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December 4, 2018

BY ECFS

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 Twelfth Street, SW  
Washington, D.C. 20554

**RE: Consolidated Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, WT Docket No. 18-197**

Dear Ms. Dortch:

In accordance with Protective Order (DA 18-624) in the above-captioned proceeding, the Communications Workers of America (“CWA”) submits the enclosed public, redacted version of CWA’s Comments on Applicants’ New Econometric Study, including supporting exhibits.

A Highly Confidential version of this filing is being filed with the Commission on this date and will be made available pursuant to the terms of the Protective Order. Please contact me with any questions.

Sincerely,



Allen P. Grunes  
Counsel to Communications Workers of America

Attachment

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**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of )  
 )  
Applications of T-Mobile US, Inc., )  
 )  
and ) WT Docket No. 18-197  
 )  
Sprint Corporation )  
 )  
For Consent to Transfer Control of the Licenses )  
and Authorizations )

**Comments of Communications Workers of America  
on Applicants' New Econometric Study**

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## I. INTRODUCTION

Five months after their Public Interest Statement was filed and subsequent to the end of the comment cycle in this proceeding, the Applicants now have come forward with a completely new merger simulation model prepared by a new group of economists. In doing so, they have presented the Commission and third-parties with a moving target as they continue to attempt to sell the benefits of this anticompetitive merger.<sup>1</sup>

Applicants, however, are not writing on a clean slate. Over the past five months, starting with the Public Interest Statement and continuing through the comment period, Applicants and their many outside consultants have made numerous sworn and unsworn statements about the proposed transaction. These assertions, to the extent they are inconsistent with Applicants' latest effort, should not simply be disregarded by the Commission. There is a record here, and inconsistency matters.

As we showed in our prior comments, nothing so far in the record supports the four major claims made in the Public Interest Statement. The merger will *not* increase employment, will *not* result in better service to rural America, is *not* justified by Sprint's alleged competitive weakness, and is *not* necessary for the rollout of advanced 5G services. The only consistency among Applicants' army of economists to date is that they are willing to make whatever assumptions that will lead them to the results Applicants are seeking. In this respect, the latest

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<sup>1</sup> This is the same criticism Sprint and its economists pointedly made when attacking the AT&T/T-Mobile merger. It is even more apt here. *See, e.g.*, Stanley M. Besen, Stephen D. Kletter, Serge X. Moresi, Steven C. Salop & John R. Woodbury, *An Economic Analysis of the AT&T-T-Mobile USA Wireless Merger*, 9 JOURNAL OF COMPETITION LAW & ECONOMICS 23, 43 (2013). Like the authors of that article, we view "this after-the-fact surprise submission to be an admission by [the Applicants] that [their] initial filings were inadequate."

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effort, which the Commission has characterized as “a substantial body of new material,” which relies on “a newly submitted data set and new methodologies,” is no different.

The new economic model prepared by John Asker, Timothy Bresnahan, and Kostis Hatzitaskos of Cornerstone Research (the “Cornerstone Report”) directionally overstates the alleged merger benefits through various assumptions and omissions. For example, the discussion of consumer behavior relegates price sensitivity to a footnote. The model assigns a single price to each brand, which does not reflect the fact that consumers actually face a variety of prices and terms. It ignores potentially important determinants of consumer choice such the location of stores. And it makes assumptions which suggest that consumers may be more sensitive to small changes in quality than they really are. These and other modelling decisions in the Cornerstone Report are likely to have led to overestimates of the benefits of the proposed merger. (*See* Comments of Professor Heski Bar-Isaac, attached hereto as Appendix A.)

Significantly, the Cornerstone Report also does not make use of the parties’ own engineering model despite Neville Ray’s sworn statement that “[a]ny other approach would be highly misleading and provide outcomes that are not factually based.” Nor does it make use actual network performance data (or pricing data, switching data or demographic data) even though such data is readily available to the Applicants and could provide relevant inputs as well as a means to check the model’s results. At the same time, however, the Cornerstone Report simply imports Compass Lexecon’s earlier 5G efficiency analysis into Cornerstone’s 4G LTE model, despite the fact that none of Compass Lexecon’s claimed efficiencies would materialize for a minimum of 3 years.

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The Cornerstone Report also provides no new evidence that rural Americans would see any benefit from the proposed merger. Indeed, by the authors' own admission, the Nielsen Mobile Performance data used in the analysis [REDACTED]. (See Second Supplemental Declaration of Dr. Andrew Afflerbach, attached hereto as Appendix B.)

In short, the Cornerstone Report diverges sharply from the major claims Applicants have been making over the past five months, contains modeling decisions that likely overestimate the merger's benefits, ignores actual data that is readily available to the Applicants, jettisons their own engineering model, and imports speculative efficiencies claims.

The proposed merger, as currently structured, does not serve the public interest.

**II. THE CORNERSTONE REPORT CONTAINS ASSUMPTIONS AND OMISSIONS WHICH TEND TO OVERSTATE MERGER BENEFITS**

The Cornerstone Report directionally overstates the alleged merger benefits through various assumptions and omissions.

To start with, a significant problem with the Cornerstone Report is that it does not directly estimate consumer responsiveness to price. As the authors of the report state, "We cannot do this as part of our demand model. Ideally, we would have data where different consumers faced different prices either across locations or over time. This would allow us to estimate how choices vary with prices." (Cornerstone Report ¶ 74.) Such data no doubt exists but was not provided to the economists by the Applicants. And this is a significant omission.

As CWA's economic expert Professor Heski Bar-Isaac notes in his comments (Appendix A), prices are key to evaluating welfare and consumer decisions. The way that they are treated in

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the modelling of consumer behavior is important and has a significant bearing on results. It is therefore disconcerting that in introducing the demand model, sensitivity to prices is only discussed in a footnote. (Cornerstone Report ¶ 63 n. 54.) Pricing and consumers' sensitivity are then briefly discussed in two paragraphs (Cornerstone Report ¶¶ 74-75) and in the Appendix (in 5.3.2).

In particular, it appears that the Cornerstone model assumes that prices enter utility for all consumers in exactly the same way: independently of location, demographics, type of use (low/moderate/high), and type of service. This is particularly problematic as the measure of price is so highly aggregated in the model: A single price is assigned to each of the brands. As Professor Bar-Isaac notes, this approach is likely to lead to results that would make consumers relatively insensitive to prices, and thereby to overestimate the benefits of the proposed merger.

Second, as Professor Bar-Isaac discusses, the Cornerstone Report takes a novel approach to assessing a consumer-specific measure of network quality. The report is novel in its use of [REDACTED] to attempt to create a user-specific measure of network quality. This aims to allow the authors to assess how consumers react to network quality while at the same time recognizing that there may be different brand preferences in different locations, for different usage types, and for different demographics. However, the validity of that approach rests on an assumption that may be inappropriate and calls into question the reliability of the results.

As the authors note (in paragraph 50), there are potentially important determinants of choice that are not explicitly accounted for in the model and instead are captured by the

stochastic term,  $\epsilon$ . These include, for example, exposure to advertising and proximity to retail stores.

However, it seems reasonable to believe that such factors are closely related to where a consumer spends time. In addition, choices by firms of where to advertise and where to place stores are likely related to their quality at different locations. For example, it seems highly unlikely that firms place billboards in random locations or along roads where their network quality is particularly low.

The concern is that where the consumer spends time and may face advertising is directly related to the individualized measure of network quality [REDACTED]

[REDACTED]

Consequently consumer choice that is attributed to network quality may in fact reflect that consumers are reacting to advertising exposure or store locations, for example, leading to an overestimate of consumers' sensitivity to network quality. This sensitivity is key to the findings and so such bias in estimation could have significant consequences for the findings of the report. In particular, the impact of quality may well be overstated.

Of course, with data on advertising expenditure and store locations (data that one would imagine may be available to the carriers), one could better account for such effects and obtain more reliable estimates.<sup>2</sup>

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<sup>2</sup> Separately, we note that Applicants have declined to provide any detailed modeling of their store opening/closing plans following the merger, even though they have access to all of the information needed to do this modeling.



Third, the Cornerstone Report contains other measurement errors that could similarly lead to bias. For example, as Professor Bar-Isaac discusses, the imputation method used to assess the quality of non-premium brands may be leading to bias. Significantly, the likely bias is in the direction of concluding that consumers are more sensitive to small changes in quality than they really are. Professor Bar-Isaac discusses a number of additional sources of bias in his comments which are attached. He also offers a critique of the manner in which the Cornerstone economists seek to demonstrate the explanatory power of their model.

### **III. THE CORNERSTONE REPORT IGNORES APPLICANTS' OWN ENGINEERING MODEL**

Another fundamental problem with the Cornerstone merger simulation model is that it does not rely on presumably superior data, including the Applicants' own engineering model. As discussed below, Applicants themselves have cautioned against proceeding in this fashion. Yet their economists do so here.

As Dr. Afflerbach notes:

It is difficult to understand why the analytical tools that were central to the engineering analysis in the Public Interest Statement, are not used or mentioned in a Report where the current network performance of Sprint and T-Mobile is central. It is difficult to understand why hypothetical models positing percent increases in speed over the NMP [Nielsen Mobile Performance] or of Sprint obtaining T-Mobile coverage and T-Mobile obtaining Sprint speeds were used to model scenarios of Sprint and T-Mobile network improvement, rather than the actual modeled performance of New T-Mobile from the company's own detailed engineering modeling.<sup>3</sup>

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<sup>3</sup> Afflerbach Decl. ¶ 16 (footnotes omitted).

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In his Reply Declaration about the engineering model, T-Mobile’s Chief Technology Officer Neville Ray discussed the Applicants’ intention to rapidly begin to migrate current Sprint customers to the T-Mobile network in order to be able to refarm spectrum for 5G use. The Applicants stated that the full integration of Sprint and T-Mobile, assuming the merger is permitted, would take place over a three-year period. Among the engineering challenges the Applicants have said they would face in this process is to maintain the current quality of service for Sprint subscribers who migrate to the T-Mobile network while at the same time avoiding problems with congestion on the T-Mobile network due to the additional traffic. Congestion, if not managed, would result in a loss of quality for current T-Mobile subscribers as well as for current Sprint subscribers.

Repeatedly, Applicants have stated that their goal is to *maintain* the quality of T-Mobile’s existing LTE network during the migration and refarming. For example, in his Reply Declaration, Neville Ray states:

- “Having an accurate forecast of the traffic load on the network is a crucial step for maintaining a high quality of experience for subscribers.” (Ray Reply Decl. ¶ 8.)
- “Our modeling projections demonstrate that average LTE performance for New T-Mobile will be maintained during the refarming process to 5G.” (Ray Reply Decl. ¶ 18.)
- “The LTE engineering module was utilized to gauge the amount of spectrum that could be refarmed from LTE to 5G without adverse effects to the user experience on the LTE network.” (Ray Reply Decl. ¶ 20.)

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- “As we are combining the networks, we will ensure that the transition occurs without any short-term disruption or service degradation to customers.” (Ray Reply Decl. ¶ 43.)
- “Our network modeling projections demonstrate that there will be no negative impacts on LTE performance during the refarming process.” (Ray Reply Decl. ¶ 60.)

Each statement is concerned with keeping quality levels where they are. And indeed, this appears to be no easy task, as Applicants attest: “Our company goal is to fund and mitigate congestion in the network completely; however, absolute congestion avoidance is impractical due to issues with timely access to infrastructure, stochastic nature of traffic, and challenges with deploying congestion solutions.” (Ray Reply Decl. ¶ 10.)

Indeed, Applicants go further, suggesting that any other approach would be “highly misleading” and “not factually based.” (Ray Reply Decl. ¶ 58.) As Applicants state: “What our current engineering model has done for the transaction is carefully and precisely estimate the capacity available for the New T-Mobile, T-Mobile, and Sprint networks based on the cell site and spectrum resources available to each company. Any other approach would be highly misleading and provide outcomes that are not factually based.” (Ray Reply Decl. ¶ 58.)

Notwithstanding this admonition, the Applicants now dispense with their own engineering model; instead, through their latest merger simulation model, they put forward a “best-of-both” scenario, in which LTE service for subscribers improves in quality of speed and coverage:

New T-Mobile plans to combine the complementary spectrum assets of Sprint and T-Mobile to deliver better coverage and better speeds in more areas than either standalone can deliver on its own. We calculate the marginal costs that would

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make the merger competitively neutral under a scenario that captures some of these improvements to the following limited degree.

- If Sprint has lower time on LTE than T-Mobile in a particular geogrid where we can measure both, we improve Sprint to T-Mobile’s time on LTE value.
- If T-Mobile has lower speeds than Sprint in a particular geogrid where we can measure both, we improve T-Mobile to Sprint’s speed value.
- To the extent that Sprint or T-Mobile improve in a geogrid, we also improve the corresponding non-premium brand, Boost/Virgin or MetroPCS, respectively.<sup>4</sup>

These improvements cited by Cornerstone apparently are not part of the engineering model. There is no reason to believe that they would occur in the next three years, during the integration period, when the goal is just to keep quality from declining. And to the extent that they are modelled to take place in 2021 or later, one needs to ask how this optimization of LTE fits with the Applicants’ stated goal of transitioning to 5G. If the current engineering model and financial model do not contemplate this “best-of-both” LTE scenario, then the hypothetical exercise Cornerstone has undertaken is likely to be, according to their earlier statements, both “highly misleading” and not “factually based.”

At the same time, however, Cornerstone simply imports Compass Lexecon’s 5G efficiency analysis into its 4G model, despite the fact that none of the Compass Lexecon claimed efficiencies would materialize for a minimum of 3 years. (*See* Cornerstone Report ¶¶ 90 and Israel et al. Decl. ¶ 4 (Sept. 17, 2018.)) As Professor Bar-Isaac points out, the Cornerstone Report presents an essentially static approach. In effect this supposes that any quality improvements or

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<sup>4</sup> Cornerstone Report ¶ 104.

cost savings would be instantaneous. One might be concerned that the effects of the proposed merger on pricing might arise rather sooner than the effects on network quality and costs, where the scenarios on these often draw on projections for 2021 or later. The welfare implications of a transitional period might be substantive – all the more so given that in the transition period consumers being ported across networks in a merged entity may experience some congestion and quality degradation that is not accounted for in the analysis. Moreover, as Professor Bar-Isaac notes, projections several years ahead in an industry that features considerable technological innovation may be unreliable.

**IV. THE CORNERSTONE MERGER SIMULATION DOES NOT ADDRESS THE MERGER’S LIKELY IMPACT IN RURAL AMERICA**

CWA’s expert Dr. Andrew Afflerbach, in the attached Second Supplemental Declaration, explains how the Cornerstone Report glosses over rural areas. The Cornerstone Report relies on

[REDACTED]

The dataset and methodology [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]. Therefore, as Dr. Afflerbach concludes, the model is not representative of the network performance of a large percentage of rural America.

Even if the rural areas were well represented in the geographic sampling, Dr. Afflerbach notes how [REDACTED]

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<sup>5</sup> Afflerbach Decl. ¶ 11, quoting Cornerstone Report ¶ 171.

[REDACTED]

[REDACTED]<sup>6</sup>

Finally, the Cornerstone Report, as Dr. Afflerbach notes, provides no separate set of analysis of the users from rural areas, nor consideration of if, and how, rural users respond to changes in performance or pricing.<sup>7</sup>

Accordingly, there is nothing in the Cornerstone Report that changes Dr. Afflerbach’s conclusion that for the majority of the rural U.S. population, the merged “New T-Mobile” would provide no real benefits.<sup>8</sup>

**V. THE MODEL GENERATES RESULTS WHICH ARE, ON THEIR FACE, SUSPECT**

The Nielsen Mobile Performance dataset used in the model is limited to only [REDACTED]

[REDACTED]

[REDACTED]. The KPMG StreamShare data is limited to a single three-month period.

Given the time limitations in the Nielsen Mobile Performance and KPMG StreamShare data, it is not surprising that the diversion ratios in the Cornerstone Report yield some results that, on their face, appear highly suspect. For example, the Cornerstone Report suggests that

[REDACTED]

[REDACTED]. (Cornerstone Report Ex. 12 ¶ 76.) Likewise, it suggests that [REDACTED]

[REDACTED]. (Cornerstone

<sup>6</sup> Afflerbach Decl. ¶ 15, quoting Cornerstone Report ¶ 162.

<sup>7</sup> Cornerstone Report ¶ 253.

<sup>8</sup> Afflerbach Decl. ¶ 8.

Report Ex. 12 ¶ 76.) [REDACTED]

[REDACTED]. (Cornerstone Report Ex. 12 ¶ 76.) In other words, the Cornerstone Report suggests that [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].

We note, as we have noted before, that there is a long history of head-to-head competition between Sprint and T-Mobile.<sup>9</sup> The failure of the dataset to pick up this competition does not show that the competition has gone away. Rather, we suggest, it shows a major limitation with the selected data.

Another example illustrates the same point. Applicants suggest that a [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] (Cornerstone Report ¶ 63.)

But the Applicants never corroborate this finding, which appears wrong as a matter of common sense, with internal pricing documents or any independent empirical evidence. And their data does not distinguish between plans, including unlimited plans and plans with data caps. Rather, we are simply urged to accept this assertion as true. The more likely reason for this odd result is, as Professor Bar-Isaac has noted, that the model is likely to overestimate consumers'

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<sup>9</sup> CWA Comments at 24-30.

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sensitivity to network quality, and thus overestimate the value that consumers place on a tiny improvement in quality.

**VI. CONCLUSION**

The Cornerstone Report diverges sharply from the major claims Applicants have been making over the past five months, contains modeling decisions that likely overestimate the merger's benefits, ignores actual data that is readily available to the Applicants, jettisons their own engineering model, and imports speculative efficiencies claims.

Respectfully submitted,

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WORKERS OF AMERICA*

December 4, 2018



**APPENDIX A:  
COMMENTS BY HESKI BAR-ISAAC  
Professor, Rotman School of Management  
University of Toronto**

## Heski Bar-Isaac<sup>1</sup> Comments on T-Mobile/Sprint Cornerstone Study

In response to a request from the Communications Workers of America to evaluate the Cornerstone study on the proposed T-Mobile/Sprint merger, I have prepared the comments below to represent my preliminary assessment.

### Introduction

The Cornerstone analysis is built on estimating consumer behavior (a model of demand) and firm behavior (supply). In particular their estimation uses current data for 4G LTE to evaluate different possible scenarios of the effects of the proposed merger and associated changes to network quality. The Cornerstone study also draws on the analysis of Israel, Katz, and Keating in assessing ranges of cost efficiencies and network quality improvements that might arise, which are projections that incorporate a transition to 5G, rather than the current 4G LTE network that the Cornerstone analysis is based on.

The modelling framework aims at highlighting the role of quality of service, and central to the analysis are the results on how consumers value and respond to changes in quality of service and to prices.

In evaluating the Cornerstone study's analysis to support the proposed merger, there are several aspects which give cause for concern. Most notable among them are the treatment of

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<sup>1</sup> Heski Bar-Isaac is a Professor in the Economics Analysis and Policy Area at the Rotman School of Management, at the University of Toronto. He currently serves on the Editorial Board of the *American Economic Review*, and is an associate of CRESSE and research fellow of the CEPR. He has previously served as an editor of the *Journal of Industrial Economics*, and co-editor of the *International Journal of Industrial Organization* and on the Executive Committee of the European Association for Research in Industrial Economics. He has published work in the leading economic journals such the *American Economic Review*, *Review of Economic Studies* and the leading journals specializing in industrial organization, including the *RAND Journal of Economics*, the *Journal of Industrial Economics*, and the *International Journal of Industrial Organization*.

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prices and consumers' sensitivity to price changes, and potential biases in estimating consumers' sensitivity to network quality. I describe these concerns in greater detail below and discuss a number of other issues.

### **Response to price changes**

Prices are key to evaluating welfare and consumer decisions. Clearly, the way that they are treated in the modelling of consumer behavior is important and has a significant bearing on results.

In the Cornerstone study, it is disconcerting that in introducing the demand model, sensitivity to prices is only discussed in a footnote (Footnote 54). Pricing and consumers' sensitivity is then briefly tackled later in a couple of paragraphs (74-75) and in the Appendix (in 5.3.2). In particular, the study assumes that prices enter utility for all consumers in exactly the same way: independently of location, demographics, type of use (low/moderate/high), and type of service

[REDACTED]

This is particularly problematic since the measure of price is so highly aggregated: A single price is assigned to each of the brands. Using the ARPU measure in the consumer's choice problem does not reflect that underlying the single "price" for each carrier are a variety of prices and contracts that individual consumers face in reality. [REDACTED]

[REDACTED]

[REDACTED]<sup>2</sup>

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<sup>2</sup> Moreover, Footnote 61 in the study might be somewhat overstating the limits of common practice which typically tries to use all the data available. Consider the celebrated the Berry, Levinsohn, and Pakes (1995) paper,

Allowing for consumers with different characteristics to have different price coefficients in utility would seem to more closely reflect the decision problems that different consumers actually face. In addition, using all the available price data, would likely affect the results. In particular, by allowing variation in consumer characteristics to respond to network quality much more than to prices, this approach may lead to results that would make consumers appear relatively insensitive to prices, and, thereby, overestimate the benefits of the proposed merger.

Moreover, the Cornerstone study does not allow the total number of consumers purchasing service to depend on prices. Footnote 48 comments on the latter observation and suggests that this may be understating the pro-competitive effects if more consumers end up buying. This is true; however, in case prices go up (which they might given the reduction in the number of firms competing and with the supposed additional quality) it seems more than plausible that some consumers will be excluded from the market with detrimental welfare effects; particularly, given that such more marginal consumers are likely to be relatively sensitive to changes in prices (a feature which the analysis does not allow).

In particular, it is difficult to directly determine what the authors of the study project for prices (though this is a calculation that is required for their analyses of compensating variation, and must have been conducted for their analysis, though it is not reported). One would have

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for example, which uses “the list retail price (in \$1000's) for the base model” as a measure of price for each car model (p. 869). Some may feel that the exercise in the Cornerstone study is perhaps more akin to aggregating so as to represent all models for each car manufacturer by one or two prices.

thought in evaluating the likely effects of the proposed merger, it would have been reasonable to consider the impact on prices.<sup>3</sup>

### **Other possible bias in estimating demand**

The study is novel in its use of [REDACTED] to attempt to create a user-specific measure of network quality. This aims to allow the authors to assess how consumers react to network quality while at the same time recognizing that there may be different brand preferences in different locations, for different usage types, and for different demographics. This is a technically sophisticated approach that builds in a novel and interesting way on state-of-the-art technique. However, the validity of the approach relies on an assumption that is rather strong and may be inappropriate, as explained below. This calls into question the reliability of the results.

Consider the formula in paragraph 51. For the approach to deliver meaningful results it relies on the assumption that the elements not otherwise captured by the model (denoted by  $\epsilon$ ) are unrelated to the network quality that an individual faces (denoted by  $x$ ).

As the authors note (in paragraph 50), there are potentially important determinants of choice that are not explicitly accounted for in the model and instead are captured by the stochastic term,  $\epsilon$ : such as exposure to advertising and exposure to retail stores.

However, it seems reasonable to believe that such exposure is closely related to where a consumer spends time. In addition, choices by firms of where to advertise and where to place

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<sup>3</sup> As is the case, for example, in the merger simulation considered by Yurukoglu et al., “The Welfare Effects of Vertical Integration In Multichannel Television Markets,” *Econometrica*, Vol. 86, No. 3, March 2018 which the study cites (in Footnote 63).

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stores are likely related to their quality at different locations. For example, it seems highly unlikely that firms place billboards in random locations or along roads where there network quality is particularly low.

The concern here is that where the consumer spends time and may face advertising is directly related to the individualised measure of network quality [REDACTED]

[REDACTED]

[REDACTED]

Consequently consumer choice that is attributed to network quality may in fact reflect that consumers are reacting to advertising exposure or store locations, for example, leading to an overestimate of consumers' sensitivity to network quality. This sensitivity is key to the findings and so such bias in estimation could have significant consequences for the findings of the study.

In particular, the impact of quality may well be overstated.

Of course, with data on advertising expenditure and store locations (data that one would imagine may be available to the carriers), one could better account for such effects and obtain more reliable estimates.

A related issue with potentially great impact is that the study takes as given the state of the network. In practice, the state of the network reflects choices that the firms have made on how much to invest and where: presumably based on (past) projections of demand and usage, and, related to the point above, in concert with its advertising and store location decisions: A firm that has recently upgraded equipment in a particular location may spend more on billboards, have people handing out flyers, etc. in that location. A firm with a store in a mall will

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presumably ensure that service quality there is fairly high. If there is a particular carrier which is not much used on a particular road, then one might expect that carrier would not have installed the towers and made the investments to improve quality along it.

Consequently, what is attributed to demand responding to network quality might, instead, reflect that firms invest where there is usage or anticipated demand. Again, this implies that the benefits of quality improvements might be overstated.

**Other measurement issues that may lead to bias**

The imputation method used to assess quality of non-premium brands may be leading to bias.

[REDACTED]

[REDACTED]

[REDACTED] By imputing a relatively high quality to non-premium brands in such a case [REDACTED]

[REDACTED] consumers might be estimated to be more sensitive to small changes in quality than they really are.

In addition, rather than using actual network speeds, the study uses standardized measures of speed. [REDACTED]

[REDACTED]

[REDACTED] Therefore, to the extent that the anticipated effects on network coverage are describing actual average speeds rather than “standardized” speeds, the welfare benefits of quality improvements may be overstated.

**Other concerns and notes**

The study presents an essentially static approach. In effect this supposes that any quality improvements or cost savings would be instantaneous.

One might be concerned that the effects of the proposed merger on pricing might arise rather sooner than the effects on network quality and costs, where the scenarios on these often draw on projections for 2021 or later. The welfare implications of a transitional period might be substantive. More so given that in the transition period consumers being ported across networks in a merged entity may involve some congestion and quality degradation that is not accounted for in the analysis. Moreover, projections several years ahead in an industry that features considerable technological innovation may be unreliable.<sup>4</sup>

When the study draws on the Israel, Katz and Keating Declaration to assess potential impacts of the proposed merger on quality and costs; it is worth noting that those are future projections several years ahead. Further, assertions of what constitute conservative assumptions would surprise many economists: [REDACTED]

[REDACTED]

Finally, in assessing how well the demand model represents actual demand, a strawman that is considered [REDACTED] is rather odd. Few would dispute that allowing for greater heterogeneity is likely to more accurately reflect consumer preferences. It is odd therefore to demonstrate the explanatory power of the model (and an approach that stresses consumer responses to quality) by comparing to a model that [REDACTED]

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<sup>4</sup> Even setting aside that the proposed merger may in itself have consequences for the rate of future technological innovation and progress.



[REDACTED]

[REDACTED]

[REDACTED] Instead, the comparison made would rather overstate the importance of network quality in consumer decision-making.

### **Conclusion**

Overall, there are several modelling decisions in the Cornerstone study that are likely to have led to overestimates of the benefits of the proposed merger.

**APPENDIX B:  
SECOND SUPPLEMENTAL DECLARATION OF  
ANDREW AFFLERBACH, PH.D., P.E.  
Chief Executive Officer and Chief Technology Officer,  
CTC Technology & Energy**

**REDACTED—FOR PUBLIC INSPECTION**  
**BEFORE THE**  
**FEDERAL COMMUNICATIONS COMMISSION**  
**WASHINGTON, D.C.**

WT Docket 18-197            )  
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**SECOND SUPPLEMENTAL DECLARATION OF ANDREW AFFLERBACH, PH.D.,  
P.E.**

1. I have been the Chief Executive Officer and Chief Technology Officer of Columbia Telecommunications Corporation (d/b/a CTC Technology & Energy), a communications engineering consultancy, since 2000, and was Senior Scientist at CTC from 1996 until 2000. I specialize in the planning, design, and implementation of communications infrastructure and networks. My expertise includes fiber and wireless technologies and state-of-the-art networking applications. I have closely observed the development of wireless technology since the advent of the commercial internet in the 1990s.
  
2. As CTO, I am responsible for all engineering work and technical analysis performed by CTC. I have planned and overseen the implementation of a wide variety of wired and wireless government and public safety networks. I have advised cities, counties, and states about emerging technologies, including successive generations of wireless networks across a range of licensed and unlicensed spectrum bands. I have developed broadband technology strategy for cities including San Francisco, Seattle, Atlanta, Washington, D.C., and New York; for states including Connecticut, Delaware, Kansas,

Kentucky, and New Mexico; and for the government of New Zealand’s national broadband project.

3. I have designed wireless networks for large cities, counties, and regions. I lead the CTC team advising the State of Texas Department of Transportation and many local governments on wireless facilities standards and processes. I also lead the CTC technical teams conducting FirstNet planning for the District of Columbia and the State of Delaware.
4. I have prepared extensive technical analyses for submission to the US Federal Communications Commission and US policymakers on broadband expansion to underserved schools, libraries, and other anchor facilities; on due diligence for the IP transition of the US telecommunications infrastructure; and on the relative strengths and weaknesses of various wired and wireless technologies.
5. Under my direction, the technical team at CTC has advised hundreds of public and non-profit clients, primarily in the United States. My technical staff has been engaged on projects encompassing the evaluation or planning of hundreds of miles of fiber optics and hundreds of wireless nodes in rural, suburban, and urban areas across the country. My experience with rural broadband engineering encompasses the full range of geographic typologies in the United States, from the desert and mountains of the West to the plains in the Midwest to the mountain and coastal areas of the East.
6. I am a licensed Professional Engineer in the Commonwealth of Virginia and the states of Delaware, Maryland, and Illinois. I received a Ph.D. in Astronomy in 1996 from the University of Wisconsin–Madison and an undergraduate degree in Physics from

Swarthmore College in 1991. My full CV was included in my September 2018 Declaration.

7. I am filing a Supplemental Declaration to the Declarations I filed in September and October 2018. This Supplemental Declaration contains my review of the ECONOMIC ANALYSIS OF THE PROPOSED T-MOBILE/SPRINT MERGER, by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos of Cornerstone Research (hereafter, “the Cornerstone Report” or “The Report”), provided by T-Mobile and Sprint on November 6, 2018. The Cornerstone Report models the potential response of smartphone users to hypothetical changes in network performance and prices and draws on earlier statement from T-Mobile and Sprint regarding improvements in network performance. The Report does not provide any further detail or changed information about T-Mobile or Sprint’s technical plans.
8. I therefore have no changes in my original conclusion: For the majority of the rural U.S. population, the merged New T-Mobile will provide customers with the same performance as T-Mobile.
9. As discussed below, a) the Cornerstone Report does not contain analysis that is specific to rural areas, [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]
10. The Report creates models from a dataset drawn from the Nielsen Mobile Performance (NMP) dataset. The NMP was collected from [REDACTED] users [REDACTED]  
[REDACTED]

[REDACTED]. Based on analysis of that dataset, the Report develops a dataset of standardized average speed, worst speed, LTE coverage and worst LTE coverage for areas where users traveled.

11. This dataset and methodology [REDACTED]  
[REDACTED].<sup>1</sup>

12. Therefore, the model is not representative of the network performance of a large percentage of rural America.

13. The Report describes how [REDACTED] has divided the U.S. into “geogrid” areas of different sizes.<sup>2</sup> In the rural areas, the performance measurements are averaged over a significantly larger grid area [REDACTED]

[REDACTED]. However, the outcome of geogrid averaging is that the rural use is painted with a much broader brush, and therefore the model is less able to track the specifics of performance in rural areas—eg., how it changes away from a major road corridor, as terrain and foliage varies, and with distance from a cell site.

14. [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

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<sup>1</sup> Cornerstone Report, paragraph 171.  
<sup>2</sup> Cornerstone Report, p. 83-86.

[REDACTED]

[REDACTED]<sup>3</sup>

15. Even had the rural areas been well represented in geographic sampling, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>4</sup>

16. The Report provides no separate set of analysis of the users from rural areas, nor consideration of if and how rural users respond to changes in performance or pricing.

Analysis is presented of the roles of [REDACTED]

[REDACTED] but not of the effect of living in a rural area.<sup>5</sup>

17. The Report uses performance data derived from the NMP [REDACTED]

[REDACTED]

[REDACTED] However, there is no comparison between the performance derived from these methods and the likely performance from T-Mobile and Sprint's actual network data nor is there a comparison with the engineering models developed by these companies, even though using the company's own data and models would potentially be a more direct way to estimate the performance on T-Mobile and Sprint's networks and in any case would provide an important check on the validity of the Report's approach. It is difficult to understand why the analytical tools that were central to the engineering analysis in the Public Interest Statement,<sup>6</sup> are not used or

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<sup>3</sup> [REDACTED]

<sup>4</sup> Cornerstone Report, para 162.

<sup>5</sup> Cornerstone Report, para 253.

<sup>6</sup> Public Interest Statement Appendix B, Declaration of Neville Ray, Executive Vice President and CTO of T-Mobile, paragraphs 19 and 25.

mentioned in a Report where the current network performance of Sprint and T-Mobile is central. It is difficult to understand why hypothetical models positing percent increases in speed over the NMP or of Sprint obtaining T-Mobile coverage and T-Mobile obtaining Sprint speeds were used to model scenarios of Sprint and T-Mobile network improvement,<sup>7</sup> rather than the actual modeled performance of New T-Mobile from the company's own detailed engineering modeling.

### *Conclusions*

18. An analysis with a specific focus on rural areas, and coverage of more than [REDACTED] of rural America, would potentially reach different conclusions about rural Americans' sensitivity to network performance and price. Rural areas are less likely to have coverage from four providers. They may have only one provider, may have a regional provider other than the major four providers, or may have no provider. Many also have a much lower threshold for service – lacking 3G or 4G service, or only having service in select areas.
19. Many rural Americans live in an entirely different reality of cellular and mobile broadband service than the rest of the U.S. Therefore, the Cornerstone Report, with its focus on users [REDACTED] its [REDACTED] [REDACTED], its lack of analysis of rural Americans as a subset of the population, and its lack of detailed analysis of rural service areas, does not effectively analyze how the reality of rural American might change in a merger.


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<sup>7</sup> Cornerstone Report, paragraph 89.



DATED: Kensington, Maryland

December 4, 2018

A handwritten signature in cursive script, appearing to read "Andrew Afflerbach".

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Andrew Afflerbach, Ph.D., P.E.

