Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)
	)
Establishing a 5G Fund for Rural America	) GN Docket No. 20-32

REPLY COMMENTS OF COALITION OF RURAL WIRELESS CARRIERS

David A. LaFuria
John Cimko

LUKAS, LAFURIA, GUTIERREZ & SACHS, LLP
8300 Greensboro Drive, Suite 1200
Tysons, Virginia 22102
(703) 584-8678
dlafuria@fcclaw.com

Its Attorneys

July 27, 2020

TABLE OF CONTENTS

SUMMARY

There was broad agreement in Comments filed in this proceeding that the Commission should not spend $8 billion of taxpayer dollars on a 5G Fund auction without first having accurate maps. Rural citizens living in areas that need support may be harmed if support is inaccurately targeted, or invested in areas that deliver very little bang for the buck. Moreover, accurate maps will allow bidders to make efficient auction and deployment decisions.

Most parties favor Option B (collecting new data before funding 5G deployment), suggesting that the Commission adopt a tighter timeline to complete its Digital Opportunity Data Collection process and produce the maps needed to conduct the auction properly. NERA Economic Consulting posits that the value of more accurate maps is likely to offset the costs of delaying the availability of 5G Fund support. A short delay will result in a superior auction outcome and prevent potentially significant waste if an outdated proxy is used to determine eligible areas.

Most parties agree that under the recently enacted Broadband DATA Act, the Commission is not permitted to conduct an auction until coverage maps are in place. Congress directed that "any new award of funding" must use maps developed in accordance with Broadband DATA Act requirements.

The Commission's proposal to change the transition mechanism for carriers receiving legacy support should be rejected. Beginning the phase down of support to legacy carriers before the auction violates numerous Congressional actions prohibiting the FCC from doing so until the 5G Fund mechanism is fully implemented. In addition, starting the phase down based

on proxy maps risks harming rural consumers living in high-cost areas that are incorrectly designated as ineligible.

With respect to compliance obligations, most commenters agree that the Commission should not adopt mechanisms that force carriers to spend potentially millions of dollars to perform three speed tests in every single square kilometer of a served area, or to provide service to areas in circumstances that would demonstrably waste support.

No party advocated in favor of allowing 5G Fund support to be used to meet T-Mobile's merger commitments, and the Coalition reiterates its belief that T-Mobile should be barred from participating in the 5G Fund auction. In its attached paper, NERA describes an auction scenario it considered which reveals that allowing T-Mobile to pre-select census tracts would misallocate resources and possibly harm competition. NERA concludes that the Commission should focus on creating strong incentives for auction participants to consider the likely build-out plans of competitors, and that the best way to do that is through a well-designed competitive auction, based on accurate maps.

In addition to barring T-Mobile from the 5G Fund auction, the Coalition argues that the Commission should not make service areas ineligible for 5G Fund support based on T-Mobile's promise to deploy 5G broadband in those areas. Relying on a "phantom" coverage map built on T-Mobile's promises is not the best way to ensure that 5G Fund support will maximize rural coverage. Instead, the Commission should base service area eligibility exclusively on accurate maps submitted by all carriers (including T-Mobile) that identify areas that currently have access to 5G service.

The Coalition opposes satellite operators' proposals to increase the latency threshold to 200 ms, pointing out that, among the major carriers, 4G LTE networks commonly operate at latency levels well below 100 ms, and 3G networks commonly operate at levels well below 200 ms. There is no good public policy reason to fund network standards that would be lower than the standards met by our nation's 3G networks, which themselves will be all but obsolete in a short time.

Finally, Coalition members note that legacy high-cost support has enabled the construction, maintenance, and upgrading of facilities in rural areas that would never have been built without legacy support. There are today many networks serving rural Americans for which no rational business plan could support the construction and operation of towers, switch capacity, backhaul, and ancillary equipment needed to serve.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Establishing a 5G Fund for Rural America	)	GN Docket No. 20-32

REPLY COMMENTS OF COALITION OF RURAL WIRELESS CARRIERS

The Coalition of Rural Wireless Carriers ("Coalition"),[1] by counsel, hereby submits these Reply Comments, in response to the *Notice of Proposed Rulemaking and Order,* released by the Commission in the above-captioned proceeding.[2] The Coalition states the following:

---

[1] Coalition members include Carolina West Wireless, Inc.; Cellular South Licenses, LLC dba CSpire; East Kentucky Network, LLC dba Appalachian Wireless; Cellular Network Partnership, a Limited Partnership, dba Pioneer Cellular; Smith Bagley, Inc. ("SBI"); United States Cellular Corporation ("U.S. Cellular"); and Union Telephone Company dba Union Wireless.

[2] *Establishing a 5G Fund for Rural America, Universal Service Reform – Mobility Fund,* GN Docket No. 20-32, WT Docket No. 10-208 (closed), Notice of Proposed Rulemaking and Order, 35 FCC Rcd 3995 (2020) ("*NPRM*") (setting July 27, 2020, as the deadline for filing reply comments).

I. **There Is Broad Agreement That Accurate Maps Should Be Developed Before Auctioning $8 Billion of Support.**

With few exceptions, there is broad agreement in the record that the Commission should not spend $8 billion of taxpayer dollars on a 5G Fund auction without first having accurate maps.[3] This auction is far too important to rural Americans to settle for the Commission's investing any significant amount of 5G support inefficiently.

At a recent hearing, U.S. Senator Roger Wicker noted with approval Commissioner O'Rielly's commitment that he would not support moving forward with the 5G Fund until the Commission completes the new maps required by the Broadband DATA Act ("BDA").[4] Commissioner Rosenworcel made the same point, criticizing the Commission's plan to spend 80% of Rural Digital Opportunity Fund ("RDOF") support this year in a Phase I auction, at a time

---

[3] *See* Verizon Comments at p. 7; AT&T Services, Inc. ("AT&T"), Comments at pp. 3-5; Competitive Carriers Association ("CCA") Comments at p. 8; National Association of Regulatory Utility Commissioners ("NARUC") Comments at p. 4; NTCA–The Rural Broadband Association ("NTCA") Comments at p. 8. The Coalition argues in its Comments that "[t]he FCC should not proceed to invest $8 billion without having an accurate picture of where mobile wireless coverage and 5G broadband are needed in rural America." Coalition Comments at p. 9 (footnote omitted).

[4] *See Oversight of the Federal Communications Commission*, *Hearing Before the S. Comm. on Commerce, Science, & Trans.*, 116th Cong. (June 24, 2020) ("Senate Oversight Hearing"), *accessed at* https://www.commerce.senate.gov/2020/6/oversight-of-the-federal-communications-commission (starting at 1:12:36 and 1:50:42). NARUC, agreeing with the Coalition, argues that:

> The FCC must require current and accurate mobile wireless data coverage mapping prior to awarding any dollars from the 5G Fund. Any other action would be inconsistent with, if not the letter, certainly the intent of Congress when it passed the Broadband Data Improvement Act just a little over two months ago.

NARUC Comments at p. 4 (footnote omitted). *See* Coalition Comments at pp. 7-9.

when broadband mapping data is demonstrably flawed.[5] In concurring with the Commission's

Digital Opportunity Data Collection item from just last week, Commissioner Starks stated:

> I will continue to oppose efforts to rush the 5G Fund out the door
> without first fixing our maps. We have for years spent and,
> because of RDOF, will for the next decade spend, billions and
> billions of dollars without a comprehensive understanding of
> where broadband is and is not. Without doubt, today marks the
> beginning of the end of that era.[6]

In its recent paper, NERA Economic Consulting ("NERA") concludes that, by developing

accurate maps in advance of the auction, the Commission will "provide all market participants

with significantly more accurate information which they can use to improve the efficiency of

their own deployment—and bidding strategies."[7] If the Commission goes forward with its

proposal to distribute 89% of the 5G Fund budget before it has accurate mapping data, it risks

imposing undue and avoidable harm on rural consumers, because it would be highly likely that

funding would not be accurately targeted and would fail to deliver the maximum bang for the

buck. The Commission should not allocate any substantial portion of the 5G Fund budget for

distribution until accurate maps required by the BDA are completed.[8] Accordingly, the

---

[5] Senate Oversight Hearing (starting at 0:33:10).

[6] *See Establishing the Digital Opportunity Data Collection*, *et al.*, WC Docket No. 19-195, *et al.*, Second Report and Order and Third Further Notice of Proposed Rulemaking, FCC 20-94 (rel. July 17, 2020) ("*Second R&O*") at p. 129 (Statement of Commissioner Starks, Concurring).

[7] Jeffrey A. Eisenach & Hector Lopez, *Maximizing the Benefits of the 5G Fund for Rural America,* NERA Economic Consulting, July 2020 ("*NERA Paper*") at p. 10 (copy attached in Exhibit A).

[8] In discussing this problem in the RDOF context, Commissioner Rosenworcel stated:

> [T]he FCC will distribute 80 percent of these broadband funds for the next decade. If
> you think that sounds irresponsible, you're right. Because when a major trade associa-
> tion studied the accuracy of our existing data and maps, it found an error rate of nearly

Coalition opposes Verizon's proposal to invest half of the 5G Fund in Phase I,[9] and instead urges

the Commission to conduct the auction using accurate mapping data that yields the most

efficient deployment of public funds.

II. There Is Broad Agreement That Option B, With a Tighter Timeline, Is Superior to Option A.

Most parties, and all terrestrial broadband service providers, reject Option A because it

would invest support funds without accurate maps and because a modified Option B is viable

and preferable.[10] Similar to the Coalition's proposal, Verizon, CPUC, NTCA, NARUC, and CCA all

support Option B, with a tighter time frame for developing needed mapping data.[11]

AT&T supports Option B, firmly in the camp of ensuring that accurate maps are

developed, at the earliest possible date, before conducting an auction.[12] Consistent with the

Coalition's advocacy, Verizon projects that selecting Option B should delay the auction one

year, not two.[13] NERA posits that the value of more accurate maps, "is likely to offset the costs

---

two in five. None of us would ever invest our own funds this way. We shouldn't be so cavalier with public dollars—especially when they are being spent to solve the digital divide…."

Second R&O at p. 127 (Statement of Commissioner Rosenworcel, Approving in Part, Dissenting in Part).

[9] Verizon Comments at p. 3.

[10] *But see* AST&Science LLC Comments at p. 23.

[11] Verizon Comments at p. 7; NTCA Comments at p. 8; NARUC Comments at p. 5; CCA Comments at p. 9.

[12] AT&T Comments at p. 3.

[13] Verizon Comments at p. 7 (footnote omitted) (noting that "[t]he benefits of accurately targeting support where it is needed far outweigh any harm from a one-year delay" of the start of the 5G Fund Phase I auction).

of delaying the availability of 5G Funds, especially since deployment in the marginal areas targeted by the 5G Fund is unlikely to begin immediately."[14]

A one-year delay is a small price to pay in order to realize significant benefits to all Americans.[15] First, accurate maps will deliver the most benefit to rural Americans within the limited budget available.[16] Second, the possibility of wasting billions of dollars that the vast majority of Americans provide through their telephone bills, will be minimized.[17] This Commission, which has been at the forefront of attacking waste, fraud, and abuse in all universal service support mechanisms,[18] should not adopt any policy that risks significant waste of taxpayer funds.

---

[14] *NERA Paper* at p. 9.

[15] It also should be noted that the Commission is making progress toward adopting mapping require-ments consistent with the requirements of the BDA. *See Second R&O*. As Commissioner Starks points out, "[t]oday's Order is an important step on the path Congress has laid out [in the BDA]." *Id*. at p. 129.

[16] As the Coalition explains in its Comments, "[t]aking … extra time to improve mapping resources serves the public interest because support will be invested far more efficiently than it would using FCC Form 477, and certainly much more than using a proxy for mobile coverage, as proposed by the Commission in Option A." Coalition Comments at p. 14.

[17] The Coalition agrees with CCA that:

> [T]he Commission should not proceed to spend $9 billion of taxpayer money without first measuring the problem that the Commission aims to solve. If we don't know where connectivity is and is not available today—in other words if we don't measure the "digi-tal divide"—we won't be able to direct support efficiently to address the problem.

CCA Comments at p. 8.

[18] Chairman Pai, for example, in observations relating to the Lifeline program, has cautioned against tol-erating practices that "represent[ ] hundreds of millions of dollars each year in potentially wasted funds. And [this] means that hundreds of millions of dollars each year do not serve American citizens in need of the program's assistance. Countenancing this state of affairs isn't compassion. It's an abdication of duty." *Bridging the Digital Divide for Low-Income Consumers*, *et al*., WC Docket No. 17-287, *et al*., Fifth Report and Order, Memorandum Opinion and Order and Order on Reconsideration, and Further Notice of Proposed Rulemaking, 34 FCC Rcd 10886, 10989 (2019) (Statement of Chairman Pai).

III. The Broadband DATA Act Requires Maps Before Auctions.

In its Comments, the Coalition demonstrates that the BDA directs the FCC "to use [the BDA-mandated] coverage maps (1) to determine the areas where broadband … service is and is not available, and (2) when making any new award of funding with respect to the deployment of broadband … service."[19] Under the statute's plain language, the Commission is not permitted to conduct an auction until the coverage maps are in place.

Most parties agree. NARUC states that any action other than developing accurate mobile wireless data coverage mapping prior to awarding any 5G Fund support would be inconsistent with the law.[20] CCA notes that the text of the BDA mandates that any new award of funding can only occur after creating the maps required by the BDA.[21] CCA convincingly explains that, given that 5G Fund auction rules have yet to be adopted, the 5G Fund falls squarely within Congress's use of the words "any new award of funding" under the BDA.[22] At the Commission's recent open meeting, Commissioner O'Rielly stated his views on the BDA:

> Congress expected the FCC to use the new maps for future
> decision making and not rush ahead in creating new subsidy
> programs absent this important data. _The law is fairly clear on
> this point_, but in case it wasn't, I've heard directly from a number

---

[19] Coalition Comments at p. 8 (quotation marks omitted) (quoting _Broadband Deployment Accuracy and Technological Availability Act_, Report of the S. Comm. on Commerce, Science & Trans., S. REP. No. 116-174, at 2 (Dec. 12, 2019)).

[20] NARUC Comments at p. 4.

[21] CCA Comments at p. 7.

[22] _Id_.

of Senators on exactly what they expect from the Commission,
and I intend to follow their expectations.[23]

Accordingly, the statute must be understood to require the Commission to first develop

the required maps, and then to conduct one or more auctions based on those maps.[24]

**IV.   A Phase Down of Legacy Support for Ineligible Areas Must Not Commence Until
Accurate Mapping Data Is Developed.**

In its Comments, the Coalition demonstrates that the Commission may only begin the

phase down of support to carriers receiving legacy support in areas declared to be ineligible in a

manner that is consistent with the 2016 Appropriations Act.[25] One of the proposals set forth in

the *NPRM*, which would begin the phase down following the effective date of an order in this

proceeding and the release of the final list of areas eligible for 5G Fund support,[26] would

commence the phase down of legacy support before the Mobility Fund Phase II program

(renamed as the 5G Fund) is "implemented."[27]

---

[23] *See Second R&*O, at p. 125 (Statement of Commissioner O'Rielly) (emphasis added).

[24] *See*, *e.g.*, CTIA Comments at p. 5 (footnotes and quotation marks omitted) (explaining that, "[i]n order to make such funding available effectively and without delay, the Commission should move expeditiously to determine the areas eligible for 5G Fund support based on a new coverage data collection as required by the Broadband DATA Act. The Broadband DATA Act requires the Commission to develop new maps of where broadband is available and where it is not, and use such maps … when making any new award of funding with respect to the deployment of broadband internet access service intended for use by residential and mobile customers.").

[25] *See* Coalition Comments at pp. 25-30 (citing the Consolidated Appropriations Act, 2016, Pub. L. No. 114-113, 129 Stat. 2242 (2015) ("2016 Appropriations Act")).

[26] *NPRM*, 35 FCC Rcd at 4019 (¶ 75).

[27] Coalition Comments at pp. 26-30; AT&T Comments at p. 18, n.46.

Implementation of this program requires more than just adopting an order and releasing a map of Rural-Urban Commuting Area ("RUCA") Code areas. As AT&T explains:

> As a legal matter, it is not clear that the timing of the Commission's proposed phase down is consistent with Congress's requirement that the Commission not recommence the phase down in wireless carriers' legacy high-cost support until MF II or its successor "is implemented." … [I]t is difficult to say that the Commission has "implemented" the 5G Fund when it proposes to begin phasing down support months in advance of the 5G Fund Phase I auction.[28]

Consistent with the plain dictionary meaning of the term "implement," the Commission must do more. It must conduct an auction for Phase II of the renamed Mobility Fund support program before legacy support can be reduced. This is not only consistent with the statute, but it fulfills the purpose of the 2016 Appropriations Act and prior FCC policy of transitioning support in an orderly fashion that avoids flash cuts and gaps in support for rural areas due to administrative delay.

As the Coalition explains in its Comments, Congress took explicit steps in the 2016 Appropriations Act to ensure that legacy Mobility Fund Phase II support would continue undisturbed during any period in which the Commission sought to develop and adopt alternative funding mechanisms.[29] In fact, as the Coalition's Comments further explain, Congress underscored its intent "to 'provide certainty to rural wireless broadband users and carriers across the Nation as the … Commission continues to develop a new framework for

---

[28] AT&T Comments at p. 18, n.46 (citation omitted).

[29] Coalition Comments at p. 26 (citing § 631 of the 2016 Appropriations Act).

parts of the Universal Service Fund.'"[30] Congress accomplished this result by including

provisions in the 2016 Appropriations Act that barred the Commission from modifying its rules

that ensured that competitive eligible telecommunications carriers ("ETCs") would continue to

receive 60% of their monthly baseline support amount each month until the Commission

began disbursing Mobility Fund Phase II support.[31]

Moreover, the Commission recognized the importance of sufficient mechanisms to

phase down legacy support at the time it established the Connect America Fund program nine

years ago. Specifically, in adopting a five-year phased transition period for mobile service

providers receiving universal service support, the Commission explained that "a transition is

desirable in order to avoid shocks to service providers that may result in service disruptions to

consumers."[32]

NERA points out the negative economic consequences that an early transition may visit

on rural Americans:

> To the extent areas are classified as ineligible erroneously—i.e.,
> excluded from 5G Fund support and ultimately not built out with
> 5G service—they will not only not get 5G service but also risk
> losing service that is currently supported by legacy support within
> two years of the effective date of the rules.[33]

---

[30] *Id*. (quoting *Financial Services and General Government Appropriations Bill*, 2016, Report of S. Comm. on Appropriations, S. REP. No. 114-97, at 80 (July 30, 2015)).

[31] *Id*. at p. 27.

[32] *Connect America Fund*, *et al*., WC Docket No. 10-90, *et al*., Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17830 (¶ 513) (2011) ("*USF-ICC Transformation Report and Order*").

[33] *NERA Paper* at p. 11.

NERA suggests that the better course is to transition support away from legacy areas when the auction concludes, which will allow carriers to design networks with complete information about where 5G Fund support will be provided.[34]

The Coalition also objects to the use of RUCA Code areas to trigger the phase down of legacy support in ineligible areas. Any final list of eligible areas, which presumably will include disaggregated support areas for legacy carriers, must be based on accurate mapping data, not a decade-old proxy. RUCA Codes are untested and lack any connection to where rural carriers have constructed networks and currently provide service.[35] Such a scheme is far afield from the essential purpose of the 2016 Appropriations Act, which is to usher in an orderly transition pursuant to which support under the new program commences with the phase down. Eliminating any gap between further phase downs and the date on which support under the new program commences has been the entire purpose behind Congress' continuing legislative commands to the Commission on this matter.

---

[34] *Id*. at p. 12.

[35] The Coalition agrees with the concerns expressed by Verizon regarding the Commission's proposal to rely on RUCA Codes:

> Under that proposal, which would define as eligible any census tract associated with the U.S. Department of Agriculture's [RUCA] 5-10, as much as 67 percent of the nation's land area (excluding Alaska, Puerto Rico, and the US Virgin Islands) would be eligible for the Phase I auction. A comparison of the RUCA map to maps of 4G LTE deployment shows that much of the proposed eligible area is already served by multiple providers of 4G LTE. Providing universal service support to areas where carriers have already de-ployed towers and backhaul facilities on a widespread basis would be at odds with the Commission's goal of ensuring that mobility funding is cost-effective and targeted to ar-eas that require public funding to receive the benefits of mobility.

Verizon Comments at pp. 6-7 (footnotes and quotation marks omitted).

Accordingly, the Coalition urges the Commission to follow the law that Congress wrote and implement the 5G Fund mechanism before commencing any further phase down of legacy support. To be clear, this means that the phase down should not resume until competitive ETCs actually begin receiving 5G Fund support.[36]

V.   Compliance Measures Must Not Overburden Smaller Carriers.

Coalition members, all of whom have substantial experience participating in Mobility Fund Phase I, assert that the expense and difficulty of performing detailed drive testing to demonstrate mobile wireless coverage and throughput speeds are excessively burdensome. There are more efficient ways to demonstrate that funds have been invested appropriately and that the funded area is being adequately served.[37]

Verizon and AT&T agree, asking the Commission to accord leniency with respect to testing requirements in challenging and inaccessible areas,[38] and not to require three tests per

---

[36] *See* Coalition Comments at p. 30.

[37] *Id*. at pp. 40-41.

[38] Verizon Comments at pp. 9-10; AT&T Comments at pp. 7-11. Verizon lays bare the deficiencies of the Commission's proposed approach:

> As the Commission acknowledges in the *NPRM*, drive testing is especially challenging in the kinds of areas that will receive 5G Fund support. Rural areas receiving 5G Fund support "would likely be the most costly areas for a carrier to drive test, and such tests still may not reach large areas that have coverage but are less accessible for drive tests." The significant cost of drive testing would be reflected in higher bids, which would reduce the area covered by the program.

Verizon Comments at p. 11 (footnotes omitted) (quoting *NPRM*, 35 FCC at 4032 (¶ 111)).

square kilometer throughout an entire funded service area.[39] AT&T and CCA both request that

a carrier demonstrate a speed of 7 Mbps/1 Mbps at the cell edge, and they endorse a 90%

probability at the cell edge with a 50% load factor.[40] Verizon also supports relaxed deployment

obligations within the most challenging areas.[41]

The Coalition agrees with these proposals, and urges the Commission to adopt testing

methodologies and deployment requirements that do not force carriers to spend potentially

millions of dollars to perform three speed tests in every single square kilometer of a served

area, or provide service to areas in circumstances that would demonstrably waste support.[42] A

combination of sample measurements at the cell edge, propagation modeling, and a

reasonable drive testing regime on accessible roads can combine to deliver the same level of

assurance that citizens in rural areas are receiving the intended benefits in the areas where

services are needed.

---

[39] Verizon Comments at p. 13 (footnote omitted) (arguing that "the Commission should not adopt its proposal to require at least three speed tests in every square kilometer grid cell. That approach would require thousands of tests to cover a large area, but would still not yield a statistically valid sample, given the inherent variability of wireless signals.").

[40] AT&T Comments at p. 13; CCA Comments at p. 15.

[41] Verizon Comments at p. 9.

[42] Verizon explains that the Commission's proposed 75% coverage requirement:

> might require carriers to cover large areas of mountainous terrain with virtually no demand, and the [Commission's proposed] adjustment factor would not fully offset the additional costs. To encourage carriers to bid on such challenging census tracts, the Commission should adopt an alternative deployment requirement for challenging census tracts that focuses on road miles and population.

Id. at pp. 9-10 (footnote omitted).

The Coalition disagrees with a proposal made by the California Public Utilities

Commission ("CPUC") to require wireless carriers to deliver 5G coverage to 100% of the funded

area.[43] In many rural areas, there are places with no homes or roads, and no recreational,

industrial, or agricultural activities. In others, there is no fiber infrastructure deployment

anywhere near target cell site locations. The 85% coverage requirement proposed by the

Commission[44] takes into account the need to avoid patently inefficient investments that

otherwise could be made in these circumstances. A 100% coverage requirement would

increase bid amounts and spread limited 5G support more narrowly than an 85% requirement,

with the unfortunate result being the construction of facilities in areas otherwise best left

uncovered, at the expense of other areas that will be denied support where people live, work,

and travel, and need upgraded mobile broadband services.

VI.   T-Mobile Must Not Be Permitted to Use 5G Fund Support to Meet Its Merger Commitments.

No party supports the concept of allowing 5G Fund support to be used to meet T-

Mobile's merger commitments.[45] Even T-Mobile does not oppose limiting its ability to use 5G

Fund support to fulfill its merger commitments, provided that any condition is applied in a

competitively neutral way.[46]

---

[43] CPUC Comments at p. 5.

[44] *NPRM*, 35 FCC Rcd at 4027 (¶ 96).

[45] Verizon Comments at p. 7; Rural Wireless Association Comments at p. 20; CPUC Comments at p. 6; AT&T Comments at p. 13.

[46] T-Mobile USA, Inc. ("T-Mobile"), Comments at pp. 11-12.

Other than having T-Mobile submit accurate maps of where it will build to meet its

merger commitments, no party offers a solution that would allow T-Mobile to participate in the

5G Fund auction.[47] T-Mobile opposes that idea, stating that requiring it to submit maps of its

future deployment plans would be arbitrary and capricious.[48] Even if T-Mobile were required

to submit maps, holding T-Mobile to its commitments or measuring its investments to prevent

cross-subsidization would be a daunting regulatory task. The Coalition does not believe it is

feasible for T-Mobile to participate in the auction.

According to NERA's analysis, (i) it does not appear that allowing T-Mobile to pre-select

areas will minimize total deployment costs, and (ii) pre-selection will misallocate resources and

possibly harm competition.[49] NERA simulated a 5G Fund auction in the State of Missouri and

the results indicate that the overall costs of deployment when allowing pre-selection increase

between 70% and more than 100% in the scenarios it ran.[50] In addition, NERA notes that the

Commission need not permit T-Mobile to pre-select areas in order to avoid inefficient

overbuilding in rural areas.   NERA correctly states that there is no way to completely prevent

overbuilding, as markets are dynamic.[51] Thus, the FCC's goal should be to create strong

---

[47] *See, e.g.,* NTCA Comments at p. 8, n.15.

[48] T-Mobile Comments at pp. 2-3.

[49] *NERA Paper* at pp. 5-8.

[50] *Id.* at pp. 5-6.

[51] *Id*. at p. 8.

incentives for participants to consider the likely build-out plans of competitors, and the best way to do that is through a well-designed competitive auction, based on accurate maps.[52]

While T-Mobile seeks competitive neutrality, the Coalition notes that T-Mobile already has a significant advantage by virtue of the fact that it, and only it, can know where it will (or may) build to meet its merger requirements. If T-Mobile were permitted to participate in the 5G Fund auction, it would have the ability to cherry pick the entire nation to best suit its strategy to maximize 5G Fund support, to cross-subsidize its merger commitments, and to harm competition.[53] This is not to be critical of T-Mobile's motives—preventing cross-subsidization is a fundamental problem commonly addressed by regulators seeking to minimize incentives for anticompetitive behavior.

Accordingly, the Coalition sees no other option than to bar T-Mobile from the 5G Fund auction, until such time as its merger commitments are completed. Rural consumers, who are the statute's focus, will be best served by not risking the possibility that scarce universal service funds wind up paying for the costs of T-Mobile's compliance with its merger commitments.[54]

---

[52] *Id.* at pp. 8-9.

[53] NERA illustrates how easy it would be for T-Mobile to prevent competing carriers from obtaining support needed to justify participation in the auction by strategically pre-selecting geographic areas. *Id*. at pp. 6-7.

[54] Although the ink is barely dry on its merger approval, T-Mobile is already asking the CPUC for significant changes to the CPUC's approval order, citing "changed circumstances that have developed since the adoption of the Decision." *Joint Application of Sprint Communications Company L.P. (U-5112-C) and TMobile USA, Inc., a Delaware Corporation, For Approval of Transfer of Control of Sprint Communications Company L.P. Pursuant to California Public Utilities Code Section 854(a), et al.*, Application 18-07-011, *et al*., Joint Applicants' Petition for Modification of Decision 20-04-008 (filed June 22, 2020), at p. 1, *accessed at* https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M340/K668/340668671.PDF.

Allowing T-Mobile to have such a significant advantage, whatever its motives, would be perhaps the least competitively neutral outcome possible.

VII.   The Commission Should Not Exclude from the 5G Fund Auction Areas That T-Mobile May Serve in the Future; It Should Rely Solely on Accurate Maps Depicting Actual Coverage.

In addition to barring T-Mobile from participating in the 5G Fund auction, the Commission should not rely on any general deployment commitment T-Mobile may make as a basis for removing an area from eligibility for support in the Phase I auction. As the Coalition has explained, allowing T-Mobile, in effect, to pre-select areas for removal from the bidding process would undermine the Commission's goal of using 5G Fund support to maximize rural coverage,[55] and also "would grant T-Mobile a valuable first-mover competitive advantage by granting it the right to pre-select its 5G Fund territories without facing competition from other carriers ...."[56]

There is an additional reason that should lead the Commission to reject any mechanism that would remove areas from eligibility for 5G Fund support solely based on T-Mobile's promise that it will, at some point, deploy broadband in those areas. Rather than making presumptions concerning when, where, and to what extent T-Mobile will deliver on its merger-related promises, the Commission should rely exclusively on accurate maps to exclude from eligibility _only_ those areas that _currently_ have access to 5G service. Reliance on accurate maps

---

[55] Coalition Comments at p. 18.

[56] _Id_. at p. 19.

depicting actual, current coverage is the best way for the Commission to ensure that 5G Fund

support will maximize rural coverage.

The Coalition notes that the Commission has expressed concern that, "if we do not

adequately account for T-Mobile's [broadband deployment] commitments, we risk using finite

universal service 5G Fund support to overbuild areas where T-Mobile already has an

enforceable obligation to deploy."[57] There are sound reasons for concluding that this is a

minimal risk, and that excluding areas designated by T-Mobile from the 5G Fund auction would

run a greater risk.

As the Commission indicates in the *NPRM*, based on analysis by its staff, even if T-

Mobile were to meet all its merger-based broadband build-out commitments, these

commitments "could still leave up to approximately 81% of the rural land area of the United

States uncovered."[58] Because T-Mobile's commitment is population-based and is a nationwide

commitment, it can be met by building 5G in a much smaller area than would result from a

geographic commitment.[59] Whatever its motives, T-Mobile's commitment was not designed to

deliver 5G service throughout 90% of where rural Americans live, work, and travel. Given the

options that T-Mobile will have for selecting areas where it will deploy broadband to meet its

merger commitments, and given the Commission staff's findings that, even if T-Mobile fully

---

[57] *NPRM*, 35 FCC Rcd at 4003 (¶ 23).

[58] *Id*.

[59] *See* Coalition Comments at p. 17. As the Coalition explains, "[s]uch is the nature of a population com-mitment in a nation that is both overwhelmingly urban in population and rural in geography." *Id*. at p. 18 (footnote omitted).

17

complies with its commitment, large expanses of rural lands across the country will remain uncovered, it is reasonable to conclude that the Commission's concerns regarding overbuilding should not be given any significant weight.

In the Coalition's view, a more serious concern lies in a different direction. Specifically, if the Commission decides to rely on T-Mobile's "phantom" maps of potential future 5G coverage as a basis for excluding service areas from 5G Fund eligibility, there is a risk that T-Mobile will ultimately decide to meet its merger commitment without deploying 5G broadband in areas that have been excluded from Phase I auction eligibility. T-Mobile faces no restrictions on how it meets is coverage commitment—it can change plans as many times as it wishes without oversight.

By allowing T-Mobile to file phantom maps that exclude from the auction areas that need support, based on a commitment that can be rescinded at any time, the Commission risks stranding rural areas and the citizens who live there from receiving needed support for a decade. The possibility of this happening must be minimized, and it can be minimized, by basing 5G Fund eligibility solely on accurate maps depicting current 5G coverage, filed by all carriers, including T-Mobile.

VIII. The Commission Should Reject Requests from Satellite Providers to Reduce Performance Standards and Lower Customer Expectations.

Late last year, Chairman Pai properly shifted gears and decided that Mobility Fund II

support should be invested in the latest 5G technology.[60] The Coalition supports this endeavor,

and believes that rural citizens would too, as these investments will bring rural areas closer to

reasonable comparability with urban and suburban areas. To the extent there should be any

reduction in performance standards, they should be limited to those necessary to expand

terrestrial mobile voice and broadband services, which rural citizens need most.[61]

Satellite carrier SES Americom has proposed increasing the minimum latency standard

from 100 ms to 200 ms.[62] This proposal should be rejected. The Commission has consistently

stated that a key measure of 5G performance, to ensure reasonably comparable service, is low

latency, defined as sub 100 ms.[63] In fact, among the major carriers, 4G LTE networks commonly

operate at latency levels well below 100 ms, and 3G networks commonly operate at levels well

---

[60] *Chairman Pai Announces Plan to Launch $9 Billion 5G Fund for Rural America*, FCC News (Dec. 4, 2019), at p. 1 (quoting Chairman Pai) ("I will move forward as quickly as possible to establish a 5G Fund that would bring next-generation 5G services to rural areas and would reserve some of that funding for 5G networks that promote precision agriculture. We must ensure that 5G narrows rather than widens the digital divide and that rural Americans receive the benefits that come from wireless innovation."), *accessed at* https://docs.fcc.gov/public/attachments/DOC-361168A1.pdf.

[61] For example, if the Tribal budget is fixed, the Commission may consider adjustments to speed requirements on remote Tribal lands where it is infeasible to extend fiber to towers. SBI has argued that, although the Commission should be commended for its proposal in the *NPRM* to increase the Tribal Reserve Budget, *NPRM*, 35 FCC Rcd at 4011 (¶ 48), there is no way to know whether the proposed increase will be sufficient, and the Commission should be prepared to provide additional funding if necessary. SBI Comments at pp. 15-16.

[62] SES Americom, Inc. & O3b Limited ("SES Americom") Comments at pp. 2-3.

[63] *See, e.g., Connect America Fund, et al.*, WC Docket No. 10-90, *et al.*, Second Order on Reconsideration, 33 FCC Rcd 2540, 2554 (¶ 23) (2018).

below 200 ms.[64] Accordingly, for the FCC to step backward to a 200 ms latency standard, it would need to justify spending scarce universal service support for 5G on technologies that would potentially deliver sub-3G performance.

Satellite providers, which have constructed networks based on a business model that assumes a return on investment without support funds, have never been required to demonstrate why their technology requires support to provide services in rural areas. Support should focus first on investments in terrestrial infrastructure in areas where there is no business case for deployment. Citizens rely on their mobile devices and increasingly expect to access services everywhere they live, work, and travel.

Moreover, terrestrial 5G networks are capable of delivering technologies that industries need today, such as, for example, Ultra-Reliable Low-Latency Communication ("URLLC"). Low-latency technologies such as URLLC will proliferate in urban areas that have dense 5G networks, enabling new applications that will power our nation's industries.[65] It is critical for rural areas to keep up if they are to remain competitive in the marketplace for industrial companies to

---

[64] *See, e.g.,* Statista, *Average 4G and 3G network latency by provider in the United States in 2019 (in milliseconds)* (June 5, 2020) (revealing average network latency measurements for 4G LTE networks among the major carriers to be between 47.2 and 54 ms, while 3G networks ranged between 74.2 and 127.1 ms), *accessed at* https://www.statista.com/statistics/818205/4g-and-3g-network-latency-in-the-united-states-2017-by-provider/.

[65] *See*, *e.g.*, L.M. Ericsson, *Achieving industrial automation protocols with 5G URLLC, Taking factory automation to the next level*, *accessed at* https://www.ericsson.com/en/networks/cases/accelerate-factory-automation-with-5g-urllc (stating that "[t]hanks to the ultra-low latency and reliability of 5G URLLC, if a factory worker reaches into [a robot] cell [used for industrial automation purposes] the robot will instantly stop, making it safe for personnel not to be harmed whilst working with the machines. This instant response with guaranteed reliability is not possible through traditional Wi-Fi or previous-generation mobile networks, meaning that these machines have historically required restrictive wired technology.").

locate. Accordingly, the Commission should focus 5G Fund support solely on terrestrial 5G networks that are capable of powering low-latency applications serving both industry and consumers.

IX. Coalition Members Are Using Legacy Support for the Benefit of Rural Citizens.

In the *NPRM*, the Commission states:

> The absence of broadband public interest obligations and performance requirements does a disservice to rural Americans living in areas served by legacy support recipients because our rules do not specify that such recipients must deploy the most current wireless technologies or expand their services to meet current standards.[66]

This statement is inconsistent with the experience of each of the carriers participating in these Reply Comments. While the rules do not require legacy support carriers to deploy the most current wireless technologies, each of the signatories below has done just that. Each has installed a 4G LTE network core and has customers using compatible mobile devices. Some are prepared to move to 5G with a simple upgrade, while others have the technology in place, but are constrained from doing so by the presence of Huawei equipment in their networks. Still others, such as SBI, are constrained from extending 4G LTE throughout their networks by the lack of sufficient high-cost support, which is preventing SBI (or any other carrier) from connecting cell towers located in remote areas to fiber facilities.

---

[66] *NPRM*, 35 FCC Rcd at 4022 (¶ 84) (footnote omitted).

Each company unequivocally states that it has upgraded technologies and coverage to the extent possible with available support. For example:

- Rural consumers have benefited from U.S. Cellular's continued use of legacy support. Since the FCC's adoption of the 2011 *USF-ICC Transformation Report and Order*, U.S. Cellular has invested legacy support to expand and upgrade its network, bringing LTE/VoLTE to approximately 6,700 cell sites, the majority of which are located within the company's ETC service territory. In addition, the company has deployed LTE-Advanced to 850 cell sites and 5G to 580 cell sites.

- U.S. Cellular's investments have delivered superior service. In J.D. Power's latest survey of wireless quality, U.S. Cellular ranked first in the North Central Region, which includes Wisconsin, one of U.S. Cellular's largest deployments using legacy support in overwhelmingly rural geographies.[67]

- Over the years, C Spire has built hundreds of new cell sites using legacy high-cost support in rural areas that would not otherwise see investment. In just the past five years, the company has invested nearly $500 million in operating expenses to maintain this network, and made over $52 million in capital expenditures, which includes the construction and upgrades of several hundred additional 4G LTE cell sites.

- SBI has used legacy support to build over 200 cell sites on remote Tribal and near-Tribal lands, delivering mobile and fixed voice and broadband services into many areas that had no services prior to its entry. It has expended hundreds of millions of dollars in capital and operating expenses, and has provided the Commission with plans to invest additional sums as needed.[68]

---

[67] *Increased Wi-Fi Calling Gives Perception of Increased Wireless Network Quality, J.D. Power Finds, Verizon Wireless Delivers Best Network Quality Across Five U.S. Regions, U.S. Cellular Ranks Highest in North Central Region*, J.D. Power, Press Release (July 16, 2020), *accessed at* https://www.jdpower.com/sites/default/files/file/2020-07/2020079v2%20U.S.%20Wireless%20Network%20Quality%20Vol%202.pdf.

[68] *See* SBI Comments, filed on June 25, 2020, in this rulemaking proceeding, *accessed at* https://ecf-sapi.fcc.gov/file/106250023905491/2020%200625%20SBI%205G%20Fund%20Comments%20FINAL.pdf.

X. Conclusion.

The Coalition thanks the Commission for moving forward on a 5G Fund auction and

appreciates the opportunity to provide these Reply Comments for consideration in this

proceeding.

       Respectfully submitted,

       COALITION OF RURAL WIRELESS CARRIERS

By: _____

       David A. LaFuria
       John Cimko
       Its Attorneys

       LUKAS, LAFURIA, GUTIERREZ & SACHS, LLP
       8300 Greensboro Drive, Suite 1200
       Tysons, Virginia 22102
       (703) 584-8678
       dlafuria@fcclaw.com

July 27, 2020

<u>**EXHIBIT A**</u>

Maximizing the Benefits of the 5G Fund for Rural America

NERA Economic Consulting

July 2020

NERA
ECONOMIC CONSULTING

Maximizing the Benefits of the 5G Fund for Rural America

Jeffrey A. Eisenach
Hector Lopez

July 2020

Contents

I.   Introduction

We have been asked by the Coalition of Rural Wireless Carriers to provide an economic assessment of certain aspects of the Federal Communications Commission's (FCC or Commission) proposals for implementing the 5G Fund for Rural America (5G Fund).[1] Specifically, we have been asked to consider: (1) the proposed structure of the reverse auction, especially as it relates to the pre-existing deployment commitments of T-Mobile; (2) issues related to auction timing and the benefits of having accurate information about existing wireless deployments; and, (3) issues related to the transitioning and phase-down of legacy support programs.

To summarize, we conclude:

- The extent of 5G deployment in the U.S. will be based on interactions among individual carriers' assessments of a complex and dynamic set of factors, including but not limited to projected costs, demand, likely technological developments, market competition and government interventions (including the 5G Fund). It is impossible, *ex ante*, to forecast with precision the results of this inherently stochastic process.

- Carriers participating in the 5G Fund auction have strong incentives to assess all of these factors, including the likely deployment footprints of competitors and the economic implications of overbuilding, and to structure their bids accordingly. Thus, rather than being overly concerned about limiting support to areas where models suggest unsubsidized deployment may not occur, the Commission should define eligibility criteria broadly and allow market forces, acting through the auction, to determine how support is allocated among areas.

- In this context, the Commission's proposal to require T-Mobile to pre-identify rural areas where it plans to deploy 5G service to satisfy the deployment commitments in the Commission's T-Mobile-Sprint Order,[2] and then exclude those areas from eligibility for 5G Fund support, would distort the auction, result in inefficient 5G deployment patterns, and potentially harm competition.

- The availability of accurate information regarding current deployment patterns will enhance the ability of all carriers to make economically efficient deployment decisions, especially decisions regarding marginal deployments in areas targeted for 5G Fund support. Accordingly, the efficiency of the 5G Fund auction is likely to be significantly enhanced if the auction is held after the Digital Opportunity Data Collection (DODC) is complete.[3]

---

[1] Federal Communications Commission, *In the Matter of Establishing a 5G Fund for Rural America, Notice of Proposed Rulemaking and Order*, GN Docket No. 20-32 (April 24, 2020) (hereafter *NPRM*).

[2] Federal Communications Commission, *In the Matter of Applications of T-Mobile and Sprint for Consent to Transfer Control of Licenses and Authorizations, Memorandum Opinion and Order, Declaratory Ruling, and Order of Proposed Modification*, WT Docket No. 18-197 (November 5, 2019) (hereafter *T-Mobile-Sprint Order*).

[3] We understand the Coalition of Rural Wireless Carriers has suggested it should be possible to complete the DODC process in time to hold a 5G Fund auction in 2022 rather than 2023, as suggested in the *NPRM*. See e.g.,

- The uncertainties inherent in predicting which marginal areas are likely to require 5G Fund support imply that the Commission's proposal to withdraw legacy support from "ineligible" areas on an expedited basis could result in premature service reductions in areas where continuing support could result in enhanced deployment, including deployment of 5G.

The remainder of this white paper is structured as follows. In Section II we discuss the complexity and dynamism of the economic factors that will govern carriers' deployment decisions. In Section III, we explain the implications of that discussion for the design of the 5G Fund, including issues relating to T-Mobile's merger commitments, auction timing, and legacy support. Section IV briefly summarizes our conclusions.

II.   The Economics of 5G Deployment

The available evidence demonstrates that rapid and extensive deployment of 5G wireless networks is in the public interest and will generate significant benefits. Compared to 4G networks, 5G networks will be up to 100 times faster, connect up to 100 times more devices, transport over 1,000 times more traffic, and exhibit significantly reduced latencies.[4]

Economic evidence also demonstrates that the optimal pattern of 5G deployment is more likely to result from market-based decisions than from administrative mandates. The economic value of 5G deployments at the margin will depend on a multitude of factors which are both complex and impossible to predict in advance. Thus, for the same reasons that market mechanisms are superior to administrative allocations for allocating electromagnetic spectrum to its highest valued uses,[5] market mechanisms should be relied upon to the maximum extent possible in allocating support for 5G deployments – that is, because firms will direct 5G investments to areas where the expected long-run profits are highest.[6]

The process of designing, deploying and operating mobile wireless networks is extremely complex. For example, in its *5G Guide*, the GSMA devotes approximately 300 pages to an overview of the primary factors carriers need to consider to determine whether a deployment will be profitable.[7] Factors affecting long-run incremental revenues include the presence of existing substitutable services (e.g., 4G service from the same or other providers); the availability of complementary

---

Coalition of Rural Wireless Carriers, *In the Matter of Establishing a 5G Fund for Rural America, Comments of the Coalition of Rural Wireless Carriers,* Federal Communications Commission, GN Docket No. 20-32 (June 25, 2020) at ¶¶13-17; see also The National Association of Regulatory Utility Commissioners, *In the Matter of Establishing a 5G Fund for Rural America, Comments of the Coalition of Rural Wireless Carriers,* Federal Communications Commission, GN Docket No. 20-32 (June 25, 2020) at ¶15.

[4] GSMA, *The 5G Guide: A Reference for Operators* (April 2019) (hereafter *5G Guide*) (available at https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf).

[5] Ronald Coase, "The Federal Communications Commission," *The Journal of Law and Economics* 2;1 (1959) 1-40.

[6] *See generally*, Federal Communications Commission, *In the Matter of Establishing a 5G Fund for Rural America, Public Notice: Office of Economics and Analytics and Wireline Competition Bureau Seek Comment on Adjustment Factor Values for the 5G Fund*, GN Docket No. 20-32 (June 5, 2020) at ¶15 (hereafter *Adjustment Factors PN*) (noting that 5G deployment will occur where expected long-run revenues exceed expected long-run costs).

[7] *5G Guide.*

services (e.g., applications offering relevant local content or services); the number of customers and willingness to pay for particular levels of 5G service; and many others. Factors affecting long-run incremental costs include the availability, price, and access conditions of existing infrastructure (e.g., fiber connectivity); the availability of spectrum; topography; the amount of area to the covered; and, the capacity required to provide the expected level of service.

Both revenues and costs are likely to be highly correlated across geographically contiguous areas. Unlike fixed networks, mobile networks offer connectivity across geographies. An operator determining whether to deploy a 5G network in a given census tract must consider the impact of mobility in and out of the census tract. On the revenue side, the operator is likely to consider the additional revenue of offering roaming or wholesale access to other operators who have not entered the census tract. On the cost side, the operator must consider the likelihood of paying for access for its customers when they leave the census tract in which they reside. Consequently, an operator may optimally decide to deploy a given network architecture in areas much larger than census tracts to account for the impact of subscribers' mobility. Furthermore, the availability of spectrum may reinforce the correlation across contiguous areas. For example, an operator may need to consider whole Partial Economic Areas (PEA) to match its deployment plans and current and potential future spectrum holdings.

In addition, carriers' expectations of future revenues and costs are interdependent across carriers. For example, a carrier's expected revenue in a given area is likely to be decreasing as a function of the number and quality of other networks deployed in the same and surrounding areas. Similarly, the cost of deployment may increase as a result of increased competition for inputs (e.g., backhaul, spectrum rights). Thus, carriers can be expected to internalize their expectations of other carriers' deployment decisions in assessing the viability of their own.

Finally, all of these factors are subject to significant uncertainty. For example, long-run revenues ultimately will be affected by factors such as population shifts, changing traffic patterns, competitor deployments, and the pace of adoption of specific 5G use cases. Similarly, deployment costs will be affected by changes in technologies and markets, such as the pace of development of ORAN,[8] and government policies, such as those affecting the availability of spectrum.

III. Implications for the 5G Fund

The complexity, uncertainty, and dynamism associated with 5G deployment have important implications for the design of the 5G Fund, including specifically the Commission's proposed approach to choosing eligible areas and addressing the "overlap" between T-Mobile's merger commitments and the 5G Fund, the timing of the auction in relation to the availability of improved mapping information, and the way in which legacy support is phased out and replaced by 5G Fund support. In this section, we describe what we regard as the most significant of these implications. In the first section, we explain why requiring T-Mobile to pre-select deployment areas, and then removing those areas from auction eligibility, would be inefficient and potentially harmful to

---

[8] See e.g., Steve Libbey, "Reimagining Deployment Economics with Parallel Wireless OpenRAN," Parallel Wireless (March 31, 2020) (available at https://www.parallelwireless.com/reimagining-deployment-economics-with-parallel-wireless-openran/) ("Analysts' projections from ReTHINK show the costs of building 5G macro-cell networks will fall by 50% if deployments incorporate open architectures.").

competition. The second section discusses the implications of complexity, uncertainty and dynamism for auction timing. The third section discusses the implications for the proposed transition away from legacy support.

A. Area Eligibility and the T-Mobile Commitments

The overarching objective of the 5G Fund is to "close the digital divide and to make sure that parts of rural America are not left behind."[9] To advance this goal, the Commission proposes to allocate $9 billion in subsidies (over a 10-year period) to support deployment of 5G service to rural America. Phase I would allocate up to $8 billion, including $680 million to support 5G networks serving Tribal lands, and Phase II would allocate up to $1 billion to support 5G networks that will facilitate precision agriculture. The *NPRM* proposes to allocate Phase I support using a competitive bidding process, i.e., a reverse auction.

A central issue for the design of the Fund is to determine which areas should be eligible to receive support. As we discuss further in the next section, the *NPRM* puts forward two basic options for determining eligibility. Whichever option is selected, the Commission must decide how to address carriers' pre-existing rural deployment commitments – most notably those of T-Mobile, which has committed to deploy 5G services to 90 percent of rural Americans within six years.[10]

As the *NPRM* explains, T-Mobile's deployment commitment raises two sets of concerns. First, the Commission finds that it would be "inappropriate" to allow T-Mobile to use high-cost support to deploy 5G service in areas to which it already committed based on its merger conditions. Second, it worries that failing to account for T-Mobile's commitments would "risk using finite universal service 5G Fund support to overbuild areas where T-Mobile already has an enforceable obligation to deploy,"[11] and frustrate the goal of "redirecting high-cost support to those areas where voice and 5G broadband service would not otherwise be deployed absent support…."[12]

The *NPRM* proposes two mechanisms for addressing these concerns. Under the first option, T-Mobile would be allowed to make pre-auction binding commitments to deploy 5G services in eligible areas within the adopted deployment milestones for the 5G Fund, in effect pre-awarding those areas to T-Mobile at a $0 bid price, and otherwise prohibit T-Mobile from participating in the bidding process.[13] Under the second option, the Commission would permit T-Mobile "to identify areas before the auction where it intends to deploy 5G service and remov[e] these areas

---

[9] *NPRM* at ¶2.
[10] *NPRM* at ¶133. T-Mobile commitments are detailed in *T-Mobile-Sprint Order* at ¶25-¶32. As the *NPRM* correctly notes, T-Mobile's commitment does not obviate the need for additional support because as much as 81 percent of the rural land area of the U.S. could still remain uncovered. *NPRM* at ¶23. T-Mobile comments that if the Commission's intention is to avoid overbuilding, the Commission may need to consider all other commitments by other operators. For example, AT&T commitments regarding FirstNet. See T-Mobile, *In the Matter of Establishing a 5G Fund for Rural America, Ex-Parte*, Federal Communications Commission, GN Docket No. 20-32 (April 16, 2020) (hereafter *T-Mobile Ex-Parte*).
[11] *NPRM* at ¶23.
[12] *NPRM* at ¶24.
[13] *NPRM* at ¶130.

from the list of areas eligible to win support in the auction."[14] The Commission also seeks input on alternative approaches.[15]

As we explain below, our analysis shows that the central element of both proposals – requiring T-Mobile to commit in advance where it will deploy and excluding those areas from 5G Fund eligibility – would result in multiple economic distortions, including: (1) it would frustrate the central objective of the market-based reverse auction process by virtually guaranteeing that deployment is not carried out by the lowest cost provider; (2) it would potentially harm competition by allowing T-Mobile to choose service areas in order to achieve advantages over its competitors; and, (3) it would lock T-Mobile into a fixed and thus suboptimal deployment plan. As we further explain, pre-selection by T-Mobile is not necessary to prevent inefficient overbuilding: The optimal level of overbuilding will more likely be achieved by the interactions of rational actors in the marketplace than by administrative fiat.

1. Pre-Selection by T-Mobile Would Not Minimize Total Deployment Costs

The socially optimal utilization of 5G Fund support requires that support for each area be directed to the carrier that can economically deploy 5G services at the lowest net cost. Indeed, the central objective of a well-designed reverse auction process is to achieve (or at least approximate) precisely this result by using the price mechanism to discover the lowest-cost solution.

The *NPRM*'s T-Mobile pre-selection proposal would directly prevent the desired outcome because it would ensure that a significant proportion of marginal 5G deployments are not carried out by the lowest cost provider. This result is the inevitable consequence of the fact that T-Mobile will rationally select deployment areas based on its own private costs of deployment, which differ (and will in many cases exceed) minimum social cost.

Conceptually, the point is illustrated by a simple example. Consider two census tracts, A and B. Suppose that T-Mobile can provide 5G for a net deployment cost of $300 in A and $500 in B; and, another operator can provide 5G in A for a net deployment cost of $200 in A and $700 in B. If T-Mobile selects areas first, it will select A (i.e., it will minimize the cost of complying with its commitments). The other operator will select B. The total cost for society is $1,000. However, the socially optimal solution is for T-Mobile to cover B for $500 and for the other operator to cover A for $200, for a total of $700. In this example, the social cost of the T-Mobile pre-selection rule is $300.

To more formally illustrate the extent of the resource misallocation that would result from T-Mobile pre-selection, we simulated a 5G Fund auction in the state of Missouri. We considered two scenarios for T-Mobile selection, one in which T-Mobile pre-selects areas providing coverage to 90 percent of the rural population and the second in which it pre-selects 100 percent of the population.[16]

---

[14] *NPRM* at ¶131.

[15] *NPRM* at ¶132.

[16] The 100 percent coverage assumption is included to capture the likelihood that T-Mobile will meet its commitments by deploying more extensively in some states than others.

Figure 1 below shows the impact that T-Mobile selections would have on 5G Fund eligibility in Missouri. In the 90 percent scenario, the effect would be to remove 249 of 310 otherwise eligible census tracts from 5G Fund eligibility; if T-Mobile pre-selected 100 percent of the Missouri rural population, there would be no remaining eligible tracts.

FIGURE 1:
AUCTION ELIGIBILITY WITH PRE-SELECTION

90 Percent Pre-Selection	100 Percent Pre-Selection
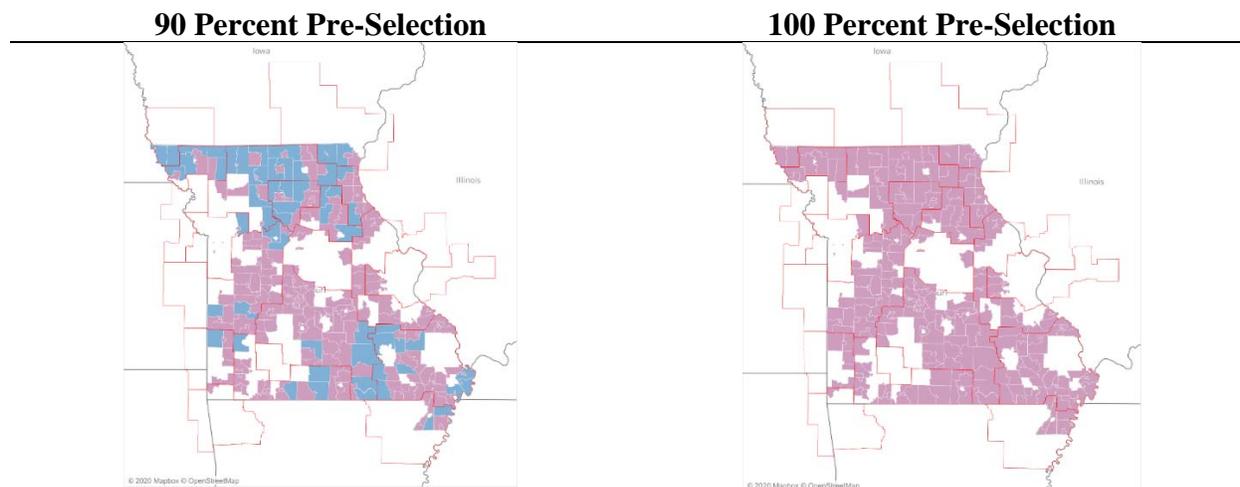
Note: T-Mobile selected areas shown in magenta. Blue areas remain eligible for the auction.

As we explain fully in Appendix A, our simulation shows that the social cost imposed by pre-selection is increasing in the heterogeneity of carriers' deployment costs (and hence required levels of support); and, that under reasonable assumptions about heterogeneity, the social costs of pre-selection are significant compared with the simulated results of a competitive auction. For example, we show that, if the support required by an operator in the 75th percentile of the cost distribution is 52 percent higher than the support needed by an operator in the 25th percentile, then pre-selection increases the total social cost by about 25 percent in the 90 percent scenario and by 41 percent in the 100 scenario. In short, allowing pre-selection creates the potential for a significant excess expenditure of support, which would necessarily reduce the 5G Fund auction's overall 5G coverage footprint and corresponding social benefit.

## 2. Pre-Selection by T-Mobile Could Harm Competition

A second problem with the proposed pre-selection rules is that they would give T-Mobile the incentive and the ability to behave strategically in its deployment commitments.[17] For example, T-Mobile could pre-select a subset of the census tracts that compose each PEA to reduce the viability of competitors' plans for future deployment. Consider, for example, an operator which is considering deploying 5G in the Rolla, Missouri (PEA 150) using C-Band spectrum, and that

---

[17] To be clear, we are not suggesting that such strategic conduct would be inappropriate in any way. To the contrary, if the Commission were to establish rules that permit it to do so, we would expect T-Mobile (or any other profit-maximizing firm) to act strategically within those rules. Rather, our point is that the Commission should not establish rules that distort the market to strategically advantage one competitor over others.

the operator needs to deploy throughout the PEA to justify acquiring the necessary C-Band licenses. Suppose the operator requires total support of $1,000 and that the total reserve support level for the 58 eligible tracts (the 58 tracts out of 84 for which the RUCA code is five or greater) is greater than $1,000. In this case, this operator (and any similarly situated operators) have an opportunity to compete effectively both for 5G Fund support and for licenses in the upcoming C-Band auction.

In this scenario, pre-selection would give T-Mobile a clear opportunity for strategic behavior. By pre-selecting a subset of otherwise eligible tracts (and thus excluding them from eligibility for 5G Fund support), T-Mobile could ensure that the total reserve support level for remaining eligible areas is less than $1,000, as illustrated in Figure 2. The effect would be to prevent competing carriers from receiving the 5G Fund support needed to justify participation in the C-Band auction, thus effectively reducing competition and potentially leaving significant areas of the PEA without 5G service.

FIGURE 2:
STRATEGIC SELECTION IN ROLLA, MISSOURI
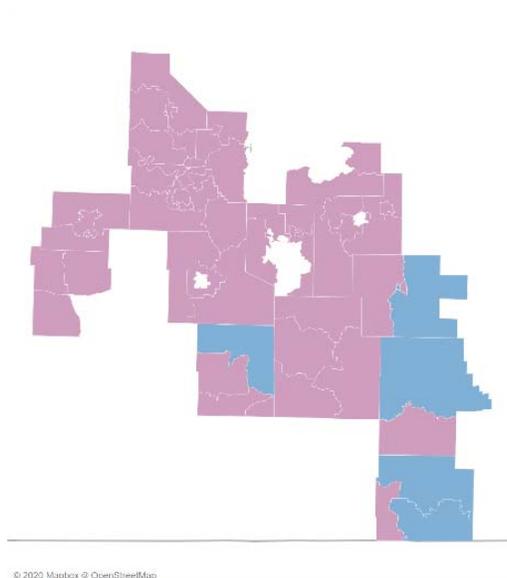
Note: T-Mobile selected areas shown in magenta. Blue areas remain eligible for the auction.

The competitive effects of such an outcome would not be limited to specific PEAs. For example, the Rolla PEA connects the cities of Columbia and Springfield; thus, the ability of a mobile operator to compete effectively in these areas could be adversely affected by its inability to deploy infrastructure between these areas, and/or the increased costs of having its customers roam on another network while passing through Rolla.

3. Pre-Selection would Lock T-Mobile Into an Inefficient Deployment Plan

Third, for the reasons described in Section II above, we agree with T-Mobile that requiring T-Mobile to pre-commit to a precise network footprint six years in advance of its completion would be inherently inefficient. As T-Mobile explains in its comments, its "precise deployment plans are…subject to changes and refinements in light of marketplace realities and conditions on the

7

ground. Population shifts, development of new communities and highways, unforeseen difficulties and delays in construction are among a few reasons why deployment plans may change."[18] As we explain above, the factors listed by T-Mobile are only a small subset of the many dynamic aspects of the 5G marketplace.

4. T-Mobile Pre-Selection is Not Necessary to Avoid Inefficient Overbuilding

While we acknowledge that the Commission has an interest in maximizing the impact of the limited funds available to support marginal deployment of 5G services, we do not believe that the proposed T-Mobile pre-selection rules are necessary to avoid inefficient overbuilding. To the contrary, a well-designed competitive auction will provide strong incentives for participants to consider the likely build-out plans of competitors in crafting their bids.

As a preliminary matter, it should be obvious from the discussion above that it is neither possible nor desirable for the Commission to prevent all overbuilding in areas receiving 5G Fund support. To the contrary, neither any one party nor even all parties taken together have the information necessary to predict where 5G services will ultimately be deployed. And while more information (such as more accurate maps of existing deployments) would allow all market participants to make more accurate (and thus more efficient) plans, no amount of information about current deployments can eliminate the uncertainties inherent in the dynamic nature of 5G markets and technologies. Hence, the proper question for the Commission is not how to prevent overbuilding, but rather how to achieve the most efficient level of overbuilding. As we explain below, the best way to achieve this goal is through a well-designed auction mechanism.

Moreover, overbuilding of areas receiving 5G Fund support will in many cases be welfare-enhancing. *Ex ante*, overbuilding may be socially optimal due to uncertainty and interdependencies across geographies and operators – different carriers may have different predictions about the economics of building out a particular area, for example due to having different assumptions about traffic growth, future use cases, or competitors' strategies. Overbuilding may also be optimal *ex post*, both because overbuilt areas may enjoy better service and lower prices as a result of intensified local competition and because the benefits of having a particular carrier serving an area are not limited to that area but rather are spread across the carrier's entire network and customer base.

Most important, the Commission should recognize that operators have strong incentives to account for the expected investment decisions of other operators when deciding where to deploy 5G. The ability to combine the collective wisdom of all market participants in the dynamic allocation of economic resources is the essential feature of market mechanisms in general, and the primary motivation for the use of auctions in the allocation of both spectrum and, in this case, subsidies.

---

[18] See *T-Mobile Ex-Parte*. See also T-Mobile, *In the Matter of Establishing a 5G Fund for Rural America, Comments of T-Mobile*, Federal Communications Commission, GN Docket No. 20-32 (June 25, 2020) at 9 ("It is also highly impractical for T-Mobile to identify the precise contours of its coverage area six years in advance. T-Mobile's precise deployment plans are not fixed and are, of course, subject to changes and refinements in light of marketplace realities and conditions on the ground. Population shifts, development of new communities and highways, unforeseen difficulties and delays in construction are among a few reasons why deployment plans may change. As a result, a provider's tentative deployment plans are not a firm basis for predicting the exact census tracts where 5G coverage will be lacking….").

Analogous to the long-standing <u>price discovery</u> precedent in spectrum auctions,[19] the Commission should consider <u>support discovery</u> as the main mechanism to allocate support.[20]

To illustrate the benefits of market-based price discovery in this context, we develop a simple example of the strategic interactions among operators in the 5G Fund auction. The example, detailed in Appendix B, compares three scenarios: i) the Commission selects areas where it believes T-Mobile will deploy and removes them before the auction; ii) T-Mobile pre-selects areas which are removed from auction eligibility; and, iii) T-Mobile selects areas to serve after the auction is held. The illustration demonstrates that under reasonable assumptions, net social costs are minimized by allowing the outcome to be dictated by the manifestation of carriers' rational expectations through the market-based auction mechanism, not pre-selection by either the Commission or T-Mobile.

B. Accurate Maps and Auction Efficiency

As noted above, the *NPRM* proposes two approaches for determining which areas would be eligible for 5G Fund support. Under Option A, the Commission would base eligibility on the U.S. Department of Agriculture's Rural-Urban Commuting Area (RUCA) classifications, designating as eligible all census tracts with RUCA codes 5-10 (except any census blocks within those areas that are urban or water-only). By using RUCA codes, the Commission expects it would be able to proceed with the Phase 1 auction in 2021.[21] Under Option B, eligibility would be based on new broadband coverage maps being developed under the Digital Opportunity Data Collection rulemaking. Eligible areas would be defined as those which lack unsubsidized 4G LTE coverage.[22] Phase I would be conducted after new broadband maps are finalized, which the Commission estimates could happen in 2023 or later.[23]

The *NPRM*'s discussion of these options suggests that the primary tradeoff between the two options is between speed, on the one hand, and the Commission's ability accurately to predict 5G deployments and thus more narrowly target support, on the other.[24] We see the tradeoff somewhat differently. On the one hand, as explained immediately above, we do not believe that narrow

---

[19] See for example Federal Communications Commission, *In the Matter of Auction 105, Public Notice: Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 105*, AU Docket No. 19-244 (March 2, 2020) at ¶178.

[20] See for example Paul Milgrom and Robert Weber, "A Theory of Auctions and Competitive Bidding," *Econometrica* 50;5 (1982) 1089-1122; Robert Wilson, "A Bidding Model of Perfect Competition," *The Review of Economic Studies* 44;3 (1977) 511-518; Peter Cramton, "Ascending Auctions," *European Economic Review* 42;3-5 (1998) 745-756.

[21] *NPRM* at ¶¶24-25. The Commission concludes that it should identify areas eligible for support based on existing mobile broadband coverage data because staff has found that these coverage data, submitted both as part of FCC Form 477 and in the one-time Mobility Fund Phase II data collection, do not really reflect actual on-the-ground coverage in many instances. *NPRM* at ¶134.

[22] *NPRM* at ¶38.

[23] *NPRM* at ¶27, n. 68.

[24] *NPRM* at ¶22 ("These two options reflect a fundamental challenge in balancing competing concerns. On the one hand, we recognize the pressing need for universal service support in rural areas that are sparsely populated, costly to serve, and have historically lacked adequate mobile service, and we seek to ensure that those areas do not fall further behind…. On the other hand…[a]ddressing the problems with mobile coverage data would allow us to better target areas in need of support but would delay the disbursement of support to many of those same areas.").

targeting of eligible areas is either necessary or desirable to achieve an efficient outcome. Rather, the Commission should rely on the market mechanism inherent in the reverse auction to achieve the optimal assignation of support.[25] As in spectrum auctions, the Commission should rely on competition to drive support levels to the opportunity cost of the funds being allocated. In particular, competition should drive support levels to zero for areas where at least two bidders agree that 5G would be provided absent 5G support.[26]

On the other hand, auction theory strongly supports the thesis that making more accurate information available to all parties will lead to a more efficient outcome.[27] By developing and making available new mobile broadband coverage maps in advance of the auction, the Commission can provide all market participants with significantly more accurate information which they can use to improve the efficiency of their own deployment – and bidding – strategies. Doing so will enhance the efficiency of the auction by giving all participants a more accurate shared baseline upon which to make bidding decisions. In our opinion, the value of this enhanced information is likely to offset the costs of delaying the availability of 5G Funds, especially since deployment in the marginal areas targeted by the 5G Fund is unlikely to begin immediately under any circumstances.

C. Transitioning Away from Legacy Support

The *NPRM* tentatively concludes that the 5G Fund would constitute a comprehensive mechanism for mobile high-cost support that serves as an alternative to Mobility Fund Phase II.[28] Accordingly, it proposes to transition each legacy support recipient's disaggregated legacy support to 5G Fund support or, in the case of areas that are ineligible for 5G Fund support or which are not "won" in the 5G Fund auction, to withdraw support altogether.[29] The Commission's proposal for the transition is summarized in Table 1.

---

[25] Support levels may not reach zero if there is aggregate uncertainty with respect to a given area receiving 5G absent funds. In this case, support levels may be competed down to a level that compensates the marginal bidder for committing to deploy.

[26] While we therefore support adoption of broader eligibility criteria than proposed in the *NPRM*, we recommend that the Commission complement this broad eligibility method with reserve prices that protect the public interest in the case of areas in with a single bidder and that it exclude from eligibility areas that have a high likelihood of unsubsidized 5G deployment.

[27] In auctions, bidders tend to benefit from having superior private information. Accurate and public maps will focus competition on the net cost of providing coverage, instead of the potentially superior information about coverage of some bidders. See Paul Milgrom and Robert Weber, "A Theory of Auctions and Competitive Bidding," *Econometrica* 50;5 (1982) 1089-1122; Paul Milgrom and Robert Weber, "The Value of Information in a Sealed Bid Auction," *Journal of Mathematical Economics* 10;1 (1982) 105-114.

[28] *NPRM* at ¶69.

[29] *NPRM* at ¶73.

<div align="center">

TABLE 1:
TRANSITION SCHEDULE FOR LEGACY HIGH-COST SUPPORT TO 5G FUND SUPPORT

</div>

Area Eligibility	Auction Result	Bidder or Recipient Status	Support Type and Timing
Ineligible	NA	NA	2-year phase down commences after effective date of rules and release of final eligible areas.
Eligible	Won in auction	Carrier is the winning bidder but does not receive legacy support for the area it won	5G Fund support commences after auction close and bidder is authorized.
Eligible	Won in auction	Carrier is the winning bidder and is a legacy support recipient for the area it won	Legacy support ceases and 5G Fund support commences after close of the auction and bidder is authorized for area.
Eligible	Won in auction	Carrier is a legacy support recipient but is not the winning bidder in the area for which it receives support	Legacy support ceases and 2-year phase down commences after auction close.
Eligible	Not won in auction	Carrier is a legacy support recipient but does not receive the minimum level of sustainable support for the area for which it receives support	Legacy support ceases and 2-year phase down commences after auction close.
Eligible	Not won in auction	Carrier is a legacy support recipient and receives the minimum level of sustainable support for the area for which it receives support	Legacy support continues for no more than 5 years after effective date of rules

Note: The minimum level of sustainable support is the lowest amount of legacy support among carriers that have deployed the highest level of technology within the state.

As the table shows, the proposed transition plan distinguishes sharply between eligible and ineligible areas, continuing support for eligible areas until the auction is complete but withdrawing support for ineligible areas immediately upon the effective date of the 5G Fund rule and the release of the final list of eligible areas. The *NPRM* justifies this approach based on the assumption that the proposed eligibility criteria (either option A or option B) can accurately predict which areas will receive unsubsidized 5G service.[30] For the reasons we have explained above, unless the Commission were to adopt a significantly broader definition of eligibility than that envisioned in the *NPRM*, we believe it is likely that its forecast of unsubsidized 5G deployment will be subject to significant prediction error.

To the extent areas are classified erroneously as ineligible – i.e., excluded from 5G Fund support and ultimately not built out with 5G service – they will not only not get 5G service but also risk losing service that is currently supported by legacy support within two years of the effective date

---

[30] *NPRM* at ¶75.

of the rules. To avoid this risk, the Commission could either (a) adopt broad eligibility criteria as we have suggested, or (b) delay the transition away from legacy support for all areas until the auction is complete (or both). By doing so, it would allow carriers to make network-wide deployment decisions based on the outcome of the auction, i.e., to design network footprints with complete information about both the locations for which they will be receiving 5G Fund support and the overall level of support.

IV.   Summary and Conclusions

A substantial body of economic research shows that policies designed to promote deployment of 5G services in marginal areas – like the 5G Fund – will generate net public interest benefits. The challenge before the Commission is to design an allocation process that maximizes the benefits of the limited resources available to achieve this objective. Given the complexities, uncertainties and dynamism of the 5G deployment process, the Commission is right to utilize a market-based approach, i.e., a reverse auction. Our analysis suggests further that the welfare-maximizing outcome will be achieved by applying relatively broad eligibility criteria and by allowing the interactions between 5G Fund support and deployments by T-Mobile (and other carriers) in rural areas to be coordinated by market-based mechanisms rather than administrative fiat. Further, auction efficiency is likely to be enhanced by the availability of more accurate mapping data, and by avoiding a premature withdrawal of legacy support to areas that may not receive 5G Fund support.

Appendix A

This appendix describes the methodology we apply to illustrate the social costs associated with requiring T-Mobile to pre-select and commit to serving rural areas and excluding those areas from eligibility for 5G Fund support.

Overview

As explained in the text, one of the sources of inefficiency associated with the *NPRM*'s approach arises from the fact that T-Mobile's private incentives for selecting marginal areas for 5G deployments diverge from the social optimum. That is, T-Mobile will rationally select areas that minimize its net private costs of meeting its deployment commitments. Except under the unlikely assumption that T-Mobile is the lowest-cost provider in each and every area, its private deployment cost will exceed the minimum social cost. The magnitude of the loss is simply the difference between T-Mobile's net costs and the net costs (i.e., lowest required support level) of the lowest-cost provider. We illustrate the magnitude of the resulting total social cost by simulating one million auctions for each of a variety of assumptions about the heterogeneity of carrier cost functions, as measured by the standard deviation of the minimum support levels required by each operator.

In addition to heterogeneity in operator costs, social losses depend on the number and characteristics of the areas pre-selected by T-Mobile. We illustrate two cases, one in which T-Mobile selects census tracts that account for 90 percent of the rural population and a second in which it chooses to cover 100 percent of the rural population. In the first case, where it does not cover all of the rural population, we assume T-Mobile selects the census tracts based on rural population density, choosing to cover the most densely populated rural areas until it achieves 90 percent population coverage.

Affected Areas

Figure A-1 shows census tracts in Missouri. There are 1,393 census tracts, of which 316 have RUCA codes ranging from 5-10, and 310 (of the 316) have at least one rural census block. We assume that these 310 tracts constitute the universe of eligible areas, as shown in Figure A-1.

FIGURE A-1:
CENSUS TRACTS IN MISSOURI

All	Eligible
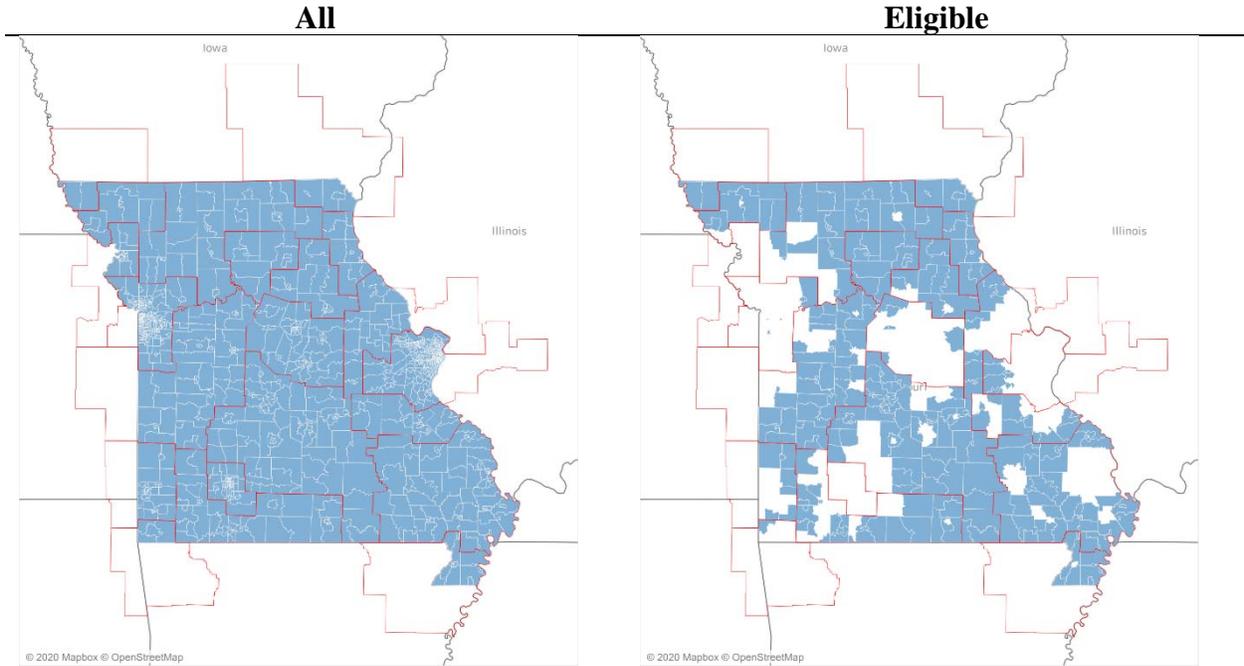
Note: Red lines show the Partial Economic Areas (PEAs) that intersect with Missouri. C-Band spectrum will be auctioned in PEAs.

Figure A-2 shows the effects of removing T-Mobile's pre-selected areas from eligibility, based on the 90 percent and 100 percent deployment assumptions described above. In numeric terms, if T-Mobile were to pre-select areas comprising 90 percent of the rural population, the effect would be to remove 5G Fund eligibility from 249 of the 310 tracts; if it chose to cover 100 percent of the Missouri rural population, there would be no remaining eligible tracts.

FIGURE A-2:
AREA ELIGIBILITY BASED ON T-MOBILE SELECTION CASE

90%	100%
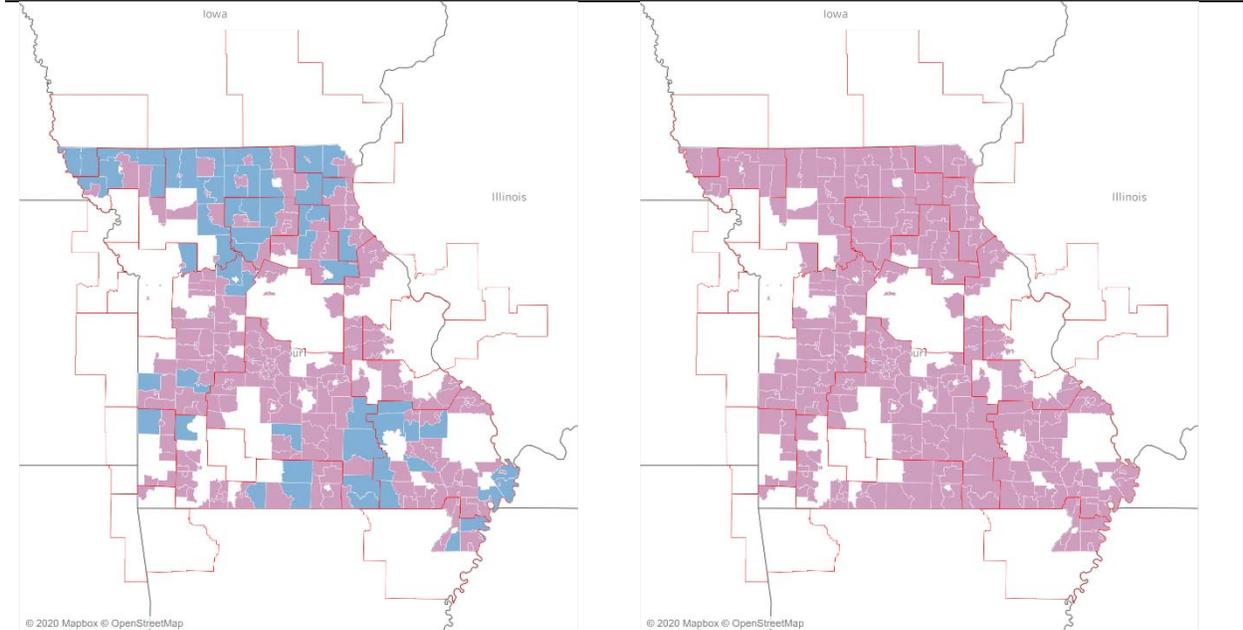
Note: T-Mobile-selected areas shown in magenta, remaining eligible areas shown in blue.

Auction Simulations and Results

In order to conduct our auction simulations, we first need to assign eligible census tracts an adjustment factor, as proposed by the Commission and discussed in the *Adjustment Factors PN*. Specifically, the Public Notice classifies census tracts into nine categories based on demand factors and terrain elevation. Tracts are classified as having Low, Medium, and High demand. Low Demand areas have median income of approximately $25,000; Medium Demand areas have median income of $35,000; High Demand areas have median income of $65,000. Similarly, the Public Notice proposes to classify terrain elevation into three categories: Flat, Hilly, and Mountainous. Flat areas are those with an elevation standard deviation between 0 and 40; Hilly areas have an elevation standard deviation between 40 and 115; areas with elevation standard deviation greater than 115 are Mountainous. The resulting adjustment factors are shown in Table A-1.

TABLE A-1:
PROPOSED ADJUSTMENT FACTORS VALUES

		Terrain Elevation		
		Flat	**Hilly**	**Mountainous**
Demand	Low	1.2	2.4	3.9
Factors	Medium	1.1	2.3	3.5
	High	1.0	2.0	3.0

Using the data sources shown in Table A-6, we use the criteria described in the *Adjustment Factors PN* to classify and assign adjustment factors to Missouri census tracts, as shown in Tables A-2 through A-4.[31]

<div align="center">

TABLE A-2:
INCOME CLASSIFICATIONS OF MISSOURI CENSUS TRACTS

</div>

Demand	Number of Tracts	Median Household Income 2017		
		Min	**Median**	**Max**
Low	154	$ 5,129	$ 25,093	$ 29,727
Medium	247	$ 29,737	$ 35,013	$ 39,297
High	985	$ 39,325	$ 55,455	$ 203,300
No Income	7			

Note: The Census Bureau does not provide an estimate of the 2017 median household income in 7 census tracts in the state of Missouri

<div align="center">

TABLE A-3:
TERRAIN CLASSIFICATIONS OF MISSOURI CENSUS TRACTS

</div>

Terrain	Number of Tracts	Elevation Standard Deviation		
		Min	**Median**	**Max**
Flat	1,360	1.3	12.2	39.4
Hilly	33	40.2	44.5	64.8
Mountainous	0	0	0	0

<div align="center">

TABLE A-4:
ADJUSTMENT FACTOR CLASSIFICATIONS ELIGIBLE MISSOURI CENSUS TRACTS

</div>

	Flat	Hilly	Mountainous	Total
Low	15	0	0	15
Medium	90	10	0	100
High	184	11	0	195
Total	289	21	0	310

To capture the effects of operator heterogeneity, we assume that the minimum required support per area for operator i in census tract j is a random variable $s_{ij} = z_i * f_j$, where z_i is a lognormal random variable with mean one and f_j is the adjustment factor proposed by the Commission based on our classification of census tracts. We consider ten cases for the standard deviation, from 0.01 to 5.12.[32] Figure A-3 shows the lognormal density for a standard deviation of 0.32.

---

[31] The FCC does not provide a classification methodology.

[32] We show results across a wide range simply for completeness. Each incremental level of standard deviation represents a doubling from the prior level. The exercise is robust to other distributions. We used a lognormal to avoid defining arbitrary minimum and maximum thresholds for a bounded-support distribution; and avoid censored values in case of a normal centered around one, which could result in negative costs.
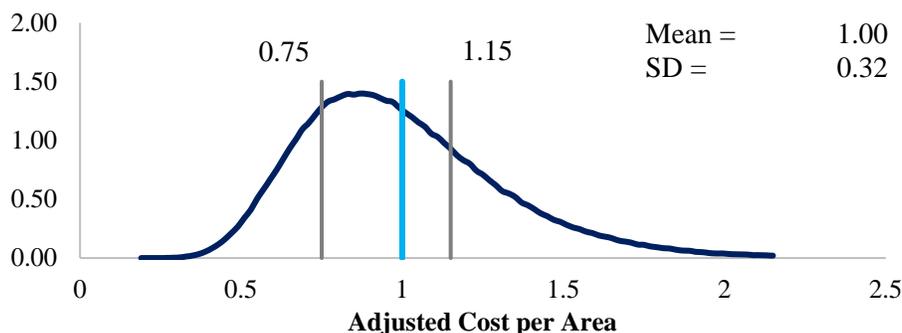
Note: We model the minimum required support per area for an operator in a census tract as a random variable zf, where z is a lognormal random variable with mean one, and f is the adjustment factor proposed by the Commission.

For each combination of T-Mobile coverage and standard deviation, we simulate one million auctions. For each realization of minimum support, we calculate three alternatives: an alternative where T-Mobile selects first, a competitive auction with four bidders competing for all areas, and the social optimum.[33]

For the social optimum, we define the social cost as the sum of the realized minimum cost, i.e., $SocialCost = \sum \tilde{z}_j * f_j * A_j$, where $\tilde{z}_j$ is the lowest realization of support level (across five operators) and A_j is the area of census tract j.

For the competitive auction, we define the social cost as the sum of the realized minimum cost, i.e., $AuctionSocialCost = \sum \hat{z}_j * f_j * A_j$, where $\hat{z}_j$ is the lowest realization of support level (across four bidders for the auction) and A_j is the area of census tract j.

For the T-Mobile selection case, we calculate the sum of the cost for T-Mobile for the areas chosen plus the social cost of an auction with four bidders for the remaining areas, i.e., $TMOSocialCost = \sum_{j \in S} \dot{z}_j * f_j * A_j + \sum_{j \notin S} \hat{z}_j * f_j * A_j$, where $\dot{z}_j$ is T-Mobile's realization, and S is the set of census tracts selected by T-Mobile.

For each realization, we calculate the ratios $SocialCostMultiple = \frac{TMOSocialCost}{SocialCost}$, and $AuctionCostMultiple = \frac{TMOSocialCost}{AuctionSocialCost}$. Finally, we average the cost multiples across all realizations in the same scenario.

Our results are reported in Table A-5. The first column indicates the assumed standard deviation of the distribution of operator support levels. The second column shows the implied ratio between

---

[33] We assume four bidders because there are five economically significant operators in Missouri: AT&T, Verizon, T-Mobile, US Cellular and Chariton Valley. We assume that T-Mobile will not participate in the 5G auction fund as proposed by the Commission. June 2019 coverage data from Form 477 shows a total of eight mobile operators in Missouri, three have very limited footprints and we assume are not likely to compete in the 5G Fund auction. The operators not included in the simulation are Chat Mobility, North East Colorado Cellular and Northwest Cell.

the support required by an operator in the 75th percentile of the support distribution and an operator at the 25th percentile. Thus, for example, an assumed standard deviation of 0.32 implies that an operator at the 75th percentile would face costs 52.4 percent higher than an operator at the 25th percentile. The third and fourth columns show the estimated social cost of T-Mobile pre-selection based on the 90 percent and 100 percent coverage assumptions. Thus, for example, if the standard deviation of carrier costs is 0.32, and T-Mobile chose to cover 90 percent of the rural population, deployment costs would exceed the social optimum by 28.1 percent. If T-Mobile chose to cover 100 percent of the rural population, deployment costs would exceed the social optimum by 47.8 percent. Similarly, when compared to an auction with four bidders, letting T-Mobile pre-select areas before the auction increases social cost by 24.4 percent in the 90 percent case and 41.5 percent in the 100 percent case.

TABLE A-5:
SOCIAL COST OF T-MOBILE PRE-SELECTION

Standard Deviation	Cost Multiple	Social Cost Multiple		Auction Cost Multiple	
		T-Mobile at 90%	T-Mobile at 100%	T-Mobile at 90%	T-Mobile at 100%
0.01	1.014	1.007	1.012	1.006	1.010
0.02	1.027	1.014	1.024	1.012	1.021
0.04	1.055	1.028	1.048	1.025	1.042
0.08	1.114	1.058	1.099	1.052	1.088
0.16	1.239	1.125	1.212	1.109	1.186
0.32	1.524	1.281	1.478	1.244	1.415
0.64	2.204	1.695	2.182	1.590	2.003
1.28	3.776	2.868	4.172	2.520	3.586
2.56	6.809	6.028	9.536	4.856	7.554
5.12	11.611	13.624	22.430	10.129	16.526

The results are further illustrated in Figure A-4, which shows the social cost and auction cost multiples for each standard deviation.

FIGURE A-4:
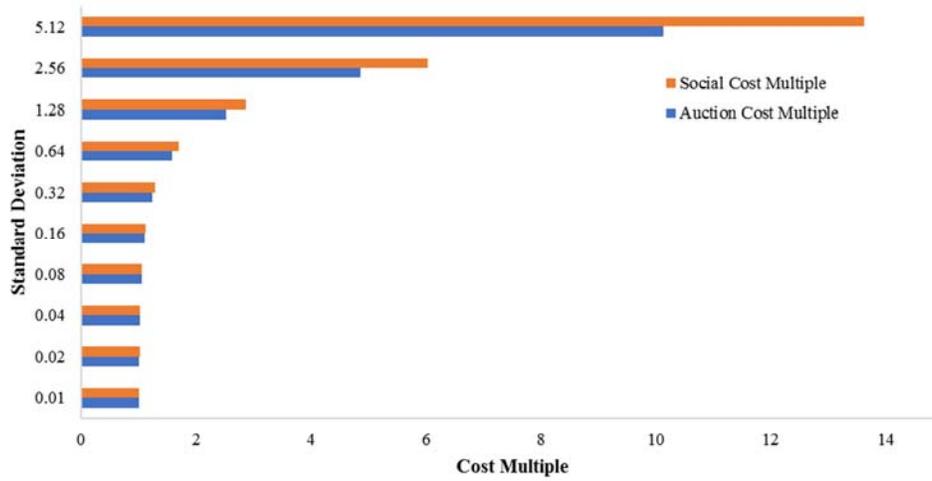**SOCIAL COST OF T-MOBILE PRE-SELECTION**

Table A-6 lists our data sources.

TABLE A-6:
DATA SOURCES

Data	Source
RUCA Classification	USDA
Terrain	Provided by US Cellular
Median Household Income 2017	Census Bureau
Mobile Coverage	Mobile Deployment Form 477 June 2019
Urban Rural Classification	Census Bureau
Population 2010	Census Bureau
Census Tracts Shapefile	Census Bureau
Partial Economic Areas Shapefile	FCC
Adjustment Factors	FCC

Appendix B

This appendix develops a simple example that highlights some of the strategic interactions operators and bidders may consider when deciding where to invest and how to bid in the 5G Fund auction. We compare three scenarios: i) the Commission selects areas it believes T-Mobile is likely to serve and removes them from auction eligibility; ii) T-Mobile selects areas to serve, and the Commission removes them from auction eligibility; and, iii) T-Mobile chooses which areas to cover after the auction is held.

Consider three areas A, B, and C, and three operators X, Y, and T-Mobile, each of which may deploy 5G if given sufficient support or, in the case of T-Mobile, as part of its merger commitments. We assume that T-Mobile needs to select one area to comply with its commitments.

The net cost of deployment and operations for each operator when no other operator is present in the market is shown in Table B-1. For X and Y, net cost represents the minimum support necessary to provide coverage; for T-Mobile, net costs represents the cost of complying with its merger obligations.

TABLE B-1:
NET COST OF DEPLOYMENT

	A	B	C
T-Mobile	3	4	5
X	2	5	6
Y	4	3	7

We assume that the net cost increases if two or more operators enter the same area. For example, as a result of 'duplicating' infrastructure to serve the same total subscribers. In particular, we assume that T-Mobile's cost would increase by 3, X's costs by 5, and Y's cost by 4 if another operator enters an area. All else equal, an operator would prefer to be the only provider of 5G in an area.

We believe this example provides a useful illustration as to how the market mechanism mitigates the potential for inefficient overbuilding. In allocating the 5G Fund, the Commission is concerned about coordinating deployment between T-Mobile and 5G Fund recipients. Coordination is only relevant for those areas where the probability of T-Mobile building as part of its commitments is less than one. Areas where the Commission is certain that T-Mobile will deploy (or has already deployed) as part of its commitments can be removed from the 5G Fund auction. After all the areas with certain deployment have been removed, T-Mobile would still need to cover some percentage of the rural population.

In the example, areas A, B, and C represent alternative ways in which T-Mobile could comply with its remaining commitments at the time of the auction, with any one of the three areas being sufficient to achieve compliance. Since complying with the commitments is costly, T-Mobile will select at most one.

1. The Commission selects areas

In this scenario, the Commission uses its own estimates of T-Mobile's net deployment costs to select areas to exclude from eligibility. However, the Commission has imperfect information: In contrast with the actual net costs in Table B-1, the Commission believes that T-Mobile's cost is lowest in area B. Consequently, assuming that T-Mobile will choose to minimize its net cost of compliance, the Commission removes Area B from eligibility.

X and Y then compete in an auction for A and C. X wins area A with a support of 4, and area C with a support of 7. After the auction, T-Mobile rationally selects B.

The result is that all areas receive 5G, and the total cost is $2 + 4 + 6 = 12$. The Commission spends 11 in the auction.

2. T-Mobile selects areas

We assume that the Commission requires T-Mobile to select areas. In response, T-Mobile selects areas to minimize its compliance cost. In this case, it selects area A.

X and Y compete in an auction for B, and C. X wins C with a support of 7, and Y wins B with a support of 5.

The result is that all areas receive 5G, and the total social cost is $3 + 3 + 6 = 12$. The Commission spends 12 in the auction.

3. All areas are included in the auction.

T-Mobile selects where to deploy after observing the auction outcomes. In making their bidding decisions during the auction, X and Y take into account T-Mobile's best response to their choices.

X and Y compete in an auction for A, B, and C. X wins A with support 4, Y wins B with support 5, and neither bids for C because they anticipate that T-Mobile would select C if C does not have an operator with high-cost support (whereas T-Mobile could select A or B to minimize its own cost of compliance if all areas have 5G Fund support).

The result is that all areas receive 5G, and the social cost is $2 + 3 + 5 = 10$. The Commission spends 9 in the auction.

Discussion

The example illustrates bidders' incentives to anticipate T-Mobile's commitments when competing in the 5G auction, and T-Mobile's incentives to react optimally to auction results. Competition among multiple bidders through the auction leads to an efficient outcome via information aggregation. In practice, we expect bidders to anticipate T-Mobile's post-auction decisions by balancing the probability of facing post-auction competition by T-Mobile and the probability of winning support.

NERA
ECONOMIC CONSULTING

NERA Economic Consulting
1255 23rd Street NW
Washington D.C. 20037
Tel: 1 (202) 466-3510 Fax: 1 (202) 466-3605
www.nera.com