# Exploring the Role of Tribal Governance Capacity in Internet Availability on American Indian Land

NR Brouwer [*]

February 26, 2024

The lack of internet access on American Indian and Alaskan Native lands is a frequently discussed component of greater socioeconomic inequalities faced by American indigenous communities. Explanations for this disparity often center around barriers that increase the costs to broadband internet deployment. In this paper, I attempt to identify the barriers to deployment that are unique to Indian Country, as well as factors of tribal government capacity that may enable tribal governments to overcome structural barriers and reduce the digital divide. Using data on internet access at the census block level from 2014 to 2019, I utilize a distance threshold identification strategy to identify otherwise similar tribal and non-tribal census blocks to estimate the effect of tribal land ownership on cable internet availability. Finding significant gaps in internet availability on tribal land, I then examine four determinants of tribal government capacity (gaming business, Bureau of Indian Affairs funding, participation in self-governance contracts, and a reservation economic freedom index) to observe how tribal governance power may reduce internet access inequality. I find that only one of these four measures is correlated with improved internet access on tribal land.

[*]Graduate Student, University of California, Merced, *nbrouwer@ucmerced.edu*

# Introduction

Access to broadband internet on American Indian land has been notably lacking for most, if not all, of the internet era, a phenomenon sometimes referred to as the ”tribal digital divide” (Bauer, Feir and Gregg 2022). Indian Country faces not only the same connectivity challenges that the rest of the nation deals with (i.e. rural locations making deployment more expensive, low economic growth reducing the interest of private companies in investing, etc.), but also challenges unique to Indian Country (i.e. complicated land tenure systems, relatively insecure property rights, etc.).

Overcoming these unique barriers is in many ways a government capacity challenge. If they are to be overcome at all, the challenges require Native Nations to engage in significant planning processes to make deployment possible in the face of often less-than-preferable pre-conditions, coordinating with other actors like private internet service providers or federal government agencies like the Bureau of Indian Affairs (BIA) or the Federal Communications Commission (FCC) to open the doors necessary to enable investment on tribal land, and structuring their land and business regulations to facilitate development. Tribal governments, through their power and institutional capabilities, therefore, play an important role in facilitating internet access for their citizens.

In this paper, I examine the tribal digital divide and the role tribal governments may play in minimizing it. First, using internet availability data at the census block level, I compare land just within and just outside tribal territories to identify how tribal ownership of land effects internet access. From this analysis, I find that tribal control of census blocks reduces the likelihood of cable internet availability by 4.4 to 8.3 percentage point, confirming that there are unique barriers to broadband deployment in these territories. I then look at four possible measures of tribal governance capacity to explore how stronger tribal governments may enable internet provision. Specifically, I look at four possible measures of tribal governance capacity: participation in the gaming industry, funding from the Bureau of Indian Affairs, participation in self-governance compacts with the federal government, and a reservation economic freedom index. Of these four measures, I find that having entered a compact with the federal government is correlated with a large reduction in the tribal digital divide, while the other three had no statistically significant effect.

These findings contribute to two important strains of research in American Indian politics. First, it builds on research estimating the costs imposed on native communities by the history of damaging and inconsistent federal policy (e.g. Dippel 2014, , Leonard, Parker and Anderson 2020Schroedel, Rogers and Dietrich, 2023). Disorganized, poorly thought out and implemented, and often times antagonistic policies towards native communities have saddled modern Native Nations with a number of economic burdens. My analysis does not parse out the individual impacts of historical federal oversight, such as land allotment or fractionation, but my analysis does point to a negative impact that may be the result of the bundle of these poor policy legacies.

Second, my findings contribute to the discussion on the importance of tribal governance and tribal institutions in improving the socioeconomic conditions in Indian Country (e.g. Cornell and Kalt 1992, Evans 2011, Akee, Jorgensen and Sunde 2015, Anderson and Ratté 2022). Work on native communities, for understandable reasons, often focuses on how these groups suffer from the consequences of actions taken by other actors. This perspective risks ignoring the agency of native communities to act on their own behalf. By examining not just what costs Native Nations bear, but also what traits make Native Nations more successful, this work helps refocus research on tribes as the governing actors that they are.

The remainder of the paper is structured as follows. First, I review research on American Indian tribal governments and governance on tribal land. Next, I discuss the issue of internet access and why tribal governance quality should matter. Then I go through two empirical steps. First, similar to Bauer, Feir and Gregg (2022), I estimate the causal effect of tribal ownership of land through a spatial threshold identification strategy. Second, I run exploratory analysis with four measures of tribal governance capacity to examine possible correlations in the relationship between native land and internet availability. I conclude with some thoughts how future work can improve on this work.

## Governance in Indian Country

As of January 2024, there are 347 federally recognized tribes in the contiguous states. (Federal Register 2024). Recognized either through acts of Congress or the more modern process established by the Bureau of Indian Affairs (BIA), these groups are acknowledged as sovereign political bodies, establishing a formal relationship between the tribe and the federal government. This relationship confers a number of benefits to the tribe, such as access to various federally funded programs and exemption from state taxes, but also makes the tribe subject to Congressional plenary power, which allows Congress to dictate policy to tribes under its responsibilities to act in whatever ways they think is in the "best interest of its Indian 'wards'" (McCulloch and Wilkins 1995, Tsosie 2006).

The bounded power of recognized tribes can be observed in a number of political domains on tribal land. In conjunction with federal recognition, tribes may also have land set aside for use by the tribe, typically held in trust by the federal government. This land may be referred to collectively as Indian Country and includes over 500 different reservations, off-reservation trust areas, and other indigenous land designation in the contiguous forty-eight states, spanning over fifty million acres of land. In theory, it is on Indian Country that tribal governments should have jurisdiction to create, implement, and enforce laws in accordance to the preferences of the tribal government. (Wilkins and Stark 2017). However, the purview of tribal governments in Indian Country is limited by a number of ways. For example, the Major Crimes Act of 1885 gave the federal government jurisdiction over criminal cases involving major felonies like murder, rape, and arson. Almost 70 years later, Congress would pass Public Law 83-280 (PL280), which transferred in a number of states both criminal and civil prosecution power from the tribe to the states those tribes resided in (Anderson and Parker 2008).

We can also look at the gaming business in Indian Country to see the limitations of tribal power. While not all tribes operate gaming facilities, and most of the revenue being generated from Indian gaming is concentrated among a minority of tribes, the gaming business has become a major source of revenue and employment for many tribes (Akee, Spilde and Taylor 2015). This economic opportunity was largely shaped by the Supreme Court case *California v. Cabazon Band of Mission Indians* and the subsequent Indian Gaming Regulatory Act (IGRA). In 1987, the *Cabazon* case ruled that gambling was a regulatory issue and not a criminal issue, thus California could not restricting gaming operations on tribal land. In 1988, the IGRA was signed into law by President George H.W. Bush and required that tribes negotiate a compact with the state the facility would reside in if they wanted to engage in the most profitable forms of gambling (e.g. blackjack, roulette, slots, etc.). This means that in the gaming realm, tribal policy is not just restricted by the federal government, but by state governments. This shifts policymaking from an internal process within a tribal government to one of campaigning, lobbying, and negotiating with a third party in the state (Corntassel and Witmer 2008).

The most involved actor on Indian Country outside of tribal entities, however, is undoubtedly the Department of the Interior and the BIA. Originally created under the War Department to reduce conflict between the United States and tribes, the BIA has often been characterized as particularly paternalistic in its treatment of tribes (Wilkins and Stark 2017). Evans (2011) gives a more complex image of the BIA, arguing that the institution is made up of both bureaucrats who might hoard power and be slow to react to the needs of native communities as well as bureaucrats who are genuinely invested in helping native communities. Regardless of how one views the BIA, its influence in Indian Country and tribal governance is undeniable. The creation and adoption of modern tribal constitutions under the Indian Reorganization Act was heavily managed by the BIA and constitutional amendments still require BIA approval (Lemont 2006). Permitting and leasing land to non-Indians requires BIA approval (Anderson and Ratté 2022). Mortgaging land held in trust by the federal government also requires Interior approval (Alston, Crepelle, Law and Murtazashvili 2021). More generally, the complex and messy federal bureaucracy active on tribal territory is frequently pointed to as a barrier to tribal governments actually asserting their power and improving their communities (Crepelle 2019).

This is not to say that federal involvement in Indian Country is bad, as Evans (2011) would be quick to remind us that the BIA is an important component to building tribal governance. Frye and

Parker (2016) also take a more measured approach, finding that tribes with greater BIA involvement (as a consequence of participating in the Indian Reorganization Act) had lower economic growth on average compared to tribes with relatively less BIA involvement. However, tribes with less BIA involvement had greater variation in their growth rate, implying that BIA involvement may have reduced high-end economic outcomes for native communities, but also avoided low-end ones.

Despite the many ways in which external actors control development on tribal territory, the American Indian politics literature has also articulated that indigenous institutions matter. Tribal governments have an undeniable role to play in assigning, leasing and zoning land, regulating business and environmental issues, levying taxes, and providing and managing social services like housing, education, and healthcare (O'Brien 1993). The power of tribal governments may be ultimately bounded by the trust relationship with the federal government, but tribal governments still have significant agency.

In fact, Cornell and Kalt (1992) argue that because so much of what determines economic growth on Indian Country is out of the hands of tribal governments, it becomes more important to improve the factors tribes have the most control over: political institutions. Scholars since then have discussed a number of ways in which tribal political institutions matter. Cornell and Kalt (2000) examines how executive, legislative, and judicial constitutional organization correlates with economic growth and employment. Akee, Jorgensen and Sunde (2015) extend this analysis by arguing that tribal constitutional institutions are plausibly instrumented by the political party of the presidency at the time of constitution adoption. Subsequently, they find that tribes with an indirectly elected executive had lower poverty rates. Stratmann (2023) combines a number of political and economic institutions to construct an index of economic freedom for 90 reservations and finds a correlation with household income. Dippel (2014) argues that tribes which were formed through from the forced coercion of many distinct indigenous communities into a single tribe see greater political factionalism and creates economic uncertainty for potential investors.

Of course, institutions should not always be thought of as better or worse than alternatives, but as possessing strengths and weaknesses that should be weighed. For example, Wellhausen (2017), building off the work of Anderson and Parker (2008), considers how tribal governments sometimes have to make a credibility-sovereignty trade-offs when considering institutions. She estimates that tribes affected by PL280, a legal institution that improves the credibility of economic investments on tribal lands but hurts the sovereignty of the tribal government, had slightly improved economic outcomes. tribes may be willing to pay that cost in order to maintain what they believe is their rightful sovereign power.

Understanding that governance in Indian Country is a patchwork of political influences from federal, state and tribal governments, I now turn to the primary topic of this paper: availability of broadband internet.

## Internet Access and Tribal Governments

In 2020, the FCC estimated that 27.7% of Americans on tribal land lacked access to high-speed fixed broadband internet compared to 22.3% of Americans living in rural areas (Federal Communications Committee 2020). Similarly, researchers at the American Indian Policy Institute estimated that 18% of tribal residents had no access to the internet, and another 33% relied on using their smartphone for internet access (Howard and Morris 2019). The issue of internet access in indigenous communities was highlighted during COVID-19, when the internet became a particularly vital resource for employment, education, and information dissemination. Subsequently, the Tribal Broadband Connectivity Program (TBCP) was created in the 2021 Bipartisan Infrastructure Law and the Consolidated Appropriations Act, allocating $3 billion to improving internet access on tribal land. Through the TBCP, tribal governments apply to the program to fund projects related to improving internet access (BroadbandUSA 2023). To understand what tribes might spend this grant money on, and what role tribal governments play in internet deployment generally, it's worth giving a brief description of what broadband internet is and how it typically expands.

The term broadband internet refers to any type of internet access that provides a download speed of at least 25 mb/s and an upload speed of at least 5 mb/s. The term is typically used to distinguish between newer internet technologies that enable higher access speeds (cable, DSL, fiber, fixed wireless, and satellite) compared to older internet technologies like traditional dial-up services. These five types of broadband technology vary in their mode of transmission. Most importantly for the analysis in this paper, cable, DSL, and fiber require the laying of cables to connect households to the internet. Fixed wireless and satellite technologies, in contrast, transmit digital information wirelessly between receivers at customers' households and broadcast towers and satellites, respectively (BroadbandUSA 2016).

Broadband internet service is typically provided by private internet service providers (ISPs). These ISPs face significant initial costs to building broadband infrastructure and tend to prefer urban areas where the marginal cost to adding new customers will be lowest due to the geographic concentration of households. This means that rural areas tend to be unappealing to ISPs, as building out their infrastructure to rural households presents a significant costs with little potential for cheap future customer growth (Null 2013).

Even though internet access is typically privately provided, local governments also play an important role in facilitating access. Municipal governments are important facilitators of general economic development through policy tools like land use regulation and business permitting processes (Leigh and Blakely 2016). For broadband infrastructure, permits to access public infrastructure like roads ad sidewalks, as well as easements that grant access to private property, are major components to deployment (Pew Charitable Trusts 2022). Local governments may also choose to publicly supply internet access, something which is particularly appealing to rural areas where ISPs are less willing to invest. Publicly supplied internet tends to use fixed wireless technology because it has a much lower cost to deployment than DSL, cable, and fiber, although it may not be as consistent or fast (Mandviwalla, Jain, Fesenmaier, Smith, Weinberg and Meyers 2008).

Based on this brief characterization of internet infrastructure, what should we expect internet connectivity to look like in Indian Country? Households on tribal land tend to be low income and located in rural areas, so we should expect that ISPs have few incentives to build infrastructure, especially costly technologies like DSL, cable, and fiber. Simply put, the cost to build the infrastructure would be high, and the expected value from the invest would be low. Additionally, there are unique barriers to operating on tribal land. Due to disastrous historical federal policies like allotment, land tenure in Indian Country is very complex, which makes it difficult for ISPs to actually build infrastructure on tribal land. ISPs also can't simply engage with only with tribal governments because land held in federal trust requires BIA involvement. So even if an ISP wanted to build internet infrastructure on tribal land, they might find it to be exceedingly slow and difficult to actually begin construction because of federal involvement.

These hurdles are not necessarily entirely impossible to overcome for native communities. Tribal governments with significant revenues may be able to subsidize ISP projects to reduce the up-front costs of deployment. Tribes with more skilled and better-manned bureaucracies might be able to improve the planning and permitting process, reducing some of the drawbacks ISPs may worry about when considering investing on tribal land. These tribes might also be better at facilitating communication between the tribe, the ISP, and the federal government, again minimizing some of the headaches that might arise otherwise. Tribes could also choose to forgo private suppliers and instead public provide internet access. However, this choice would still require the tribe have significant revenue to deal with up-front infrastructure costs, as well as technical and bureaucratic power to plan, implement, and run an internet network.

From this observation, it makes sense to say that tribal governance capacity should matter for partially determining internet access.[1] This seems to line up with many of the issues identified by the federal government. In a 2021 report, the Department of the Interior identified seven barriers to deployment: insufficient data, missing building blocks, insufficient funding, complex permitting, low adoption, weak economic development, and poor coordination (Department of the Interior 2021). The issue for tribes is not just one of ruralness or poverty, but also a lack of state capacity on the part of tribal governments to start and finish projects. If we look at the goals for the tribal projects funded by TBCP, we see that a number of tribes plan to use the money to carry out

[1] I invoke here the concept of state/governing capacity as simply a way of expressing technical and organization abilities of a political body to accomplish want it wants. See Suryanarayan (2024) for a larger discussion on the meaning and study of state capacity.

planning, engineering, feasibility, and sustainability studies, to run environmental impact studies, or to make permitting plans (BroadbandUSA 2023). The funding is not just to buy equipment or to build infrastructure, it's to subsidize bureaucratic activity. Clearly, there is a element of bureaucratic overload or ineptness to the tribal digital divide.

If it is the case, then, that bureaucratic competence is a significant component to understanding internet access on tribal land, then two implications should follow. First, even after holding other factors like geography and economic status constant, there should still be a negative effect from tribal ownership of land on internet access. If there is no difference between tribal and non-tribal land after holding these elements constant, then the previously discussed unique complications to building in Indian Country and tribal governance capacity to overcome these barrier must not matter. (Bauer, Feir and Gregg 2022) attempt to isolate the causal effect of tribal ownership of land on internet access and find large, significant effects, which gives this implication greater credence. Second, assuming there is still a disparity in internet access after controlling for other factors, then tribes with greater governance capacity should have higher rates of internet access compared to lower capacity tribes.

In the next section, I look at data on internet access in Indian Country to test these two implications. First, in a similar analysis to (Bauer, Feir and Gregg 2022), I attempt to estimate the causal effect of tribal ownership on internet availability using a different dataset. Second, I use this estimate as a benchmark in more exploratory work on how tribal governance capacity may improve internet connectivity.

# Estimating the Effect of Tribal Control on Internet Access

## Measuring Internet Access Disparity

To test the implication that tribal ownership of land should have a negative effect on internet access, I need to compare census blocks under tribal ownership to land not under tribal control. Of course, the locations of tribal blocks are not random. If I were to simply compare all tribal census blocks to all non-tribal blocks, it would be difficult to discern the unique effect of tribal governance. A common identification strategy to solve this problem would be to subset the sample to only land that rest just inside a threshold just within and just outside a tribal reservation to account for unobserved variation that should be minimized at the border. Identifying the borders of tribal land, however, is difficult. While many reservations look like a typical political boundary (a single, contiguous polygon), one of the legacies of changes in federal policy regarding tribal land is that a significant portion of reservations have some form of checker-boarding pattern where small patches of tribal land are interspersed with non-tribal land.

Under the same logic of looking at the border, however, I instead set an inclusion restriction where the center of a census block of either type must be within a certain distance of at least one census block of the opposite type to be included in the analysis. I use four distance thresholds for robustness: 10 kilometers, 5 kilometers, 2.5 kilometers, and 1 kilometer. The goal of this exercise is to create a sample of tribal and non-tribal census blocks that are similar in all ways except for tribal ownership.

In order to determine which census blocks are under tribal jurisdiction, I calculate for each block whether it overlapped with a tribal territory every year from 2011 to 2019. Only census blocks that never overlapped (what I will call non-tribal blocks) or always overlapped (what I will call tribal blocks) were included in the final sample. A vast majority of census blocks were consistently overlapping or never overlapping, as the borders of census blocks and tribal territory largely match because the Census Bureau tries to take into account tribal boundaries when drawing block (Bureau of the Census 1994). Additionally, I remove blocks that had a population of zero in the 2010 census. Because all land in the United States, including uninhabitable geography bodies of water, must belong to a census block, it is not reasonable to assume that all blocks represent a market for internet service. Removing these blocks helps to ensure my analysis only compares blocks where people actually live in case tribal land were systematically more likely to include uninhabitable land.

Census blocks are the primary unit of analysis for this paper because I measure internet access using the FCC's Form 477 data. All broadband providers (including both private ISPs and municipal governments) are required to submit to the FCC twice a year a list of all census blocks they could *offer service to at least one location inside the census block*, as well as the speed and technology used for the service (Federal Communications Committee 2022). From these lists, I calculate for every six months from December 2014 to December 2019 (a total of 11 time periods) whether each block had at least one broadband provider claim they could service that block. I do this both for cable internet access and fixed wireless access.

It is worth noting here that using Form 477 data comes with some downsides. Bauer, Feir and Gregg (2022) perform a similar analysis to what I propose here, but they explicitly reject using Form 477 data and instead use estimates of internet access from the American Community Survey and private internet speed measurement companies. The primary argument against Form 477 data is that they overestimate internet access, perhaps particularly so in Indian Country (Howard and Morris 2019). In order for an internet provider to list a census block as being within their service range, they only need to be able to supply internet to one location in that block. To see why this might be an issue, imagine two census blocks, both with 100 households. In the first block, all 100 households have internet access. In the second block, only one household has internet access. In the FCC data, these two blocks would have the same measure of internet access: one.

While a more precise measurement of internet access would be preferable, I think Bauer, Feir and Gregg (2022) too quickly dismisses the usefulness of Form 477 data for this analysis. Form 477 data will likely always overestimate internet access in blocks, regardless of tribal ownership. Unless a block has 100% coverage, it will be overestimated. If tribal and non-tribal census blocks are both just as likely to be have their access overestimated, this is just an issue of noise, not bias. If (Howard and Morris 2019) is correct and Form 477 is systematically more likely to overestimate internet access for tribal land than it is for non-tribal land, then the bias would cut against finding results, as tribal and non-tribal blocks would look artificially similar. If this is the case, an effect estimated from Form 477 data can be thought of as a floor effect. The only concern would be if Form 477 is systematically more likely to overestimate internet access for non-tribal land. In this case, an effect found from tribal jurisdiction may simply be a type-I error attributable to overestimating the difference in access between tribal and non-tribal land. Because most scholars tend to believe that the systematic overestimation is on the tribal side, using Form 477 should be fine for estimating a floor effect of tribal governance on internet access.

Form 477 data also have significant benefits. Most importantly, they allow for the estimation of internet access at the smallest geographic unit drawn by the Census Bureau (Bureau of the Census 1994). This is extremely helpful for identifying similar tribal and non-tribal units to compare. The assumption that units in close proximity to one another are comparable is more believable when the units are small, implying less variation within the unit. The small size also means that there are more units in total. Also, Form 477 data are collected twice a year, allowing for the creation of a panel dataset instead of a cross-sectional one. This means the analysis can also take into change over time.

To highlight the value of Form 477 data, I compare what a sample of my data looks like compared to a rough approximation of the data used in Bauer, Feir and Gregg (2022) in Figure 1. The smallest geographic unit Bauer, Feir and Gregg (2022) can estimate internet access for is the block group level, one higher than the block level. This spatial aggregation, however, makes a massive difference in the units being compared. By using Form 477 data and census blocks, I'm able to more comfortably assume the similarities in my units.

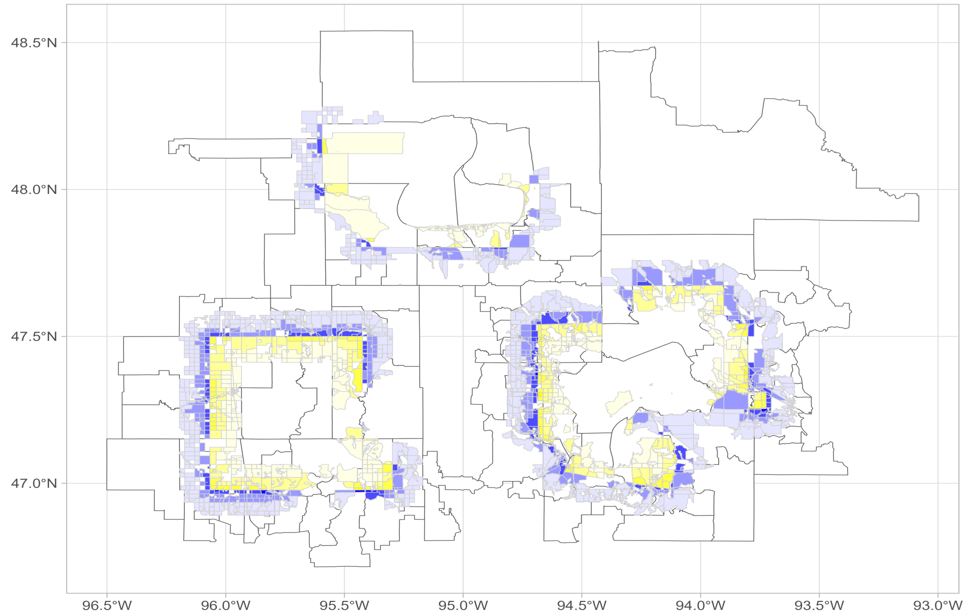



Figure 1: White Earth, Red Lake, and Leech Lake Reservations, as represented in my data (small blue and yellow polygons) and Bauer, Feir and Gregg (2022) data (large black and white polygons). Blue polygons represent non-tribal census blocks, yellow polygons represent tribal census blocks. The intensity of the color represents what the smallest distance threshold the block is included in. This plot includes slightly more polygons than what was actually included in Bauer, Feir and Gregg (2022), and thus this figure should only be used to roughly compare the relative size and number of polygons between the two, not as an exact comparison.

## Balance Testing

To evaluate how successful the distance threshold strategy was at creating comparable census blocks, I also look at the balance of a number of potentially relevant covariates. This is somewhat challenging because census blocks are so small, individuals may be identifiable in the data, so many Census measures are not publicly available at the block level. For example, comparing the balance on household income would be helpful, but is not available. Regardless, I am able to observe the balance of total population (as reported in the 2010 Census), total households (as reported in the 2010 Census), geographic size, average terrain ruggedness, and distance to urban areas. Total population and households may be relevant to internet access because they could increase demand for internet, and therefore increase the willingness of an ISP to invest. Geographic size, ruggedness, and distance to urban areas are potential costs to providing service, and therefore may reduce internet access as they increase. Because there is no exact prediction on how large the nearest urban area needs to be to impact broadband availability, I look at distances from cities with populations of at least 5,000, 10,000, 50,000, and 100,000. I log all of these covariates to account for significant skew in each.

I report the balance of each covariate in Table 1 at each distance threshold sample by regressing covariates individually by the tribal ownership binary variable. I include time period and geographic area[2] fixed effects as well to focus on variation within the same time period and same geographic area.

Table 1: Balance Test: Covariate Correlations with Tribal Designation

| | 10k | 5km | 2.5km | 1km |
|---|---|---|---|---|
| Population (ln) | -0.30*** | -0.23*** | -0.19*** | -0.13** |
| | (0.06) | (0.05) | (0.04) | (0.05) |
| Households (ln) | -0.30*** | -0.24*** | -0.19*** | -0.11** |
| | (0.04) | (0.04) | (0.04) | (0.05) |
| Area (ln) | 0.46*** | 0.52*** | 0.29*** | 0.07 |
| | (0.11) | (0.13) | (0.10) | (0.06) |
| Ruggedness (ln) | 0.06 | 0.06* | 0.03 | 0.03 |
| | (0.04) | (0.03) | (0.03) | (0.03) |
| 5k City Dist. (ln) | 0.48*** | 0.30** | 0.18** | 0.05 |
| | (0.10) | (0.12) | (0.08) | (0.04) |
| 10k City Dist. (ln) | 0.48*** | 0.29** | 0.18** | 0.06* |
| | (0.11) | (0.11) | (0.07) | (0.03) |
| 50k City Dist. (ln) | 0.30*** | 0.15** | 0.09** | 0.02 |
| | (0.09) | (0.06) | (0.03) | (0.02) |
| 100k City Dist. (ln) | 0.17** | 0.07 | 0.04* | 0.02* |
| | (0.07) | (0.04) | (0.02) | (0.01) |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01

Based on the coefficients presented in Table 1, it appears that the spatial thresholds identifi-

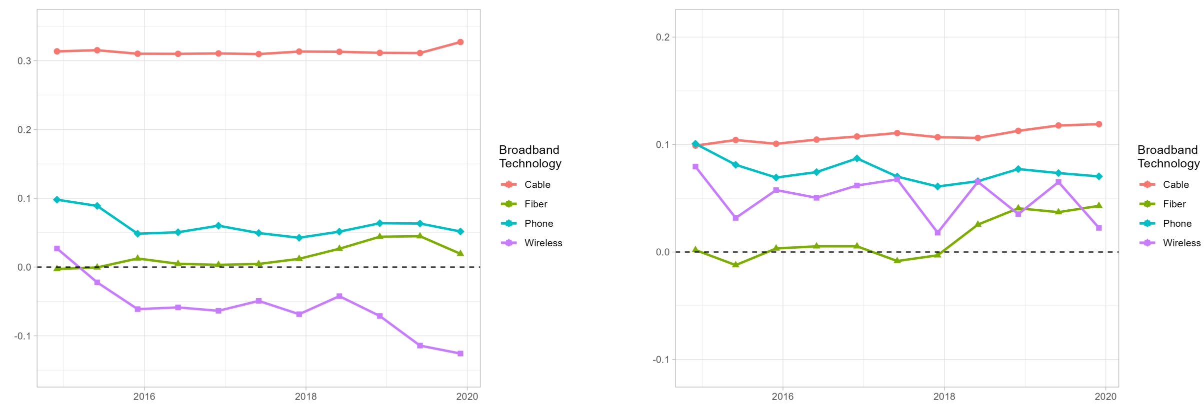
[2]The geographic area being used for the fixed effect is based on which tribal area the census block overlapped with (for tribal census blocks) or the tribal area that the closest tribal census block belongs to (for non-tribal census blocks). For example, the tribal and non-tribal census blocks closest to the Red Lake Reservation would all be included in the Red Lake reservation group.

cation strategy may not be entirely successful at creating similar units at most of the thresholds. Despite the small size of the census blocks, at the 10 kilometer threshold sample, there is a clear imbalance in every covariate except for terrain ruggedness. Based on these results, tribal census blocks are more likely at the 10 kilometer threshold to have fewer residents, fewer households, a larger geographic size, and a greater distance to urban areas, which all theoretically predict lower internet availability. In the smallest threshold sample, 1 kilometer, many of these differences are no longer statistically significant or only significant at the $p < 0.1$ level. This lends some confidence that the 1 kilometer inclusion restriction was somewhat successful in accounting for variation between census blocks in a way the larger thresholds were not. However, they were still likely to have fewer residents and households. Because of this imbalance, I will control for these variables in the final analysis.

Figure 2 show the difference in pooled average internet access by technology between non-tribal and tribal census blocks at the 10 kilometer and 1 kilometer thresholds. At the 10 kilometer threshold, 30 percentage points more non-tribal census blocks had cable internet available than tribal census blocks. Conversely, by 2019, over 10 percentage points more tribal census blocks had cable internet available than non-tribal census blocks. This suggests that the non-tribal blocks may be more likely to be urban (hence the greater supply of the more costly cable technology) and tribal blocks more likely to be rural (and thus are more likely to use the cheaper, but less stable fixed wireless technology). This is another point of evidence that the tribal and non-tribal census blocks are systematically different at the 10 kilometer threshold.

At the 1 kilometer threshold, there are two important shifts. First, the range of the differences in average access are reduced, from approximately $-0.1$ - 0.3 to 0 - 0.1, mostly from a reduction in the differences in cable and fixed wireless availability. If the tribal and non-tribal census blocks are similar, this more modest difference in access makes more sense than the drastic 30 percentage point difference in cable observed at the 10 kilometer threshold.

Second, non-tribal census blocks always had greater internet availability than non-tribal census




(a) 10km Threshold

(b) 1km Threshold

Figure 2: Average internet access by technology types across all tribal census blocks subtracted from average internet access across all non-tribal blocks. Positive values on the y-axis indicate greater average access on non-tribal blocks, negative values indicate greater average access on tribal blocks

blocks, regardless of technology.[3] Additionally, the greatest differences were in cable and DSL availability,and less so for fixed wireless. This observations makes sense with the theory that tribal governance matters for building internet infrastructure because cable, DSL, and fiber technologies require building infrastructure on tribal land, while fixed wireless technology can theoretically provide internet to native communities without needing to access tribal land. Instead of building on tribal land, a fixed wireless internet provider interested in accessing a native market can simply build their broadcast towers just off reservation land where permitting may be quicker and easier, but still close enough to native markets to broadcast signal to them. An internet provider who uses cable, on the other hand, could not do this. They would need to physically lay cable on tribal land.

## Results

To properly estimate the causal effect of tribal ownership on internet availability, I use linear probability models to regress the availability of cable and fixed wireless internet on whether a census block was owned by a tribe. Similar to the balance check, I include time period and geographic area fixed effects to ensure that the estimates are driven comparisons of tribal and non-tribal census

[3]Te exception to this is the early years of fiber, which makes sense given that fiber is the newest technology and would likely not be anywhere but major urban areas in the mid-2010s.

blocks in the same time period and geographic area. Additionally, I cluster standard errors by time period and geographic area.

The first models I estimate are a relatively naive models regressing internet access on block ownership without any other controls beyond the fixed effects. Thus, the model can be written as:

$$internet_{it} = \beta_0 + \beta_1 Tribal_i + \eta_i + \delta_t + \varepsilon_{it}$$

The outcome variable $internet_{it}$ is a binary variable indicating the presence of at least one service provider offering internet access (either cable or fixed wireless, depending on the model) to at least one location in census block $i$ in time period $t$. $Tribal_i$ is a binary variable which indicates whether a census block $i$ belongs to a tribe. $\eta_i$ and $\delta_t$ indicate the geographic area and time period fixed effects, respectively. $\varepsilon_{it}$ represents the error term for each observation.

I report the results of this model at all thresholds and for both cable and fixed wireless internet in Table 2. In Panel A, we see that tribal ownership was negative and statistically significant across all distance thresholds. Substantively, this model predicts a negative effect of approximately a 4.4 to 17.5 percentage point reduction in cable internet availability on tribal land. The smallest distance threshold sample shows the smallest predicted difference, which should be expected given the previous observation that these blocks were more similar than other distance threshold samples. In Panel B, we see that tribal ownership did not predict any effect on the availability on fixed wireless internet availability. This comports with the idea that tribal ownership should only impact the ability to develop infrastructure on tribal land.

Taken together, the results of both the cable and fixed wireless models fit the theory I've proposed. However, as discussed earlier, there are still systematic differences between census blocks, even at the smallest distance threshold sample. Additionally, the effect of tribal land control may be heterogeneous across different tribal territories. In particular, tribal land in California and Oklahoma may function differently than other areas. California has more tribal areas than any other state, but they tend to be extremely small, sometimes only containing one or two census blocks in total. Because of their small size, and their preponderance to locate a casino on that small land base, California tribal land may have higher rates of internet access compared to other tribal areas.

Table 2: Naive Estimate of the Effect of Tribal Control on Internet Access

| | *Panel A* | | | |
|---|---|---|---|---|
| | Cable Internet Availability | | | |
| | 10km | 5km | 2.5km | 1km |
| Tribal | $-0.175^{***}$ | $-0.149^{***}$ | $-0.089^{***}$ | $-0.044^{**}$ |
| | (0.036) | (0.034) | (0.027) | (0.020) |
| Adj. $R^2$ | 0.601 | 0.607 | 0.619 | 0.636 |
| | *Panel B* | | | |
| | Fixed Wireless Internet Availability | | | |
| | 10km | 5km | 2.5km | 1km |
| Tribal | −0.003 | 0.004 | 0.008 | 0.009 |
| | (0.021) | (0.016) | (0.009) | (0.007) |
| Adjusted $R^2$ | 0.568 | 0.584 | 0.626 | 0.649 |
| Observations | 2,900,326 | 1,272,491 | 546,227 | 169,972 |
| Census Blocks | 263,666 | 115,681 | 49,657 | 15,452 |
| Geographic Areas | 353 | 348 | 333 | 289 |

All models include geographic area and time period fixed effects.
$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

On the other hand, land control in Oklahoma, especially eastern Oklahoma, has a much different history that tribal land in other states. Because of allotment and the ascension to Oklahoma to statehood, tribal land in eastern Oklahoma was thought to have disappeared (Cleary 2023). Because of this, Oklahoma tribal areas (referred to officially by the Census Bureau as *Oklahoma Tribal Statistical Areas* (OTSA)) may have had less tribe and federal involvement in the regulation of business and land use in their territory.

To account for the fact that there may be heterogeneous effects in California and Oklahoma, I use a new model with the same specifications used in the models in Table 2, except I now include two interactions terms, one between tribal ownership and belonging to a tribe in California,[4] and another between tribal ownership and belonging to an OTSA. The model can be written as:

$$internet_{it} = \beta_0 + \beta_1 Tribal_i + \beta_2 Tribal_i \times California_i + \beta_3 Tribal_i \times OTSA_i + \eta_i + \delta_t + \varepsilon_{it}$$

In this model, both $California_i$ and $OTSA_i$ are binary variables. It is worth noting that they are only included in the interaction term and not also as individual terms in the model because they do not vary over time and are ubiquitous across all census blocks in a geographic area, therefore their effects outside the interaction term are contained inside the geographic area fixed effect term. For interpretation, this means that the $\beta_1 Tribal_i$ term now represents the effect of tribal ownership when the geographic area is not in California or Oklahoma. $\beta_2 Tribal_i \times California_i$ and $\beta_3 Tribal_i \times OTSA_i$ represent the additional effect of tribal ownership when a census block is in a Californian or OTSA geographic region. In expectation, my theory would predict that $\beta_1$ should be negative, and that $\beta_2$ and $\beta_3$ should be positive.

To account for the systematic differences still remaining between census block types, I also use a model that controls for all the covariates included in the balance test. This model can be written as:

$$internet_{it} = \beta_0 + \beta_1 Tribal_i + \beta_2 Tribal_i \times California_i + \beta_3 Tribal_i \times OTSA_i + X_i + \eta_i + \delta_t + \varepsilon_{it}$$

[4]I label any tribal area with greater than 30% of it's census blocks in California as a California tribe.

The $X_i$ represents the vector of covariates for census block $i$, including population, households, geographic size, average terrain ruggedness, and distance to cities with populations of at least 5,000, 10,000, 50,000, and 100,000. I measure these variables cross-sectionally, and thus they do not vary over time.[5]

In Table 3, I report the results of these two models only at the 1 kilometer threshold because the blocks in this sample are the most believably similar and should be the best and hardest test to find a significant effect. In Panel A, we see that the results largely match what my theory would predict. Tribal land outside of California or OTSAs had a negative, statistically significant effect on cable internet availability. Depending on whether other controls are included, tribal land under these conditions saw a reduction in cable internet availability of about 6.1 to 8.3 percentage points compared to non-tribal land. These effect sizes are actually larger that the effect size estimated in the 1 kilometer sample in Panel A in Table 2. In comparison, Panel B shows that once again there was no estimated effect of tribal land on wireless internet availability.

Turning to the interactions effects, we see that both predicted a large, positive effect on cable internet availability, but only the California interaction was statistically significant. Taken additively, the models predict that tribal land in California should be equally as likely to have cable internet availability as their surrounding non-tribal land, or about 1 percentage point higher likelihood of availability, depending on whether covariates are included.

Taken together, these results largely fit with the findings in Bauer, Feir and Gregg (2022). Comparing these results is not necessarily one-to-one because Bauer, Feir and Gregg (2022) examines internet access irrespective of internet technology, but they estimate a negative effect of tribal control of about 8.1 to 15.0 percentage points. My models estimate a negative effect of approximately 4.4 to 17.5 percentage points. Taken together, it appears that there is a significant effect of tribal

[5]A small number of blocks are dropped in the covariates-included models because of slight missingness in the terrain ruggedness data. Very small blocks on the coast were outside the 1 kilometer by 1 kilometer resolution dataset I used for terrain ruggedness. In total, only three blocks are dropped.

Table 3: Effect of Tribal Land on Cable and Fixed Wireless Internet Access at 1km Threshold

| | *Panel A* | |
|---|---|---|
| | Cable Internet Availability | |
| | (1) | (2) |
| Tribal | $-0.083^{***}$ | $-0.061^{***}$ |
| | (0.019) | (0.016) |
| Tribal × California | $0.083^{***}$ | $0.071^{***}$ |
| | (0.019) | (0.017) |
| Tribal × OTSA | 0.195 | 0.196 |
| | (0.140) | (0.136) |
| Includes Controls | No | Yes |
| Adjusted $R^2$ | 0.639 | 0.689 |
| | *Panel B* | |
| | Fixed Wireless Internet Availability | |
| | (1) | (2) |
| Tribal | 0.005 | 0.006 |
| | (0.008) | (0.008) |
| Tribal × California | $-0.005$ | $-0.0003$ |
| | (0.008) | (0.009) |
| Tribal × OTSA | 0.052 | 0.049 |
| | (0.039) | (0.039) |
| Includes Controls | No | Yes |
| Adjusted $R^2$ | 0.649 | 0.652 |
| Observations | 169,972 | 169,939 |
| Census Blocks | 15,452 | 15,449 |
| Geographic Areas | 289 | 289 |

All models include geographic area and time period fixed effects.
$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

ownership on cable internet availability. With these estimates as a baseline, I now move on to the second part of the analysis concerning how tribal governance capacity might reduce these negative effects.

# Tribal Governance Capacity

## Capacity Factors

Quantifying tribal governance capacity is not a straightforward task. In the state capacity literature, measures of bureaucratic capacity often focus on GDP, tax revenue, ratings of the rule of law, and the quality of institutions (Hendrix 2010). To my knowledge, there are currently no measures of tribal GDP or tax revenue. This requires the use of somewhat more subjective measures of tribal governance capacity. Because there is no obvious best way to measure tribal governance capacity, I look at four different possible determinants/proxies for governance capacity.

The first measure I consider is whether a tribe operates a casino. Numerous works have found positive economic effects from tribes operating a casino, both qualitatively (Cattelino 2008) and quantitatively (Cornell, Kalt, Krepps and Taylor 1998, Gonzales, Lyson and Mauer 2007). Assuming casinos increase tribal revenue, participation in the gaming industry may lead to higher investment into bureaucratic power compared to tribal governments who do not participate. Tribes involved in gaming might also be more engaged in federal and state politics (Corntassel and Witmer 2008). This engagement might make the tribal government better connected to outside actors, enabling the facilitation of outside investment. Operating a casino could also be seen as a proxy for the ability to competently lobby and negotiate with outside actors, as operating class III gaming facilities requires approval from the state government. I operationalize participation in the gaming industry as a binary variable where 1 indicates a tribal government owning a casino.

The second measure I consider is funding from the Bureau of Indian Affairs. Evans (2011) makes the argument that federal funding, largely acquired from the BIA, is an important component to tribes building bureaucratic expertise. Specifically, she highlights that support from the BIA improves technical information needed to solve policy problems, gives the tribe greater knowledge of the interests and incentives of other actors, and exposure them to potentially better organizational structures. Of course, this can also been seen as something of a proxy. Tribes with better bureaucratic power might be able to better apply and win grants from the BIA. In another paper, a coauthor and I have collected the total federal funds each tribe has received each year from 2013 to 2021 (Brouwer and Provins 2024), Combining this data with estimates of total tribal enrollment size collected by the Department of Housing and Urban Development,[6] I estimate the total BIA funding per capita each year from 2014 to 2019. In order to account for skew in the data, I log this measure.

The third measure I consider is whether a tribe has entered into a compacting relationship with the BIA. In 1975, the Indian Self-Determination and Education Assistance Act (ISDEAA) was signed into law and allowed tribes to request a contract to plan, conduct, and administer specific programs otherwise controlled by the Department of the Interior or Health and Human Services. These contracts allowed tribes to act more like local governments by managing the delivery of various services (Stuart 1990). These agreements are commonly referred to as contracts, self-determination contracts, or 638-contracts.

In 1994, the federal government amending the ISDEAA to create the much more flexible compacting system. The requirements for a tribe to enter a compact are higher than a contract, as tribes have to have maintained a contract agreement for at least three years without fiscal issues. Under a compact agreement, unlike a contract agreement, tribal governments can determine the priorities of the programs covered by the compact and reallocate funding appropriately, and the federal government cannot easily re-assume the responsibilities of the compact without specific reasons (Delaney 2016). Agreements made under the 1994 amendment are commonly referred to as compacts or self-governance compacts. Appropriately 50% of tribes have entered into a compacting agreement with the BIA, according to the Office of Self Governance.[7]

[6]Enrollment data available at https://www.hud.gov/program_offices/public_indian_housing/ih/codetalk/onap/ihbgformula

[7]https://www.bia.gov/as-ia/osg

In theory, both self-determination contracts and self-governance compacts should increase the governance capacity of a tribe. For example, concerning forestry management, Krepps and Caves (1994) observes that tribes that entered a self-determination contract on forestry management had better timber yields and higher sale values. Similarly, in a case study of the Hoopa Valley tribe's self-governance compact on forestry, Harris, Blomstrom and Nakamura (1995) observe that timber production was no worse under tribal management than it was under the BIA, and that the tribe had much greater flexibility in how it ran its programs.

I focus in this analysis on self-governance compacting. Self-governance may impact tribal governance capacity by enabling a tribe to organize their bureaucracy in a more efficient fashion, or to align spending on the reservation with the goals of the tribe. There could also be a proxy element to self-governance. Tribes that enter into a compact have to prove some bureaucratic competence, so being in a self-governance compact could simply indicate that a tribe meets some minimum threshold of bureaucratic competence. The Office of Self Governance publishes a list of all tribes that have ever entered into a compact, albeit with no information on the programs included in the compact, and the initial year they entered the compact. Based off this list, I create a binary variable that takes the value 1 in any year a tribal government had a compact with the federal government.

Finally, the last measure of tribal governance capacity that I include in this analysis is the Reservation Economic Freedom Index (REFI) created by Stratmann (2023). This index attempts to capture the various political factors that may influence investment on tribal land, including codes and parameters of business regulation and taxation, legislative-executive organization, and judicial professionalization and power. These factors may influence investment either by enabling the tribal government to act more efficiently, or by removing possible concerns from private investors that they will be mistreated or expropriated. REFI values range from 0 to 13, with 13 representing the highest level of economic freedom. Unfortunately, only 90 tribes are included by Stratmann (2023), and it excludes all tribes in Oklahoma, so the sample in models using this index are much smaller.

Before moving on to the results, it is important to note that these four measures are taken at the tribal government level. For the purposes of this analysis where census blocks are the unit of analysis, these capacity factors can be thought of as geographic area factors, as they will be uniform across all census blocks in a geographic area at a given time period.

It is also important to emphasize that the coefficients being estimated in this exercise are not causal. This means, for example, that any statistically significant estimates I observe could be due to the inverse of the relationship I'm proposing and that actually tribes with greater internet access lead to higher governance capacity. I also cannot dismiss other factors that may determine both internet access and governance capacity. Tribal governance capacity is surely endogenous to a number of other tribal factors, and the design in this paper is not equipped to eliminate the effects of these alternative factors. The findings in this section should be taken as an exploration into possible relationships between internet availability and tribal governance capacity, not as the direct effect of tribal governance capacity on internet availability.

## Results

To examine the correlations between tribal governance capacity and internet access, I use the same model construction as the model used in Table 3, including all covariates. Using the 1 kilometer threshold sample, I estimate the effect of each governance capacity factor separately. The model used can be written as either:

$$internet_{it} = \beta_0 + \beta_1 Tribal_i + \beta_2 Tribal_i \times California_i + \beta_3 Tribal_i \times OTSA_i + \beta_4 TGC_i + \beta_5 Tribal_i \times TGC_i + X_i + \eta_i + \delta_t + \varepsilon_{it}$$

$$internet_{it} = \beta_0 + \beta_1 Tribal_i + \beta_2 Tribal_i \times California_i + \beta_3 Tribal_i \times OTSA_i + \beta_4 Tribal_i \times TGC_i + X_i + \eta_i + \delta_t + \varepsilon_{it}$$

Where $TGC_i$ represents the value of a tribal governance capacity measure and $Tribal_i \times TGC_i$ represents the interaction between tribal ownership and a given value of tribal governance capacity. Whether the individual $TGC_i$ term is included depends on the specific governance capacity measure. The values of self-governance compacting and log BIA funding per capita are not necessarily constant across time in a given geographic area. Each year BIA funding may fall or rise, and some tribes enter into compacts during the time period being studied. Because of this variation, the individual coefficient of both measures are also included separate from the interaction term. The measures of casino ownership and REFI did not change in a geographic region over time, and therefore the individual coefficients estimates are not included in the model. For the dependent variable, I look at just predicted cable internet access, as that is the measure of internet access I expect tribal governance capacity to influence.

Table 4 presents the results for each governance capacity factor. Overall, the results are mixed. The model that best matches what my theory would predict is the self-governance model. In this model, the tribal variable indicates that census blocks belonging to a tribe which never entered a compact, and which do not reside in California or an OTSA had a reduced likelihood of having cable internet access of approximately 8.9 percentage points compared to non-tribal census blocks under the same conditions. Conversely, we see in the interaction term that blocks belonging to a tribe that had entered a compact saw a predicted increase in cable internet availability of about 10.3 percentage points. This means that census blocks outside of California and Oklahoma that entered a federal compact had an associated increase in the likelihood of having cable internet available by 5.9 percentage points compared to non-tribal census blocks in geographic areas of tribes with self-governance compacts.

The results of the other three models do not fit the prediction of my theory. To fit my theory, the coefficient of the tribal ownership alone variable should be negative, representing the availability of cable internet when governance capacity is low. The interaction term with the tribal governance capacity measure should then be positive, indicating the increased likelihood at cable internet availability as capacity increases. In the other three models, the tribal control variable is negative, but it is not statistically significant. The interaction term coefficient, however, is both negative and statistically insignificant, in total contrast to my theory. I'm not certain why this would be the case. Perhaps these measures are particularly noisy determinants of tribal governance capacity, or maybe not good measures of capacity in relation to the bureaucratic power necessary for internet

Table 4: Association Between Tribal Governance Capacity Factors and Cable Internet Availability

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | Cable Internet Availability | | | |
| | Casino | BIA | Self-Gov | REFI |
| Tribal | −0.031 | −0.001 | −0.089*** | −0.006 |
| | (0.019) | (0.152) | (0.019) | (0.139) |
| Tribal × California | 0.068*** | 0.069*** | 0.084*** | 0.085*** |
| | (0.017) | (0.018) | (0.019) | (0.023) |
| Tribal × OTSA | 0.199 | 0.183 | 0.158 | |
| | (0.136) | (0.122) | (0.122) | |
| Tribal × Casino | −0.034 | | | |
| | (0.021) | | | |
| BIA Funding per capita (ln) | | −0.009 | | |
| | | (0.014) | | |
| Tribal × BIA Funding per capita (ln) | | −0.008 | | |
| | | (0.021) | | |
| Self-Governance | | | −0.039*** | |
| | | | (0.010) | |
| Tribal × Self-Governance | | | 0.103*** | |
| | | | (0.032) | |
| Tribal × REFI | | | | −0.009 |
| | | | | (0.018) |
| Observations | 169,939 | 167,570 | 169,939 | 81,972 |
| Census Blocks | 15,449 | 15,389 | 15,449 | 7,452 |
| Geographic Areas | 289 | 286 | 289 | 83 |
| Adjusted $R^2$ | 0.689 | 0.695 | 0.690 | 0.718 |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01

availability.

# Discussion

The management of land and economic development in Indian Country is complicated in ways that other land is not. The analysis of this paper supports the finding in (Bauer, Feir and Gregg 2022) that tribal ownership of land has a negative effect on internet availability. At the beginning of this paper, I characterized this effect of tribal ownership as a bundle of policies and structural issues that may reduce the ability of native communities to properly plan, partner, permit, and implement broadband infrastructure. In future work, it will be important to parse these different issues and understand more clearly where in the process of broadband deployment are there breakdowns, and what institutional features create them. Without better information and data on the operation of tribal governments, analysis like this is somewhat akin to a magic trick. As scholars, we have some idea of what is possible and theories about why we see what we see, but we can't actually look at how the magic trick works very well. In this way, better data are like a peek behind the curtain that let us see how the magic trick works.

I also attempt in this paper to explore the possible value of tribal governance capacity in the relationship of tribal land and internet access. While not causally identified and largely mixed in results, my findings suggest that tribes which have entered self-governance compact agreements may be fundamentally different than other tribal nations in regards to bureaucratic power. This thread may be valuable to pull on going forward as political science studies tribal bureaucracy in greater detail.

Based on the mixed results I found in tribal governance, future work should also consider more seriously how to measure tribal capacity. Most scholars of American Indian politics agree that tribal governments have an important role to play in governance. Going forward, it will be valuable to quantify exactly what institutions and properties make tribal governments operate better. This is a difficult task, as state capacity has strong endogeneity problems making the estimation of causal effects difficult (Hendrix 2010). Therefore, not only will data collection and measurement be important, but also coming up with clever research designs to isolate the effects of tribal governance capacity.

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# Appendix

Table A1: Effect of Tribal Ownership on Internet Availability at All Thresholds (No Covariates)

| | *Panel A* | | | |
|---|---|---|---|---|
| | Cable Internet Availability | | | |
| | 10km | 5km | 2.5km | 1km |
| Tribal | −0.177*** | −0.169*** | −0.125*** | −0.083*** |
| | (0.039) | (0.041) | (0.032) | (0.019) |
| Tribal × California | 0.165*** | 0.167*** | 0.124*** | 0.083*** |
| | (0.039) | (0.040) | (0.032) | (0.019) |
| Tribal × OTSA | −0.029 | 0.012 | 0.097 | 0.195 |
| | (0.087) | (0.092) | (0.089) | (0.140) |
| Adjusted $R^2$ | 0.602 | 0.608 | 0.621 | 0.639 |
| | *Panel B* | | | |
| | Fixed Wireless Internet Availability | | | |
| Tribal | −0.012 | 0.003 | 0.004 | 0.005 |
| | (0.021) | (0.014) | (0.011) | (0.008) |
| Tribal × California | 0.011 | −0.003 | −0.004 | −0.005 |
| | (0.020) | (0.014) | (0.011) | (0.008) |
| Tribal × OTSA | 0.027 | 0.004 | 0.026 | 0.052 |
| | (0.052) | (0.057) | (0.031) | (0.039) |
| Adjusted $R^2$ | 0.568 | 0.584 | 0.626 | 0.649 |
| Observations | 2,900,326 | 1,272,491 | 546,227 | 169,972 |
| Census Blocks | 263,666 | 115,681 | 49,657 | 15,452 |
| Geographic Areas | 353 | 348 | 333 | 289 |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01

Table A2: Effect of Tribal Ownership on Cable Availability at All Thresholds (Including Covariates)

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | Cable Internet Availability | | | |
| | 10km | 5km | 2.5km | 1km |
| Tribal | −0.103*** | −0.106*** | −0.080*** | −0.062*** |
| | (0.024) | (0.025) | (0.024) | (0.016) |
| Tribal × California | 0.128*** | 0.132*** | 0.102*** | 0.072*** |
| | (0.026) | (0.029) | (0.026) | (0.017) |
| Tribal × OTSA | 0.011 | 0.027 | 0.099 | 0.196 |
| | (0.070) | (0.078) | (0.094) | (0.136) |
| Population (ln) | 0.041*** | 0.036*** | 0.037*** | 0.034*** |
| | (0.004) | (0.005) | (0.006) | (0.008) |
| Households (ln) | 0.041*** | 0.047*** | 0.044*** | 0.045*** |
| | (0.006) | (0.008) | (0.009) | (0.013) |
| Area (ln) | −0.048*** | −0.045*** | −0.039*** | −0.032*** |
| | (0.004) | (0.004) | (0.004) | (0.005) |
| Ruggedness (ln) | 0.003 | −0.0003 | −0.005 | −0.002 |
| | (0.005) | (0.007) | (0.009) | (0.015) |
| 5k City Dist. (ln) | −0.075*** | −0.049*** | −0.054** | −0.069** |
| | (0.011) | (0.014) | (0.019) | (0.025) |
| 10k City Dist. (ln) | −0.011 | −0.032* | −0.019 | 0.005 |
| | (0.012) | (0.017) | (0.022) | (0.028) |
| 50k City Dist. (ln) | 0.040 | 0.076** | 0.043** | −0.0004 |
| | (0.022) | (0.033) | (0.017) | (0.023) |
| 100k City Dist. (ln) | −0.040 | −0.081* | −0.082* | −0.101* |
| | (0.025) | (0.036) | (0.037) | (0.052) |
| Observations | 2,898,797 | 1,271,809 | 545,996 | 169,939 |
| Adjusted $R^2$ | 0.692 | 0.683 | 0.685 | 0.689 |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01

Table A3: Effect of Tribal Ownership on Wireless Availability at All Thresholds (Including Covariates)

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | Fixed Wireless Internet Availability | | | |
| | 10km | 5km | 2.5km | 1km |
| Tribal | −0.012 | 0.003 | 0.004 | 0.006 |
| | (0.020) | (0.014) | (0.012) | (0.008) |
| Tribal × California | 0.018 | −0.005 | −0.004 | −0.0003 |
| | (0.020) | (0.014) | (0.012) | (0.009) |
| Tribal × OTSA | 0.027 | −0.017 | 0.015 | 0.049 |
| | (0.052) | (0.061) | (0.025) | (0.039) |
| Population (ln) | 0.007 | 0.004 | 0.007 | 0.010 |
| | (0.004) | (0.005) | (0.004) | (0.005) |
| Households (ln) | −0.005 | −0.001 | $-0.009^{**}$ | $-0.013^{*}$ |
| | (0.005) | (0.006) | (0.004) | (0.007) |
| Area (ln) | $0.005^{*}$ | 0.004 | $0.009^{***}$ | $0.005^{*}$ |
| | (0.002) | (0.003) | (0.002) | (0.003) |
| Ruggedness (ln) | −0.002 | −0.002 | −0.007 | −0.009 |
| | (0.006) | (0.007) | (0.006) | (0.008) |
| 5k City Dist. (ln) | $0.033^{**}$ | $0.040^{**}$ | $0.029^{*}$ | 0.015 |
| | (0.012) | (0.015) | (0.013) | (0.018) |
| 10k City Dist. (ln) | $-0.058^{***}$ | $-0.056^{**}$ | $-0.042^{**}$ | −0.045 |
| | (0.017) | (0.018) | (0.016) | (0.025) |
| 50k City Dist. (ln) | 0.053 | 0.075 | 0.045 | 0.022 |
| | (0.032) | (0.043) | (0.032) | (0.027) |
| 100k City Dist. (ln) | −0.037 | −0.056 | −0.059 | −0.031 |
| | (0.037) | (0.050) | (0.050) | (0.051) |
| Observations | 2,898,797 | 1,271,809 | 545,996 | 169,939 |
| Adjusted $R^2$ | 0.574 | 0.591 | 0.630 | 0.652 |

All models include geographic area and time period fixed effects.

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A4: Governance Capacity Models at 1km (All Variables Listed)

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | Cable Internet Available | | | |
| | Casino | BIA | Self-Gov | REFI |
| Tribal | −0.031 | −0.001 | −0.089*** | −0.006 |
| | (0.019) | (0.152) | (0.019) | (0.139) |
| Tribal × California | 0.068*** | 0.069*** | 0.084*** | 0.085*** |
| | (0.017) | (0.018) | (0.019) | (0.023) |
| Tribal × OTSA | 0.199 | 0.183 | 0.158 | |
| | (0.136) | (0.122) | (0.122) | |
| Tribal × Casino | −0.034 | | | |
| | (0.021) | | | |
| BIA Funding per capita (ln) | | −0.009 | | |
| | | (0.014) | | |
| Tribal × BIA Funding per capita (ln) | | −0.008 | | |
| | | (0.021) | | |
| Self-Governance | | | −0.039*** | |
| | | | (0.010) | |
| Tribal × Self-Governance | | | 0.103*** | |
| | | | (0.032) | |
| Tribal × REFI | | | | −0.009 |
| | | | | (0.018) |
| Population (ln) | 0.034*** | 0.034*** | 0.034*** | 0.042*** |
| | (0.008) | (0.008) | (0.008) | (0.011) |
| Households (ln) | 0.045*** | 0.046*** | 0.046*** | 0.039** |
| | (0.013) | (0.013) | (0.013) | (0.017) |
| Area (ln) | −0.032*** | −0.032*** | −0.032*** | −0.043*** |
| | (0.005) | (0.005) | (0.005) | (0.008) |
| Ruggedness (ln) | −0.003 | −0.002 | −0.002 | −0.001 |
| | (0.015) | (0.015) | (0.015) | (0.023) |

| | | | | |
|---|---|---|---|---|
| 5k City Dist. (ln) | −0.062** | −0.060** | −0.060** | −0.061 |
| | (0.022) | (0.022) | (0.021) | (0.038) |
| 10k City Dist. (ln) | 0.003 | 0.002 | 0.002 | 0.024 |
| | (0.026) | (0.026) | (0.026) | (0.040) |
| 50k City Dist. (ln) | 0.001 | 0.001 | 0.001 | 0.016 |
| | (0.022) | (0.022) | (0.022) | (0.012) |
| 100k City Dist. (ln) | −0.100* | −0.100* | −0.101* | −0.059 |
| | (0.051) | (0.051) | (0.050) | (0.076) |
| Observations | 169,939 | 167,570 | 169,939 | 81,972 |
| Census Blocks | 15,449 | 15,389 | 15,449 | 7,452 |
| Geographic Areas | 289 | 286 | 289 | 83 |
| Adjusted $R^2$ | 0.689 | 0.695 | 0.690 | 0.718 |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01

Table A5: Governance Capacity Models at 10km (All Variables Listed)

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | Cable Internet Available | | | |
| | Casino | BIA | Self-Gov | REFI |
| Tribal | −0.099** | −0.171 | −0.140*** | −0.139 |
| | (0.032) | (0.235) | (0.027) | (0.195) |
| Tribal × California | 0.131*** | 0.127*** | 0.146*** | 0.136** |
| | (0.029) | (0.032) | (0.030) | (0.043) |
| Tribal × OTSA | 0.011 | 0.025 | −0.051 | |
| | (0.072) | (0.070) | (0.057) | |
| Tribal × Casino | −0.006 | | | |
| | (0.039) | | | |
| BIA Funding per capita (ln) | | −0.004 | | |
| | | (0.005) | | |

| | | | | |
|---|---|---|---|---|
| Tribal × BIA Funding per capita (ln) | | 0.010 (0.033) | | |
| Self-Governance | | | −0.015*** (0.003) | |
| Tribal × Self-Governance | | | 0.141** (0.047) | |
| Tribal × REFI | | | | 0.004 (0.026) |
| Population (ln) | 0.042*** (0.004) | 0.042*** (0.005) | 0.042*** (0.004) | 0.044*** (0.006) |
| Households (ln) | 0.042*** (0.006) | 0.043*** (0.006) | 0.042*** (0.006) | 0.042*** (0.011) |
| Area (ln) | −0.049*** (0.004) | −0.049*** (0.004) | −0.049*** (0.004) | −0.051*** (0.005) |
| Ruggedness (ln) | 0.002 (0.005) | 0.003 (0.005) | 0.003 (0.005) | 0.004 (0.008) |
| 5k City Dist. (ln) | −0.068*** (0.010) | −0.068*** (0.010) | −0.067*** (0.010) | −0.083*** (0.017) |
| 10k City Dist. (ln) | −0.011 (0.012) | −0.011 (0.012) | −0.011 (0.012) | 0.011 (0.019) |
| 50k City Dist. (ln) | 0.038 (0.021) | 0.037 (0.021) | 0.036 (0.021) | 0.014 (0.016) |
| 100k City Dist. (ln) | −0.039 (0.024) | −0.039 (0.025) | −0.037 (0.024) | 0.013 (0.020) |
| Observations | 2,898,797 | 2,839,864 | 2,898,797 | 1,228,975 |
| Adjusted $R^2$ | 0.691 | 0.688 | 0.692 | 0.698 |

All models include geographic area and time period fixed effects.
*p<0.1; **p<0.05; ***p<0.01