

Market Size and Local Television News

Kim Makuch and Jonathan Levy

January 15, 2021

OEA Working Paper 52

Office of Economics and Analytics
Federal Communications Commission
Washington, DC 20554

Abstract

We examine the relationship between the number of independent local television news operations in a market and market size. Estimating a series of ordered logit and ordered probit entry models using 2019 data, we find a strong relationship between market size, measured by number of television households, and the number of independent local television news operations, with diminishing returns to market size. Using the estimated models, we determine market size thresholds above which we predict a market will be able to sustain two, three, or four or more local news operations.

Through its broadcast station ownership rules and review of proposed mergers, the FCC advances three policy goals: competition, diversity, and localism. This analysis sheds light on the effects of FCC regulation of station ownership on the policy goals in markets of different sizes. In some markets, there may be a tradeoff between localism and diversity. In these cases, a merger that eliminates a source of local news may be optimal, even though it reduces viewpoint diversity, if the merged entity improves the quality or increases the quantity of local news programming, strengthening localism. This analysis could help policymakers assess whether a market is likely able to sustain the current number of local news operations or whether a proposed merger is likely to result in a favorable tradeoff of diversity for localism.

These working papers are intended to stimulate discussion and critical comment within the FCC, as well as outside the agency, on issues that may affect communications policy. The analyses and conclusions set forth are those of the authors and do not necessarily reflect the view of the FCC, other Commission staff members, or any Commissioner. Given the preliminary character of some titles, it is advisable to check with the authors before quoting or referencing these working papers in other publications. All titles are available on the FCC website at <https://www.fcc.gov/reports-research/working-papers/>.

Market Size and Local Television News

Kim Makuch and Jonathan Levy¹

1. Introduction

This paper analyzes the relationship between the supply of local television news as defined by the number of independent news operations and various market characteristics, with a focus on market size. The FCC exercises its authority over local television station ownership to advance three policy goals: competition, diversity, and localism.² Historically the agency has examined the number of independent news operations in local markets as an indicator of performance with respect to its diversity goal.³ The FCC has also examined the amount of local news provided by local television stations, at the station and market levels, as an indicator of performance with respect to its localism goal.⁴ The agency, however, does not regulate media content directly; rather it advances its policy goals via structural regulation, i.e., ownership rules and review of proposed mergers. The present analysis aims to better understand how the FCC's structural regulation of station ownership affects the achievement of its policy goals in markets of different sizes.

Television stations are the single most important source of local news, so this paper focuses on the FCC's local television station ownership rule.⁵ The rule prohibits common ownership of more than two full power television stations in a market as defined by the Nielsen designated market area (DMA), subject to two additional conditions: (1) mergers among two stations ranked in the top-four by audience share are prohibited (Top-Four Prohibition), and (2)

¹ Kim Makuch is an economist at the FCC and Jonathan Levy was Deputy Chief Economist of the FCC at the time this paper was completed. The views expressed in this paper are our own and do not reflect those of the FCC or the U.S. government. We would like to thank Glenn Woroch, Wayne Leighton, anonymous reviewers, and seminar participants at the FCC for their helpful comments and suggestions.

² See *2018 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, MB Docket No. 18-349, Notice of Proposed Rulemaking, 33 FCC Rcd 12111, paras. 24, 39, 43, 44, 46, 61 (2018), <https://www.fcc.gov/document/fcc-commences-2018-quadrennial-review-media-ownership-rules-0> (2018 *Quadrennial Review Notice*). See also *2002 Biennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, MB Docket 02-277, Report and Order, 18 FCC Rcd 13620, paras. 17-85 (2003), <https://www.fcc.gov/document/2002-biennial-regulatory-review-review-commissions-broadcast-3> for a detailed description of the policy goals.

³ See *2014 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996 et al.*, MB Docket No. 14-50, Further Notice of Proposed Rulemaking and Report and Order, 29 FCC Rcd 4371, para. 73 & n.181 (2014)

<https://www.fcc.gov/document/2014-quadrennial-regulatory-review-0> (2014 *Quadrennial Review Order*) referencing FCC-commissioned studies by Brocas, Carrillo, and Wilkie (2011) and Savage and Waldman (2011) which suggest a positive impact on viewpoint diversity from the presence of multiple independent television outlets.

⁴ See *Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, MB Docket No.09-182, Notice of Proposed Rulemaking, 26 FCC Rcd 17489, paras. 179-181 (2011) <https://www.fcc.gov/document/fcc-releases-notice-proposed-rulemaking-media-ownership-rules>.

⁵ 47 CFR § 3555(b). The rule applies only to full power stations.

mergers that would reduce the number of independent television station “voices” below eight are also prohibited (Eight Voices Test).⁶

Pursuant to Congressional instructions, the FCC reviews its media ownership regulations every four years.⁷ The *2018 Quadrennial Review Notice* reiterates the agency’s media policy goals: competition, diversity, and localism. Localism refers to content that is tailored to the needs and tastes of the local community to which the broadcast station is licensed. Diversity includes the concept of viewpoint diversity, the provision of civic and political information from a wide range of perspectives to provide citizens with the information needed to discharge the obligations of citizenship.

The FCC’s current justification for the local television station ownership rule is that it promotes competition. However, the *2018 Quadrennial Review Notice* also references the Commission’s diversity and localism goals in connection with this rule.⁸ Moreover, in its *2017 Reconsideration Order*, the Commission indicated that diversity and localism could be relevant to the evaluation of a proposed merger of top-four television stations.⁹ The *2017 Reconsideration Order* specified five factors to consider in analyzing specific proposals for top-four station mergers.

(1) ratings share data of the stations proposed to be combined compared with other stations in the market; (2) revenue share data of the stations proposed to be combined compared with other stations in the market, including advertising (on-air and digital) and retransmission consent fees; (3) market characteristics, such as population and the number and types of broadcast television stations serving the market (including any strong competitors outside the top-four rated broadcast television stations); (4) the likely effects on programming meeting the needs and interests of the community; and (5) any other circumstances impacting the market, particularly any disparities primarily impacting small and mid-sized markets.¹⁰

⁶ A recent attempt by the FCC to eliminate the Eight Voices Test and apply the Top-Four Prohibition on a case-by-case basis was vacated by the 3rd Circuit. *Prometheus Radio Project v. FCC*, 939 F.3d 567 (3d Cir. Sept. 23, 2019). On January 19, 2021, the Supreme Court will hear the FCC’s case to appeal the 3rd Circuit Court’s decision. Under the local television station ownership rule, all full-power television stations (both commercial stations and non-commercial educational stations) are considered voices. Therefore, the Eight Voices Test requires that a market be left with eight independent full power stations following a merger. Our data shows that most markets (138 out of 210) had eight or fewer full power stations in 2019.

⁷ Telecommunications Act of 1996, Pub. L. No. 104-104, § 202(h), 110 Stat. 56, 111-12 (1996) (1996 Act); Consolidated Appropriations Act, 2004, Pub. L. No. 108-199, § 629, 118 Stat. 3, 99-100 (2004) (Appropriations Act) (amending Sections 202(c) and 202(h) of the 1996 Act). In 2004, Congress revised the then-biennial review requirement to require such reviews quadrennially. See Appropriations Act § 629, 118 Stat. at 100.

⁸ *2018 Quadrennial Regulatory Review* at para. 61 (“Although intended primarily to promote competition, does the Top-Four Prohibition also preserve, as a byproduct, a sufficient level of localism or viewpoint diversity in local markets? We seek comment on whether and how the Commission should consider elimination of an independent local news operation or a reduction in local news programming.”).

⁹ *2014 Quadrennial Regulatory Review – Review of the Commission’s Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, MB Docket No. 14-50, Order on Reconsideration and Notice of Proposed Rulemaking, 32 FCC Rcd 9802 (2017) <https://www.fcc.gov/document/fcc-modernizes-broadcast-ownership-rules-0> (2017 *Reconsideration Order*).

¹⁰ *2017 Reconsideration Order* at para. 82 (citations omitted).

As suggested by the fifth factor above, the Top-Four Prohibition may not serve the public interest in markets of all sizes. In some markets, the FCC may face a tradeoff in pursuing its media policy goals through ownership regulation.

The number of independent local news operations a market can sustain is a function of the demand for local news in the market and the cost of providing local news.¹¹ Of course, in equilibrium, a market will not have more local news operations than it can sustain, but, some local news markets may have departed from equilibrium, prompting a move to consolidation. Both supply and demand side changes could cause a departure from equilibrium. On the supply side, the costs of providing local news may have risen over time, at least in some markets.¹² In addition, the expansion of non-broadcast sources of local news may have affected citizen demand for local television news.¹³ Further, demand for advertising during local news programming may have fallen as a result of advertisers placing ads online.

A proposed merger of stations which had both been producing local news presents a trade-off—having more independent outlets is likely to enhance diversity and may also enhance competition and localism. However, if the market is out of equilibrium, then the reduction in independent newsrooms could reduce diversity but preserve or even increase the quantity and quality of local news relative to its state in the absence of the proposed merger. Local news production is characterized by high fixed costs, and advertising revenue remains the major source of station revenue. Combining two stations, therefore, can aggregate audience across different segments of the market, enable news to be transmitted in additional time slots, and even expand over-the-air coverage, all of which can lead to increased revenue. With increased revenue and the ability to spread fixed costs over two stations, there could be an increase in the quality or quantity of local news available in the market.¹⁴

Our analysis sheds light on this tradeoff and could potentially be used by the Commission in evaluating proposed television station mergers, especially those that would result in the

¹¹ In economic theory, the minimum efficient scale (MES) of production is the lowest level of output such that long run average costs are minimized. If MES is large compared to market demand, the market will support fewer firms and conversely if MES is small compared to market demand, the market will support more firms. Tirole (1988). Thus, MES and market demand (which we find to be heavily influenced by market size) interact to determine the equilibrium number of firms.

¹² This could be due to competitive pressure for stations to maintain an online presence in addition to over-the-air content. There is suggestive evidence that cost pressures may be present in medium and small markets. See Fratrick (2020) at p. 7, stating that over the period 2014-2018 the share of total operating costs devoted to local news increased in markets ranked 51 and above. Fratrick (2020) asserts that, in general, spreading high fixed costs over more stations can enhance viability of local news operations.

¹³ For example, in a limited number of markets local news channels are available on cable television. In general, this provides additional competition for local television news, but in at least one market the cable news channel is owned by a local news-producing television station, essentially allowing it to increase its scale of operations. In addition, some local news is native to the Internet, although much of it is user-generated and may not be precisely comparable to news provided by a television news operation.

¹⁴ This could be achieved by a merger of two stations, one of which was not previously producing local news or by a merger of two stations both of which had produced local news. Fratrick (2020). This study was commissioned by Gray Television. Most of the consolidation events cited involve combinations in which the acquired station was not previously producing local news.

elimination of an independent newsroom. Any analysis of such a proposed merger would also need to consider the impact on competition, the Top-Four Prohibition's primary justification.

This analysis measures the supply of local television news in a market by the number of independent news operations in the market using 2019 data. Using the number of independent news operations as the variable of interest tracks the Commission's query in the *2018 Quadrennial Review Notice*, and it is also consistent with research indicating that, for viewpoint diversity, the number of independent providers of news is important.¹⁵

Estimating a series of ordered logit and ordered probit entry models shows a strong relationship between market size, measured by number of television households, and the number of independent television newsrooms, with diminishing returns to market size. This is plausible, given the high fixed costs of local news production, low marginal costs of distribution, and the public good character of video content as a non-rival good. The analysis includes other control variables as well, but market size appears to be the key driver.

Using the estimated models, we determine market size thresholds above which a market is likely able to sustain two, three, or four or more local news operations. To determine the entry thresholds, we compute the predicted probabilities of having at least two, at least three, and at least four local news operations for a range of TV household values.¹⁶ We then set an acceptance criterion to determine the entry threshold values. For example, under an acceptance criterion of 50%, the entry threshold for the second local news operation is the lowest value of TV households at which the probability of having at least two local news operations exceeds 50%. An acceptance criterion of 50% finds the value of TV households at which a market is slightly more likely than not to have at least the target number of local news operations. Higher acceptance criteria lead to higher threshold estimates and a larger number of markets are predicted not to be able to sustain the target number of local news operations. In markets below the threshold, mergers of two local news operations might be considered more favorably because the market may not be large enough to sustain the current number of local news operations. A priori, 50% is the lowest reasonable acceptance criterion, but we have no principled way to specify a higher level. Policymakers employing our framework may reasonably choose to employ some other acceptance criterion above 50%. We report thresholds under acceptance criteria of 50% and 75% as a summary of our results.

Under a 50% acceptance criterion and using the ordered logit specification with 2019 data, the results suggest market size thresholds for two, three, and four or more local news operations to be about 35,000, 175,000, and 615,000 TV households, respectively. These thresholds suggest that the largest 51 markets, containing 69% of U.S. television households, could support four or more independent local news operations. Under a 75% acceptance criterion and using the ordered logit specification, the results suggest thresholds of about 70,000, 310,000, and 800,000 TV households for two, three, and four local news operations, respectively. Under this criterion, the results suggest the largest 38 markets, containing 61% of U.S. television households, could support four or more local news operations.

¹⁵ See references to *2014 Quadrennial Review Order supra* n.2 and, for an earlier theoretical analysis, see Besley and Prat (2006).

¹⁶ See Section 5 for a detailed explanation of the methodology used to calculate the predicted probabilities.

This analysis and the extensive data collection completed could be useful in future analysis of television station mergers. When a proposed merger of two stations would eliminate an independent local news operation, policymakers could calculate the probability that a particular market could support the current number of news operations using the estimated coefficients from our preferred specification and market data. If the market is unlikely to sustain the current number of local news operations, the best outcome may be for the market to have one fewer news operation, which would likely allow the remaining news operations to capture a larger share of ad revenue and, potentially, to improve programming quality, including for local news.

Section 2 of this paper provides background information on local television news and its financing. Section 3 describes the data used. Section 4 explains the empirical specifications chosen, while Section 5 reports the results. Section 6 contains brief conclusions and suggestions for future research.

2. Background

2.1 Sources of Local News

Citizens obtain local news from a variety of sources, but television is the most prominent source. The most comprehensive recent survey of U.S. local news consumption comes from the Pew Research Center.¹⁷ The survey, completed in late 2018, asked respondents if they “often” or “ever” employ various sources and platforms to obtain local news. Television is the leading source by both measures (38% and 86%, respectively) followed by radio (20%, 79%); daily newspaper (17%, 68%); and online-only sources (5%, 23%). Historically, newspapers were a much more important source of local news, but the situation has changed with the collapse of the newspaper advertising market in the face of increasing online consumption of newspaper and other news content.¹⁸

The survey also asked respondents about the platforms on which they consume local news. Although online-only local news sources are not commonly used, the Pew Survey indicates that citizens go online to access local news content from traditional sources. Still, the largest share of respondents preferred to get local news from television (41%), while a slightly smaller share preferred to get local news online (37%). Much smaller shares of respondents preferred to get local news from a printed newspaper (13%) and radio (8%).¹⁹

2.2 Local Television News Industry Over Time

¹⁷ Pew Research Center (2019).

¹⁸ Abernathy (2020).

¹⁹ Most respondents (81%) accessed radio over-the-air, with only 15% accessing radio online. The survey also indicates that the largest share of respondents (70%) found weather to be important for daily life. The third largest share (41%) found traffic and transportation to be important for daily life. These findings may reflect a situation in which radio news is frequently accessed while driving and consists largely of weather and traffic news rather than civic information.

Our analysis utilizes cross-sectional data from July 2019. For a historical perspective on the provision of local television news we look to survey data from the Radio Television Digital News Association (RTDNA) and its predecessor.²⁰ The surveys indicate that in 2018, 706 local television stations originated news as compared to the 637 independent news operations in 2019 in our dataset.²¹ An additional 363 stations carried news from the originators. By comparison, in 2010, 745 stations originated news and 223 carried news from originators. In all, from 2010 to 2018, the number of local television stations originating news dropped by 5.2% and the total number of stations carrying local news increased by 10.4%.

These data suggest that the local television news sector is in reasonably good shape, but that it faces some challenges. Although this paper does not analyze the total quantity of local news (i.e., number of hours, which has been rising²²) or its content, the impact of market size and potential mergers on the number of independent local news providers is important to study.

2.3 Local Television Station Revenues

Most local television station revenues come from advertising. This source has been relatively flat over the past 10 years in nominal terms and has declined in real terms. However, retransmission consent revenues have risen considerably over the same period, so total station revenues are up.²³ S&P Global estimates that, over the period 2010-2018, advertising revenues increased by 11.6%.²⁴ Adjusting these estimates for inflation shows that advertising revenue fell by 3.1% over the period.²⁵

Retransmission consent revenue increased significantly during this period, as did total local station revenue. Since some retransmission consent fees are passed through by stations to their affiliated networks, it is not possible to know the precise impact on revenue available to the station. However, gross station revenue increased in real terms by 32.6% over the period 2010-2018.²⁶

²⁰ RTDNA (2019); RTDNA (2011). Both studies were conducted by Prof. Robert Papper of Hofstra University.

²¹ RTDNA's measure (stations originating local news) is somewhat different from our measure (independent news operations) because our measure counts stations with shared ownership or a shared services agreement as one independent news operation. In most cases our measures are the same, but if, for example, two stations with the same owner each produce a separate local news program, the RTDNA count would be two while our count would be one.

²² RTDNA (2019); RTDNA (2011).

²³ These are aggregate figures, which may mask different trends in markets of different sizes.

²⁴ The nominal increase in ad revenue over the period 2010-2019 was 3.8%, but it is more illuminating to compare even-numbered years to each other (or odd-numbered years to each other) since political advertising which occurs predominantly in even-numbered years provides a significant revenue boost. In 2018, political advertising accounted for 14.5% of total station spot ad revenue. S&P Global, *U.S. TV station industry total revenue projections, 2009-2024* (June 2019).

²⁵ The figures were adjusted for inflation using Bureau of Labor Statistics, *CPI for All Urban Consumers (CPI-U) 1982-84=100 (Unadjusted) - CUUR0000SA0*, <https://fred.stlouisfed.org/series/CPIAUCNS> (last accessed Dec. 3, 2020).

²⁶ S&P Global, *U.S. TV station industry total revenue projections, 2009-2024* (June 2019); Bureau of Labor Statistics, *CPI for All Urban Consumers (CPI-U) 1982-84=100 (Unadjusted) - CUUR0000SA0*, <https://fred.stlouisfed.org/series/CPIAUCNS> (last accessed Dec. 3, 2020).

3. Data

For the analysis, we require data on market size and the number of independent local news operations in each television market. In addition, we need information on other factors that influence demand for local news programming and the cost of local news provision in each market. In this section, we describe the key variables used in the analysis after first defining television markets.

3.1 Television Market Definition

In the analysis, we use Nielsen DMAs to define local TV markets. There are 210 mutually exclusive DMAs in the United States. Using DMAs as the market definition is appropriate because all households in a DMA have access to stations located in the DMA through a cable or satellite television provider and possibly via over-the-air signal. In addition, most households only view stations located in their own DMA.²⁷ In all but 13 DMAs, viewership of in-market stations makes up more than 85% of total household viewing.²⁸

3.2 Independent Local News Operations

To compile a count of independent local news operations for each market, we used information on local news programming aired as well as information on station ownership and operation. Using the Nielsen Local TV View (NLTV) database, we generated a list of all programs classified as local news that aired in July 2019.²⁹ We matched the programs and associated stations to information on station ownership, service sharing agreements, and news director from BIA Kelsey's Media Access Pro database.³⁰ With this information, we generated groups of stations in the same market that (1) were owned by the same company, (2) had a service sharing agreement, or (3) shared a news director. Each group of stations was considered an independent operation, and each group that aired at least one local newscast was counted as an independent local news operation.³¹

In Figure 1, a histogram shows the number of independent local news operations in each market in 2019. The median market had three local news operations, and the market with the most local news operations was Houston, Texas with eight. Only Glendive, Montana, the smallest DMA, did not have any local news operations.

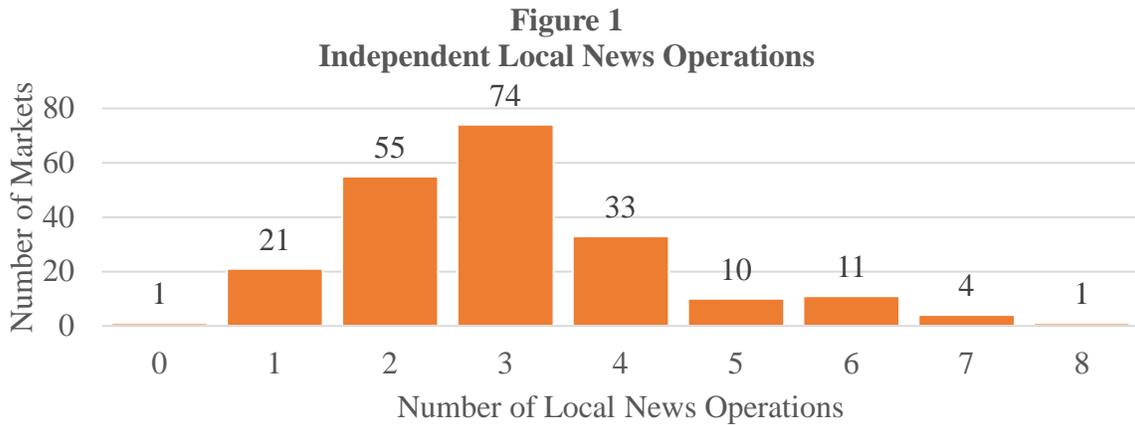
²⁷ Some households are also able to view out-of-market stations over the air or, if the FCC determines a station is "significantly viewed" in an area outside of its DMA, cable and satellite operators in that area are permitted to carry the out-of-market station.

²⁸ We calculated the in-market station viewership share using Nielsen household ratings for all viewed stations in May 2018. We use viewing data from May 2018 because, beginning in June 2018, Nielsen stopped measuring television viewership in the Juneau, Alaska and Glendive, Montana DMAs.

²⁹ We collected local news programs that aired during the July 2019 sweeps period (July 4, 2019 – July 31, 2019).

³⁰ The term service sharing agreements refers to local marketing agreements and joint sales agreements. Under these agreements, one station provides services such as ad sales, newscast production, financial services, or contract negotiation to a second station in the same market that is owned by a different firm. See Keach Hagey, *Sinclair Draws Scrutiny Over Growth Tactic*, The Wall Street Journal (Oct. 20, 2013) for a description of the practice.

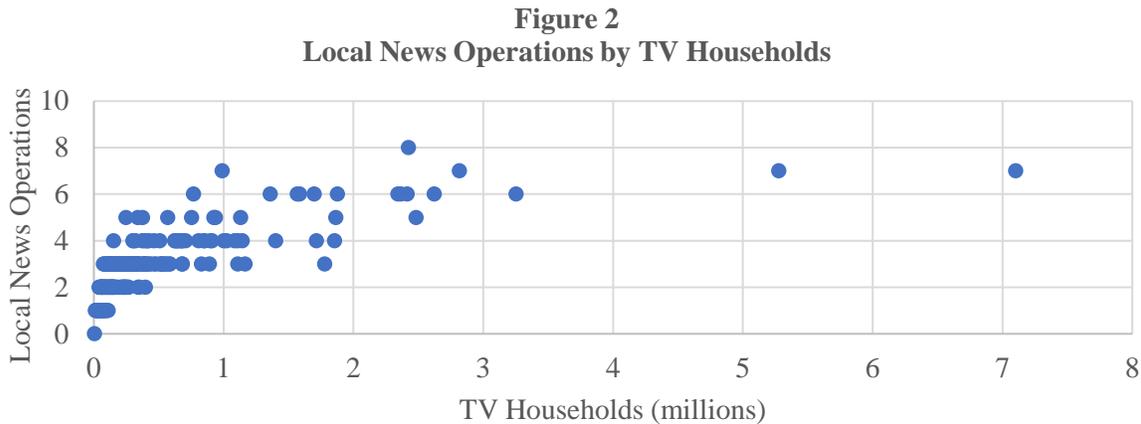
³¹ See Appendix 2 for a more detailed description of the process by which we determined the number of independent local news operations in each market.



Sources: Nielsen, *NLTV Database*; BIA Kelsey; *Media Access Pro Database*.

3.3 Independent Variables

Our measure of market size is Nielsen’s estimate of TV households for each market.³² In Figure 2, a scatterplot shows local news operations and TV Households in 2019.

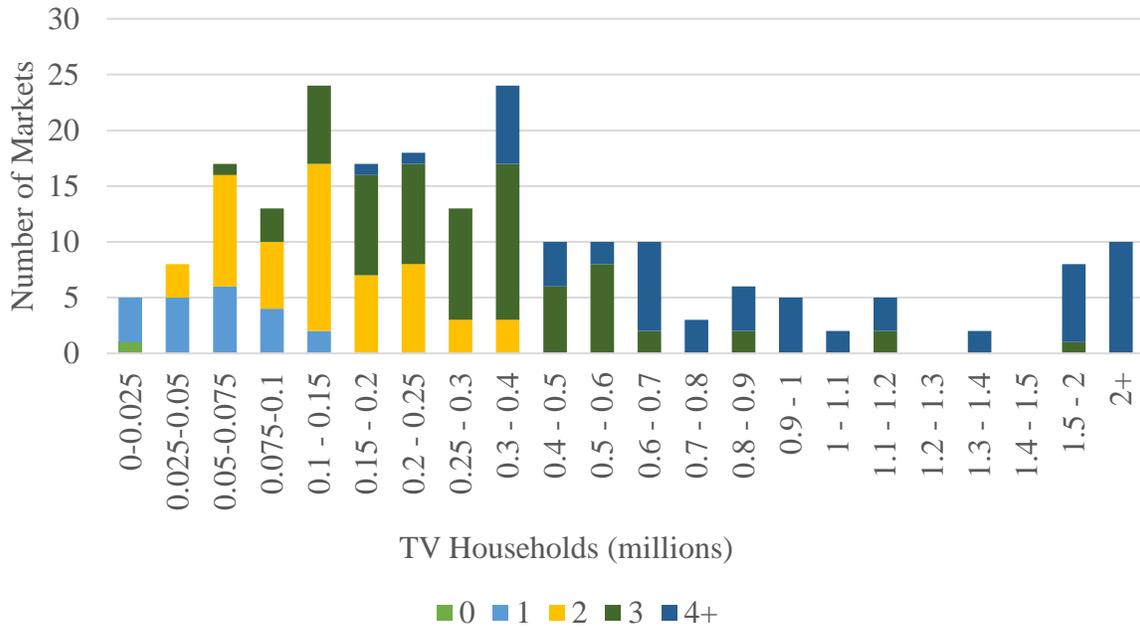


Sources: Nielsen, *NLTV Database*; BIA Kelsey, *Media Access Pro Database*; Nielsen, *2018-2019 Universe Estimates: DMA TV Households Estimates by Market Section*.

The bar charts in Figure 3 report, for a given range of TV households, the distribution of markets that had 0, 1, 2, 3, and 4 or more local news operations in 2019.

³² Nielsen, *2018-2019 Universe Estimates: DMA TV Households Estimates by Market Section* (2018). The 2018-2019 estimates reflect the DMA population as of January 1, 2019. Nielsen recently began including broadband-only households in its DMA TV household estimates. The TV household estimates used in the analysis do not include broadband-only households. The estimates used are available at <https://mediatracks.com/resources/nielsen-dma-rankings-2019/>.

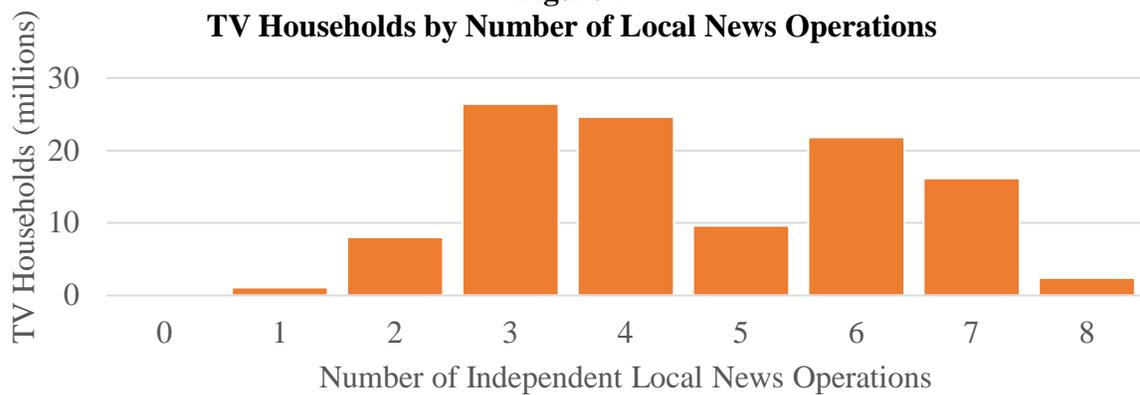
Figure 3
Local News Operations by TV Households



Sources: Nielsen, *NLTV Database*; BIA Kelsey, *Media Access Pro Database*; Nielsen, *2018-2019 Universe Estimates: DMA TV Households Estimates by Market Section*.

Figure 4 shows the total number of TV households in markets with different numbers of local news operations. This graph shows that most TV households had access to at least four local news operations in 2019, even though the median market had three local news operations (Figure 1).

Figure 4
TV Households by Number of Local News Operations



Sources: Nielsen, *NLTV Database*; BIA Kelsey, *Media Access Pro Database*; Nielsen, *2018-2019 Universe Estimates: DMA TV Households Estimates by Market Section*.

In addition to TV households, we also include demographic variables that may affect demand for local news programming or demand for advertising. We include the share of

Hispanic TV households, per capita income, and the share of working age population, defined here as share of population aged 18 to 64, for each market.³³ Economic activity within a market also influences the demand for advertising; therefore, we include a measure of GDP for each market.³⁴

Several other factors may affect the demand for local news and advertising and the cost of producing local news. For example, if a market covers multiple states, local newscasts might decide to cover multiple state governments to attract viewers residing in all states. This would increase the cost of news production and likely reduce the number of newscasts in the market. Alternatively, local newscasts might decide to differentiate themselves by focusing coverage on only one state. This scenario would likely lead to more local news operations in the market. To capture these effects, we include the share of TV households that live outside the state with the largest share of TV households in the market.³⁵

The distribution of population within a market may also affect the cost of news production and the demand for advertising; therefore, we also collect the population density of each market.³⁶ In addition, merger applicants have argued that stations in markets with multiple population centers only attract viewers and advertising spending from the immediate area.³⁷ Further, if cities within the same market are located far from each other, the cost of news

³³ Hispanic TV household share and working age population share come from Nielsen, while per capita income comes from BIA Kelsey Media Access Pro. Nielsen, *2018-2019 Universe Estimates: DMA, County, and State Levels – TV Households and Persons by Age/Sex Therein* (2018); BIA Kelsey, *Media Access Pro Database* (accessed July 3, 2019).

³⁴ Estimates of 2018 GDP by county come from the Bureau of Economic Analysis. U.S. Bureau of Economic Analysis, *Real Gross Domestic Product by County 2015-2018*, <https://apps.bea.gov/regional/histdata/releases/1219gdpcounty/index.cfm>. See Appendix 3 for a detailed description of the process by which county-level GDP estimates were aggregated to DMAs.

³⁵ For example, consider a market that covers three states; 35% of TV households in the market live in the first state, 25% of TV households in the market live in the second state, and 40% of TV households in the market live in the third state. The third state is called the home state because the largest number of market TV households live in it. Then, the out of state share is the share of TV households in the market living outside the home state (60%). This information comes from Nielsen. Nielsen, *2018-2019 Universe Estimates: DMA, County, and State Levels – TV Households and Persons by Age/Sex Therein* (2018).

³⁶ Estimates of population density come from the U.S. Census, *American Communities Survey, Five Year Estimates 2013-2017*. The data were obtained through IPUMS NHGIS. Steven Manson, Jonathan Schroeder, David Van Riper, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 14.0 [Database]. Minneapolis, MN: IPUMS. 2019. <http://doi.org/10.18128/D050.V14.0>. See Appendix 3 for a detailed description of the process by which census tract-level estimates were aggregated to DMAs.

³⁷ Sinclair Broadcast Group made this argument during its attempted acquisition of Tribune Media Company as it sought a waiver of the Top-Four Rule for the Greensboro – High Point – Winston Salem, NC market. Sinclair Broadcast Group, *Amendment to FCC Form 315, February 2018* at 13 https://licensing.fcc.gov/cdbs/CDBS_Attachment/getattachment.jsp?appn=101779327&qnum=5140©num=1&exhnum=3 (February 2018). Before Tribune terminated the deal, Sinclair decided instead that it would divest a station in the Greensboro market to comply with the Top-Four Rule and did not pursue a waiver in the Greensboro market further.

production may be higher. Therefore, we include the distance between cities in the market.³⁸ To further measure cost in each market, we also include a measure of the cost of living.³⁹

As mentioned above, households within a market usually view TV stations located in the same market, but some markets have high rates of out-of-market station viewership. We do not control directly for out-of-market viewership because the variable is likely to be endogenous to the model. Instead, we control for the size of the market (measured in TV households) relative to the neighboring markets. Households in a relatively small market may also feel connected to a neighboring larger market and watch local news from that market. To control for possible inaccuracies in market definition, we include the ratio of the average number of TV households across neighboring markets and TV households in the original market $\left(\frac{\text{neighbor DMA TV HHS}}{\text{TV HHS}}\right)$. A value greater than one indicates that the neighboring markets are larger, on average, than the original market. Finally, we include the number of full power stations because the number of full power stations is a rough upper bound on the number of local news operations in each market.⁴⁰ Table 1 presents summary statistics of the variables.

Table 1: Summary Statistics	mean	med	min	max	SD
Local News Operations	3.03	3	0	8	1.40
TV Households (millions)	0.52	0.26	0.004	7.10	0.81
Full Power Stations	7.75	7	1	27	4.62
Hispanic TV Households Share	0.10	0.05	0.01	0.95	0.15
Per Capita Income (\$10,000s)	4.05	3.86	2.41	7.63	0.69
Working Age (18 - 64) Share	0.59	0.59	0.52	0.64	0.02
GDP (\$ trillions)	0.09	0.04	0.0005	1.65	0.18
Population Density (per sq. mile)	162.06	90.09	2.59	1891.4	230.14
Distance between Cities (miles)	15.49	0	0	107.07	22.82
Out of State Share	0.09	0	0	0.65	0.15
Cost of Living Index	87.00	86.76	62.50	128.61	11.95
Relative Size (neighbor DMA TVHHS/TVHHS)	4.03	2.09	0.00	53.45	6.50
Number of Observations	210				

4. Empirical Specification

³⁸ Nielsen names DMAs by the cities within the DMA that have a licensed TV station. If a DMA has more than two named cities, the distance between cities in the DMA is the smallest distance between any two named cities in the DMA. City longitude and latitude information was downloaded from Simple Maps. Simple Maps, *US Cities*, <https://simplemaps.com/data/us-cities> (last visited Sept. 9, 2020).

³⁹ The cost of living index comes from the Bureau of Economic Analysis. U.S. Bureau of Economic Analysis, *Regional Price Parities by State and Metro Area*, <https://www.bea.gov/data/prices-inflation/regional-price-parities-state-and-metro-area>. The U.S. average price level is equal to 100, therefore an index value of 105 indicates prices in the area are, on average, 5% higher than the U.S. average. See Appendix 3 for a detailed description of the process by which the metropolitan statistical area-level estimates were aggregated to DMAs.

⁴⁰ In a small number of markets, low power stations also air local news programs.

We use an ordered logit model to model the relationship between the number of local news operations in a market and the market's size and demographic characteristics as well as other factors that may affect the demand for or cost of local news provision in the market. Ordered logit models⁴¹ are used to model outcomes that are inherently ordered or ranked. In this case, the outcome of interest is the number of local news operations in a market so the ordering is straightforward (a market with four local news operations has more local news operations than a market with three local news operations, a market with three local news operations has more local news operations than a market with two local news operations, etc.).⁴²

In the model, the number of local news operations is determined by an underlying, unobserved variable.⁴³ In our case, the unobserved variable can be described as the attractiveness of the market for local news. Attractiveness is modeled as:

$$\text{Attractiveness}_i = x_i' \beta + \varepsilon_i,$$

where $x_i' \beta$ is the systematic component of attractiveness and ε_i is the error term. The errors follow a standard logistic distribution.⁴⁴ The latent variable (attractiveness) is divided by J-1 cut points (γ) into J categories of the observed outcome (local news operations) in the following way:

$$\begin{aligned} \text{Local News Operations}_i &= 1 \text{ if } x_i' \beta + \varepsilon_i < \gamma_1 \\ &= 2 \text{ if } \gamma_1 \leq x_i' \beta + \varepsilon_i < \gamma_2 \\ &\dots \\ &= J \text{ if } \gamma_{J-1} \leq x_i' \beta + \varepsilon_i. \end{aligned}$$

⁴¹ For more information on the ordered logit model, see Jeliazkov and Rahman (2012).

⁴² The dependent variable that is our principal interest – the number of local TV news operations – is a count variable, i.e., a non-negative integer. Consequently, we could explain this variable in terms of market characteristics by estimating any of several well-known count data regression models. See Cameron and Trivedi (2013). In fact, we estimate below what is the most common count model, the Poisson regression. In our case, that model relates the logarithm of the expected number of local news operations to a linear function of unknown parameters and observed market characteristics. Estimation results of the Poisson regression gives us a robustness check of the results we computed for our ordered logit model. Nevertheless, the ordered logit model remains our preferred specification because the latent value interpretation lends itself in a natural way to calculation of thresholds of market sizes. In contrast, the Poisson regression and its various derivatives place strong restrictions on the feasible distributions of the count variable and their relationship to explanatory variables such as the number of TV households in the local market.

⁴³ The local television station ownership rule has been in effect for many years, so it is possible that the distribution of independent local news operations would have been different in the absence of the rule. Since we are interested in the maximum number of local news operations a market can sustain, we are only concerned with the possibility that the rule reduces the number of local news operations in some markets. If the number of independent local news operations is lower in some markets than it would have been in the absence of the rule, this would lead us to underestimate the effect of TV households and, in later analysis, overestimate the threshold values. It is unclear, however, whether the rule has reduced the number of local news operations in some markets. By preventing station mergers, the rule may prohibit combinations that would have generated an additional source of local news. On the hand, the rule may prohibit combinations that would have consolidated two independent local news operations into one operation. Finally, the rule may prevent station mergers that have no effect on the number of local news operations.

⁴⁴ Another commonly used ordered choice model is the ordered probit model. In the ordered probit model, the errors follow a standard normal distribution. In the next section, we also show results from the ordered probit model.

Given this model, the probability that the outcome (local news operations) is equal to a certain value is given below.

$$\begin{aligned}
\text{Prob}(y_i = 1) &= \text{Prob}(x_i' \beta + \varepsilon_i < \gamma_1) \\
&= \text{Prob}(\varepsilon_i < \gamma_1 - x_i' \beta) \\
&= F_L(\gamma_1 - x_i' \beta) \\
\\
\text{Prob}(y_i = 2) &= \text{Prob}(\gamma_1 \leq x_i' \beta + \varepsilon_i < \gamma_2) \\
&= \text{Prob}(\varepsilon_i < \gamma_2 - x_i' \beta) - \text{Prob}(\varepsilon_i < \gamma_1 - x_i' \beta) \\
&= F_L(\gamma_2 - x_i' \beta) - F_L(\gamma_1 - x_i' \beta) \\
&\dots \\
\text{Prob}(y_i = J) &= \text{Prob}(x_i' \beta + \varepsilon_i \geq \gamma_{J-1}) \\
&= 1 - \text{Prob}(x_i' \beta + \varepsilon_i < \gamma_{J-1}) \\
&= 1 - F_L(\gamma_{J-1} - x_i' \beta),
\end{aligned}$$

where F_L is the standard logistic cumulative distribution function:

$$F_L(z_i) = \frac{1}{1 + e^{-z_i}}.$$

5. Results

Table 2 presents the results of the ordered logit model estimated by maximum likelihood. In addition to the ordered logit model, we also present estimates from ordered probit, Poisson, and linear regression models. The ordered logit and ordered probit specifications split the outcome variable, local news operations, into four ordered categories (< 2, 2, 3, and 4+ local news operations).⁴⁵ Results from the familiar linear regression model and the Poisson model, a count data model, are included to show the robustness of the coefficient signs and significance levels across specifications.⁴⁶ The ordered logit specification is slightly preferred to the ordered probit specification because the ordered logit predicts a slightly higher share of outcomes correctly. The magnitudes of the estimated coefficients, however, are not directly comparable across models. The effect of TV households under different models can be compared through the estimated entry thresholds reported in Table 3.

⁴⁵ A specification with five ordered categories (<2, 2, 3, 4, and 5+) was also run, but the assumption of proportional odds was rejected in the Brant test. The proportional odds assumption (sometimes called the parallel regression assumption) underlies the ordered logit and ordered probit models. In these models, we assume that the relationship between each pair of outcome groups is the same. In other words, the models assume that the coefficients that describe the relationship between the lowest category and all higher categories are the same as the coefficients that describe the relationship between the next lowest category and all higher categories, and so on. See Greene and Hensher (2009).

⁴⁶ Appendix 1 also includes estimates from the logit and probit models. In the logit and probit models, we split the outcome variable at four because we are particularly interested in estimating the threshold between three and four local news operations. This threshold is most relevant for the FCC's local TV ownership rule which prohibits firms from owning two of the top-four stations in a market.

Several variables described in Table 1 are not included in the specifications in Table 2. Full power TV stations, GDP, and population density were found to be collinear with TV households and were excluded from the final specifications so that the marginal effect of TV households, the variable of greatest interest, could be better captured. The cost of living measure was collinear with per capita income and was therefore excluded. The collinearity between income and cost of living is important to keep in mind when interpreting the marginal effect of income. The estimated effect of income may capture both demand effects related to audience demographics and cost effects.

Table 2: Regression Models: Estimated Coefficients

	Ordered Logit	Ordered Probit	Poisson	OLS
TV Households (millions)	8.047*** (1.783)	4.073*** (0.866)	0.446*** (0.055)	1.973*** (0.191)
TV Households Squared	-1.014*** (0.223)	-0.514*** (0.108)	-0.053*** (0.009)	-0.21*** (0.031)
Hispanic Share	13.462*** (2.690)	8.487*** (1.505)	1.938*** (0.335)	5.719*** (1.119)
Hispanic Share Squared	-12.86*** (3.294)	-8.19*** (1.907)	-1.816*** (0.499)	-5.295*** (1.640)
Income per Capita	-0.68** (0.331)	-0.397** (0.171)	-0.058** (0.027)	-0.213*** (0.081)
Share Working Age	17.538** (8.614)	10.778** (4.776)	2.468** (1.055)	6.798** (2.743)
Distance between Cities >50 miles	-0.221 (0.480)	-0.142 (0.269)	-0.079 (0.062)	-0.197 (0.149)
Relative Size Ratio	-0.132*** (0.033)	-0.087*** (0.019)	-0.029*** (0.005)	-0.041*** (0.010)
Share Out of State	6.859* (3.542)	4.042** (1.949)	0.997*** (0.344)	2.569** (1.076)
Share Out of State Squared	-12.333* (7.448)	-7.24* (4.083)	-1.783** (0.752)	-4.844** (2.412)
Cut point 1	6.93*** (5.227)	4.233*** (2.864)		
Cut point 2	9.712*** (5.246)	5.846*** (2.873)		
Cut point 3	13.242*** (5.270)	7.843*** (2.888)		
Constant			-0.432 (0.623)	-1.303 (1.647)
Observations	210	210	210	210
Likelihood Ratio Index	0.425	0.425	0.127	
R-Squared				0.768
Share Correctly Predicted	0.629	0.624	0.505	0.495

Notes: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% significance levels respectively. The ordered logit and ordered probit specifications divide local news operations into four ordered categories: < 2, 2, 3, and 4+ local news operations. The coefficient magnitudes are not directly comparable across models. See Table 3 for a comparison of the entry thresholds under different models.

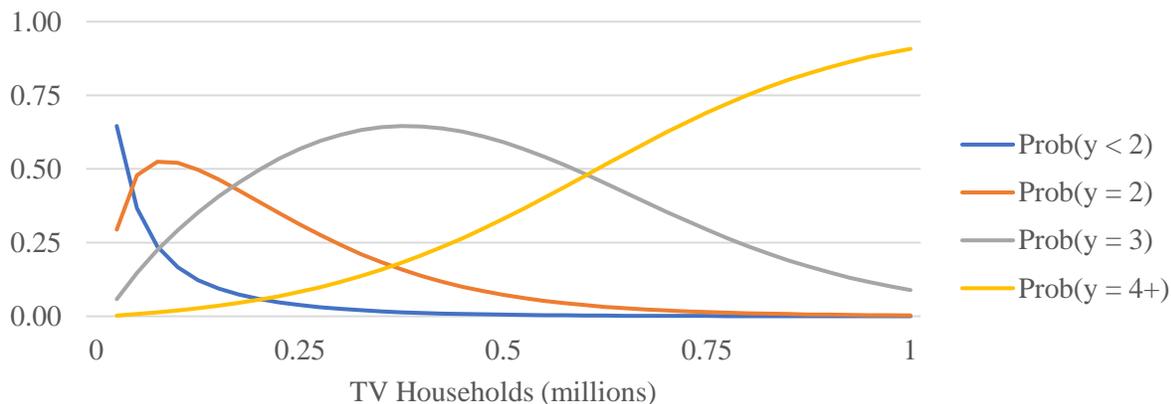
We describe the marginal effects of the variables on the probability of each outcome in detail below. In general, a positive coefficient indicates that an increase in the variable is expected to increase the number of local news operations.⁴⁷

5.1 Market Size Entry Thresholds

Since market size (TV households) is one of the explanatory variables in the models, we can estimate entry thresholds by evaluating each model’s predictions at various levels of market size to summarize the results.

For the ordered logit and probit models, outcome probabilities ($\text{Prob}(y < 2)$, $\text{Prob}(y = 2)$, $\text{Prob}(y = 3)$, and $\text{Prob}(y \geq 4)$) are predicted for all markets using a common value for TV households⁴⁸ and the observed values of all other variables.⁴⁹ Then, for each outcome, the predicted probabilities are averaged across markets. Figure 5 plots the results of these calculations under the ordered logit specification for values of TV households ranging from 0 to 1 million.

Figure 5
Predicted Probabilities by TV Households
(Ordered Logit)



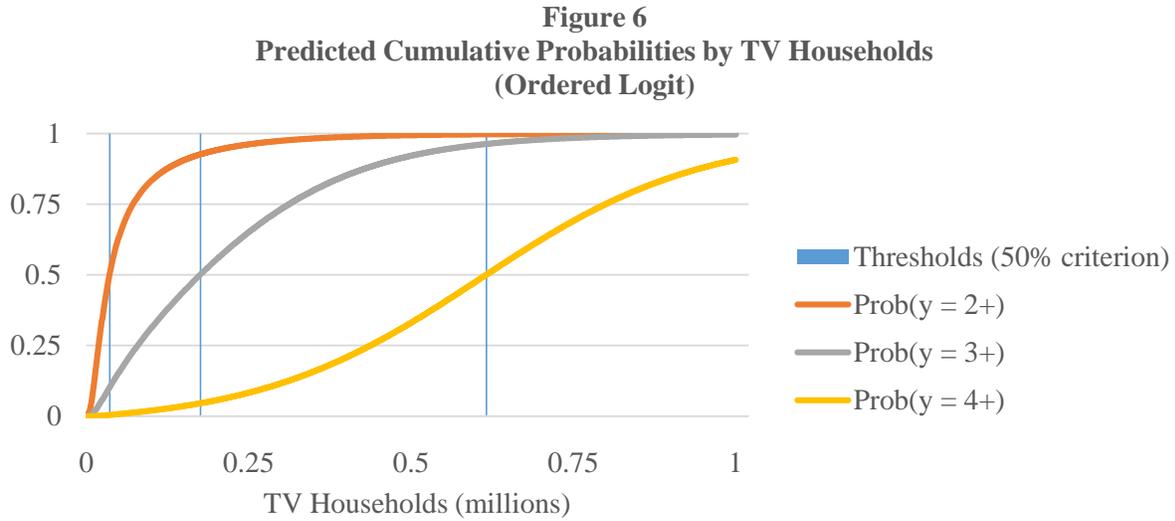
To determine the entry thresholds, we compute the predicted cumulative probabilities (i.e., $\text{Prob}(y \geq 2)$, $\text{Prob}(y \geq 3)$, and $\text{Prob}(y \geq 4)$) for the same range of TV household values. We then set an *acceptance criterion* to determine the entry thresholds. The entry threshold for the n th local news operation is the lowest value of TV households at which the probability of having at least n local news operations exceeds the acceptance criterion. Figure 6 shows the entry

⁴⁷ Variables with quadratic terms cannot necessarily be interpreted as described above. The effects of TV households, share Hispanic, and share out of state are described below.

⁴⁸ In addition to TV households and its square, the relative size ratio also depends on the value of TV households and varies based on the common value of TV households used.

⁴⁹ As the number of TV households varies, we assume that the share of incremental TV households that are Hispanic is the same as the share of Hispanic TV households in the observed market. In other words, the share of Hispanic TV households remains constant as TV households varies.

threshold values for a 50% acceptance criterion graphically. An acceptance criterion of 50% is the lowest sensible acceptance criterion, and setting the criterion higher increases the entry thresholds. We computed entry thresholds for the ordered logit and ordered probit specifications above under 50% and 75% acceptance criteria.



For the Poisson and linear regression models, we predict the number of local news operations in each market using a common value of TV households and the observed values of all other variables. Then, the predicted values are averaged across markets. We define the entry threshold for the n th local news operation as the lowest value of TV households at which the predicted number of local news operations rounds to n .⁵⁰ Table 3 presents the entry thresholds for all specifications.

Table 3: Market Size Entry Thresholds (TV Households)

		Ordered Logit	Ordered Probit	Ordered Logit	Ordered Probit	Poisson	OLS
Acceptance Criterion		50%	50%	75%	75%	—	—
Firm	1	—	—	—	—	7,519	13,978
	2	35,551	35,497	71,661	70,486	27,884	28,821
	3	175,088	166,846	311,739	322,966	146,237	158,915
	4	615,539	646,598	799,173	870,264	734,866	643,888

Notes: For the ordered logit and ordered probit models, the n th entry threshold occurs at the lowest value of TV households at which the predicted probability of having at least n firms exceeds the acceptance criterion. For the Poisson and linear regression models, the n th entry threshold occurs at the lowest value of TV households at which the predicted number of firms rounds to n .

⁵⁰ For example, the entry threshold for the first local news operation occurs at the value of TV households where the expected number of local news operations just exceeds 0.5.

As noted above, the thresholds for the ordered logit and ordered probit specifications are larger under the 75% acceptance criterion than under the 50% acceptance criterion. The second and third firm entry thresholds from the Poisson and linear regression models are smaller than the corresponding ordered logit and ordered probit model thresholds. The size of the fourth firm entry threshold ranges from about 615,000 to 870,000 TV households.

5.2 Marginal Effects of Other Covariates

Figures 7-10 show the predicted probabilities of each outcome as the indicated variable changes and all other variables are held at their observed values under the ordered logit specification.⁵¹ As shown in Figure 7, an increase in Hispanic share increases the probability that a market has four or more local news operations until the Hispanic share reaches about 50%. Once the Hispanic share reaches 50%, further increases in the Hispanic share reduce the probability that a market has four or more local news operations. This result suggests that ethnically diverse markets support more local news operations.⁵² This could be because news operations differentiate themselves to serve different segments of diverse markets.

Figure 7
Predicted Probabilities by Share Hispanic
(Ordered Logit)

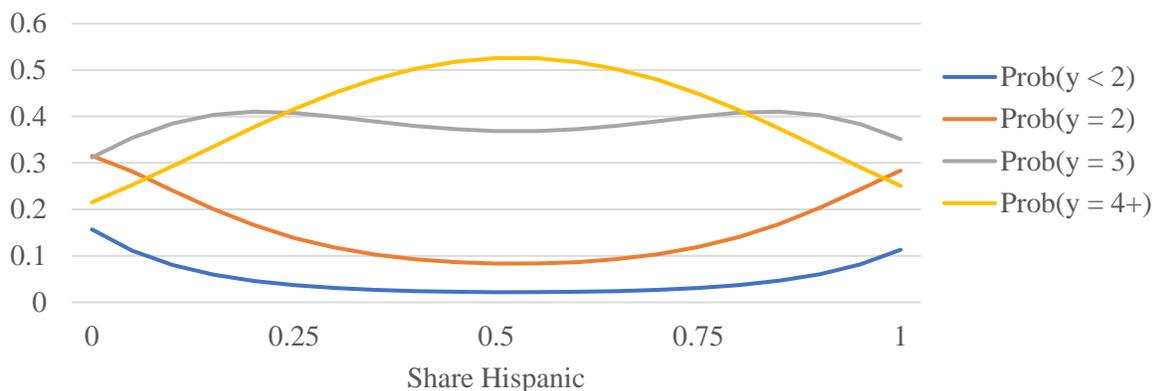


Figure 8 shows that as income increases, markets are more likely to have fewer local news operations. This finding is somewhat surprising because advertisers value high-income viewers more highly than low-income viewers. Since programs with high income viewers generate large advertising revenues, we would expect markets with more high-income residents to sustain more local news operations. Instead, this finding may indicate that high-income

⁵¹ The predicted probabilities for the ordered logit are shown as an example. The probabilities are similar for the ordered probit model.

⁵² Earlier versions of the paper also included shares of African American and Asian American TV households in the analysis. Although we found no effect of these variables on local news operations, we do not believe that this phenomenon is exclusive to the Hispanic population. It may be that the share of Hispanic TV households is large enough in a significant number of markets to make the result visible in our estimates, whereas the effect of other racial and ethnic groups is not visible because these groups are smaller overall and concentrated in a smaller number of markets.

consumers do not watch local news on television at high rates and may instead get local news from other sources or may prefer national news. In addition, income is positively correlated with the cost of living and the result may reflect that higher costs limit the number of local news operations.

Figure 8
Predicted Probabilities by Income
(Ordered Logit)

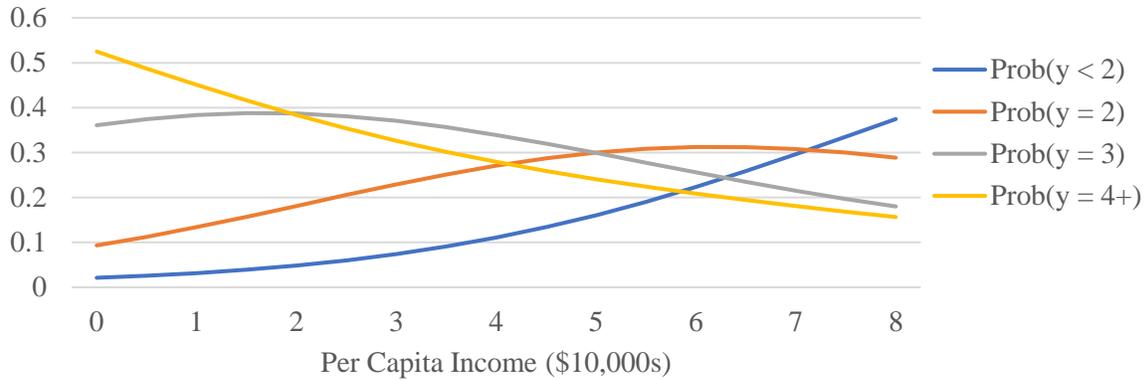


Figure 9 shows that as the share of working age population increases, markets are more likely to have more local news operations. In this case, advertisers likely value viewers of working age more highly than viewers in other age groups. Therefore, local news operations in markets with a greater share of working age population generate more advertising revenue and the market supports more local news operations.

Figure 9
Predicted Probabilities by Share Working Age
(Ordered Logit)

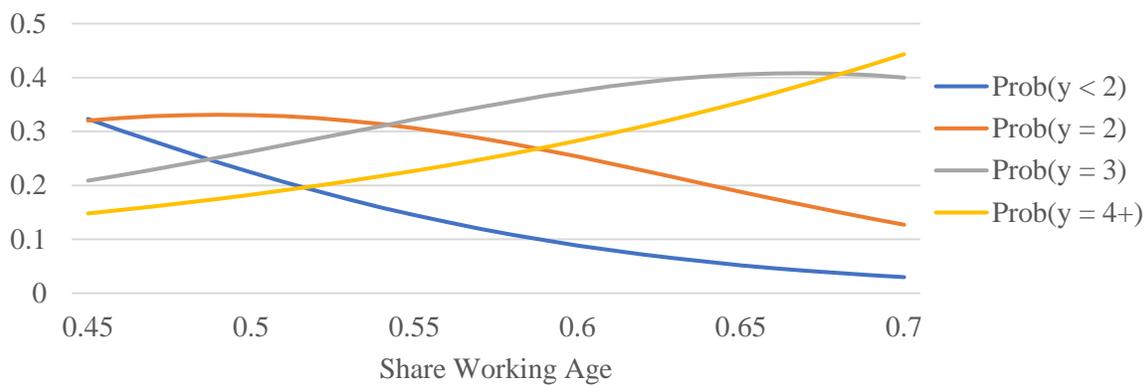
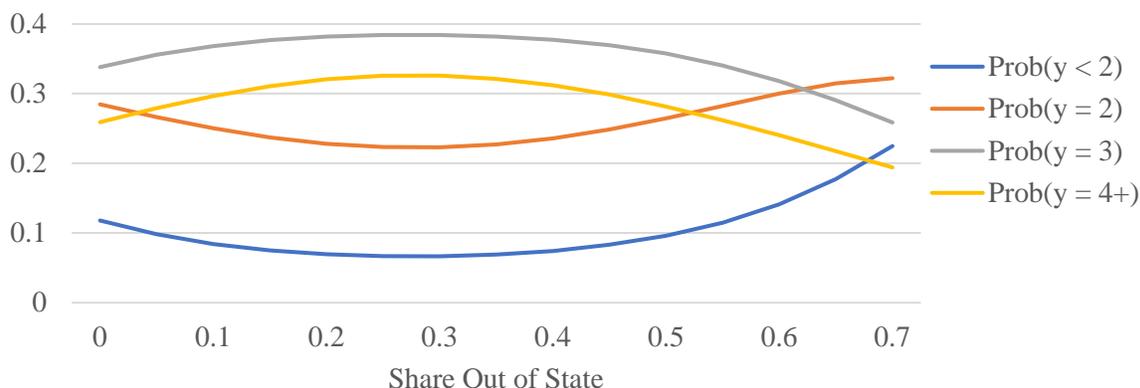


Figure 10 shows that increases in the out of state share increase the likelihood that a market has more local news operations until the out of state share reaches about 30%. After that, increases in share out of state reduce the likelihood of having more local news operations.⁵³

Figure 10
Predicted Probabilities by Share Out of State
(Ordered Logit)



6. Conclusion

The FCC seeks to advance its policy goals of competition, localism, and diversity through its local television station ownership rule and its review of proposed television station mergers. Television markets, however, vary greatly in size, and it is important to consider whether optimal policy differs for markets of different sizes. This paper examines the relationship between the number of independent local news operations and market size and other market characteristics.

We estimate market size thresholds above which a market is likely able to sustain at least two, three, or four independent local news operations. At the threshold TV household values and holding all other variables at their observed values, the average probability of having the target number of local news operations just exceeds the chosen acceptance criterion. We report results using 50% and 75% acceptance criteria. Using data from 2019, the results of our preferred ordered logit specification and a 50% acceptance criterion, suggest market size thresholds for two, three, and four or more local news operations of 35,000, 175,000, and 615,000 TV households, respectively. Under a 75% acceptance criterion and the ordered logit specification, the results suggest thresholds of about 70,000, 310,000, and 800,000 TV households for two, three, and four local news operations, respectively. The threshold estimates summarize the average effect of TV households on the number of local news operations across markets under a chosen acceptance criterion. A higher threshold estimate, other things equal, corresponds to a

⁵³ In interpreting this result it is important to remember that a large majority of markets (86%) have an out of state share below 30%.

larger number of markets that are predicted not to be able to support the target number of local newsrooms and hence a larger number of markets in which mergers of two local news operations might be considered more favorably.

We expect our findings to be useful in merger deliberations to better understand the effects of a proposed merger on the Commission's policy goals. In a merger analysis, the regression results and data from the market could be used to assess the likelihood that the market will sustain the current number of local news operations. In some markets, there may be a tradeoff between localism and diversity. A merger that eliminates a source of local news may be optimal, even though it reduces viewpoint diversity, if the merged entity improves the quality or increases the quantity of local news programming, strengthening localism. Of course, any analysis of a proposed merger would also need to consider the merger's impact on competition, an important third policy goal.

This paper measured viewpoint diversity through the number of independent local news operations in a market. In future research, it may be important to again measure localism through the amount of local news available. The relationship between local news quantity and market structure was last analyzed in 2011 using data from 2007 and 2009.⁵⁴ In addition, while compiling data on independent local news operations, we discovered regional news operations in several markets. In these cases, stations in neighboring markets (usually commonly owned) produce a newscast covering multiple markets together. Further analysis of this practice including its effect on localism would be useful.

⁵⁴ Erb (2011).

References

- Abernathy, Penelope Muse (2020). News Deserts and Ghost Newspapers: Will Local News Survive? <https://www.usnewsdeserts.com/reports/news-deserts-and-ghost-newspapers-will-local-news-survive/>.
- Besley, Timothy and Andrea Prat (2006). Handcuffs for the Grabbing Hand? Media Capture and Government Accountability. *American Economic Review* Vol. 96(3): 720-736.
- Brocas, Isabelle, Juan D. Carrillo, and Simon Wilkie (2011). A Theoretical Analysis of the Impact of Local Market Structure on the Range of Viewpoints Supplied. *FCC 2010 Media Ownership Study* 9, <https://www.fcc.gov/general/2010-media-ownership-studies>.
- Cameron, Colin A. and Pravin K. Trivedi (2013). Regression Analysis of Count Data. Cambridge University Press.
- Erb, Jack (2011). Local Information Programming and the Structure of Television Markets. A *FCC 2010 Media Ownership Study* 4, <https://www.fcc.gov/general/2010-media-ownership-studies>.
- Fratik, Mark (2020). The Impact on the Amount of News Programming from Consolidation in the Local Television Station Industry. <https://gray.tv/uploads/documents/Gray%20Local%20News%20Programming%20Report%20.pdf>.
- Greene, William H. and David A. Hensher (2009). Modeling Ordered Choices. <http://pages.stern.nyu.edu/~wgreene/DiscreteChoice/Readings/OrderedChoiceSurvey.pdf>.
- Jeliazkov, Ivan and Mohammad Arshad Rahman (2012). *Binary and Ordinal Data Analysis in Economics: Modeling and Estimation*. In: Xin-She Yang (ed). *Mathematical Modeling with Multidisciplinary Applications*. Wiley.
- Pew Research Center (2019). For Local News, Americans Embrace Digital but Still Want Strong Community Connection. <https://www.journalism.org/2019/03/26/for-local-news-americans-embrace-digital-but-still-want-strong-community-connection/>.
- RTDNA (2019). 2019 Research: Local TV and Radio News Strengths. https://www.rtdna.org/article/2019_research_local_tv_and_radio_news_strengths.
- RTDNA (2011). 2011 Staffing Report. <http://bobpapper.com/clients/>.
- Savage, Scott J. and Donald M. Waldman (2011). Consumer Valuation of Media as a Function of Local Market Structure. *FCC 2010 Media Ownership Study* 2, <https://www.fcc.gov/general/2010-media-ownership-studies>.
- Tirole, Jean (1988). *The Theory of Industrial Organization*. The MIT Press.

Appendix 1: Logit and Probit Results

Table A1: Logit and Probit Regression Estimated Coefficients

	Logit	Probit
TVHHs	4.695*** (1.586)	2.518*** (0.738)
TVHHs Squared	-0.566*** (0.189)	-0.303*** (0.088)
Hispanic Share	13.708*** (4.473)	8.449*** (2.464)
Hispanic Share Squared	-11.361** (5.499)	-7.155** (3.018)
Income per Capita	-0.663 (0.495)	-0.397 (0.253)
Share Working Age	26.262* (13.549)	15.857** (7.566)
Distance between Cities >50 miles	-0.03 (1.022)	-0.06 (0.519)
Relative Size Ratio	-0.528*** (0.185)	-0.304*** (0.102)
Share Out of State	8.577 (6.398)	5.336 (3.312)
Share Out of State Squared	-22.472 (14.659)	-13.793* (7.380)
Constant	-16.285** (7.992)	-9.75** (4.413)
Observations	210	210
Likelihood Ratio Index	0.580	0.584
Share Correctly Predicted	0.886	0.886

Notes: Robust standard errors in parentheses. In these models, success means market has at least four local news operations and failure means market has fewer than four local news operations.

Table A2: Market Size Entry Thresholds for Four Local News Operations (TV Households)

	Logit	Probit	Logit	Probit
Acceptance Criterion	50%	50%	75%	75%
	653,317	679,028	955,494	1,026,311

Notes: Entry thresholds found by calculating each market's probability of having at least four local news operations by varying the number of TV households and using the observed values for other market characteristics. These probabilities are then averaged over all markets. The first value of TV households for which the probability of having at least four local news operations exceeds the acceptance criterion is reported above. See Section V for a detailed description of the threshold calculation.

Appendix 2: Procedure to create local news operations variable

Data Sources:

Nielsen – Program-level observations for programs classified as local news during July 2019 sweeps period.

Variables: viewing source (call sign and channel number), program name, market

Note: Stations classify their own programs. There are no established criteria for classifying a program as local news.

BIA – Station-level observations for all stations. (Data pulled July 3, 2019.)

Variables: call sign, owner, news director (email and name), JSAs, LMAs, market

Nielsen program observations (and associated stations) are matched to BIA station observations based on call sign and market of station.

Procedure:

1. Automatically identify programs as local news using Nielsen program names.
 - a. *Call sign in program name.* If call sign of any station licensed in the same market appears in program name, program is verified as local news.
 - b. *Channel number in program name.*
 - i. If channel number of station is greater than 12 and appears in program name, program is verified as local news.
 - ii. If channel number of station is less than or equal to 12 and appears in more than 50% of program names associated with station, programs are verified as local news. Local news program names often include the time the program airs (e.g. News at 6). Therefore, if the station's channel number is less than or equal to 12, we require a larger share of program names aired by the station to contain the channel number to confirm the program as local news.
2. Identify connections between stations to establish non-independence of stations using Nielsen program names and BIA station observations.
 - a. Identify stations airing newscasts from other in-market stations from Nielsen program names.
 - i. If call sign of in-market station appears in program name, identify other station as a connection of original station.
 - b. Identify connections between stations based on shared ownership, shared news director, or JSA/LMA between stations from BIA station observations.
3. In each market, divide stations into mutually exclusive groups such that there are no connections between stations in different groups.
4. For groups that do not have at least one automatically verified local news program, manually check for local news program.

- a. Through the manual checks, we identified 18 regional newscasts in 13 markets. In these cases, stations in multiple markets produced and aired a newscast together that covered the area. If a group aired only a regional newscast but not a local newscast, the group was not counted as an independent local news source.
5. Check stations that are recorded as airing local news but have no news director.
 - a. Check that station's programs were correctly classified as local news, and check for other connections to stations in the same market unreported in the BIA Media Access Pro database.
 - b. Make individual corrections as necessary.

Appendix 3: Procedure to aggregate select variables to DMA-level

The analysis uses some variables that are reported by county or by metropolitan statistical area (which are made up of counties), not DMA. Fortunately, nearly all U.S. counties belong to only one DMA. Seven counties, however, are split between two DMAs. In these counties, we determine the share of the county population and land area that belongs to each DMA. We do this by using information on the intersection of zip code areas and census tracts.⁵⁵ Although Nielsen does not report which census tracts belong to each DMA, it does report the zip codes that belong to each DMA.⁵⁶ Therefore, we can assign census tracts or partial census tracts to DMAs. In the end, only 25 census tracts are split between two DMAs. These tracts represent about 0.03% of U.S. population and about 0.35% of U.S. land area. Once the population and land area are assigned to a DMA, we aggregate the land area and population to the county-level. With these estimates in hand, we can calculate population density, GDP, and cost of living for each DMA.

Population Density: With estimates of population and land area for each DMA, we calculate population density directly.

GDP: These estimates are available for U.S. counties. To calculate DMA GDP, we add up the GDP of all counties in a DMA that belong only to that DMA. For counties that belong to two DMAs, we divide GDP in proportion to the population share of the county that belongs to the DMA. The final estimate is the sum of the GDP of all counties and partial counties that belong to the DMA.

Cost of Living Index: The estimates are available for all metropolitan statistical areas (MSAs). In addition, an average value is reported for all non-metropolitan areas. Importantly, MSAs are made up of counties. Each county in the data set is assigned a cost of living value based on the MSA it is located in or its status as a non-metropolitan area. Then, to compute the cost of living index for each DMA, we compute a weighted average of the cost of living in all counties that make up the DMA, where the average is weighted by use the county population. For the seven counties split between DMAs, we weight by the population assigned to the partial county.

⁵⁵ U.S. Census, *2010 ZCTA to Census Tract Relationship File*, https://www.census.gov/geographies/reference-files/2010/geo/relationship-files.html#par_textimage_674173622 (last visited December 15, 2020).

⁵⁶ Within the counties that are split into two DMAs, no zip codes are split into two DMAs.