



# EXPLORING THE COST OF INTERNET

Across neighborhoods in Louisville



CONNECTED  
NATION



PAGE 3

INTRODUCTION

PAGE 5

BACKGROUND

PAGE 8

RESEARCH QUESTIONS

PAGE 9

BROADBAND PRICE VARIATIONS  
BY NEIGHBORHOOD

PAGE 12

THE IMPACT OF NEIGHBORHOOD  
CHARACTERISTICS ON BROADBAND PRICING

PAGE 16

CONCLUSION

PAGE 18

APPENDIX A: METHODOLOGY

PAGE 20

APPENDIX A: OPERATIONALIZATION

PAGE 22

APPENDIX A: RESULTS

PAGE 28

REFERENCES





Starting on April 10, 2024, the Federal Communications Commission (FCC) mandated that all internet service providers (ISPs) providing standalone internet service display consumer-friendly broadband labels at the point of sale.<sup>1</sup>

These labels were designed to provide consumers with more information about the service they are purchasing.

A standard broadband label typically includes attributes such as the monthly price, contract length, network metrics (including download/upload speeds and latency), and any additional fees. In many ways, this rule represented a meaningful step forward by affording individuals the transparency they need to make informed decisions about their internet service<sup>2</sup>. It also allowed consumers to see which ISPs serve their household and choose the plan that best meets their needs.

While this policy facilitates transparency for consumers at the point of purchase, it does not enable broader pricing comparisons across households or neighborhoods. The FCC does not maintain a central repository for home internet prices, which would enable researchers, advocates, and policymakers to assess affordability across geographic areas. Furthermore, the agency does not require ISPs to report pricing, an important factor for many consumers.

Given that many households across the country struggle to afford home internet service, these local comparisons are critical for understanding the factors that influence internet pricing. Examining what drives local internet price differences is vital to understanding internet affordability nationwide and informing efforts to close the Digital Divide<sup>3</sup>.

This research revolves around two central questions. First, to what extent do internet prices vary across neighborhoods in the same city? Second, what neighborhood-level characteristics account for these price differences?

To investigate these questions, we manually compiled a dataset of advertised internet speeds and prices for a random subset of residential addresses in Louisville, Ky. In total, Connected Nation gathered information on 6,300 addresses from the two predominant ISPs in the city that serve the largest share of households in the Louisville metro area.

**Among the key findings from our study:**

- *Wireline internet prices vary significantly between neighborhoods. The average price of fiber internet from a top provider ranges from \$0.09 per Mbps to \$0.18 per Mbps, and the average price of cable internet from a second internet service provider ranges from \$0.15 per Mbps to \$0.22 per Mbps<sup>4</sup>.*
- *One provider's fixed wireless internet prices did not vary within or between neighborhoods.*
- *A provider offered neighborhoods with higher median household incomes significantly lower wireline internet prices than neighborhoods with a lower median household income when calculated by cost per megabit per second. Given that prices were averaged across speeds within neighborhoods, this difference likely reflects how the provider targets geographic areas for their internet plans; households in neighborhoods with lower median household incomes were offered a 50 Mbps plan at \$25 per month (lower cost per month, but higher cost per Mbps), while households in more affluent areas did not receive this option.*





The now-defunct Affordable Connectivity Program (ACP), administered by the FCC, lessened the affordability burden for many families. The program began in May 2021, as the Emergency Broadband Benefit (EBB) – a program designed to make internet service more affordable during the COVID-19 pandemic, when many in-person services halted operations. During this period, covered households received \$50 off their internet service (or \$75 for households on Tribal lands), which was taken directly off the sticker price by participating ISPs.

At the end of that year, the EBB was transformed into the ACP, with some minor changes to further the longevity of the program and eliminate barriers to participation. Notably, the \$50 monthly subsidy was reduced to \$30, more households qualified based on income and/or receiving other government subsidies<sup>5</sup>, and households could receive a one-time \$100 subsidy toward the purchase of a new computing device.

However, the program did not receive renewed funding from Congress. It stopped accepting new enrollments in February 2024, and the program ended on June 1, 2024. At that point, 23,269,550 households had signed up and were collectively saving \$712,912,115 each month<sup>6</sup>. This number represented 17.7% of all American households<sup>7</sup>.

The FCC surveyed participants before the funding lapsed, and the results painted a dreary picture about the state of broadband affordability. Over 3 out of 4 respondents (77%) said losing their ACP benefit would disrupt their service by making them change their plan or drop internet service entirely<sup>8</sup>. This finding is especially glaring considering over two-thirds of respondents (68%) reported having inconsistent or no internet service at all before the program.



Not all ACP participants were new subscribers; many used the relief on their pre-existing internet bills to offset the rising costs of groceries and housing. However, the program did connect some households for the first time. When accounting for the role of the cost of living, John Horrigan and the Benton Institute for Broadband & Society found a significant relationship between program enrollment and broadband adoption growth<sup>9</sup>. With the program now shuttered, the longevity of these gains is uncertain.



ISP subscription numbers since the program ended suggest that some households have indeed canceled their broadband subscriptions. In Q4 of 2024, Charter, the second-largest broadband ISP in the country, reported 177,000 lost connections, over 20,000 more than expected<sup>10</sup>. Meanwhile, the largest ISP, Comcast, shed 199,000 subscribers during the same time<sup>11</sup>.

At the same time, data from the National Telecommunication and Information Administration's (NTIA) Internet Use Survey illustrates a downward trend over time, with households dropping their internet connections because of cost. The November 2023 iteration of the survey estimates that 3,106,247 households do not go online at home due to the expense, down from 4,367,681 in November 2021 and 8,899,166 in July 2013<sup>12</sup>.

Utilizing publicly available data, recent analyses from the Technology Policy Institute show that broadband prices have decreased across most speed tiers over the last decade<sup>13</sup>. Moreover, internet service prices rose more slowly than overall inflation in the same time frame; prices started increasing relative to overall inflation starting in late 2022.

Further analyses from Broadband Now illustrate that trend. From 2016 to 2022, the average price of internet has decreased by 14% for speeds of 25–99 Mbps, 33% for 100–499 Mbps, and 42% for speeds over 500 Mbps<sup>14</sup>. The price of internet service provided via fiber connections has also decreased by 39% since 2015 – a larger decrease than cable or DSL<sup>15</sup>.

Additional analyses from USTelecom's Broadband Pricing Index (BPI) reveal the same. When adjusting for inflation, they find that consumer-choice broadband<sup>16</sup> plans have decreased in price by 54.7% from 2015 to 2023, and the fastest broadband plans have decreased by 55.8%<sup>17</sup>. Moreover, they find that price as a function of speed decreased over time. In 2015, households with consumer-choice plans paid \$1.52 per Mbps while households on speed plans<sup>18</sup> paid \$0.87 per Mbps. By 2023, the average cost for consumer-choice plans dropped to \$0.29 per Mbps (an 81.2% price drop) and speed plans to \$0.18 per Mbps (a 79.6% drop).

Despite these findings, consumers report paying more for their internet service than ever before. A 2025 survey published by CNET found that 63% of U.S. adults have seen their internet bills increase in price over the past year; on average, this amounts to a \$195 price increase over 12 months<sup>19</sup>. Moreover, 1 in 5 U.S. adults who pay for home internet have had to downgrade their plan, switch ISPs, or cancel service due to these price increases – in line with expectations from the FCC's ACP survey.

While this result appears to be at odds with other research showing price decreases, the discrepancy can be attributed to speed increases over time and the structure of discounts and fees. According to the USTelecom pricing report, from 2015 to 2023, the average consumer-choice plan's download speed increased from 43 Mbps to 104 Mbps, a 141.5% jump<sup>20</sup>. Meanwhile, the average

speed plan's download speed increased from 141 Mbps to 306 Mbps, a 117.1% jump. By and large, these trends illustrate that Americans are subscribing to faster internet plans that cost more.

Another factor to consider when comparing internet plans pertains to methodology: these analyses compare the cost of internet, but bills that obscure totals using bundling, discounts with varying expiration dates, and avoidable and unavoidable fees make it difficult to determine how much households actually pay. A recent analysis from Consumer Reports looked at over 22,000 consumer broadband bills and could only identify a price for just over 18,000 of them<sup>21</sup>. Without this transparency, making comparisons between households and across neighborhoods becomes increasingly difficult.

Meanwhile, limited research has attempted to understand the drivers behind local internet pricing. Paul et al. (2023)'s analysis of internet prices finds substantive differences at the block group level, and attributes variation in carriage value to spatial clustering (contiguous block groups have similar prices), competition between ISPs (lower prices from cable providers facing competitive pressure from fiber providers), and median household income in some cities (indirectly based on fiber deployment rates)<sup>22</sup>.

Analyses by Narichanea (2022) similarly emphasize the importance of broadband competition to bring down prices<sup>23</sup>. Meanwhile, a report authored by the California Community Foundation and Digital Equity LA investigated internet price disparities across neighborhoods in Los Angeles County and suggested that low-income neighborhoods pay more for the same internet services than high-income neighborhoods<sup>24</sup>. Similarly, Nair (2025) finds that low- and middle-income communities spend a higher share of their income on broadband and often rely on slower or low-quality plans<sup>25</sup>. For these reasons, further analyses are needed to better understand the landscape of internet affordability at the local level.





Our analyses focus on **two primary research questions...**

**1**

**How much do home internet prices vary between neighborhoods?**

This portion of the study relies wholly on descriptive statistics and is broken down by the top two ISPs in Louisville, Ky., referenced here as Provider 1 and Provider 2.

**2**

**What neighborhood-level characteristics influence pricing differences between neighborhoods?**

This analysis requires inferential statistics.



# BROADBAND PRICE VARIATIONS BY NEIGHBORHOOD



For this portion of the study, we examined the services offered by two ISPs serving the Louisville, Ky., metropolitan area. These providers, referred to as Provider 1 and Provider 2, were chosen because they offer service to the largest number of addresses in the city. To analyze their service offerings, we collected pricing data on 25 addresses in each of the city's 125 census tracts from the providers' websites<sup>26</sup>.

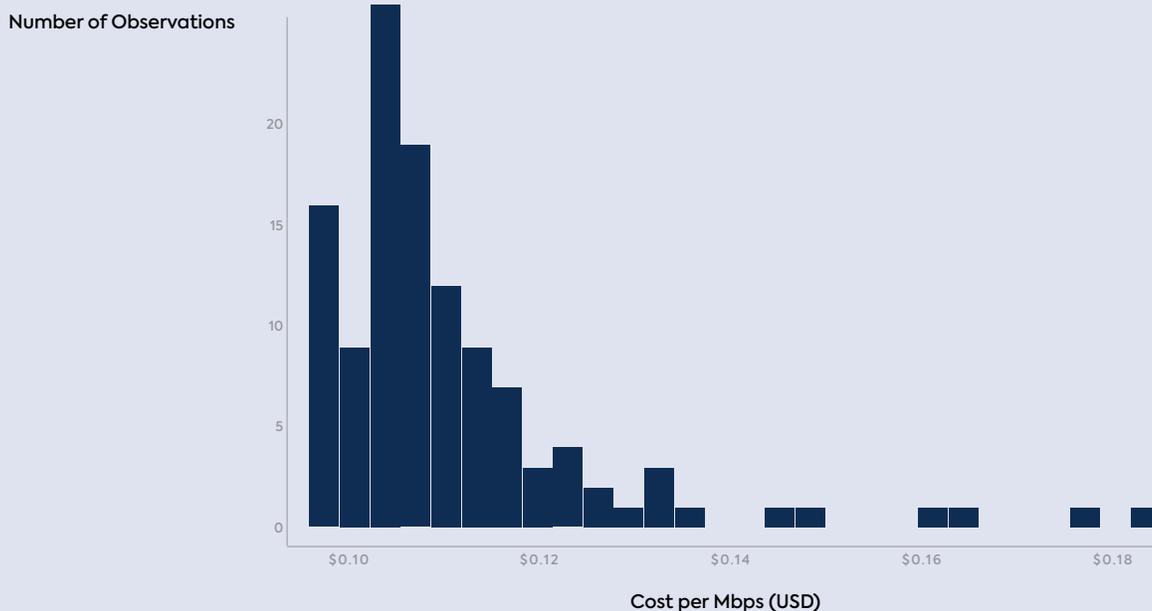
Provider 1 offers fiber, DSL, and fixed wireless home internet services to different households across Louisville. Just under 3 out of 4 addresses analyzed (72.5%) could purchase fiber internet service from Provider 1. Another 1 in 5 (19.5%) addresses searched could purchase fixed wireless internet service, and 6.1% could only purchase DSL internet service. The remaining 1.9% of addresses could not purchase internet service, which includes

households without coverage, businesses falsely categorized as residences, and invalid addresses.

Among all addresses analyzed, the cost of fiber averages approximately \$0.11 per Mbps across Provider 1's advertised plans. Figure 1 (below) shows the distribution of average fiber costs per Mbps across Louisville's neighborhoods for Provider 1.

Among neighborhood averages, the cost of fiber averages around \$0.11 per Mbps. The data exhibit a strong right skew, with local averages ranging from just over \$0.09 per Mbps to nearly \$0.19 per Mbps, and the mode hovering around \$0.11 per Mbps. This variation illustrates notable differences in pricing between neighborhoods, with some paying nearly twice as much per Mbps as others.

**Figure 1: Distribution of Fiber Costs per Mbps (Provider 1)**



# BROADBAND PRICE VARIATIONS BY NEIGHBORHOOD



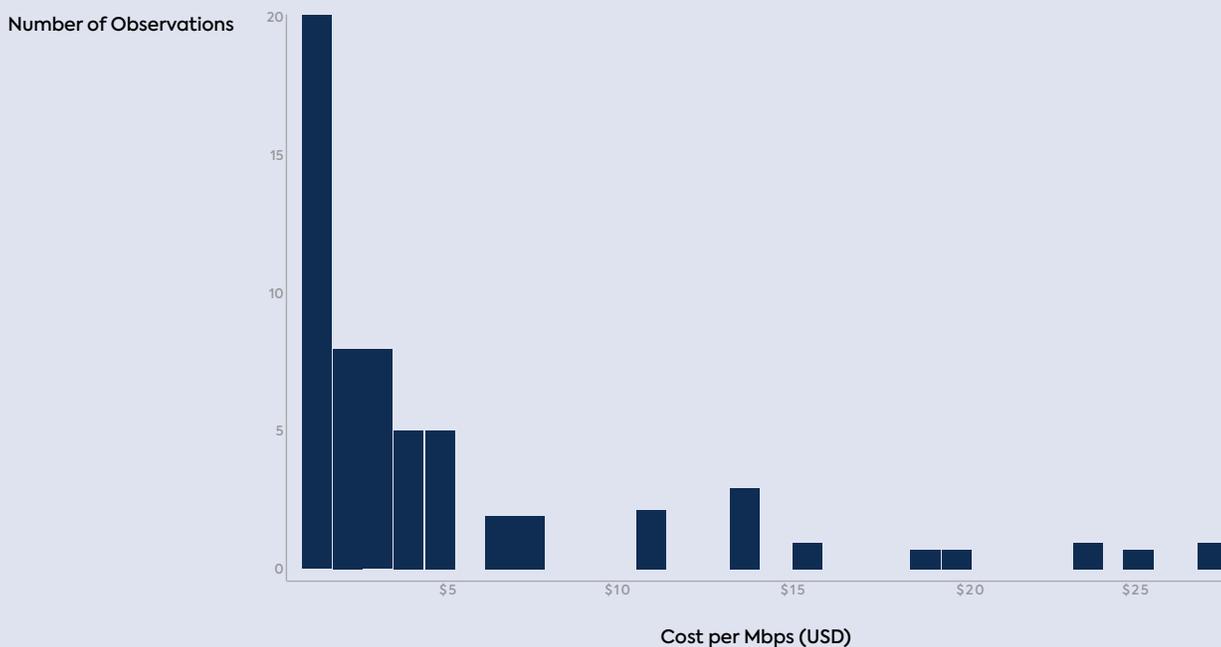
Figure 2 (below) depicts the distribution of Provider 1's average DSL costs across neighborhoods in Louisville<sup>27</sup>.

Across addresses, the cost of DSL internet service averages about \$3.94 per Mbps – making it significantly more expensive than fiber connections for each additional megabit per second. As the histogram shows, these data also exhibit a right skew, with local averages ranging from \$0.60 per Mbps to \$26.87 per Mbps. That said, many

neighborhoods did not have any addresses with DSL offerings, and many others had only one or two.

At the neighborhood level, the cost of DSL service averages around \$4.20. This difference between the address-level average and neighborhood-level average indicates that some neighborhoods may be more reliant on legacy infrastructure than others and therefore subject to higher internet costs.

**Figure 2: Distribution of DSL Cost per Mbps (Provider 1)**



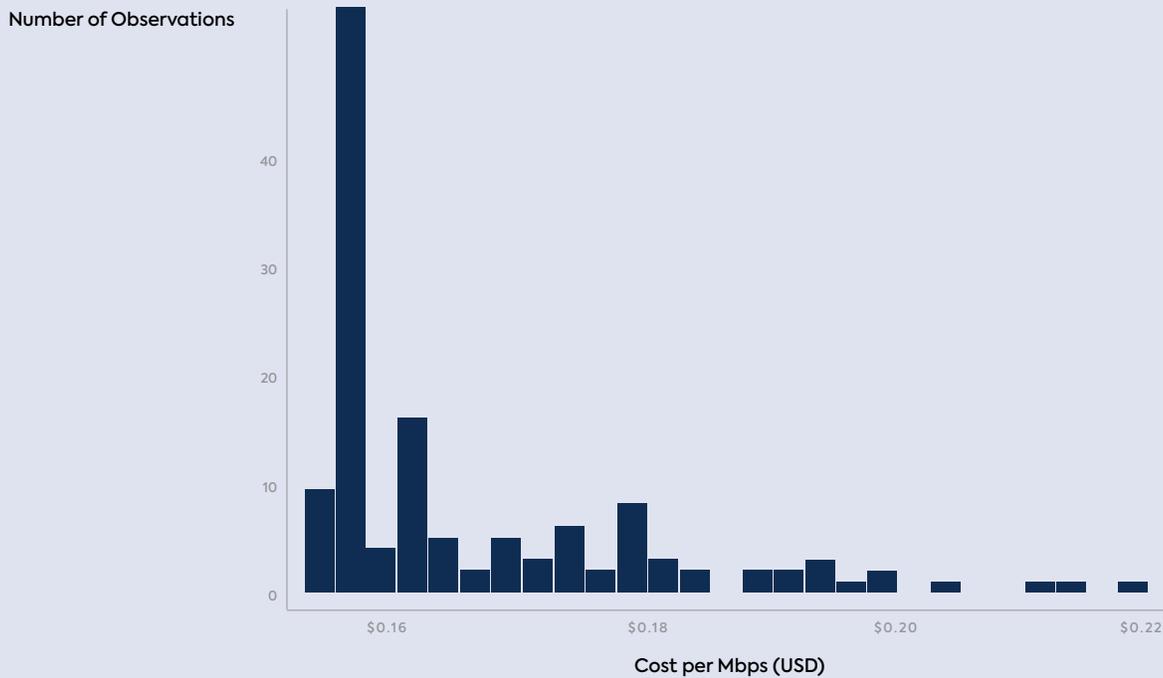
# BROADBAND PRICE VARIATIONS BY NEIGHBORHOOD



Across addresses, the cost of Provider 2's cable internet service averages around \$0.17 per Mbps. This average price is higher than the average fiber price from Provider 1, but much more affordable than Provider 1's average DSL price. At the neighborhood level, the cost of cable internet also

averages around \$0.17 per Mbps. Like the other wireline data, cable internet prices exhibit a strong right skew, with local averages ranging from \$0.15 per Mbps to \$0.22 per Mbps, and a mode around \$0.16 per Mbps.

**Figure 3: Distribution of Cable Cost per Mbps (Provider 2)**



# THE IMPACT OF NEIGHBORHOOD CHARACTERISTICS ON BROADBAND PRICING



The second research question probes the neighborhood-level characteristics that influence pricing variation, which requires inferential statistics.

Arguments to tackle this question revolve around two causal mechanisms: capital expenditures (CapEx) and market competition. CapEx refers to the upfront investment costs required to build or update physical

infrastructure. In the context of wireline internet, this includes laying cables, installing conduit or trenching, purchasing and installing network equipment, and labor and permitting costs. These costs are high, fixed, and necessary to complete projects. Because these investments do not vary with the number of subscribers at first, ISPs must recoup these upfront expenditures over time by charging consumers for their services. This cost-recovery model means that areas with higher CapEx should experience higher prices.

Market competition shapes internet prices by influencing the strategic behavior of ISPs. Having more ISPs in an area drives them to compete for customers, gives customers more choices, and should bring prices down. Conversely, when there are barriers to entry and limited competition, ISPs have more pricing power and can afford to charge higher rates without churning customers.

# THE IMPACT OF NEIGHBORHOOD CHARACTERISTICS ON BROADBAND PRICING



These factors led us to examine the following variables of interest:

## POPULATION DENSITY

In theory, neighborhoods with higher population density should have lower wireline internet prices for several reasons. Because households are closer together, ISPs can serve more of them with shorter lengths of cable or fiber lines. Moreover, these areas may already have ducts, conduits, and access points, which reduce the need for new construction. This reduces the cost of installation projects because they would require less CapEx for trenching, cabling, and labor costs.

Providers can also cover the cost of infrastructure (e.g., poles, rights-of-way, switches) more easily, given that they would have more potential subscribers in those areas, and recoup CapEx more quickly. This quicker payoff shortens the return-on-investment (ROI) period and affords ISPs the flexibility to offer subscribers lower prices. Finally, densely populated areas may attract multiple providers to the market, increasing competition between them. This competitive pressure may push down prices for internet service.

For these reasons, we expected that neighborhoods with higher population density would be associated with lower wireline internet prices. However, statistical modeling found that population density had no significant impact on pricing<sup>28</sup>.



## AVERAGE HOUSEHOLD SIZE

The proposed relationship between average household size and lower internet prices stems in part from consumer demand and from how prices are operationalized. Larger households with more internet users have higher aggregate bandwidth needs, as multiple individuals may be streaming, working, or gaming simultaneously. To avoid lag, these households may be more likely to subscribe to plans with higher speeds if they can afford it.

Given a greater demand for high-speed service, ISPs may advertise plans with higher speeds or invest in faster infrastructure to meet this demand. Moreover, these high-speed plans often come with a lower cost per Mbps than entry-level plans, meaning these neighborhoods would have lower prices than neighborhoods with smaller average household sizes.

For these reasons, we expected that neighborhoods with higher average household sizes would be associated with lower wireline internet prices. However, once again, statistical analyses found that average household size had no significant impact on pricing.

# THE IMPACT OF NEIGHBORHOOD CHARACTERISTICS ON BROADBAND PRICING



## CONCENTRATION OF MULTI-DWELLING HOUSING UNITS (MDUS)

With respect to MDUs, landlords and property managers can act as gatekeepers for infrastructure access. For ISPs to plan fiber deployment, they often need to obtain “right-of-entry” agreements that grant consent to lay cable throughout the property. Landlords may be reluctant to permit these projects for several reasons. While ISPs often cover most costs, landlords may be asked to cover some installation costs, which could be expensive in older buildings with more physical constraints. Moreover, the construction could take a while and disturb tenants. Landlords may not see the perceived benefit of the project if it does not lead to higher rents, and given their status as gatekeepers, they can veto the buildout in favor of pre-existing internet options.

Additionally, property owners may enter into revenue-sharing agreements with a single ISP, limiting competition further. These dynamics can result in buildings with an effective monopoly on internet service, where one ISP has access, limiting tenant choice. Even without a monopoly, fewer ISPs covering these households give consumers fewer home internet options to choose from, and ISPs have more pricing power. This environment could drive higher prices per Mbps. For these reasons, we expected that neighborhoods with a higher concentration of MDUs would be associated with higher wireline internet prices. However, statistical analyses found that the concentration of MDUs had no significant impact on pricing.

## MEDIAN HOUSEHOLD INCOME

In addition to dynamics related to CapEx and competition between providers, we probed the potentially negative relationship between income levels and wireline internet prices substantiated in the extant literature. Given that high-income neighborhoods<sup>29</sup> and ZIP codes<sup>30</sup> tend to subscribe to higher median download speeds, and higher speed plans often come at a lower price per Mbps, this relationship should be significant within the Louisville context also.

For these reasons, we expected that neighborhoods with a higher median household income would be associated with lower wireline internet prices when prices per megabit per second are calculated. This was not the case for Provider 1; statistical analyses found no significant relationship between median household income and pricing. However, our analyses point in that direction for Provider 2; neighborhoods with higher median household incomes had significantly lower wireline internet prices per megabit per second.

This finding may be explained by Provider 2’s approach to tackling affordability and how the data were aggregated. Provider 2’s prices for individual speed plans did not differ within or between neighborhoods. Rather, they offered a 50 Mbps speed plan specifically in lower-income neighborhoods at \$30 per month – cheaper overall, but more expensive per Mbps. Given that our price per Mbps variable averages all speed plans offered by the provider in a neighborhood, neighborhoods with more households offered a 50 Mbps plan have higher wireline prices on average.

# THE IMPACT OF NEIGHBORHOOD CHARACTERISTICS ON BROADBAND PRICING

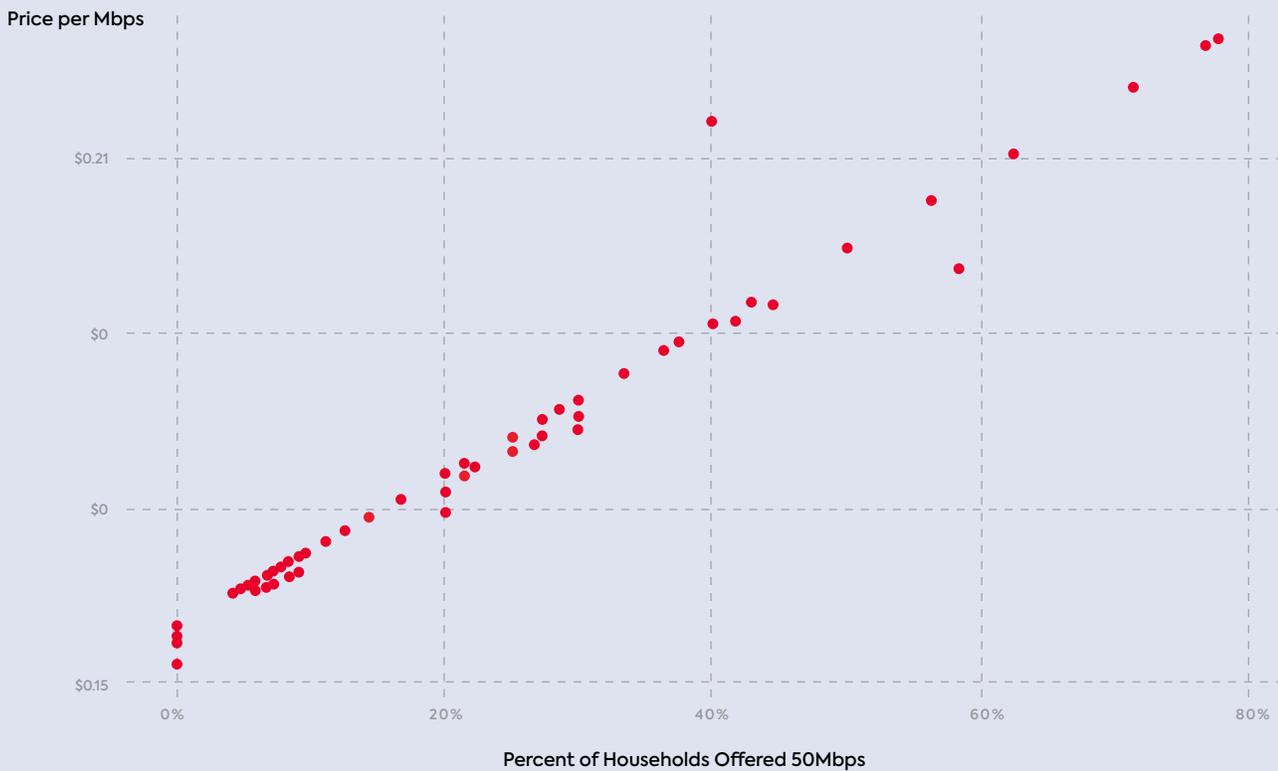


Figure 4 (below) illustrates the relationship between the percentage of households offered 50 Mbps plans and average cost per Mbps at the neighborhood level.

As the scatter plot in Figure 4 shows, there is almost a perfectly linear relationship between the percentage of households offered 50 Mbps service plans and wireline internet prices per

Mbps for Provider 2. This suggests that the decision to offer a cheaper (overall) plan to low-income neighborhoods inflated the cost per Mbps in these neighborhoods, creating an illusion of higher prices. That said, considering low-income households earn less, they will likely spend more of their income on broadband even with these cheaper plans<sup>31</sup>.

**Figure 4: Relationship between the Percent of Households Offered 50 Mbps Service and Price per Mbps (Provider 2)**





This study sought to examine residential wireline internet prices across neighborhoods in Louisville, Ky.



Given that the federal government does not publish data on how much households pay for their service, researchers cannot easily make comparisons within and between neighborhoods. To remedy this, we compiled a data set of 25 addresses for each census tract in the city, then manually searched internet prices on provider websites for the two largest ISPs. This endeavor ultimately collected data on 6,300 addresses across the city's 126 census tracts. These data were then used to construct averages of price per Mbps across wireline plans and analyzed to understand the extent of price variation within and across neighborhoods. Preliminary analyses highlighted wide price variation between neighborhoods, especially among Provider 1's fiber and DSL services.

Further analyses assessed the factors that drive this price variation between neighborhoods. Hypotheses emphasized the impact of CapEx and market competition. Under circumstances where providers can offset infrastructure costs or recoup them quickly, internet prices should be lower. Similarly, in areas with robust market competition between providers, prices should be lower.

Gamma regression models tested the impact of four primary independent variables on average internet prices – population density, average household size, the percentage of households living in MDUs, and median household income. Among them, only median household income emerged as significant, and only for Provider 2. Specifically, as a neighborhood's median household income increased, internet prices per Mbps tended to decrease. Moreover, this relationship disappeared when accounting for the percentage of households that are offered 50 Mbps internet service from Provider 2 – suggesting that the provider factored low-income communities into its pricing strategy and offered them an affordable plan to reduce customer churn.



These analyses are part of an ongoing effort to understand internet pricing for all Americans. Given the inconclusive results thus far, further research is needed to understand local-level pricing variation. Unfortunately, the data collection method pursued by this study requires substantial time and labor. As a recent Pew analysis highlights, a gap in pricing and affordability data at the federal level makes it challenging to understand what households pay for their service and how affordability impacts market competition and broadband adoption

overall<sup>32</sup>. Furthermore, the lack of pricing transparency could be driving price inflation; making pricing data open and available could put pressure on providers to lower their prices in response to more transparent competition.

To fully understand these dynamics, policymakers must invest in independent, standardized data collection on what households pay. Without such an investment, policymakers remain ill-equipped to craft effective internet policy.





The federal government provides two sources of information about internet pricing: the FCC's Urban Rates Survey (URS) and the U.S. Census Bureau of Labor Statistics (BLS)'s internet service price index. The URS collects data about available internet plans and depicts what is available to consumers choosing a broadband service<sup>33</sup>. In that sense, it illustrates the market that people face when selecting their plan (without promotions or discounts).

The survey, however, does not reflect what households actually pay, nor does it provide information on the number of households that subscribe to each plan. Moreover, the focus on pricing in urban areas excludes rural areas.

In contrast, the BLS's price index compares changes in quality-adjusted prices over time and allows for comparisons to how other prices have changed, as measured by the Consumer Price Index<sup>34</sup>. However, these figures represent averages, not internet prices themselves.

While these data sources can offer us comparability benchmarks, they cannot dive deeper into patterns within and across neighborhoods. For this reason, further data collection was necessary for this project.

To assess the hypotheses above, this paper focuses on residential terrestrial fixed broadband in Louisville, Ky<sup>35</sup>. Louisville is a mid-sized, diverse city with a population of 246,141<sup>36</sup>. It has a wide array of neighborhoods, ranging from dense urban areas to suburban tracts, making it suitable for testing the hypotheses above.

Analyses rely on data collected from ISP websites. To start, the authors subset 25 random addresses in each census tract from the U.S. Department of Transportation's National Address Database (NAD)<sup>37</sup>. Louisville has 126 census tracts, with an average population of 4,233 in each tract. Random selection ensures that no one area of the census tract is overrepresented in the data. Some of these addresses turned out to be businesses, vacant lots, or bridges, so not every tract ended up with 25 observations.

Census tracts make sense as the unit of analysis because they offer fine spatial detail for making local comparisons and are more stable than ZIP codes. Moreover, this unit of analysis allows for merging from other data sets like the American Community Survey (ACS), run by the U.S. Census Bureau, and the FCC's BDC provider data, which offer relevant independent and control variables.

Human coders then manually searched for each address on the ISPs' websites and input the speed and price information into a Google Sheet. From there, the data were aggregated at the census tract level, transformed into price per Mbps, and merged into other datasets for further analysis.

While Louisville has multiple ISPs offering terrestrial fixed broadband, according to the FCC's BDC provider data, only two serve more than 80% of residential addresses in the city<sup>38</sup>. This analysis focuses on these two providers to ensure that most addresses searched would have coverage and, therefore, data on pricing. For the sake of these analyses, they will be



referred to as Provider 1 and Provider 2. Provider 1 offers connections via fiber, DSL, and licensed fixed wireless in Louisville. Meanwhile, Provider 2 offers cable connections exclusively.

Beyond using summary statistics to address the first research question, the authors tested the hypotheses above using gamma regression models. A member of the generalized linear model family, gamma regression is best used for positive, right-skewed continuous outcome variables such as costs.

This approach is appropriate because wireline internet prices are bounded by zero, highly skewed, and exhibit multiplicative variance, meaning that variance increases with the mean. Ordinary least squares (OLS) regression would be a bad fit for this data because it assumes a normal distribution of errors and constant variance, which could lead to biased estimates. The authors performed all data analyses in R.





The following section details the source of each of the variables used in the analyses and how they are measured.

**Cost per Mbps**, the primary dependent variable, stems from data collected from provider websites. Coders captured all speed tiers available at each residential address and their associated prices. From there, the authors divided the plan prices from their download speeds to calculate the cost per Mbps of each plan, and averaged them for each address, technology type, and provider. The average cost per Mbps represents the average price of all addresses within each census tract.

**Population density**, the primary independent variable for Hypothesis 1, derives from population estimates provided by the 2023 ACS five-year estimates for each census tract in Louisville. Data on the geographic area (in square feet) of each census tract come from the 2017–21 ACS TIGER/Line Shapefiles. Using these two metrics, the authors calculated population density by dividing the area by the total population of each tract.

**Average household size**, the primary independent variable for Hypothesis 2, comes from the 2023 ACS five-year estimates for each census tract in Louisville.

**Percent of households in MDUs**, the primary independent variable for Hypothesis 3, also comes from the 2023 ACS five-year estimates for each census tract in the city. The data table disaggregates housing by 1-unit structures, 2-or-more-unit structures, and mobile homes or other types of units.

**Log of median household income**, the primary independent variable for Hypothesis 4, also stems from the 2023 ACS five-year estimates for each census tract in the city. The authors took the logarithm of these data to stabilize variance and reduce skewness.

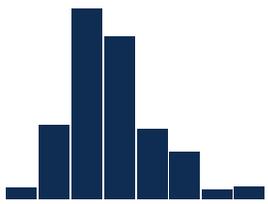
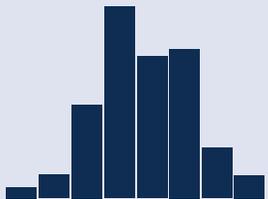
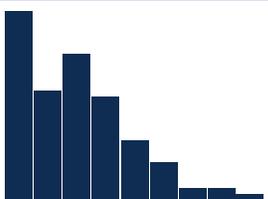
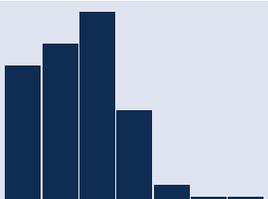
**Observations per tract** measures the number of addresses that had pricing data available when coders collected data from provider websites. Some addresses represented non-households, so no residential pricing data was available. Provider websites instructed coders to call to provide additional information about some addresses, to which coders were instructed not to follow up. Finally, Provider 2 did not display pricing information for any addresses they currently served, limiting the number of addresses per tract further. This variable is used as a control variable when bivariate models indicate a significant relationship between the hypothesized independent variable and average internet prices.

**Percent of households offered 50 Mbps service** measures the percentage of addresses that were offered a 50 Mbps plan from Provider 2. This variable is used as a control variable when bivariate models indicate a significant relationship between the hypothesized independent variable and average internet prices for Provider 2.



Figure 5 (below) illustrates summary statistics for each of the primary independent variables.

**Figure 5: Summary Statistics<sup>44</sup>**

No	Variable	Stats/Values	Freqs (% of Valid)	Graph
1	Median.income...dollars. [numeric]	Mean (sd): 43062.3 (13522) min ≤ med ≤ max: 14609 ≤ 40503 ≤ 86149 IQR (CV): 15594.8 (0.3)		
2	Average.household.size [numeric]	Mean (sd): 2.5 (0.3) min ≤ med ≤ max: 1.6 ≤ 2.4 ≤ 3.2 IQR (CV): 0.4 (0.1)	76 distinct values	
3	X2.or.more.unit.structures [numeric]	Mean (sd): 0.2 (0.2) min ≤ med ≤ max: 0 ≤ 0.2 ≤ 0.9 IQR (CV): 0.3 (0.8)	104 distinct values	
4	Density [numeric]	Mean (sd): 0 (0) min ≤ med ≤ max: 0 ≤ 0 ≤ 0 IQR (CV): 0.3 (0.8)	125 distinct values	



The remaining results revolve around the second research question and test the hypotheses listed previously.



First and foremost, Figure 6 (below) summarizes the relationship between the number of addresses with pricing data in each census tract and the cost of fiber internet service per Mbps for Provider 1<sup>45</sup>.

Notably, the gamma regression results indicate a negative and significant relationship between the two variables. In other words, for Provider 1, as the number of observations with price information per census tract increases, the cost of fiber internet service per Mbps tends to decrease. This finding represents a puzzle, as addresses did not have pricing information for several reasons, including households without coverage, businesses falsely categorized as residences, and invalid addresses. However, this raises the possibility that the presence (or absence) of pricing information could be meaningfully correlated with some characteristics of the local broadband market.

**Figure 6: Gamma Regression, Number of Observations per Tract (Provider 1)**

	Cost of Fiber per Mbps
Number of Observations per Tract	-0.008** (0.003)
Num.Obs.	122
AIC	-678.1
BIC	-669.7
Log.Lik.	342.049
RMSE	0.02
R2 Nagelkerke	0.07
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	



Figure 7 (below) investigates the same relationship between the number of observations with pricing information and the cost of internet per Mbps, but for Provider 2's cable internet service. This table also includes an analysis of the relationship between the percentage of addresses offered 50 Mbps service from Provider 2 and the cost of their internet service per Mbps.

Again, the gamma regression results indicate a negative and significant relationship between the two variables. To rephrase, for Provider 2, as the number of observations with price information per census tract increases, the cost of cable internet service per Mbps tends to decrease. This finding parallels the same relationship for Provider 1. While the mechanism behind the relationship is unclear, these models underscore the importance of including this variable in multivariate models when the bivariate relationship is significant.

The additional control variable, the percentage of addresses offered 50 Mbps service, has a positive and significant relationship with the cost of cable internet service per Mbps. Moreover, the R-squared statistic for this bivariate model indicates that the variable of interest explains 98% of the variance in the dependent variable.

This striking result represents the uniformity of Provider 2's pricing across households. With a few exceptions, households received the same price quotes for each of the provider's speed tiers. However, some neighborhoods had a larger share of households offered 50 Mbps service than others, which increased the average price per Mbps. Given that Provider 2 may offer 50 Mbps service to specific households based on other socio-economic characteristics (i.e., income), the authors utilize this variable as a control in Provider 2's multivariate models when the bivariate relationship of interest is significant.

**Figure 7: Gamma Regression, Relevant Control Variables (Provider 2)**

	Cost per Mbps	Cost per Mbps
Number of Observations per Tract	-0.008*** (0.002)	
Percent of Addresses Offered 50 Mbps Service		0.482*** (0.007)
Num.Obs.	126	126
AIC	-717.7	-1176.1
BIC	-709.2	-1167.6
Log.Lik.	361.871	591.046
RMSE	0.01	0.00
R2 Nagelkerke	0.17	0.98

+ p < 0.1, \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001



Figure 8 (right) evaluates Hypothesis 1 for Provider 1, looking at the posited relationship between population density and fiber prices per Mbps.

The independent variable emerges as insignificant in this model, meaning there is no relationship between population density and the cost of fiber per Mbps across neighborhoods in Louisville. This finding runs counter to Hypothesis 1, which expected a negative relationship between the two variables.

**Figure 8: Gamma Regression, Population Density (Provider 1)**

Cost of Fiber per Mbps	
Population Density	-200.918 (239.207)
Num.Obs.	122
AIC	-670.6
BIC	-662.2
Log.Lik.	338.324
RMSE	0.02
R2 Nagelkerke	0.01
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	

Figure 9 (right) investigates the same relationship for Provider 2, but with cable price per Mbps as the dependent variable instead of fiber price per Mbps.

Once again, the population density variable emerges as insignificant. In other words, there is no relationship between population density and the cost of cable internet service per Mbps for Provider 2. This finding contrasts with the expectations of Hypothesis 1.

**Figure 9: Gamma Regression, Population Density (Provider 2)**

Cost per Mbps	
	(143.506)
Num.Obs.	126
AIC	-697.2
BIC	-688.7
Log.Lik.	351.595
RMSE	0.02
R2 Nagelkerke	0.02
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	



Moving forward, Figure 10 (right) shows the gamma regression results summarizing the relationship between average household size and fiber price per Mbps for Provider 1.

The bivariate regression results show no significant relationship between average household size and fiber cost per Mbps for Provider 1. This finding contrasts with the expectations of Hypothesis 2, which suggested a negative relationship between the two variables.

**Figure 10: Gamma Regression, Average Household Size (Provider 1)**

	Cost of Fiber per Mbps
Average Household Size	0.027 (0.049)
Num.Obs.	122
AIC	-670.1
BIC	-661.7
Log.Lik.	338.067
RMSE	0.02
R2 Nagelkerke	0.00
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	

Figure 11 (right) examines the relationship between average household size and cable cost per Mbps for Provider 2.

Again, the model emerges insignificant. In other words, there is no relationship between average household size and Provider 2's cable price per Mbps. These null findings for both Provider 1 and Provider 2 run counter to the expectations outlined in Hypothesis 2.

**Figure 11: Gamma Regression, Average Household Size (Provider 2)**

	Cost per Mbps
	(0.029)
Num.Obs.	125
AIC	-688.1
BIC	-679.6
Log.Lik.	347.061
RMSE	0.02
R2 Nagelkerke	0.00
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	



The next set of models analyzes the hypothesized relationship between the percentage of households living in MDUs and wireline internet prices per Mbps. Figure 12 (right) focuses on Provider 1’s fiber internet service.

The bivariate regression results show no significant relationship between the two variables. In other words, the percentage of households living in MDUs does not impact Provider 1’s fiber prices per Mbps in Louisville’s census tracts. This finding runs counter to theoretical expectations outlined in Hypothesis 3.

**Figure 12: Gamma Regression, Households Living in MDUs (Provider 1)**

	Cost of Fiber per Mbps
Percent of Households in MDUs	-0.094 (0.076)
Num.Obs.	122
AIC	-671.6
BIC	-663.2
Log.Lik.	338.813
RMSE	0.02
R2 Nagelkerke	0.02
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	

Figure 13 (right) investigates the same relationship but using Provider 2’s cable prices per Mbps as the dependent variable.

Like the results from Provider 1, the bivariate model analyzing the relationship between the percentage of households in MDUs and the cost of cable internet service per Mbps is insignificant for Provider 2.

**Figure 13: Gamma Regression, Households Living in MDUs (Provider 2)**

	Cost per Mbps
Percent of Households in MDUs	0.061 (0.045)
Num.Obs.	125
AIC	-690.1
BIC	-681.6
Log.Lik.	348.057
RMSE	0.02
R2 Nagelkerke	0.02
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	



Finally, Hypothesis 4 centers around the impact of income on wireline internet prices per Mbps. Figure 14 (right) analyzes this relationship for Provider 1’s fiber internet prices.

According to these results, a neighborhood’s median household income does not influence the price of fiber per Mbps from Provider 1, running contrary to the expectations outlined in Hypothesis 4.

Figure 15 (bottom right) replicates this model for Provider 2’s cable internet service.

Unlike Figure 14, the bivariate model indicates a negative and significant relationship between the log of median household income and the cost of cable per Mbps for Provider 2. Restated, this finding means that as a neighborhood’s median household income increases, the cost of Provider 2’s cable internet service per Mbps tends to decrease – in line with Hypothesis 4. This relationship remains robust even when controlling for the number of observations per census tract.

However, adding the percentage of households offered 50 Mbps internet service into the model makes the income variable insignificant. The authors suggest this could be a case of endogeneity, where Provider 2 offers 50 Mbps service more frequently in neighborhoods with lower household incomes because the plan offers the lowest monthly price point. In other words, the cheaper plan could be an intentional marketing strategy to maintain subscriber volume.

**Figure 14: Gamma Regression, Median Household Income (Provider 1)**

	Cost per Mbps
Log of Median Household Income	-0.064 (0.046)
Num.Obs.	122
AIC	-672.0
BIC	-663.6
Log.Lik.	339.016
RMSE	0.02
R2 Nagelkerke	0.02
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001	

**Figure 15: Gamma Regression, Median Household Income (Provider 2)**

	Cost per Mbps	Cost per Mbps	Cost per Mbps
Log of Median Household Income	-0.165*** (0.022)	-0.140*** (0.021)	-0.004 (0.005)
Number of Observations per Tract		-0.006*** (0.001)	
Percent of Addresses Offered 50 Mbps Service			0.479*** (0.008)
Num.Obs.	125	125	125
AIC	-738.6	-752.0	-1164.3
BIC	-730.1	-740.7	-1153.0
Log.Lik.	372.313	380.014	586.157
RMSE	0.01	0.01	0.00
R2 Nagelkerke	0.33	0.41	0.98
+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001			



<sup>1</sup> “Consumer Broadband Labels Now Required Nationwide at Online and In-Store Points of Sale,” April 10, 2024. Federal Communications Commission. <https://docs.fcc.gov/public/attachments/DOC-401797A1.pdf>

<sup>2</sup> Using the term internet is intentional in this case. According to the FCC, broadband is defined as internet service with speeds of at least 100 Mbps download and 20 Mbps upload. Given the focus on prices regardless of speed offerings, the term internet would be more appropriate than the term broadband.

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<sup>4</sup> Due to the variety and inconsistency of speed tiers across providers, prices have been calculated as a function of Mbps.

<sup>5</sup> Households automatically qualified for the ACP if they were already enrolled in the Lifeline program, if their median household income was less than 200% of the federal poverty guidelines, or if an individual at the household received any of the following benefits: Medicaid/Medical, Supplemental Security Income (SSI), Women, Infants, and Children (WIC), Federal Public Housing Assistance (FPHA), veterans pension or survivors benefit, a national school lunch or breakfast program, a Federal Pell grant, Bureau of Indian Affairs general assistance, or Temporary Assistance for Needy Families (TANF).

<sup>6</sup> “ACP Enrollment and Claims Tracker.” Universal Service Administrative Co., August 30, 2024. <https://www.usac.org/about/affordable-connectivity-program/acp-enrollment-and-claims-tracker/>

<sup>7</sup> U.S. Census Bureau. “American Community Survey 1-Year Estimates,” 2023. Released 2024. <https://data.census.gov/table/ACSST1Y2023.S1101>

<sup>8</sup> “ACP Consumer Survey.” Federal Communications Commission, June 3, 2024. <https://www.fcc.gov/acp-survey>

<sup>9</sup> Horrigan, John. “Gain and Sustain: The Affordable Connectivity Program Is Getting More People Online.” Web blog. Benton Institute for Broadband & Society, November 1, 2023. [www.benton.org/blog/gain-and-sustain-affordable-connectivity-program-getting-more-people-online](http://www.benton.org/blog/gain-and-sustain-affordable-connectivity-program-getting-more-people-online)

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<sup>11</sup> Neenan, Jake. “Comcast Down 199,000 Broadband Subs.” Web blog. Broadband Breakfast, April 24, 2025. <https://broadbandbreakfast.com/comcast-down-199-000-broadband-subs/>

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<sup>14</sup> Shevik, Jason. “Broadband Pricing Changes: 2016 to 2022.” BroadbandNow, May 5, 2023. <https://broadbandnow.com/internet/broadband-pricing-changes>

<sup>15</sup> Cooper, Tyler. “Internet Plan Prices Have Not Increased in Nearly a Decade.” BroadbandNow, October 16, 2024. <https://broadbandnow.com/research/broadband-pricing-trends>

<sup>16</sup> In this context, consumer-choice broadband plans refer to providers’ most popular speed tier of broadband service in a given year.

<sup>17</sup> Menko, Arthur. “2023 Broadband Pricing Index: Broadband Prices Continue to Decline.” USTelecom, October 2023. <https://ustelecom.org/wp-content/uploads/2023/10/USTelecom-2023-BPI-Report-final.pdf>

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- <sup>27</sup> Provider 1's fixed wireless costs do not vary across neighborhoods.
- <sup>28</sup> Detailed explanations of the methodology behind the statistical modeling and the results of these analyses can be found in the Appendix.
- <sup>29</sup> Paul, Udit, Jiamao Liu, David Farias-Ilerenas, Vivek Adarsh, Arpit Gupta, and Elizabeth Belding. "Characterizing Internet Access and Quality Inequities in California M-Lab Measurements." ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies (COMPASS), June 29, 2022, 257–65. <https://doi.org/10.1145/3530190.3534813>
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- <sup>35</sup> The original abstract proposed a comparison between census tracts in Louisville and census tracts in Detroit, Mi. Unfortunately, due to data collection constraints, the focus is currently limited to Louisville.



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<sup>37</sup> "National Address Database." U.S. Department of Transportation, June 2025. <https://www.transportation.gov/gis/national-address-database>

<sup>38</sup> "National Broadband Map." Federal Communications Commission, December 31, 2024. <https://broadbandmap.fcc.gov/data-download/nationwide-data>

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<sup>41</sup> U.S. Census Bureau. American Community Survey 5-Year Estimates, 2023. Released 2024. [https://data.census.gov/table/ACSST5Y2023.S1101?q=households&g=310XX00US31140\\$1400000](https://data.census.gov/table/ACSST5Y2023.S1101?q=households&g=310XX00US31140$1400000)

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<sup>44</sup> The graphs column depicts histograms of the frequency distributions of each variable.

<sup>45</sup> While Louisville has 126 census tracts, the data collection effort for Provider 1 ended up with four neighborhoods that did not have any addresses with fiber availability. Therefore, models for Provider 1 have 122 observations instead of 126.



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