulk of a change is consummated (according to the COALS providers data) on one day, and a few additional changes are made some days or months later. An example of this phenomenon is shown in table 10. This process reduces the number of observed switch groups (and thus the number of mergers we report) from 896 to 713.

As a check on our data cleaning procedures, we compare our final Comcast merger list (including dates) to the data we collected from the Comcast letters. We successfully match nearly all of the 119 reported Comcast acquisitions.[22]

To understand the geographic layout of the merger, we compare the distance of each CUID within a switch group with all of the CUIDs owned by the acquiring company at the time of the switch (excluding other CUIDs acquired within the same group). Distances are

[20] Figure 11 has examples of this sort of cleaning.

[21] 47 C.F.R 76.1610, available at http://www.gpo.gov/fdsys/pkg/CFR-2010-title47-vol4/pdf/CFR-2010-title47-vol4-sec76-1610.pdf

[22] We believe our mismatches are due to differences in the names of entities as reported by Comcast and recorded in COALS.

calculated from latitude/longitude data with the Equirectangular Approximation which has high accuracy over the relatively short distances we observe.

8.6 Horizontal purchases

We distinguish between horizontal and conglomerate purchases with a simple process: For each CUID involved in the acquisition event, we examined the list of the acquiring company's existing properties at the time of the merger for an exact community name match. If a match is found, the CUID is flagged as a potential horizontal merger. Since we cannot confirm overbuild directly, we excluded those CUIDS which referred to townships or unincorporated areas of counties and parishes. It is unlikely that companies would pursue an overbuild strategy in these rural areas.

8.7 Annual Report Data

To ground our subscription rate assumptions, we acquired all annual report data from 2002-2009 from the FCC. The FCC requires all cable systems with greater than 20,000 subscribers, as well as a random sample of smaller systems, to submit an annual report with details of their coverage, subscription rates, and offerings. These reports are filed at the Physical System level and are integrated into COALS upon submission. While this data is considered public, the FCC has agreed to an industry request to hold the report data for three years before release.

Unfortunately, due to the design of COALS, the annual report data does not contain any point-in-time geographic linkage information. In other words, we cannot identify which historical annual report corresponds to which CUIDs. Whenever a CUID is attached to a new PSID, it is immediately linked to all filings for that PSID and all previous linkages are destroyed. For example, Verizon registered a CUID for Medford, MA (CUID MA0484) in 2012 and attached it to their existing regional PSID, 020666. COALS lists a 2008 annual report as a relevant filing for this CUID, despite the CUID's failure to exist in that year. Unfortunately, there does not seem to be a solution to this obstacle at this time.[23]

[23]We asked the FCC to release any geographic link data (beyond the "present-time view" available in COALS) they possess under the Freedom of Information Act. Mike Perko, the Chief of the FCC's Office of Communications and Industry Information, asserted no such information existed, and that storing such information was "not in the public interest." Since the lack of such information significantly reduces the

While we cannot precisely identify which physical systems controlled which CUIDs, we regress the number of subscribers on the number of households covered by the system interacted with year dummies. This regression captures the overall decline in cable subscription rates and is used to ground the value assumptions made in our potential merger exercise.

usefulness of annual report data and hampers the FCC's ability to make informed decisions, we must disagree.

Municipality Type	**CUIDs**
Incorporated Borough	1,733
Incorporated City	10,873
Incorporated Town	8,878
Incorporated Village	4,211
Privately owned settlement	1,072
State or Federal Reservation	440
Unincorporated area adjacent to incorporated community	1,478
Unincorporated area commonly known as	5,809
Unincorporated unnamed area within a County or Parish	4,211
Grand Total	45,146

Table 1: CUID types identified by the FCC

Total number of CUIDs	45,146
Average number of providers per CUID	1.85
Std. dev.	1.14
CUIDs with single provider	22,986
CUIDs with more than 5 providers	690

Table 2: Summary of cleaned provider data.

Match Type	**CUIDs**
Full (County, community type and name)	21,158
County and name	5,610
Type and name	2,210
Name only	2,620
Unmatched	13,548
Total	45,146

Table 3: Breakdown of CUID/Census match quality

CUID classification	**CDP classification**
Incorporated Borough	City
Incorporated City	City
Incorporated Town	Town
Incorporated Village	Town
Privately owned settlement	Private
State or Federal Reservation	Reservation
Unincorporated area adjacent to incorporated community	Balance
Unincorporated area commonly known as	CDP
Unincorporated unnamed area within a County or Parish	Balance

Table 4: Mapping CUID classifications to CDP classifications

Number of mergers	712
Median CUIDs per merger	3
Average CUIDs per merger	21.6
Std. Dev. CUIDs per merger	82.6
Median mean distance to nearest owned CUID	.267
Average mean distance to nearest owned CUID	4.66
Std. Dev. of minimum distance to nearest owned CUID	29.98
Total CUIDs acquired	15,357
CUIDs missing population data	3,894
Median population per merger	31,123
Average population per merger	540,510.4
Std. Dev population per merger	2,861,357
Median households per merger	12,637
Average households per merger	201,099.4
Std. Dev households per merger	1,029,455

Table 5: Acquisition summary. Note: Household statistics include missing data for some rural CUIDs.

	Comcast	**Time Warner**	**Charter**	**Cox**	**AT&T**	**Adelphia**
Num. of mergers	307	157	139	34	26	49
Median CUIDs	3	3	3	3	4	4
Average CUIDs	22	23	22	19	22	13
Std. dev CUIDs	95	79	84	39	52	26
Median mean dist	0.20	0.17	0.35	1.27	3.13	0.79
Average mean dist	1.12	2.9	1.33	10.2	42.7	18.2
Std. dev mean dist	7.70	13.73	3.35	31.73	116.05	59.86
Total CUIDs	6,849	3,612	3,066	628	566	636
Missing pop data	1,830	814	900	69	108	173
Median pop	53,284	24,541	13,680	30,980	99,166	65,201
Average pop	555,237	940,561	219,075	329,859	450,493	272,204
Std dev pop	2,426,169	4,953,978	877,393	611,282	787,075	512,692
Median HH	20,898	8,759	5,633	12,446	37,691	26,114
Average HH	213,551	333,154	83,246	127,692	172,818	100,223
Std dev HH	934,400	1,718,539	323,470	236,221	302,860	183,336

Table 6: Acqusition summary by acquiring firm.

	(1)
	acquired
Mean Distance	-0.00673
	(0.00826)
Horizontal Flag	0.388
	(0.259)
HSR Flag	1.270***
	(0.0919)
HSR * Horizontal	-0.641*
	(0.317)
[1em] Num. Households	0.000000133*
	(6.47e-08)
Year Dummies	Yes
Constant	-4.665***
	(0.167)
N	39813

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Parameter estimates for the "megafirm" specification of our 'potential merger' exercise.

	(1) Comcast	(2) AT&T Broadband	(3) Cox	(4) Time Warner	(5) Charter
Mean Distance	-0.00219	-0.00832**	-0.0119	-0.00686	-0.0617
	(0.00206)	(0.00295)	(0.00839)	(0.00545)	(0.0379)
Horizontal Flag	0.663*	-9.431	1.880*	1.661***	1.802***
	(0.277)	(666.0)	(0.758)	(0.287)	(0.274)
HSR Flag	1.545***	1.340**	1.304**	0.870***	0.194
	(0.146)	(0.455)	(0.402)	(0.222)	(0.297)
HSR * Horizontal	-0.604	10.77	-1.026	-0.692	-0.427
	(0.330)	(666.0)	(1.021)	(0.395)	(0.484)
Num. Households	0.000000111	3.29e-08	-0.000000114	3.55e-08	-0.000000101
	(8.66e-08)	(0.000000369)	(0.000000443)	(0.000000132)	(0.000000308)
Year Dummies	Yes	Yes	Yes	Yes	Yes
Constant	-6.542***	-6.623***	-6.483***	-6.224***	-5.206***
	(0.386)	(0.532)	(0.457)	(0.364)	(0.265)
N	33443	5926	27391	39813	36636

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Parameter estimates for our 'potential merger' exercise assuming large firms were able to buy any small firm.

	(1) Comcast	(2) AT&T Broadband	(3) Cox	(4) Time Warner	(5) Charter
Mean Distance	-0.00227	-0.00829**	-0.0118	-0.00685	-0.0622
	(0.00209)	(0.00292)	(0.00836)	(0.00544)	(0.0380)
Horizontal Flag	0.654*	-9.435	1.868*	1.653***	1.795***
	(0.277)	(669.9)	(0.758)	(0.287)	(0.274)
HSR Flag	1.574***	1.398**	1.332***	0.919***	0.240
	(0.146)	(0.456)	(0.402)	(0.222)	(0.297)
HSR * Horizontal	-0.619	10.78	-1.026	-0.721	-0.435
	(0.330)	(669.9)	(1.021)	(0.395)	(0.484)
Num. Households	0.000000114	5.65e-08	-0.000000111	4.27e-08	-8.55e-08
	(8.61e-08)	(0.000000348)	(0.000000441)	(0.000000131)	(0.000000306)
Year Dummies	Yes	Yes	Yes	Yes	Yes
Constant	-6.534***	-6.582***	-6.477***	-6.224***	-5.203***
	(0.386)	(0.531)	(0.457)	(0.364)	(0.265)
N	33095	5723	26904	39320	36121

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9: Parameter estimates for our 'potential merger' exercise assuming small firms bought by other large firms were unavailable.

Date	**CUIDs**
January 15, 2008	364
April 25, 2008	2
August 1, 2008	2
Total	368

Table 10: An example of different dates within a "switch group." The event shown took place between Comcast and Insight Communications Co.

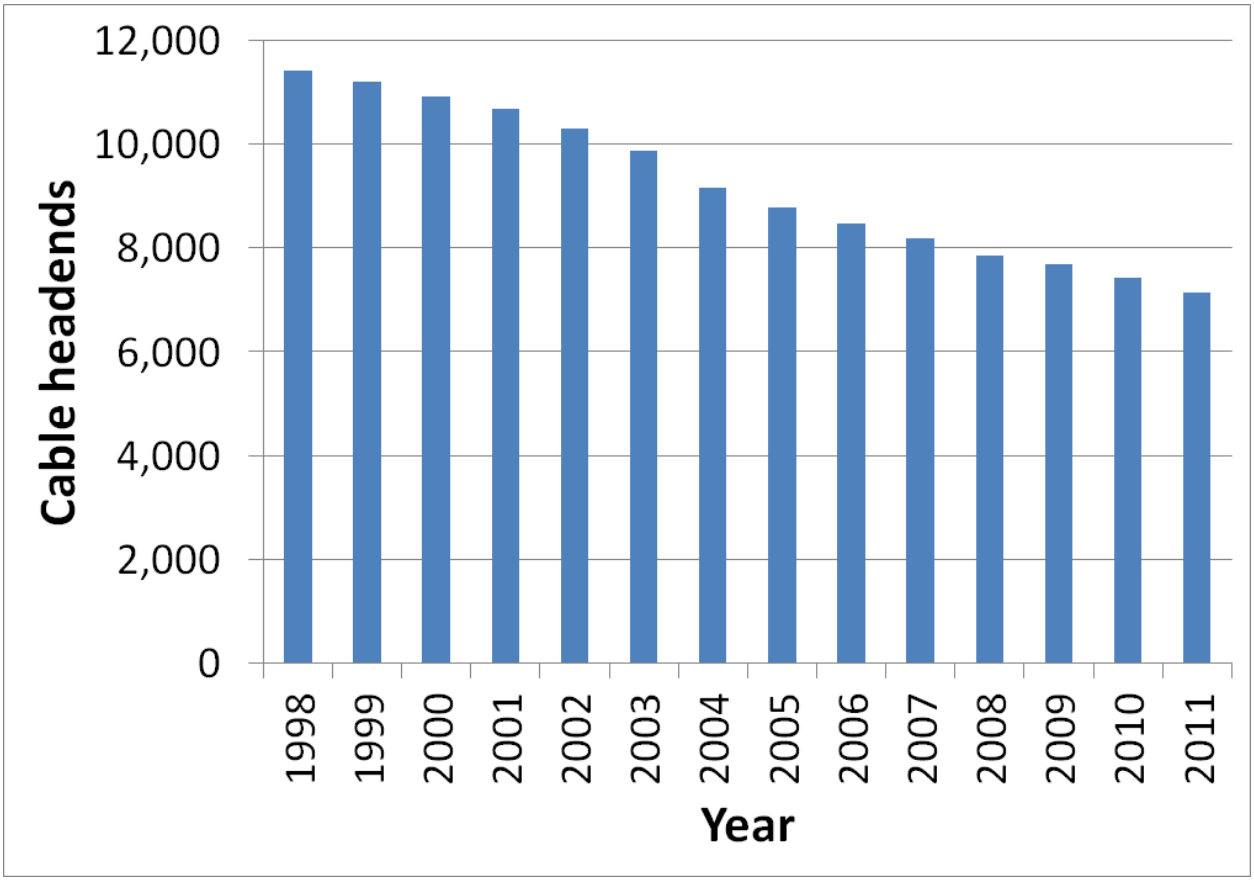

Figure 1: The number of cable headends (physical locations used to recieve and distribute programming) has decreased every year since 1998. Source: [2]

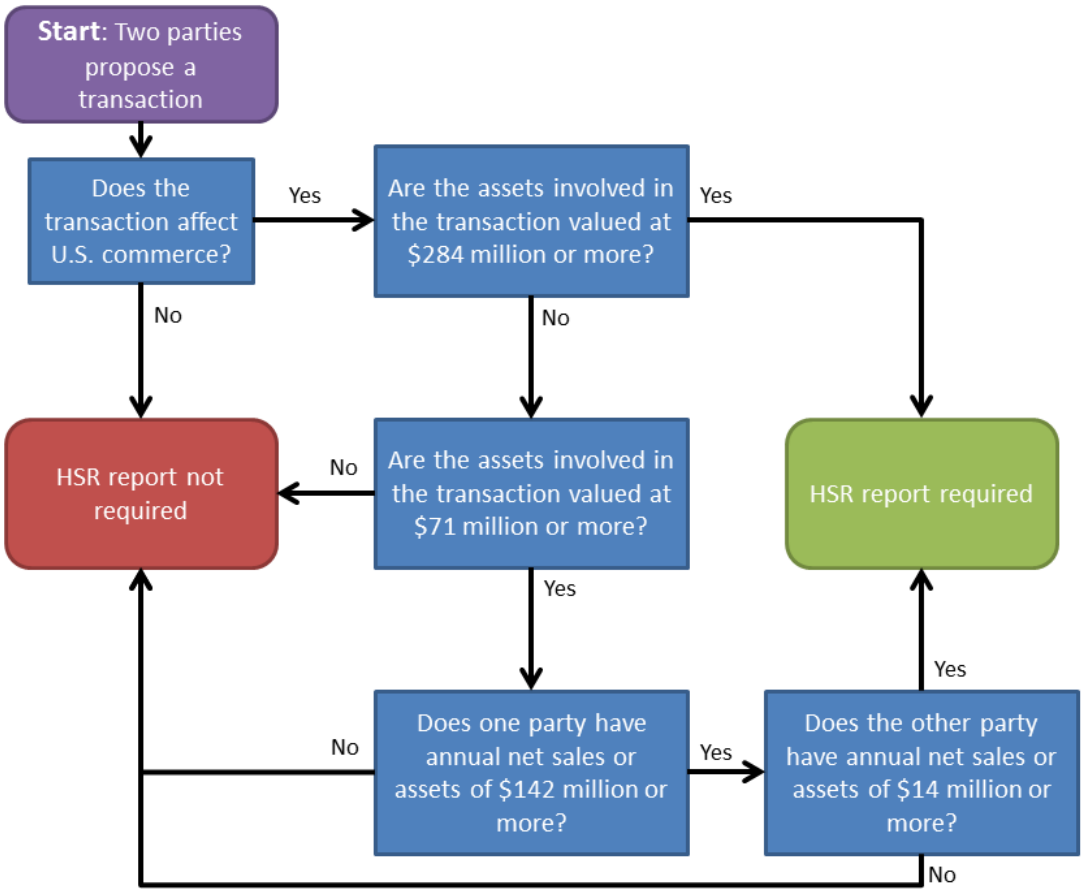

Figure 2: Flowchart of the 2013 Hart-Scott-Rodino reporting thresholds

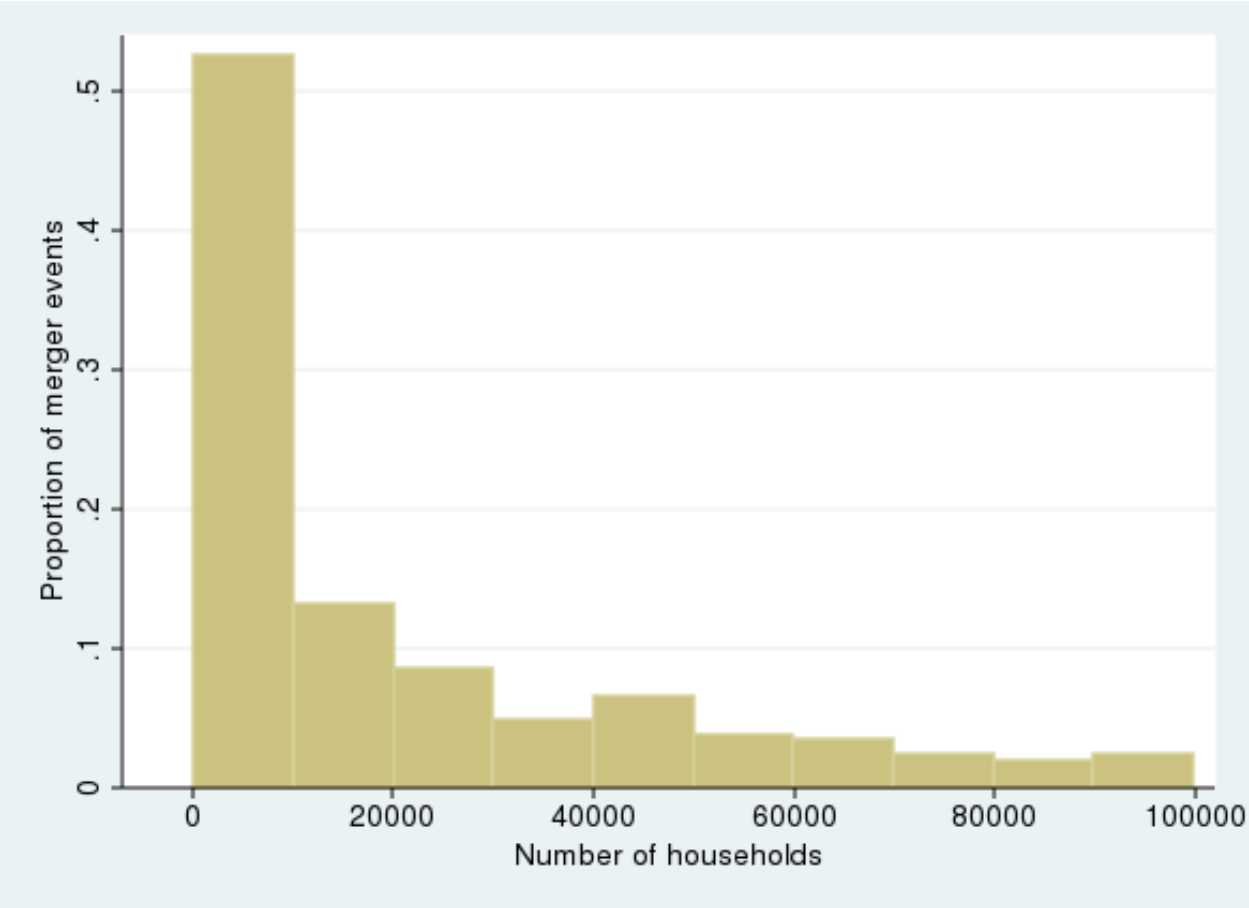

Figure 3: Histogram of the size of the 712 acquisitions we study. This chart removes a small number of extremely large transactions for clarity.

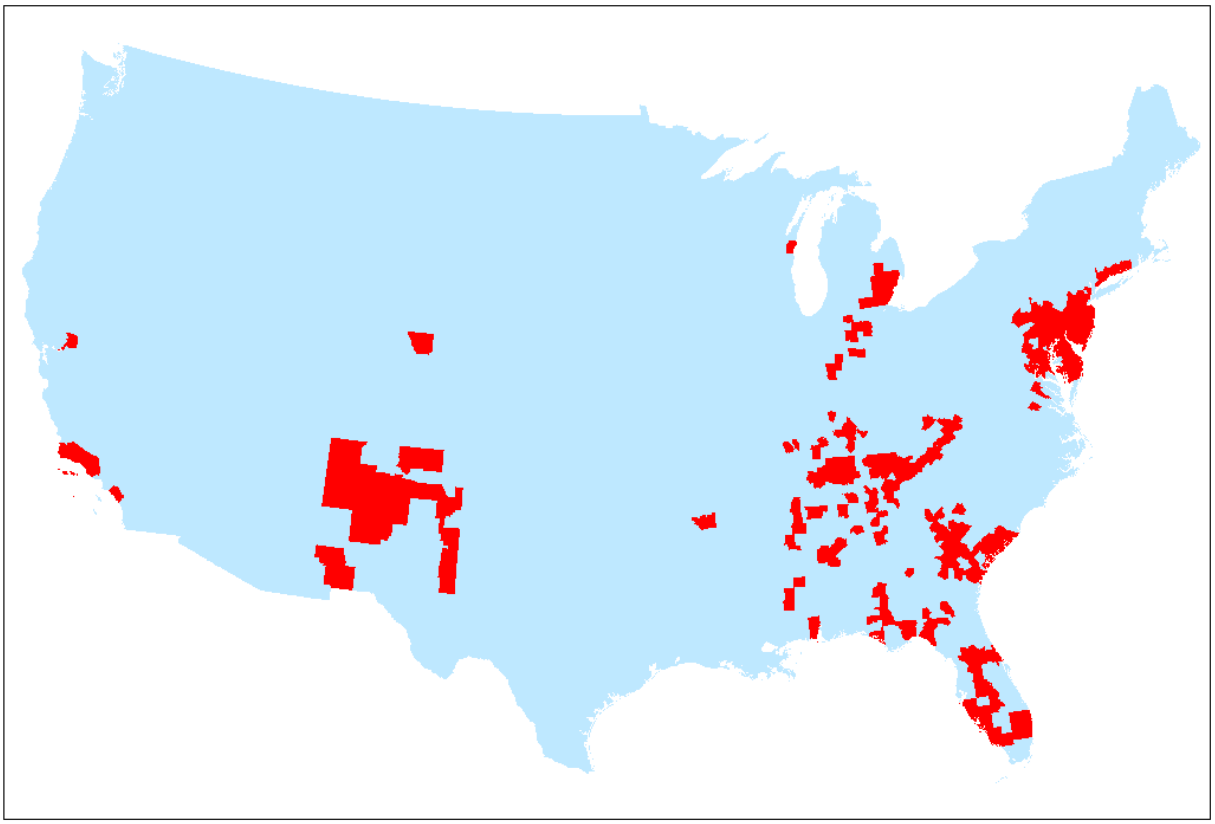

Figure 4: Map of Comcast's holdings by county in 2001. Counties are red if Comcast serves at least one community in the county.

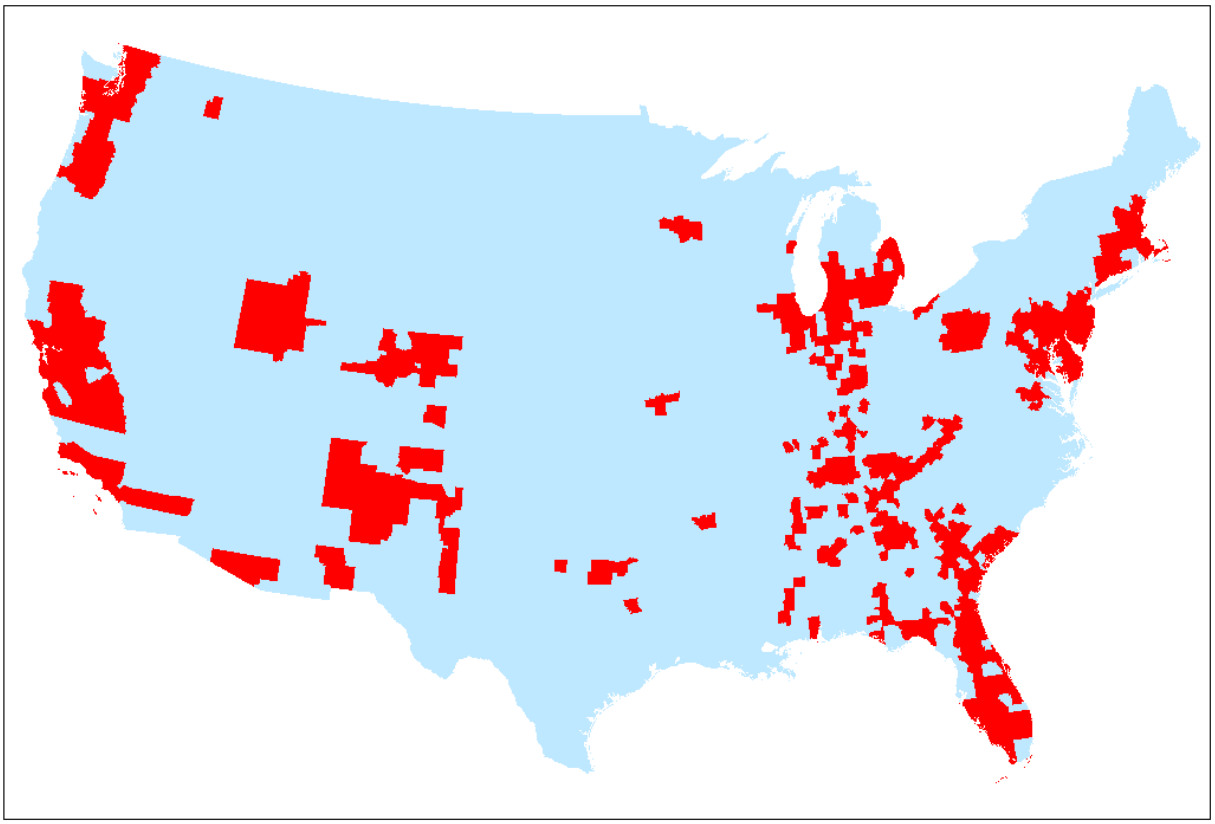

Figure 5: Map of Comcast's holdings by county in 2003. Counties are red if Comcast serves at least one community in the county.

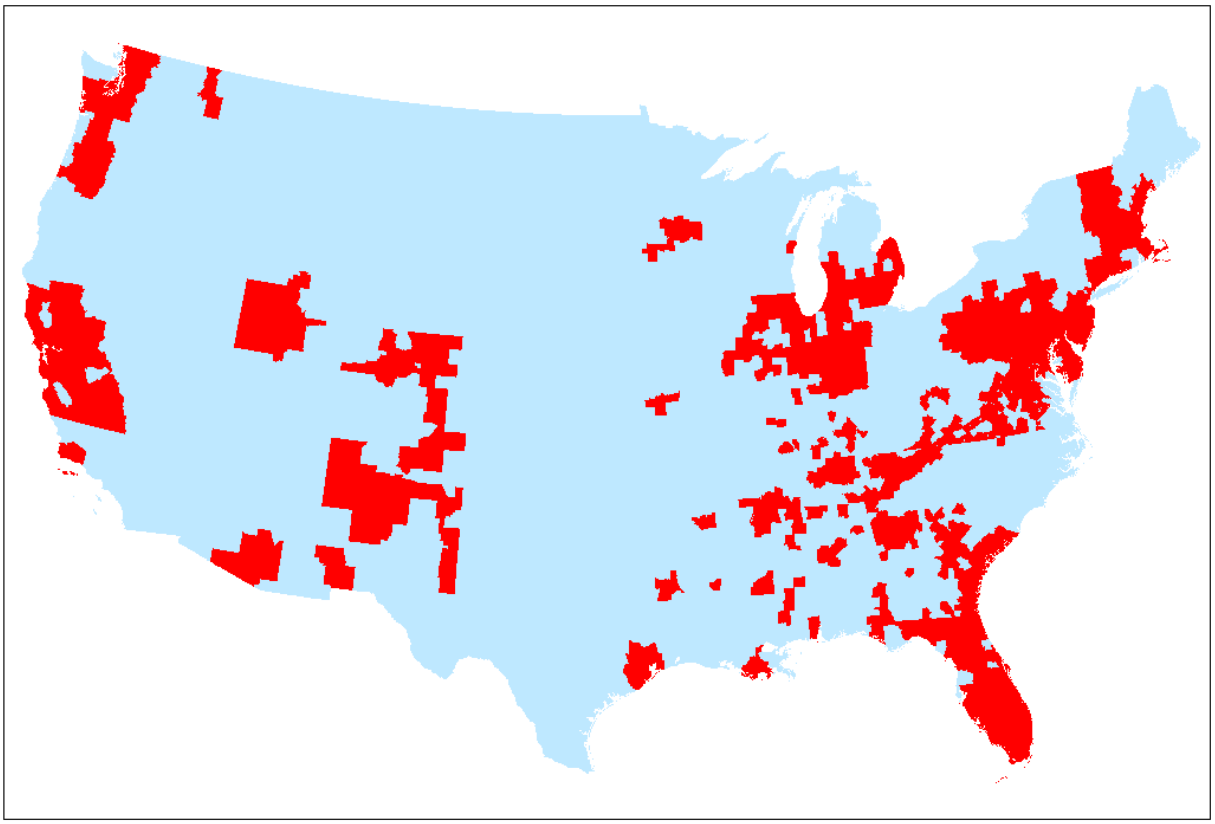

Figure 6: Map of Comcast's holdings by county in 2010. Counties are red if Comcast serves at least one community in the county.

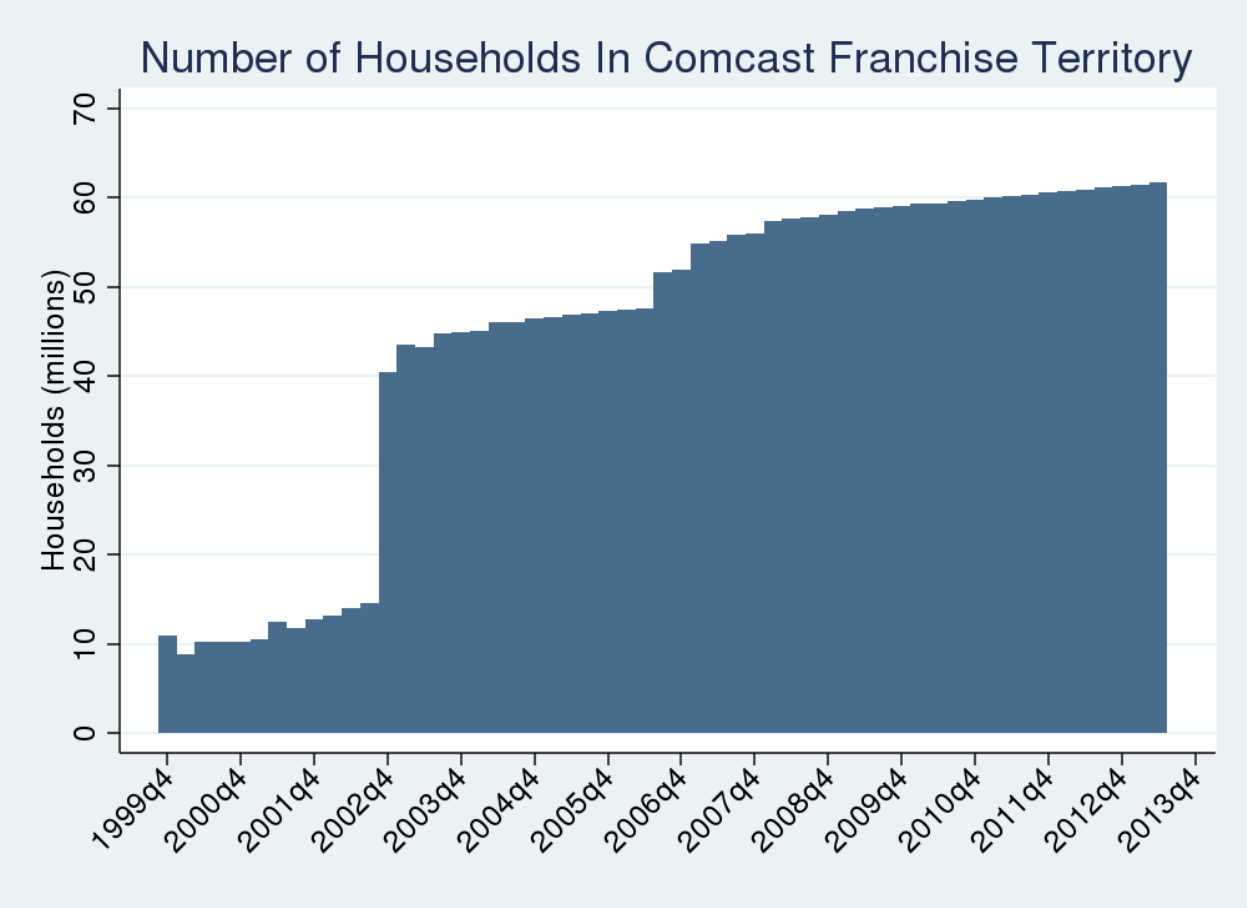

Figure 7: The number of households within Comcast's franchise territory (as identified through our PSID/Census match process) has increased steadily throughout our study period. The large jumps in 2002 and 2006 are the result of the AT&T Broadband and Adelphia acquisitions, respectively. Quarterly household counts are imputed using 2010 Census levels and 2000-2010 growth rates by county.

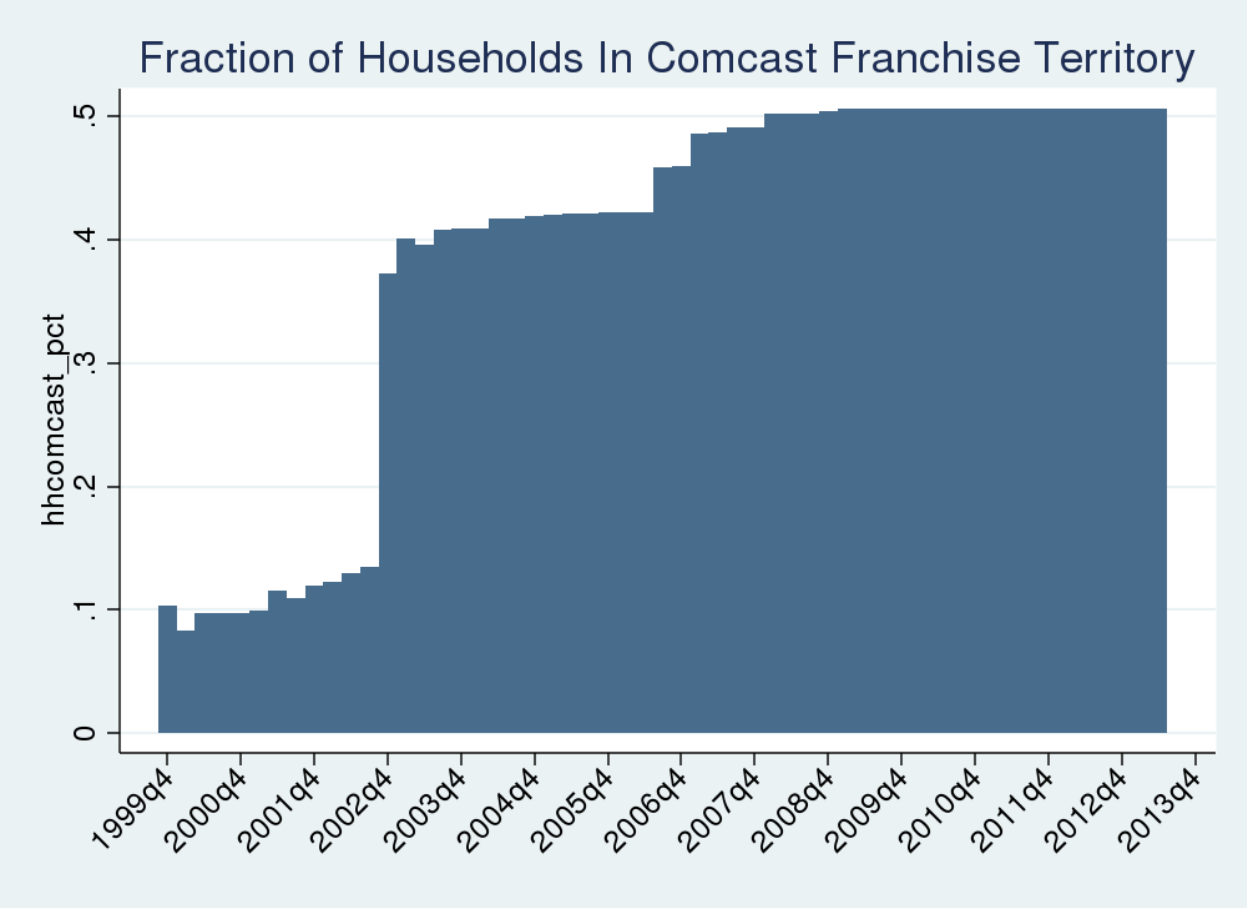

Figure 8: The percentage of households within Comcast's franchise territory (as identified through our PSID/Census match process) has increased steadily throughout our study period. The large jumps in 2002 and 2006 are the result of the Adelphia and Susquehanna acquisitions, respectively. Quarterly household counts and percentages are imputed using 2010 Census levels and 2000-2010 growth rates by county.

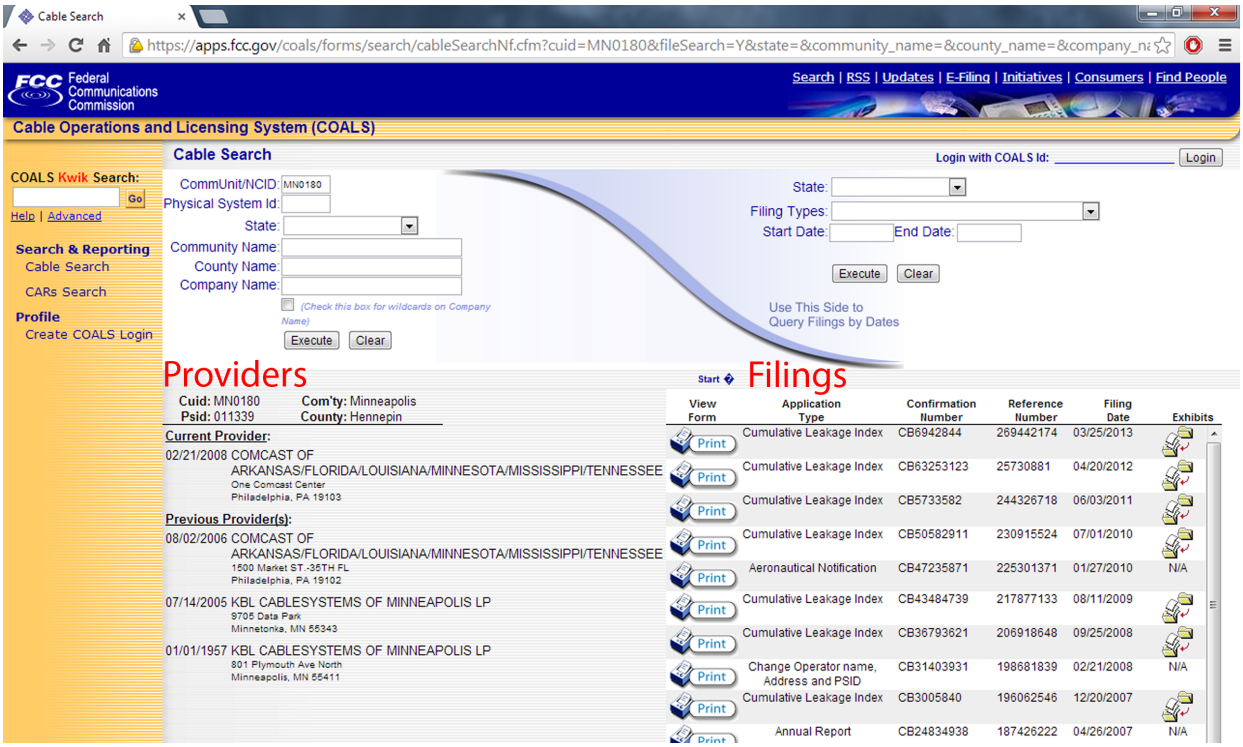

Figure 9: A screenshot of the COALS page for the cable system in Minneapolis Minnesota, with emphasis on the providers and filings information we scraped.

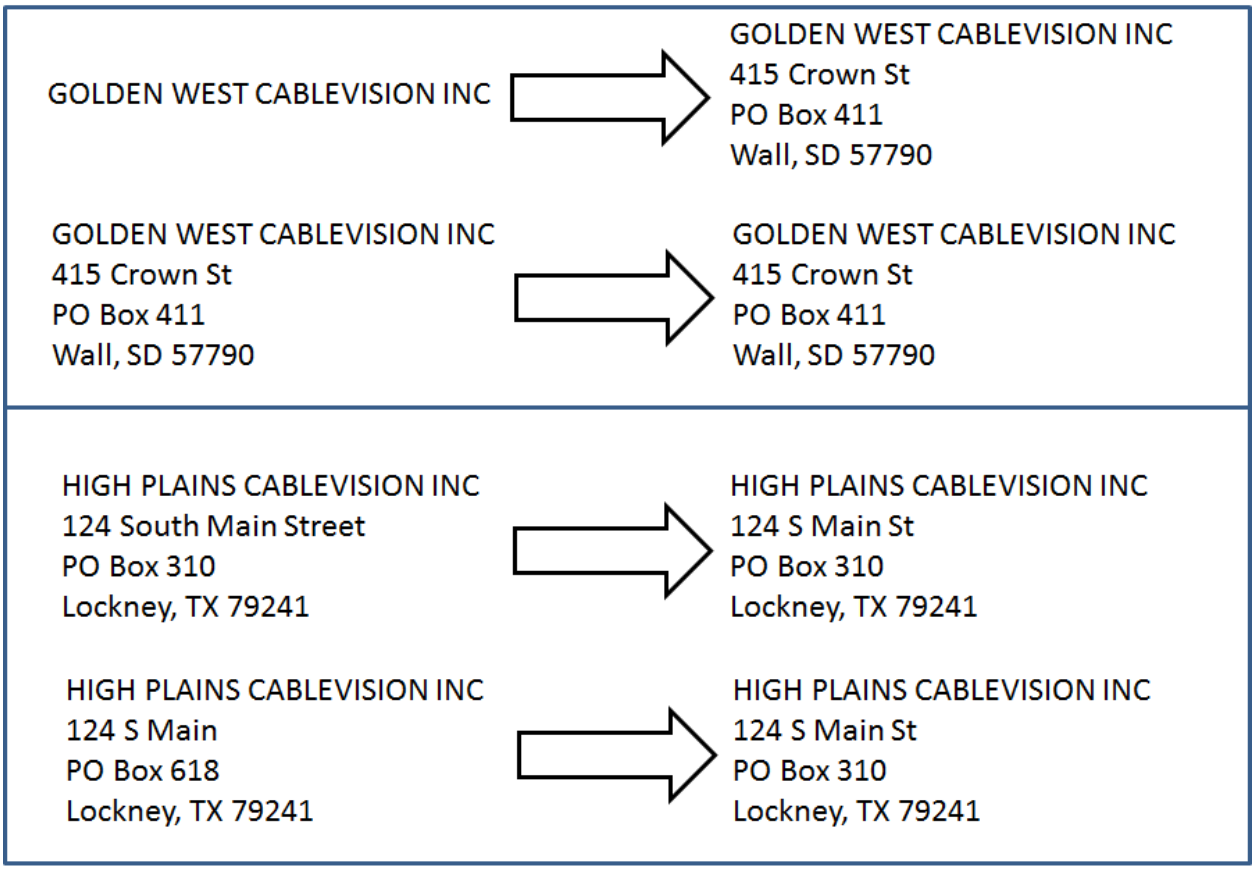

Figure 10: Top: Some legal entity entries were missing address data. We filled in missing addresses using entries with identical names where available. Bottom: When multiple addresses were found (or when addresses had typos), we used the most-common entry for all identically named entities.

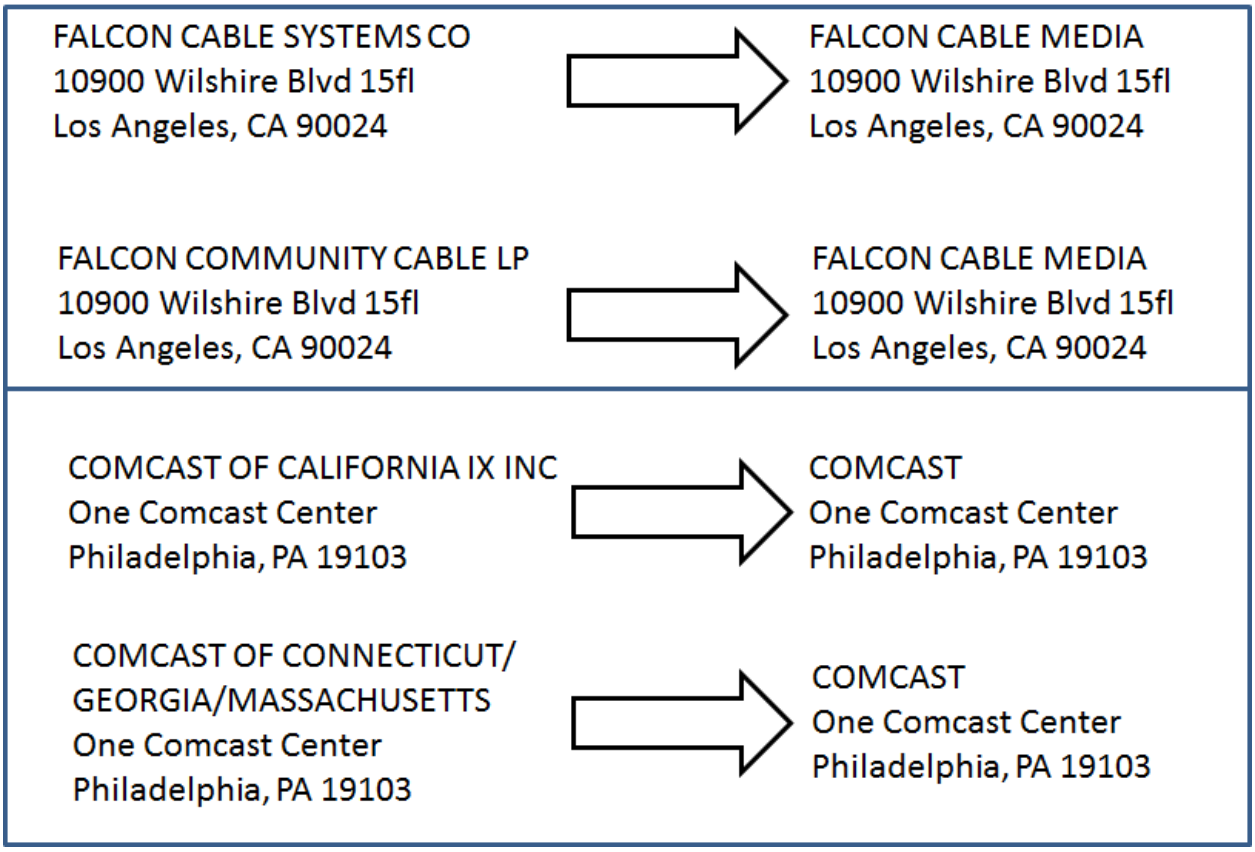

Figure 11: Top: Some legal entity differences came from subsidiaries with slightly different names. Bottom: Many cable operators operate through franchised or regionally-based subsidiaries.

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