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CONNECTED CITIES AND INCLUSIVE GROWTH (CCIG)
Policy Brief # 4
September 2019

Who Gets Access to Fast Broadband? Evidence from Los Angeles County 2014-17

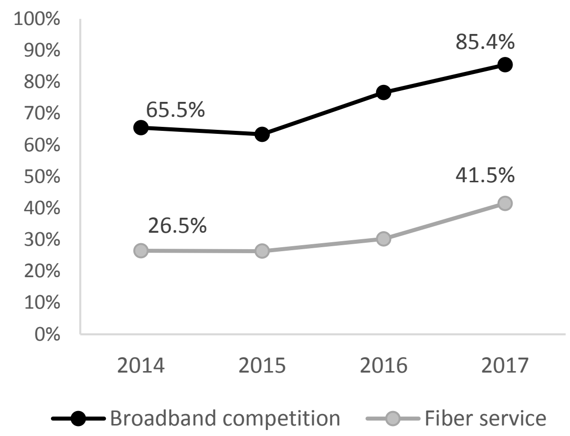
As consolidation in the US residential broadband market continues, there is concern that that Internet Service Providers (ISPs) are "cherry-picking" areas for upgrades to fast broadband services. This policy brief examines this question for Los Angeles (LA) County during the 2014-17 period. In particular, it probes for evidence that ISPs are neglecting investments in low-income areas and communities of color. The analysis is based on the most recent deployment data available for fixed residential services collected by the California Public Utilities Commission (CPUC) in combination with demographic information from the American Community Survey (ACS). Because the spatial distribution of investments cannot be directly observed, broadband competition and the availability of fiber services are used as proxies. The findings indicate that competition and fiber-based services are less likely in low-income areas and communities of color, with the most severe deficits observed in census block groups that combine poverty and a large percentage of Black residents. Alternative policy tools to address spatial inequalities in private broadband investments are outlined in the conclusion.

1. More LA residents live in areas with broadband competition and fiber availability.

During 2014-2017, ISPs made considerable infrastructure investments across LA County. As a result, the share of residents served by two or more ISPs increased to about 85% (Figure 1). This represents an additional two million residents who can choose between broadband offerings. The availability of fiber-based residential broadband also increased significantly, from 26.4% of residents in 2014 to 41.4% in 2017. This represents an additional 1.4 million residents with access to gigabit-level services (Figure 1).

At the same time, other results raise concerns about market consolidation and underinvestment. For example, while between 2014 and 2017 the number of ISP choices increased for about 2.6 million residents, about 1.1 million residents experienced a decline in the number of Internet choices. In addition, the share of census blocks served by three or more ISPs dropped by almost half (from 9.6% in 2014 to 5.7% in 2017). These trends suggest the rapid consolidation of duopoly competition in the residential broadband market in LA County.

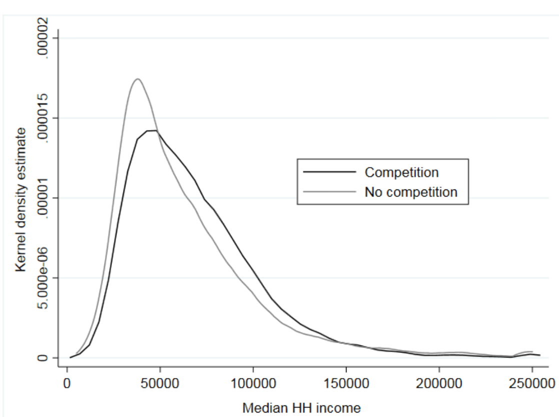
Figure 1: Competition and fiber availability in LA County (% residents)



2. Broadband investments are not equally distributed across LA County.

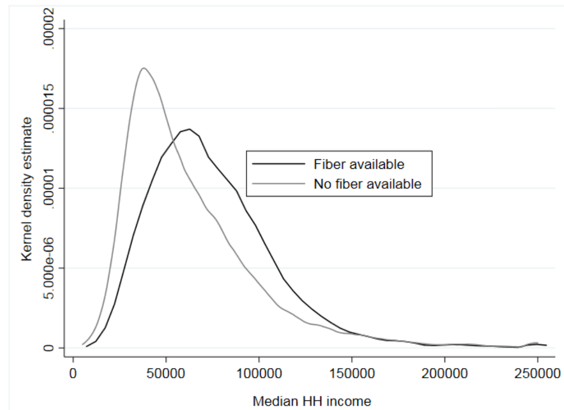
What are the sociodemographic patterns in the spatial distribution of network upgrades and investments in broadband infrastructure? The descriptive evidence suggests that these patterns are associated with income and racial factors. Figure 2 plots broadband competition along the income distribution (median household income in each census block group). As shown, the curve is right-skewed, indicating that broadband competition is more likely in the more affluent communities.

Figure 2: Broadband competition by median HH income (all years combined)



The pattern is even more apparent in the case of fiber services, as gigabit-level broadband is significantly more available in wealthier communities.

Figure 3: Fiber availability by median HH income (all years combined)

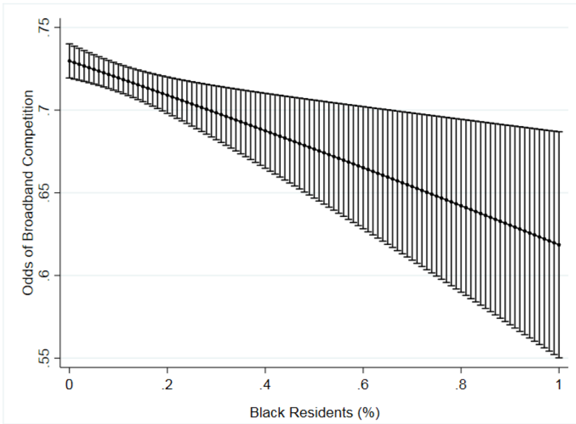


3. Isolating the effect of income and race on broadband investments.

There are numerous demographic and market variables that jointly affect the spatial distribution of broadband investments. In order to disentangle race and income factors from other variables, a series of multivariate regression models are estimated. Broadly speaking, the models estimate the odds of observing competition and fiber availability in a particular census block group, controlling for the market and socioeconomic factors that drive broadband investments. These include competition intensity, population density, and several other demographic variables (see Appendix for detailed model specification).

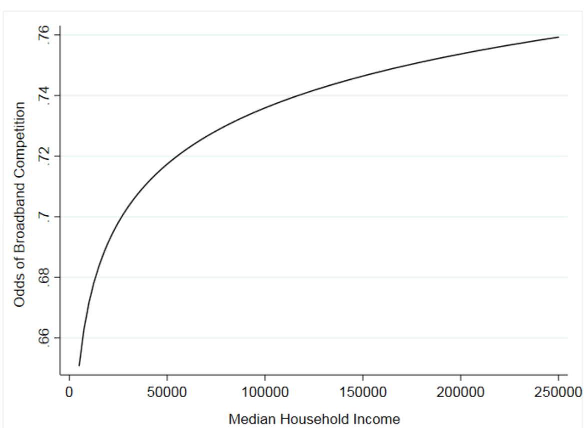
The results largely validate the hypothesis that broadband infrastructure upgrades in the 2014-17 period are skewed against less affluent areas and communities of color. For example, as shown in Figure 4, the odds of competition between two or more ISPs in a census block group are about 73% in areas with a small share of Black residents, dropping to about 62% (11 percentage points lower) in the traditional Black areas of LA County.

Figure 4: Predicted odds (with 95% CI) of broadband competition by share of Black residents (all years combined)



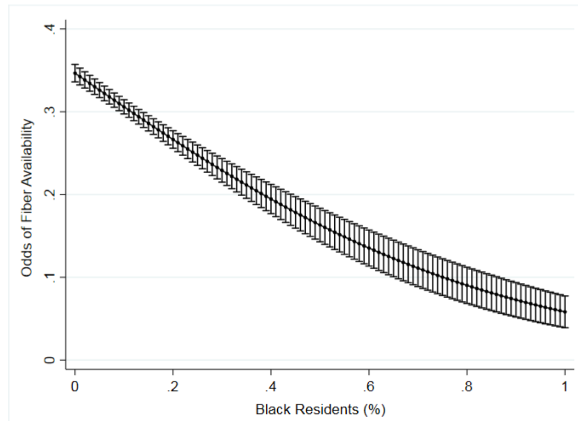
As expected, household income is also a significant predictor of whether residents have broadband choices (Figure 5). In low-income block groups, the odds of broadband competition are below 70%, climbing above 75% in the more affluent areas. In other words, low-income residents have fewer broadband options, which is typically associated with lower quality service and higher prices.[1]

Figure 5: Predicted odds (with 95% CI) of broadband competition by median HH income (all years combined)



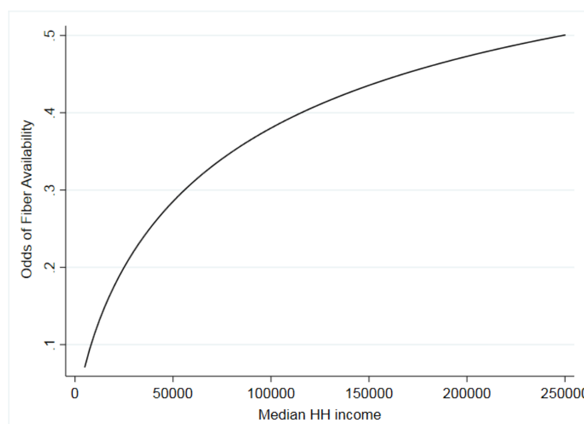
In the case of fiber-based services, the results suggest that race and income are even stronger predictors of service availability. As Figure 6 shows, the odds of fiber in a block group are about three times lower in Black-majority areas, relative to comparable areas with few African-American residents.

Figure 6: Predicted odds (with 95% CI) of fiber availability by share of Black residents (all years combined)



Similarly, while in affluent areas the odds of fiber are approaching 1 in 2, in less affluent areas they stand at about 1 in 5 (Figure 7).

Figure 7: Predicted odds (with 95% CI) of fiber availability by median HH income (all years combined)



[1] See *Broadband Competition Helps to Drive Lower Prices and Faster Download Speeds for US Residential Consumers* (Analysis Group, 2016).

4. The most severe deficits are observed in low-income Black communities.

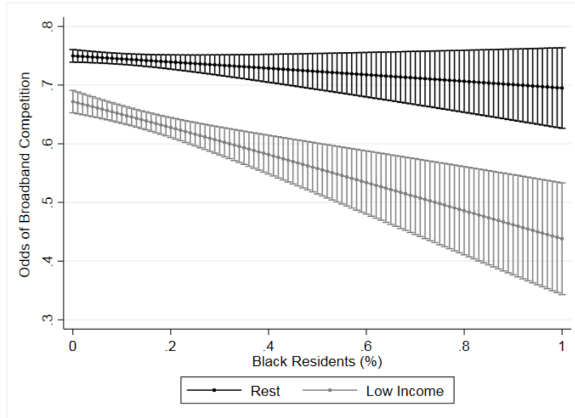
Previous studies of social inequality in Los Angeles have pointed to clustering effects in traditional Black neighborhoods, particularly in the South Los Angeles area. These communities have been historically neglected for investments in transportation, education and other public goods, thus compounding adversity and perpetuating the poverty cycle from one generation to another.[2]

In order to examine whether similar patterns of infrastructure underinvestment exist with respect to broadband, a term that captures the interaction between low-income and the share of Black residents is introduced in the estimation models. Broadly speaking, this tests the hypothesis that, above and beyond the separate effect of income and race, broadband investments are bypassing areas that combine poverty and a relatively large share of Black residents.

The results validate the clustering effects hypothesis. In particular, they suggest that broadband underinvestment is most severe in low-income Black communities. To illustrate these effects, Figure 8 replicates the plot in Figure 4 but divides block groups into low-income (bottom median income quartile) and the rest. In other words, the figure compares the odds of broadband competition between low-income and more affluent areas along the share of Black residents in each block group.

As shown, while the odds of broadband competition are higher and relatively similar in affluent areas regardless of the share of Black residents, the odds fall rapidly in poor communities as the share of Black residents increases. Notably, the odds fall below 50% in majority-Black low-income communities.

Figure 8: Predicted odds of broadband competition by income and share of Black residents (all years combined)

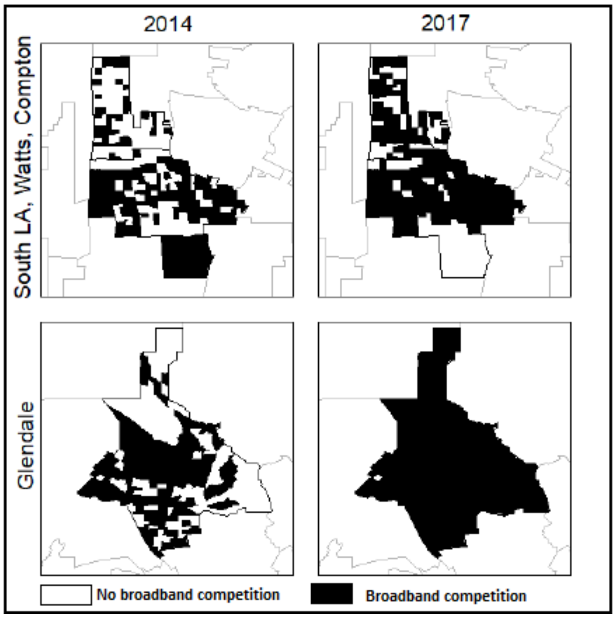


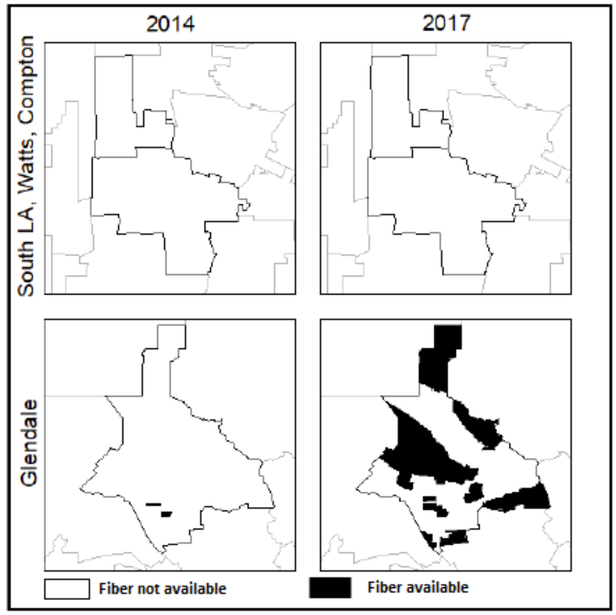
To further illustrate these patterns, Figure 9 maps the change in broadband competition and residential fiber availability between 2014 and 2017 in two areas with different socioeconomic characteristics. The first is Glendale, a relatively wealthy city of about 200,000 residents with a negligible share of Black residents (less than 1%). The second comprises the City of Compton, as well as portions of Watts in the South LA area. With a combined population of about 320,000 residents (about a third of them African-American), these are historically Black communities where the median household income is only about 60% relative to that of Glendale residents.

As shown, the pace of broadband service deployment differs considerably between these areas. In Glendale, broadband competition grew from 60% of block groups in 2014 to essentially the entire city in 2017. By comparison, about a quarter of South LA residents remained without broadband choice in 2017. Similarly, fiber coverage in Glendale jumped from less than 2% in 2014 to about a third of the city in 2017. This is in stark contrast to South LA, which remained a fiber "desert" throughout the 2014-17 period.

[2] See Matsunaga, M. (2008). *Concentrated poverty neighborhoods in Los Angeles*. Economic Roundtable.

Figure 9: Broadband competition and fiber availability in South LA vs Glendale (2014 and 2017).





Source: www.tinyurl.com/DigitalDivideLA

5. Conclusion

High-quality, affordable broadband is as critical to the social and economic vitality of communities as transportation and electricity were in the 20th century. However, unlike investments in previous critical infrastructures, broadband investments in the US are made almost exclusively by private operators. This increases the potential for market failures, threatening the equitable development of digital infrastructure.

Correcting market failures in critical infrastructure availability is a key government mandate. As such, both federal and state law are replete with provisions barring discrimination in the deployment of communication facilities on the basis of race, income and other factors.[3] The findings above suggest that broadband investments in LA County during 2014-17 did not adhere to these non-discriminatory standards. Regardless of intent, the practical effect has been the reproduction of the inequalities that have characterized the region for generations, with particular adverse effects for low-income Black communities in South LA.

There are a number of policy options to redress these trends. First, both the FCC and the CPUC have broad authority to investigate discrimination in infrastructure deployment.[4] At the local level, municipalities can leverage their infrastructure assets (including poles, rights of way and in some cases an extensive fiber backbone) to promote private investments in underserved areas. Finally, several local governments in the US and abroad operate an ISP that offers fast services at competitive prices.[5] While it is yet to be seen if this model is replicable at scale, it is nonetheless worth considering as part of the policy toolset available to promote equity in the provisioning of broadband services across LA County.

[3] In the case of California see the Digital Infrastructure and Video Competition Act (2006), Section 5810 (a).

[4] See Baynes, L. (2004). The Color of Access to Telecommunications. *Admin Law Review* 56(2): 263-351.

[5] See Crawford, S. (2019). *Fiber: The Coming Tech Revolution*. Yale University Press.

Appendix

The data on broadband deployment is sourced from the CPUC, which annually collects service availability information from all ISPs at the census block level. This information is combined with demographic data from the American Community Survey (ACS) 5-year estimates. Since the census block group level is the smallest geographical unit for which demographic data from the ACS is available, broadband availability is aggregated from the census block group level to the block group level, which likely results in overestimation of broadband availability. Following the FCC benchmark, broadband is defined as an Internet access service with advertised speeds of at least 25Mbps for data download and 3Mbps for data upload.[6]

The analysis is based on two modelling strategies. First, a pooled logit specification that estimates the effect of race and income on the two outcomes of interest (broadband competition and fiber availability), conditional on market conditions and other demographic factors. Robust standard errors clustered at the block group level are used to account for correlation between model errors for observation units across time periods. In addition, a year fixed-effects term is included to account for investment growth over the study period.

The vector of census block group controls includes the following:

- Population density
- Race composition (Black/Hispanic/Asian)
- Education (% bachelor degree or higher)
- Household size
- Median age
- Median age squared
- Median household income (log)
- Presence of children <18 (%)
- English-only household (%)

In addition, the fiber availability models include a dummy variable that captures the presence (or lack thereof) of broadband competition in the block group. The interaction models discussed in Section 4 include an additional term that captures the interaction effect between low-income (using bottom income quartile as a proxy) and the share of Black residents.

The second empirical strategy is a within-group panel data specification that allows for controlling for time-invariant unobserved differences across blocks groups. In addition, the predictor variables are lagged one period in order to account for the lengthy investment cycle involved in broadband network deployment. While this specification results in more precise estimations, there is considerable loss of information, primarily because the within-group estimator only uses information from block groups for which changes in the outcome and predictor variables are observed during the study period.

To facilitate interpretation, the results presented are based on the pooled logit specification. Results from the within-group estimations yield qualitatively similar results. The complete set of data and tables is available from the authors upon request.

The map in Figure 10 is part of an interactive online tool where the data used in this report can be visualized. The tool was created using the ESRI ArcGIS Online AppBuilder platform, and allows users to explore broadband deployment and adoption information in LA County. The tool is at www.tinyurl.com/DigitalDivideLA.

[6] FCC (2015), *Broadband Progress Report*. GN Docket No. 15-191, pp. 7 (released February 4, 2015).

About the project

This document is part of the Connected Cities and Inclusive Growth (CCIG) project, a collaboration between the USC Annenberg Research Network for International Communication (ARNIC) and the USC Price Spatial Analysis Lab (SLAB). More information about the project can be found at arnicusc.org/research/connected-cities.

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About ARNIC

The Annenberg Research Network on International Communication (ARNIC) studies the emergence of new communication infrastructures, examines the attendant transformation of government policies and communication patterns, and analyzes the social and economic consequences. The project is multi-disciplinary – including communication, sociology, economics, and political science approaches – and follows an international comparative perspective spanning North America, Latin America, Asia, Africa, the Middle East, the Pacific, Western and Eastern Europe.

About SLAB

SLAB, the Spatial Analysis Lab at USC Price, aims to advance the visualization of the social sciences for public service through research, public engagement, and teaching. Our research experiments with developing alternative cartographies and exploring their potential roles in society, endeavoring to create knowledge and narratives that support an increasingly inclusive city. Aligned with Price's commitment to social justice and equity, the various activities of SLAB focus on bringing creativity and a humanistic attention to marginalized peoples and places.

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