Evaluating the Effects of and Interdependencies among Federal Broadband Funding Programs

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ABSTRACT

Multiple federal programs have sought to expand residential broadband service to unserved and underserved communities. These programs, however, have had varying levels of success. For instance, a 2024 study examining the Connect America Fund (CAF) uncovered a significant gap between the service that Internet Service Providers (ISPs) promised regulators they offered and the service that ISPs actually advertised to users: Only 33% of residential addresses covered by CAF funding are actually able to subscribe to broadband service that meets the Federal Communications Commission's service and cost requirements, and only 55% of addresses have access to any service. Motivated by these findings, we investigate possible causes of these low serviceability rates, in part by determining whether newer programs, such as the Rural Digital Opportunity Fund (RDOF), affected ISPs' compliance with CAF program rules. To do so, we integrate public address-level data from the Universal Service Administrative Company with a novel dataset of ISP serviceability and pricing, collected using the Broadband-plan Querying Tool. We also use data identifying unserved and underserved locations under the Broadband Equity, Access, and Deployment (BEAD) program to identify overlaps between CAF, RDOF, and BEAD, with the aim of identifying locations and ISPs that have received repeated funding under multiple programs. In summary, we find that low CAF serviceability cannot be attributed to competition from RDOF. Our work helps illuminate a fragmented landscape of broadband funding programs, one in which billions of federal dollars are redundantly allocated to ISPs to serve previously funded locations, even as many rural locations lack adequate broadband service.

1 INTRODUCTION

Reliable high-speed broadband Internet access helps connect communities to essential services such as education, healthcare, and public safety [26]. For communities striving to stay connected and competitive in a digitally dominated world, residential broadband service is not just a convenience but a necessity. Without broadband, individuals are unable to fully participate in the social, economic, and educational opportunities that the Internet offers [25]. A 2024 Federal Communications Commission (FCC) report found that 24 million Americans still lack access to fixed wireline broadband connectivity at home; 28% of these Americans reside in rural areas and over 23% on tribal lands [17].

United States (U.S.) policymakers have sought to address this Internet access inequity through multibillion-dollar policy interventions. For instance, the $10 billion Connect America Fund (CAF) subsidized new broadband infrastructure in hard-to-serve regions of the U.S. Internet Service Providers (ISPs) that accepted funds under the program were required to offer service with minimum downstream speeds of 10 Megabits per second (Mbps) and upstream speeds of 1 Mbps. The Rural Digital Opportunity Fund (RDOF) program offered $20.4 billion in subsidies to ISPs that won a reverse auction to deploy broadband to rural locations that lacked service providing speeds of at least 25 Mbps downstream and 3 Mbps upstream [7]. Most recently, Congress enacted the Broadband, Equity, Access, and Deployment (BEAD) program, setting aside $42.5 billion to fund another round of broadband infrastructure deployment. Under BEAD, providers are required to offer service with speeds of at least 100 Mbps downstream and 20 Mbps upstream.

In order to effectively implement these programs and allocate resources, policymakers must understand the state of Internet accessibility and quality. This understanding helps identify the areas that are in the most need of funding and the types of interventions that are likely to be most effective. Without these insights, policymakers' efforts may be misdirected, reinforcing existing disparities rather than mitigating them. Policymakers thus require reliable, precise, and fine-grained data—ideally at a street-address-level granularity—characterizing Internet access quality.

However, existing datasets are sparse, noisy, or based on self-reported ISP information, which has been found to be unreliable [23]. Historically, the primary source of broadband availability data has been the FCC's Form 477 [11]. This dataset overstates broadband availability because it (1) considers an entire census block as served if one household in the census block is covered and (2) considers a census block to have broadband available if the service could be provided within a 10-day period [5]. In response to longstanding concerns about broadband data reliability, Congress—under the BEAD program—directed the FCC to develop a granular and accurate map of fixed broadband availability across the U.S. This directive led to the National Broadband Map [16], intended to provide address-level information about fixed broadband availability nationwide. Like Form 477, the National Broadband Map relies on ISPs' self-reported information—specifically self-reported coverage and speed data—collected through the Broadband Data Collection (BDC) program. As a result, the National Broadband Map has also given rise to concerns about data accuracy and quality: ISPs have been found to submit incorrect and overstated coverage and speed data to the FCC [1, 21, 27]. Given the critical role that the map has and will continue to play in determining eligibility for state and federal broadband funding, particularly through the BEAD program, accurate and high-quality broadband data is essential. High-quality data is important both for guiding future investments as well as for evaluating the effectiveness of past initiatives.

The Universal Service Administrative Company (USAC) is the non-profit organization designated by the FCC for overseeing the its broadband funding programs, including CAF. As part of this responsibility, USAC is tasked with managing CAF funds and monitoring compliance with CAF program rules, such as deployment milestones and minimum service requirements. To do so, USAC requires that ISPs certify their deployment progress annually and conduct performance testing to ensure that their broadband service meets speed and latency requirements. However, USAC's verification process lacks transparency around service availability, and its tests are limited only to active subscribers. Our 2024 study [22] employed a more detailed investigative methodology to examine CAF and found that it fell far short of its goals. Specifically, the study found that among the four ISPs that received the most CAF funds, only 33% of the addresses certified as served under the program could subscribe to service meeting the FCC's broadband speed requirements. Moreover, only 55% of these addresses could subscribe to any service at all. These results suggest that USAC's audit process is inadequate, reinforcing the need for more transparent verification mechanisms.

In this paper, motivated by this prior work, we investigate why CAF serviceability rates are low. One hypothesis regards the interplay with other federal programs, such as RDOF. For example, in a 2024 Broadband Breakfast article reporting on this prior work [4], some experts suggested that CAF ISPs may abandon their CAF obligations when they do not expect to be competitive against incoming service subsidized by a different program, such as RDOF. Our study investigates this hypothesis, thereby examining not only how funding initiatives affect broadband availability but also how these programs affect each other.

Specifically, our study uses public datasets that contain street address-level data on RDOF and CAF-funded locations. We use the Broadband Plan Querying Tool (BQT) [28], a tool developed by our team that mimics human users and automates querying ISPs' web interfaces, to collect information about an ISP's advertised broadband plans at any given street address. We collect data on the availability of the service, the price of the service (if available), and the download speeds that the ISPs promise to consumers at that address. Using BQT, we curate a street address-level dataset on ISP serviceability and pricing directly from the ISPs themselves.

This novel dataset, coupled with results from our previous study, allows us to evaluate the efficacy of repeated large-scale federal investments in broadband access. We compare serviceability in census block groups with and without RDOF ISP competition. To assess redundancy across programs, we employ natural language processing tools to identify overlapping addresses. Finally, by matching these results with the FCC's National Broadband Map, we analyze the extent to which ISPs receive funding through multiple programs. Our research develops insights to shape future broadband policies and initiatives and can thereby improve broadband access nationwide. It is novel in its nationwide approach to evaluating ISP serviceability, to analyzing geographic distribution and state-level variations, and to assessing differences caused by varying technology types for broadband service.

We focus on three key questions: (1) Is low ISP serviceability under CAF attributable to anticipated competition from ISPs in RDOF? (2) How many locations have been funded by more than one of CAF, RDOF, and BEAD? and (3) Where locations receive funding through multiple programs, does the same ISP benefit from multiple funding rounds?

On the first question, we conclude that the low CAF serviceability rates are not primarily attributable to competition from RDOF. This is because the overlap between the programs is minimal: only 5.51% of CAF addresses were also subject to funding under RDOF. There is also a drop of only 4 percentage points in serviceability when RDOF competition is present. On the second question, we find an overlap between CAF and RDOF of approximately 200,000 addresses, and an overlaps of about 50,000 addresses between CAF and BEAD's FCC unserved and underserved address lists. On the third question, we find that, of the addresses that overlap between CAF and RDOF, 40 ISPs benefit from both CAF and RDOF funding (i.e., appear as both the RDOF and incumbent CAF ISP) out of 445 total unique CAF-RDOF ISP pairs.

2 BACKGROUND & MOTIVATION

2.1 History of U.S. Policy Interventions

The idea of "universal service"—the notion that all Americans should have access to basic communication technology—has long been a cornerstone of federal communications policy. This concept dates back to 1907, when the president of AT&T, Theodore Vail, outlined the company's vision of "One Policy, One System, Universal Service" [24]. AT&T aimed to be the sole provider offering service to all Americans on relatively equal terms. This approach entailed subsidizing prices in high-cost regions, such as sparsely populated rural areas, through above-cost pricing in comparatively low-cost areas, such as dense urban centers. Universal access to communication technology was therefore facilitated by this system of implicit cross-subsidies within a monopoly provider's customer base, where some consumers paid above-cost rates, allowing others to pay below-cost rates [24]. Eventually, however, new competitors targeted those consumers who were paying above-cost rates, thereby undermining this system of implicit cross-subsidies and this overall approach to ensuring universal service.

To address this concern, the Telecommunications Act of 1996 included a special telecommunications tax to support the creation of the Universal Service Fund (USF) [19].

2.2 The CAF Program

Established by the FCC in 1997, the USF is divided into subfunds used to subsidize communications priorities. The USF includes programs such as the Lifeline program [13], the E-rate program [12], the High Cost program [8], and the Rural Health Care program [14], which improve the availability, affordability, and adoption of broadband in different sectors. In 2011, the High Cost program was re-termed as the CAF program [15].

CAF offered subsidies to a single ISP willing to build broadband-capable networks in a given high-cost area. The FCC allocated more than $10 billion over the course of seven years under CAF [18]. CAF was rolled out in multiple phases. Notably, the "CAF Phase II Model"[1] gave select ISPs a set subsidy based on a forward-looking cost model, in exchange for commitments to serve FCC-designated areas. CAF Phase II Model support ran from 2015 to 2020, with deployments required to be completed by the end of 2021, following a one-year extension [18]. Because CAF subsidizes the creation of monopolies in underserved regions, the FCC requires that subsidy recipients offer service and prices that are "reasonably comparable" to those in competitive urban areas [9, 19]. These conditions aim to limit the market power of subsidized providers.

2.3 The RDOF Program

RDOF [10] is, like CAF, another program under the USF's High Cost program. The FCC allocated $20.4 billion over 10 years to RDOF in order to improve fixed broadband and voice service access to unserved homes and small businesses in the U.S. RDOF employs a two-phase reverse auction. The RDOF Phase I auction (referred to as Auction 904) ended in November 2020 and allocated $16 billion for providing broadband in eligible census blocks around the country that lacked broadband service of at least 25 Mbps download and 3 Mbps upload. Bids for Auction 904 were accepted for four performance tiers: Minimum (25/3 Mbps), Baseline (50/5 Mbps), Above Baseline (100/20 Mbps), and Gigabit (1 Gbps/500 Mbps), and winning bidders must offer service at the service tier associated with their bid at every location in the census block. The RDOF Phase II Action will allocate $4.4 billion to bring broadband and voice to locations in census blocks determined as partially served by the FCC's Form 477 data with 25/3 Mbps, as well as areas from Phase I that did not receive funding [6, 20].

2.4 The BEAD Program

The Infrastructure Investment and Jobs Act (IIJA) authorized the BEAD program in 2021 [29]. BEAD gives the National Telecommunications and Information Administration (NTIA), a division of the U.S. Department of Commerce, the authority to grant more than $42 billion to states and federal territories to expand broadband Internet access to all unserved and underserved locations. Under the original BEAD Notice of Funding Opportunity (NOFO), fiber deployments were deemed priority projects, while other technologies (fixed wireless, satellite, etc.) were non-priority. By mid-2024, most states had begun selecting providers under these guidelines. On June 6, 2025, the NTIA issued a policy notice indicating the NTIA will now use the FCC's National Broadband Map to count how many locations in each state are underserved or unserved (reinforcing the importance of the National Broadband Map and granular data). The revised BEAD rules explicitly define a "Priority" project as one that delivers at least 100 Mbps download and 20 Mbps upload speeds, similar to the old BEAD rules that classified underserved areas as those lacking 100/20 Mbps service. Funding is now allocated per location to the single lowest-cost provider, resulting in only one provider being funded for each location [30].

As part of NTIA's BEAD Program, each eligible entity (i.e., state or territory) must conduct a challenge process to confirm which locations are eligible for BEAD funding. The NTIA allocates funds to each state based on the FCC's National Broadband Map, which overlays providers' self-reported data onto the National Broadband Serviceable Location Fabric compiled by CostQuest Associates (a broadband consulting firm, contracted by the FCC and NTIA) [3]. States will use the data from the National Broadband Map to determine if the locations listed are served, unserved, or

[1]Because CAF Phase II Model was the largest program under CAF for many years, CAF Phase II Model is often referred to simply as "CAF". In the remainder of this paper, when we refer to CAF, we typically refer to CAF Phase II Model specifically.

underserved, and to identify locations eligible for BEAD funding [2]. Each states receives a base grant plus additional funds proportionately allocated based on each state's share of the nation's unserved locations. After these allocations, states must conduct an NTIA-approved subgrant competition to award broadband deployment projects.

2.5 Prior Broadband Program Analysis

As described above, there is a wide range of regulatory programs aimed at addressing concerns about broadband availability. Some of these programs offer subsidies for new infrastructure in unserved and underserved regions. These programs cost taxpayers billions of dollars annually in an attempt to satisfy the long-standing aim of universal service. A complete understanding of these programs would enable us to better evaluate their success, prioritize among them, and legislate new initiatives as well as improvements to existing ones.

Unfortunately, current broadband datasets rely heavily on self-reported information from ISPs, which has been shown to be flawed [1, 21, 23, 27]. To address this, our team developed BQT [28], an automated system that queries the web interfaces of ISPs at scale by inputting a residential street address and then extracting the returned data on service availability, quality (e.g., speeds, latency), and pricing. By creating a granular, address-level dataset of broadband plans and prices, BQT enables policymakers to better understand broadband availability, speeds, costs, and the factors—such as local competition and demographic data—that might drive variation.

As noted above, our prior study of CAF, employing BQT, found that the program largely failed to achieve its intended goal of expanding reliable broadband access to underserved areas [22]. That study curated a novel dataset for 537,000 residential addresses, focusing on four major ISPs across 15 states. Specifically, we selected four ISPs that collectively received a majority of CAF funding (i.e., AT&T, Frontier, CenturyLink, and Consolidated Communications) and 15 states where the four ISPs were dominant ISPs[2].

That study revealed significant shortcomings in CAF's implementation. We found the serviceability rate, defined as a weighted fraction of addresses ISPs actively serve out of the total queried addresses, to be only 55.45%. That is, only 55.45% of the addresses certified by the ISPs as served under CAF received any service at all. The compliance rate, defined as the weighted fraction of queried addresses where ISPs serve and advertise download speeds above the FCC's 10 Mbps requirement, was only 33.03%.

[2]More details about the rationale behind the ISPs and states chosen can be found in [22]

Motivated by this prior work, our goal in this work is to investigate why serviceability rates are low. Specifically, we investigate whether newer federal programs have affected participation and compliance with existing programs. We do so by studying both how different funding initiatives have affected broadband availability, and how these programs have affected each other.

3 DATASETS

This section describes different datasets used in this study.

3.1 USAC High Cost Dataset

The USF is funded by money collected by telecommunications companies, as required by the Telecommunications Act of 1996, to support the objective of universal service. USAC oversees the collection of these contributions and manages the distribution of USF funds through four main USF programs: Lifeline, E-Rate, High Cost, and Rural Health Care [8]. As described in Section 2, CAF and RDOF are both High Cost programs.

The CAF Broadband Map (CAF Map) dataset is the basis for the CAF Map—a public, interactive map that displays the geographical locations eligible for CAF support [7]. The dataset includes a column called "Fund Type", which refers to which FCC High-Cost program type funded that broadband deployment (i.e., CAF Phase II Model, RDOF, etc.). These programs (not just CAF) are all included in the CAF Map dataset since all programs use the same USAC reporting system.

3.2 National Broadband Map Data

In response to longstanding concerns about broadband data reliability, Congress—under the BEAD program—directed the FCC to develop a granular and accurate map of fixed broadband availability across the U.S. This directive resulted in the creation of the US National Broadband Map [16], intended to provide address-level information about fixed broadband availability nationwide. The FCC National Broadband Map displays the locations where broadband service is available across the U.S., as reported by ISPs to the FCC through the FCC's Broadband Data Collection (BDC) program [16]. The ISPs file data with the FCC twice a year about fixed locations (i.e., homes and small businesses) where they offer broadband service.

3.3 FCC RDOF and CAF Defaults Datasets

When an ISP accepts money under a federal program, such as CAF or RDOF, it may, under certain circumstances, default on its obligations under the program. The FCC released a public dataset breaking down these defaults by state and ISP, revealing how many locations in each state will not be connected with broadband service and how much federal investment each state will lose due to the defaults. For the RDOF program, the raw datasets are publicly available in the results section of the FCC's Auction 904 website, split by defaults that occurred before (Pre-Authorization Defaults) and after (Post-Authorization) long-form review. The RDOF Pre-Authorization Default dataset includes defaults that occurred as of December 20, 2023, while the RDOF Post-Authorization default dataset includes defaults as of January 14, 2025. The same two datasets are available for CAF on the FCC's Auction 903 website. The CAF Pre-Authorization default dataset includes defaults that occurred as of June 14, 2022, while the CAF Post-Authorization default dataset includes defaults that occurred as of April 15, 2024.

4 METHODOLOGY

As described in Section 2.5, this study builds upon our previous research examining the efficacy of CAF. In this paper, we analyze the same four ISPs—Frontier, CenturyLink, AT&T, and Consolidated Communications—in the same 15 states evaluated in our previous study.

We merge our street-address-level dataset with public data from the USAC CAF program, the RDOF program, and the National Broadband Map for each state. To assess defaults, we analyze state-level defaults within the 15 states and determine whether there is overlap between BQT-queried address locations and locations where defaults occurred.

To investigate whether RDOF competition contributes to lower serviceability by CAF-funded ISPs, we identify overlapping census block groups between the BQT-curated and RDOF datasets. We calculate the serviceability rate, a metric that reflects the quantity of actively served addresses, to highlight the gap between the locations ISPs claim to serve and those to which they are "actually" providing service. Using this definition, we analyze serviceability rates across three distinct categories: (1) "CAF-Only", representing locations subsidized by CAF but not RDOF; (2) "RDOF Only", representing locations subsidized by RDOF but not CAF; and (3) "CAF-RDOF Overlaps", representing locations funded through both programs (i.e., where the CAF-funded ISP may have been threatened by incoming RDOF competition). This categorization allows us to assess whether the presence of RDOF ISP competition correlates with lower serviceability rates by CAF ISPs.

5 RESULTS

Our analysis is driven by three research questions (RQs), as described in Section 1. We answer these questions by dividing them into subquestions, using the datasets described in Section 3, and following the methodology described in Section 4.

Table 1: Weighted serviceability rate by CAF ISP

	CAF-Only	CAF-RDOF Overlaps	All CAF addresses
AT&T	32.58%	28.02%	31.53%
Frontier	70.30%	73.27%	70.71%
CenturyLink	90.43%	90.32%	90.42%
Consolidated	83.30%	85.69%	83.95%

RQ1: *Is low ISP serviceability under CAF attributable to anticipated competition from RDOF ISPs?*

While there is overlap between the CAF and RDOF footprints, it is relatively small—RDOF has only a 5.51% overlap with CAF's footprint. This finding alone undermines the hypothesis that low CAF serviceability is attributable to RDOF competition. Even if we accept that CAF ISPs abandoned all RDOF-funded locations, that is only ~5% of the total addresses; we found that 45% of locations were unserved in our prior study. Nevertheless, to explore whether RDOF ISP competition affects CAF ISP serviceability, we analyze the address overlaps between CAF and RDOF, and compare the overlap to addresses only under CAF.

Do serviceability rates vary when comparing CAF-Only addresses versus addresses with both CAF and RDOF-funded coverage? The serviceability rate for CAF-Only addresses is 56.60%. The serviceability rate for CAF-RDOF Overlaps is 51.63%. These results show a marginal decrease of only 5% in CAF ISP serviceability when there is RDOF competition. While there is a slight association between RDOF ISP competition and lower CAF ISP serviceability, the difference is not large enough to suggest that RDOF competition causes reduced serviceability by CAF-funded ISPs. Therefore, without further analysis to rule out other potential explanations, such as technological, state, or ISP differences, it is not possible to attribute lower CAF ISP serviceability solely to RDOF competition. We perform this analysis in the following subsections.

Do serviceability rates vary amongst the four CAF ISPs? Table 1 shows the weighted serviceability rates[3] for the four major CAF ISPs. Serviceability rates are broken down into three categories: (1) CAF-Only; (2) CAF-RDOF Overlaps; and (3) All CAF addresses, representing the weighted serviceability rates reported in [22]. AT&T shows the largest drop in serviceability rate within overlapping CAF and RDOF addresses (i.e., 4.56%). On the other hand, Frontier and Consolidated Communications show an increase in serviceability rates for overlapping CAF and RDOF addresses. These findings suggest that RDOF competition may actually motivate some ISPs to service more addresses, while other ISPs may

[3]The third column is not a direct average of the other two since the columns are weighted differently.

scale back service in anticipation of being out-competed by RDOF deployments.

Do serviceability trends vary by CAF ISP-state pairs? To further assess whether RDOF competition influences CAF ISP serviceability, we examine CAF ISP performance in 15 states. We analyze serviceability rates for each CAF ISP in each state, as indicated in Table 3 in the Appendix, separated by CAF-Only addresses versus CAF-RDOF Overlaps addresses. For AT&T, we see a weighted CAF and RDOF serviceability rate decrease in three states and an increase in four states, ranging from -24.21% to 27.14%. Frontier shows a serviceability decrease in five states and an increase in three states, ranging from -10.88% to 7.82%. CenturyLink shows a weighted serviceability decrease in two states and an increase in five states, ranging from -2.29% to 26.09%. For Consolidated Communications, we see a serviceability rate decrease in five states and an increase in one state, ranging from -12.07% to 8.1%. For more details, .

These results reinforce our argument that there is no clear trend linking the presence of RDOF ISPs to reduced CAF serviceability. The serviceability rates appear to be ISP- and region-specific rather than systematic.

Within CAF ISP-state pairs, do serviceability trends vary by CAF and RDOF ISP pairs? Our findings showed no consistent trend for CAF ISP serviceability based on the existence of an RDOF-funded ISP. Therefore, we next examine not just whether there is RDOF competition in the selected states, but also whether competition from a specific ISP matters. Upon examination of all states where the incumbent CAF ISP has RDOF competition, we notice no trend in serviceability rate based on the particular RDOF ISP. For instance, when competing with Charter Fiberlink as the RDOF ISP, AT&T exhibits a lower serviceability rate in one state but an increased serviceability rate in another state. Similarly, Frontier, CenturyLink, and Consolidated Communications exhibit mixed behaviors across different states, regardless of which RDOF ISP is present.

Within CAF ISP-state pairs, do serviceability trends vary by RDOF ISP technology type? To explore whether the RDOF ISP technology type influences CAF ISP serviceability, we analyze CAF ISP serviceability rates across different RDOF competitors, specifically based on whether the RDOF ISP deploys fiber, DSL, wireless, or another technology.

We begin by examining RDOF ISPs that deploy fiber. When AT&T is the incumbent CAF ISP, serviceability is the lowest when the RDOF ISP is Baldwin Telecom and Progressive Cooperative Communications Services, both with a serviceability rate of 0%. The serviceability rate is the highest with M-Pulse Fiber as the RDOF ISP, at 79.19%. We observe a higher ISP serviceability in Mississippi, with some serviceability rates exceeding 70%.

When Frontier is the incumbent CAF ISP, serviceability is the lowest when the RDOF ISP is Conexon Connect (serviceability rate: 11.37%), and the highest with Imagine Networks as the RDOF ISP (serviceability rate: 98.55%). When Centurylink is the incumbent CAF ISP, serviceability is the lowest when the RDOF ISP is Bright House Networks (serviceability rate: 75.68%). Finally, when Consolidated Communications is the incumbent CAF ISP, serviceability is the lowest when the RDOF ISP is Conexon Connect (serviceability rate: 63.48%), and the highest with Consolidated Communications as the RDOF ISP (i.e., double funded under CAF and RDOF, serviceability rate: 99.06%).

Finally, there are a few other trends based on the incumbent CAF ISP. For instance, we see lower serviceability rates in Florida when AT&T and Frontier are the incumbent CAF ISPs. There is higher ISP serviceability in Florida (i.e., greater than 60%) when Consolidated or CenturyLink is the incumbent CAF ISP. We observe only two wireless RDOF ISPs (i.e., Roanoake Connect Holdings and Mediacom), and 1 DSL RDOF ISP (Randolph Telephone Telecommunications), so we refrain from drawing inferences about these technology types due to limited data. Overall, we notice that the trends are not systematic across different CAF-RDOF ISP technology types, and that serviceability does not vary by the competing RDOF ISP's technology type. For more details, please refer to Table 4 in the Appendix.

Do serviceability trends vary based on whether the CAF and/or RDOF ISP defaults? To understand whether the default status of RDOF and CAF-funded ISPs affects serviceability among CAF-funded ISPs, we compare serviceability rates in states where CAF ISPs face RDOF competition that defaulted versus those that did not. To answer the question "Does RDOF competition affect CAF ISP serviceability?", we treat RDOF defaults as RDOF-CAF Overlaps and compare them to CAF-Only locations. To answer the subsequent question "Do RDOF defaults impact CAF ISP serviceability rates?", we narrow our analysis to overlaps only, and compare default-overlaps to non-default-overlaps.

None of the four CAF ISPs default on their CAF obligations. For AT&T, serviceability was lower in states like Florida, Wisconsin, and Ohio when competing with defaulting RDOF ISPs, but higher in Georgia with the same conditions. Frontier exhibits the opposite trend, with higher serviceability in Florida and Wisconsin but lower in Ohio in the presence of defaulting RDOF competitors. CenturyLink shows lower serviceability in Florida, Wisconsin, and Ohio when competing against defaulting RDOF ISPs, and higher serviceability in North Carolina. Consolidated Communications was the only CAF ISP to show a consistent pattern—in New Hampshire

Table 2: Address overlaps between CAF, RDOF, and BEAD.

Programs	Address Overlap	% of CAF Footprint	% of RDOF Footprint	% of BEAD footprint
CAF and RDOF	214,216	3.49%	13.29%	
CAF and BEAD	50,405	0.82%		17.24%
RDOF and BEAD	21		0.003%	0.007%
CAF, RDOF, and BEAD	7	0.0001%	0.0009%	0.002%

and Vermont, serviceability is higher when the competing RDOF ISP defaults. These mixed results again suggest that defaults do not contribute to low CAF ISP serviceability.

RQ2: *How many locations have been funded by more than one of CAF, RDOF, and BEAD?*

Policymakers have allocated over $10 billion for the CAF program, $20.4 billion over 10 years for RDOF, and $42.45 billion for BEAD. There are a total of 6,136,603 addresses for CAF, 815,678 addresses for RDOF, and 292,319 addresses in the FCC BEAD unserved and underserved lists[4] across all U.S. states.

Table 2 shows the address overlaps between CAF, RDOF, and BEAD across the U.S., along with the address overlap as a percentage of each program's total number of addresses. There are 214,216 addresses that overlap between CAF and RDOF. This overlap corresponds to $3.05 billion in funding (4% of $10 billion from CAF and 13% of $20.4 billion from RDOF). The overlap between CAF and BEAD is 50,405 addresses, amounting to $7.24 billion in funding (1% of $10 billion from CAF and 17% of $42 billion from BEAD). On the other hand, the overlap between RDOF and BEAD, and between all three programs, is minimal as indicated in the table.

These results suggest that, while the minimal three-program overlap is reassuring, the larger overlap between CAF and RDOF, as well as CAF and BEAD, raises concerns. The overlap between CAF and BEAD is particularly troubling because it suggests that BEAD funds may be directed toward areas that have already received public subsidies. Moreover, only 1% of addresses under CAF are BEAD funded even though our previous work found 45% of CAF addresses to be unserved by the subsidized ISP, suggesting that perhaps even more addresses should be eligible for BEAD funding.

[4]Because BEAD funding has not yet been allocated to addresses, we utilize the BEAD address lists to determine address overlaps with other federal programs, such as CAF and RDOF. We consider addresses that are underserved and unserved as "funded", even though they may not all eventually be funded under BEAD.

RQ3: *Where locations receive funding through multiple programs, does the same ISP benefit from multiple funding rounds?*

We identify a total of 445 unique CAF-RDOF ISP pairs for the addresses that overlap between the CAF and RDOF programs. 10% of these ISPs receive funding from both the CAF and RDOF programs for the same locations. Specifically, 45 of the 445 ISPs for this overlapping set of addresses benefit from multiple funding rounds. Of the four ISPs we examine, Consolidated Communications is the only provider to receive funding under both the CAF and RDOF programs.

6 POLICY IMPLICATIONS

This study examines how major federal broadband funding programs—CAF, RDOF, and BEAD—interact with one another and with the broader goals of universal service. Our findings suggest that while concerns about inter-program interference may be overstated, deeper structural weaknesses in program compliance and data accuracy can undermine federal broadband initiatives. We highlight three primary policy implications of our study, each arising out of one of our research questions.

Program competition did not meaningfully undermine compliance, but enforcement remains a core concern. Our analysis finds that incoming competition from RDOF alone cannot explain the low CAF serviceability rates uncovered in our previous work. This suggests that fears of newer federal broadband programs undercutting older ones—by incentivizing ISPs to abandon their obligations—may be overstated.

Nevertheless, we emphasize that the poor compliance with CAF obligations we observed earlier, as well as the high rate of defaults under RDOF, together reinforce a deeper issue: Subsidized ISPs often fail to meet deployment and service standards. Future programs must better address these enforcement and accountability concerns. USAC's current oversight regime, which relies on ISP self-certification and performance tests limited to active subscribers, fails to capture the scope and scale of noncompliance. To ensure that future programs avoid repeating these mistakes, policymakers should implement independent, address-level auditing systems that verify service availability and quality directly.

Program compliance should be a first-order design principle, rather than a retrospective concern left only to academic research.

Misaligned funding reflects both redundancy and omission, and points to deeper data failures. We identify a meaningful overlap among funding programs, particularly between CAF and BEAD, which are due to overlap at more than 50,000 locations. Of course, some redundancy may be expected, especially given the changes in user needs (and the associated changes to the definition of "broadband" in newer programs). Nevertheless, this overlap may suggest that taxpayers will spend billions of public dollars to fund broadband deployment in areas that have already received public subsidies—in part because ISPs failed to meet their obligations under previous programs.

Just as concerning is the risk that the overlap between programs is not large enough, given the scale of the shortcomings in previous programs. As we have already described, our prior work found that roughly 45% of CAF-funded addresses were unserved, yet only about 1% of CAF addresses are now eligible for BEAD funding. This data suggests the possibility that hundreds of thousands of genuinely unserved locations are excluded from these new funding rounds.

Indeed, this may be because BEAD funding decisions are based upon such data sources drawn from ISP-reported data (including existing FCC sources). Together, these findings suggest that flawed, ISP-reported data on broadband availability continue to distort federal funding decisions, resulting in both inefficient duplication of resources as well as the exclusion of communities that remain unserved.

Serial subsidies risk reinforcing provider failures. Among addresses that received support under both CAF and RDOF, we find that the same ISP received funding in multiple rounds for a non-trivial share of these locations. This pattern suggests that some ISPs are repeatedly subsidized to serve the same communities—perhaps even when prior rounds of funding failed to deliver adequate service.

Absent safeguards, this dynamic risks reinforcing concentration and rewarding non-compliance by entrenching a single subsidized provider. Future broadband programs should condition future funding on past compliance to ensure that public dollars do not go to subsidizing the same unfulfilled promises.

7 CONCLUSION

This study examines both how federal funding initiatives affect broadband availability, and how these programs affect each other. The overlap between CAF and RDOF—just 5.51% of CAF's footprint—combined with the 4% drop in CAF ISP serviceability when RDOF competition exists, challenges the hypothesis that newer programs such as RDOF caused low CAF ISP serviceability rates. We identify approximately 214,000 addresses overlapping between CAF and RDOF and nearly 50,000 addresses overlapping between CAF and BEAD. There are 45 ISPs that benefited from multiple rounds of funding through the CAF and RDOF programs.

Without fine-grained, address-level data and improved verification mechanisms, these programs risk misallocating billions in public funds while leaving millions of Americans without adequate Internet access. To ensure future programs succeed where previous programs have failed, it is important for policymakers to invest not only in infrastructure, but also in clear accountability standards and regulatory frameworks that prevent redundant spending across federal initiatives. Our findings highlight the need for better coordination and oversight to ensure that federal broadband service programs deliver on their promise of equitable broadband service nationwide.

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9 APPENDIX

Table 3: CAF and RDOF serviceability rates by ISP and state.

	AT&T			Frontier			CenturyLink			Consolidated		
State	CAF Only	CAF-RDOF Overlaps	All CAF	CAF Only	CAF-RDOF Overlaps	All CAF	CAF Only	CAF-RDOF Overlaps	All CAF	CAF Only	CAF-RDOF Overlaps	All CAF
FL	41.67%	17.46% ($\Delta - 24.21\%$)	38.41%		11.38%	11.38%	77.89%	92.10% ($\Delta + 14.21\%$)	78.95%	76.90%	64.83% ($\Delta - 12.07\%$)	73.23%
IA				65.53%	60.33% ($\Delta - 5.2\%$)	64.88%	87.27%	91.42% ($\Delta + 4.15\%$)	87.32%			
NC	18.82%	12.08% ($\Delta - 6.74\%$)	16.90%	61.25%	51.31% ($\Delta - 9.94\%$)	59.54%	94.53%	96.10% ($\Delta + 1.57\%$)	94.83%			
NE				53.36%		53.36%	89.91%	95.34% ($\Delta + 5.43\%$)	90.03%			
UT				75.22%	83.04% ($\Delta + 7.82\%$)	77.70%	93.51%		93.51%			
NH										92.26%	89.26% ($\Delta - 3.0\%$)	90.55%
VT										82.03%	90.13% ($\Delta + 8.1\%$)	83.45%
AL	32.89%		32.89%	60.88%	50.00% ($\Delta - 10.88\%$)	60.88%	97.17%		97.17%	98.76%		98.76%
WI	22.09%	27.94% ($\Delta + 5.85\%$)	24.25%	80.51%	81.53% ($\Delta + 1.02\%$)	80.90%	92.00%	89.71% ($\Delta - 2.29\%$)	91.67%			
OH	22.84%	13.50% ($\Delta - 9.34\%$)	21.31%	66.66%	71.85% ($\Delta + 5.19\%$)	67.36%	86.49%	85.11% ($\Delta - 1.38\%$)	86.30%			
IL	14.27%	41.41% ($\Delta + 27.14\%$)	14.35%	65.91%	59.46% ($\Delta - 6.45\%$)	65.90%	94.17%		94.17%	83.97%		83.97%
CA	39.24%		39.24%	72.56%		72.56%						
MS	33.18%	39.00% ($\Delta + 5.82\%$)	36.09%	64.39%	57.62% ($\Delta - 6.77\%$)	58.30%	100%		100%			
GA	13.96%	14.80% ($\Delta + 0.84\%$)	14.42%	66.41%		66.41%	64.13%	90.22% ($\Delta + 26.09\%$)	75.76%			
NJ							4.55%		4.55%			

Table 4: CAF and RDOF ISP serviceability rates, agnostic to technology type.

	CAF ISP: AT&T			CAF ISP: Frontier			CAF ISP: CenturyLink			CAF ISP: Consolidated Communications		
State	RDOF ISP	Technology	Serviceability Rate	RDOF ISP	Technology	Serviceability Rate	RDOF ISP	Technology	Serviceability Rate	RDOF ISP	Technology	Serviceability Rate
FL	Bright House Networks	Fiber	5.20%	Bright House Networks	Fiber	57.14%	Bright House Networks	Fiber	75.68%			
FL	Windstream	Fiber	15.32%	Windstream	Fiber	100%						
FL	Conexon Connect	Fiber	17.12%	Conexon Connect	Fiber	11.37%	Conexon Connect	Fiber	97.72%	Conexon Connect	Fiber	63.48%
FL	Mediacom Wireless	Wireless	73%									
FL										Consolidated Communications	Fiber	99.06%
IA				Mutual Telephone Company	Fiber	59.08%	Mutual Telephone Company	Fiber	89.47%			
IA				Winnebago Cooperative Telecom Association	Fiber	60%	Winnebago Cooperative Telecom Association	Fiber	93.83%			
IA				Breda Telephone	Fiber	88.45%	Breda Telephone	Fiber	86.69%			
IA							Maquoketa Rural Electric Cooperative	Fiber	66.22%			
IA							South Slope Cooperative Telephone Company	Fiber	96.75%			
IA							Miles Cooperative Telephone	Fiber	100%			
IA							Mediapolis Telephone Company	Fiber	100%			
NC	Time Warner Cable	Fiber	12.08%	Time Warner Cable	Fiber	51.31%	Time Warner Cable	Fiber	96.13%			
NC							Wilkes Telephone Telecommunications	Fiber	93.33%			
NC							Riverstreet Management Services	Fiber	100%			
NE							Nadelco Incorporated	Fiber	93.67%			
NE							Hamilton Long Distance Company	Fiber	95.83%			
NH										East Central Vermont Telecommunications District	Fiber	87.96%
NH										New Hampshire Electric Cooperative	Fiber	88.08%
NH										Consolidated Communications	Fiber	90%
NH										Time Warner Cable	Fiber	96.07%
VT										East Central Vermont Telecommunications District	Fiber	88.64%
VT										Consolidated Communications	Fiber	91.33%
VT										Charter Fiberlink	Fiber	97.06%
UT				Emery Telecom	Fiber	82.18%						
UT				Albion Telephone Company	Fiber	97.53%						
AL				Conexon Connect	Fiber	50%						
WI	Baldwin Telecom	Fiber	0%									
WI				Richland-Grant Coop	Fiber	50.98%	Richland-Grant Coop	Fiber	100%			
WI				Reedsburg Utility Commission	Fiber	76.56%	Reedsburg Utility Commission	Fiber	91.44%			
WI				La Valle Tel Corp	Fiber	89.72%						
WI	Charter Fiberlink	Fiber	27.90%	Charter Fiberlink	Fiber	81.60%	Charter Fiberlink	Fiber	89.08%			
WI	Amery Telecom	Fiber	40%	Amery Telecom	Fiber	33.44%	Amery Telecom	Fiber	100%			
WI							Lakeland Communications	Fiber	99.78%			
WI							Bruce Telephone Company	Fiber	100%			
OH	Time Warner Cable	Fiber	13.37%	Time Warner Cable	Fiber	71.27%	Time Warner Cable	Fiber	84.24%			
OH				Cincinnati Bell	Fiber	91.95%						
OH	Windstream	Fiber	16.78%				Windstream	Fiber	100%			
OH	BTC Multimedia	Fiber	19.93%				BTC Multimedia	Fiber	96.67%			
OH	Imagine Networks	Fiber	24.28%	Imagine Networks	Fiber	98.55%						
OH							Armstrong Telecommunications	Fiber	100%			
IL	Charter Fiberlink	Fiber	41.41%									
IL				McDonough Tel Coop	Fiber	38.54%						
IL				Hamilton County Tel	Fiber	62.17%						
IL				Shawnee Communications	Fiber	70.27%						
MS	We Connect Communications	Fiber	14.22%	We Connect Communications	Fiber	55.18%						
MS	Prentiss Electric Broadband	Fiber	18.45%	Prentiss Electric Broadband	Fiber	50.45%						
MS	Delta Electric Power Association	Fiber	18.60%									
MS	TecInfo Communications	Fiber	21.52%									
MS	NT Spark	Fiber	22.42%	NT Spark	Fiber	65.41%						
MS	DE Fastlink	Fiber	23.79%									
MS	Charter Fiberlink	Fiber	27.59%									
MS	Pearl River Valley Communications	Fiber	28.48%									
MS	Tishomingo Connect	Fiber	28.58%	Tishomingo Connect	Fiber	61.75%						
MS	4-County Fiber	Fiber	33.95%									
MS	Windstream	Fiber	37.62%									
MS	Telephone Electronics Communication	Fiber	37.89%									
MS	East Mississippi Connect	Fiber	38.51%									
MS	Tombigbee Fiber	Fiber	44.87%	Tombigbee Fiber	Fiber	63.84%						
MS	North East Fiber	Fiber	50.51%									
MS	Coast Electric Power Association	Fiber	53.21%									
MS	Alcorn County Electric Power Association	Fiber	56.53%	Alcorn County Electric Power Association	Fiber	48.55%						
MS	Tallahatchie Valley Internet Services	Fiber	63.98%									
MS	Tepa Connect	Fiber	68.05%									
MS	Belzoni Cable	Fiber	71.50%									
MS	M-Pulse Fiber	Fiber	79.19%									
GA	Progressive Cooperative Communications Services	Fiber	0%									
GA	Pineland Communications	Fiber	1.98%									
GA	Pembroke Tel	Fiber	3.44%									
GA	Altamaha Electric Membership Corporation	Fiber	7.17%									
GA	Conexon Connect	Fiber	13.69%									
GA	Point Broadband Fiber Holding	Fiber	22.40%									
GA	Windstream	Fiber	23.21%									
GA	Charter Fiberlink	Fiber	31.16%									
GA	Tri-County Service Center	Fiber	32.95%									
GA	TruVista Communications	Fiber	58.96%									
GA	Mediacom Wireless	Wireless	7.05%									
GA										Coastal Electric Membership Corporation	Fiber	90.22%
NC							Randolph Telephone Telecommunications	DSL	100%			
NC							Roanoke Connect Holdings	Wireless	91.26%			