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REDACTED—FOR PUBLIC INSPECTION

December 4, 2018

By ECFS

Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: **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 the *Protective Order* and *NRUF/LNP Protective Order* in the above-captioned proceeding, DISH Network Corporation (“DISH”) submits the enclosed public, redacted version of its comments and the Further Reply Declaration of the Brattle Group in response to the *Public Notice*.¹ DISH has denoted with **{{BEGIN HCI END HCI}}** and **{{BEGIN NRUF/LNP HCI END NRUF/LNP HCI}}** where Highly Confidential Information has been redacted. A Highly Confidential version of this filing is being simultaneously filed with the Commission and will be made available pursuant to the terms of the *Protective Order* and the *NRUF/LNP Protective Order*.²

Please contact me with any questions.

Respectfully submitted,

/s/
Pantelis Michalopoulos
Andrew Golodny
Counsel to DISH Network Corporation

¹ Commission Announces Receipt of Supplemental Analysis from T-Mobile; Establishes Comment Deadline, *Public Notice*, WT Docket No. 18-197, DA 18-1155 (Nov. 13, 2018).

² Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *Protective Order*, WT Docket No. 18-197, DA 18-624 (June 15, 2018) (“*Protective Order*”); Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *NRUF/LNP Protective Order*, WT Docket No. 18-197, DA 18-777 (July 26, 2018) (“*NRUF/LNP Protective Order*”).

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

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

**COMMENTS IN RESPONSE TO PUBLIC NOTICE REGARDING CORNERSTONE
REPORT**

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December 4, 2018

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**COMMENTS IN RESPONSE TO PUBLIC NOTICE REGARDING
CORNERSTONE REPORT**

I. INTRODUCTION AND SUMMARY

DISH Network Corporation (“DISH”) submits these comments and a report prepared by William Zarakas, Jeremy Verlinda and Coleman Bazelon of the Brattle Group (“Further Brattle Report”) in response to the new Cornerstone Research econometric study submitted by the Applicants in this proceeding.¹ As the Commission correctly explained, the Cornerstone Report, submitted by the Applicants long after their opposition to Petitions to Deny was due, “represents a substantial body of new material on economic issues central to the review of the proposed

¹ John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Economic Analysis of the Proposed Sprint/T-Mobile Merger* (Nov. 6, 2018), Attachment A to Letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (“Cornerstone Report” or “Report”).

transaction. It relies on a newly submitted data set and new methodologies to reach conclusions about the specific effects of the transaction not previously in the record.”²

But, like the Applicants’ previous economic analysis,³ this new and belated effort fails. The Cornerstone Report again confirms, as the Compass Lexecon Report did before it, that this transaction will lead to *higher prices* for tens of millions of consumers. Instead of denying the prospect of price increases, the Applicants seem to stake their entire case on the proposition that consumers will accept New T-Mobile’s higher prices because they are supposedly willing to pay a disproportionately large amount of money for even an ounce of improvement in the quality of their current 4G LTE service. According to the Cornerstone Report, heavy data users value a minimal **{{BEGIN HCI END HCI}}** speed increase so much that they are willing to pay **{{BEGIN HCI END HCI}}** a month for it.⁴ And, even if these valuations were correct (which they are not), they are not enough to offset the merger’s price increases under Cornerstone’s own method. For these reasons, among others, the Cornerstone Report does nothing to improve the case for this merger.

DISH’s Reply explained that the economic report prepared by the Applicants’ first team of economists, Compass Lexecon, hurts more than helps the Applicants, as it confirms that the consumer price increases likely resulting from this transaction would be significantly higher than DISH initially estimated. Whether or not the Cornerstone Report is an attempt on the

² Public Notice, WT Docket No. 18-197, Commission Announces Receipt of Supplemental Analysis from T-Mobile; Establishes Comment Deadline, DA 18-1155 (Nov. 13, 2018).

³ See Declaration of Compass Lexecon (Sept. 17, 2018) (Appendix F to Opposition) (“Compass Lexecon Declaration”).

⁴ Cornerstone Report ¶ 63.

Applicants' part to scramble a response to DISH's economic analysis, it is unresponsive and methodologically unsound. Indeed, it does not even purport to rebut DISH's evidence. At most, it is a fresh attempt at making a new case for the Applicants. The submission of the Cornerstone Report thus reveals the Applicants' justified lack of confidence in the Compass Lexecon study, but the new Report does not inspire any confidence of its own.

The Cornerstone Methodology is Flawed. The Applicants' new study attempts to recast higher prices for New T-Mobile's services as a consumer benefit. But review of Cornerstone's methodology shows that the absurdly high valuations it assigns to small service quality improvements are as wrong as they sound. First of all, Cornerstone's method disguises the manner in which the merger's harm will fall on consumers. Among many other errors, Cornerstone has disregarded the fact that a consumer's willingness to pay is affected by her income. Cornerstone has assumed a nation of Americans for whom money is no object when it comes to purchasing wireless services. Correcting Cornerstone's calculation to take income into account shows what Cornerstone has sought to obscure—lower-income consumers will disproportionately bear the brunt of the harms of this transaction, as these consumers are especially unwilling, and in many cases unable, to pay for the price increases New T-Mobile will bring.

Cornerstone's willingness to pay calculation contains other errors that cause it to understate and obfuscate consumer harm. These errors include: (1) Cornerstone's use of T-Mobile's **{{BEGIN HCI END HCI}}** margin rather than Sprint's **{{BEGIN HCI END HCI}}** one; (2) improperly lumping together a minority of very heavy data users in the "heavy data" user category, which skews upward the value attached to faster service by the

heavy user majority; (3) forgetting that quality is a two-way street, with customers favoring a carrier where it has a better network, and the carrier building a better network where it has more customers; and (4) employing an unduly narrow definition of quality—consumers value other attributes such as unlimited data plans, and Cornerstone artificially inflates a user’s willingness to pay for greater speed and quality by ignoring these factors.

Even if taken at face value, the Cornerstone Report is an exercise in rank speculation. The alleged value the Report attaches to higher service quality could conceivably offset the attendant price increases only if the proposed merger were likely to produce significant quality improvements. But that is a big “if”: the Cornerstone Report neither introduces nor relies upon any evidence of such quality improvements. Cornerstone examines exclusively *4G LTE* services, but the Applicants have not shown that such services will improve with the merger, let alone by how much.

In fact, the Applicants’ own engineering model and transition plan suggest that, if anything, 4G LTE quality will suffer for the sake of a claimed 5G transition. Instead of relying on evidence, the Cornerstone Report simply assumes that LTE speed and coverage will improve by arbitrary round numbers {{**BEGIN HCI** **END HCI**}} or that New T-Mobile’s 4G LTE service will combine the best characteristics of the Applicants’ two networks in each and every area. This assumption is both unfounded and inconsistent with the Applicants’ stated plan to transition to 5G.

The Cornerstone Report’s reliance on the marginal cost savings estimated by Compass Lexecon is also an improper mix-and-match, as these claimed savings concern exclusively 5G service. The price increases for one service—4G LTE—cannot meaningfully be offset by

supposed decreases in the cost of providing another service—5G—to other customers. Even if this were methodologically appropriate (which it is not), the Commission should not accept harm to millions of 4G LTE users in the name of future 5G customers’ speculative and hoped-for gains.

Cornerstone Confirms Customers Will Experience Price Increases. Even if all of these flaws are ignored and Cornerstone’s questionable valuations of quality are credited, the Report still does not show that the merger would be pro-competitive. To the contrary: under Cornerstone’s own “best-of-both” scenario, prices would still increase significantly for each and every one of the Sprint and T-Mobile brands, both for postpaid and for prepaid services. Further, the median consumer’s willingness to pay is significantly *less* than the price increases for each and every one of these brands and services. Finally, Brattle confirms what should have been obvious to Cornerstone from the start: the majority of consumers will not be willing to pay New T-Mobile’s large price increases.

Independent Analysis Confirms the Risk of Price Increases. The continued inability of the Applicants to show that the transaction is pro-competitive is especially troubling in light of additional recent evidence about the harms of consolidation in the mobile voice/broadband market. A study of 41 mobile voice/broadband markets has confirmed the steep price increases other countries’ consumers have experienced as a result of 4-to-3 competitor reductions.

Based on the present record, including the newly submitted alternative economic report, the Applicants have failed to demonstrate that this transaction is in the public interest.

II. CORNERSTONE ASSIGNS UNJUSTIFIABLY HIGH VALUES TO MINIMAL QUALITY IMPROVEMENTS

To prove that the proposed transaction will not cause price increases, the Applicants' new group of economists once again resorts to the idea that consumers care so much more about quality than about price that they will accept large price increases for minimal quality improvements. Compass Lexecon had relied on the same flawed logic, stating in its Declaration that "improvements in network quality . . . might be more important to consumers than modest changes in the level of their monthly bill."⁵ But Cornerstone stretches the idea even further, to the outlandish assertion that heavy data users are willing to pay a higher price of as much as {{BEGIN HCI END HCI}} per month for an increase in speed of as little as {{BEGIN HCI END HCI}}⁶ Just as incredible, Cornerstone claims that a marginal speed improvement of only {{BEGIN HCI END HCI}} is enough to convert a price increase of {{BEGIN HCI END HCI}} into average welfare gains of {{BEGIN HCI END HCI}}⁷

These findings are useful, but not for the purpose for which Cornerstone proffers them: they show what extraordinary lengths to which the Applicants have gone to attempt to salvage this deal and to present it as pro-competitive. Under Cornerstone's own logic, the Commission cannot find that this transaction is pro-competitive unless it endorses the counter-intuitive and erroneous proposition that consumers are willing to pay disproportionately higher prices for a

⁵ Compass Lexecon Declaration ¶ 124.

⁶ Cornerstone Report ¶ 63.

⁷ *Id.* ¶ 136, Exhibit 34.

slightly better product. And, as discussed below, the service improvements that Cornerstone assumes will flow from this merger remain speculative and unproven.⁸

A. Cornerstone Ignores that Willingness to Pay Depends on Income and Otherwise Overstates It

Cornerstone's study is riddled with errors that mask the way in which this merger will harm consumers. Among other things, Cornerstone has ignored an elementary fact—that income affects a consumers' willingness to pay.⁹ Cornerstone recognizes the importance of income in its cross-brand analysis.¹⁰ But inexplicably, it makes no allowance for the interaction between price sensitivity and income when it constructs the "willingness to pay" algorithm. What does this mean? Cornerstone constructs a world inhabited by customers for whom service speed matters disproportionately more than money.

Correcting for this one error shows that Cornerstone's calculations grossly overstate the willingness of lower-income consumers to pay New T-Mobile's price increases. Brattle has revised the willingness to pay algorithm to account for income by directly considering the effect of income on the price sensitivity of demand, using the same basic demand model and data presented by Cornerstone. This correction shows that willingness to pay is approximately 30% lower than what Cornerstone estimated for the bottom income quartile of subscribers.

⁸ See *infra* at 11-15.

⁹ Further Brattle Report at 12 and n.14 (citing, for example, Berry, Levinsohn, and Pakes, and Aviv Nevo).

¹⁰ Cornerstone Report ¶ 9 ("We also allow for consumers to differ in how they choose among brands depending on the characteristics of the consumer. For example . . . we allow preferences between brands to differ by income.").

Cornerstone's method also overstates most consumers' willingness to pay in other respects. For one thing, Cornerstone's calculations are based on T-Mobile's higher margins, not Sprint's lower ones. Since low margins generally imply high price sensitivity under the profit-maximization condition,¹¹ a sensitivity analysis based on the estimated Sprint margin of {{BEGIN HCI END HCI}} (rather than the estimated T-Mobile margin of more than {{BEGIN HCI END HCI}}) would result in greater price sensitivity and, correspondingly, a reduced willingness to pay.

Cornerstone also classifies as a heavy user anyone who consumes more than {{BEGIN HCI END HCI}} including a small number of users who consume a multiple of that and whose inclusion artificially inflates the willingness of more typical heavy data users to pay for quality improvements. If the fraction of consumers using more than {{BEGIN HCI END HCI}} (double Cornerstone's heavy user threshold) are treated as a separate "very heavy user" group, then the heavy users' willingness to pay for a {{BEGIN HCI END HCI}} speed increase drops from the Cornerstone estimate of {{BEGIN HCI END HCI}} to only approximately {{BEGIN HCI END HCI}} for the "premium" brands and only approximately {{BEGIN HCI END HCI}} for the "non-premium" brands.¹² This means that higher prices are *not* offset by quality improvements for many more people than Cornerstone claims.

Moreover, Cornerstone overstates the willingness to pay metric because it ignores important components of service quality in the consumer's mind beyond speed and coverage,

¹¹ See Further Brattle Report at 16-17.

¹² *Id.* at 20, Table 4.

such as the availability of unlimited plans, and combined price/quality factors (*i.e.*, the availability of unlimited plans at lower prices than offered elsewhere).

Such factors help explain what otherwise would be an inexplicable contradiction that emerges from Cornerstone's analysis. On the one hand, Cornerstone finds that each of Sprint and T-Mobile appeals less to quality-conscious users than each of AT&T and Verizon.¹³ On the other hand, it also finds that T-Mobile boasts a proportionately greater concentration of heavy data users.¹⁴ But heavy data users can be expected to be more quality conscious. If true, why would they flock to one of the two carriers least able to attract them? One answer is that quality includes components not considered by Cornerstone.¹⁵ For example, heavy data users may be more likely to choose unlimited data plans, which may also offer faster speeds and better coverage. All else equal, heavy data users would be expected to choose T-Mobile over Verizon or AT&T because T-Mobile offers a lower-priced unlimited plan, so their brand choice may be driven by lower prices, not higher quality. Omission of plan choice and price may therefore bias upwards Cornerstone's valuation of network quality improvements.

As Brattle further explains by way of example, T-Mobile offers various value-add promotions which may be correlated directly with usage type and speed. For instance, the T-Mobile ONE Plus upgrade allows HD streaming and mobile hotspots to connect other devices to

¹³ Cornerstone Report ¶ 19 (finding many consumers would experience "a reduction in network quality... if they were to use the Sprint or T-Mobile brands today.").

¹⁴ *See id.*, Exhibit 85.

¹⁵ Cornerstone recognizes, as it must, that "[c]onsumer choices are affected by many different factors." *Id.* ¶ 45, n. 44.

the Internet. This plan explicitly allows for higher throughput usage and is competitively priced; therefore, it would be positively correlated with the quality variables in Cornerstone's estimation.

This quality characteristic is omitted from the Cornerstone demand model. While Cornerstone includes a "stochastic term" that "accounts for the fact that people with identical experiences for each brand might nevertheless make different choices for reasons we cannot measure, e.g., advertising exposure or proximity to a particular brand's retail store,"¹⁶ it does not include the key quality ingredient of unlimited plan availability in this variable.¹⁷ This omission in turn overstates the value attached by users to Cornerstone's chosen quality attributes, since the willingness to pay observed by Cornerstone is in reality due in part to factors other than speed and coverage.

Cornerstone also overstates the willingness to pay by assuming that the relationship between consumer choice and network quality is a one-way street: Cornerstone assumes users choose a higher quality network because it is better. In fact, the relationship runs both ways: consumers favor a carrier in areas where it has a better network, and the carrier builds a better network in areas where it has greater appeal. Cornerstone thus sees areas of greater demand for higher quality as evidence of an extraordinarily high willingness to pay for such quality. In reality, however, these areas may also be proof of a decision made by a carrier to build a better network where the demand is, and not just a decision of the user to subscribe to the better-quality network. In the same vein, Cornerstone announces with some unjustifiable fanfare its finding that more consumers choose Sprint and T-Mobile where Sprint and T-Mobile offer better

¹⁶ *Id.* ¶ 50.

¹⁷ *See id.*, ¶ 45 n. 44

service.¹⁸ Of course they would. Such truisms cannot carry the weight Cornerstone assigns to them without further analysis.

B. The Cornerstone Report Posits That the Merger Will Be Procompetitive By Assuming It Results In Benefits That the Applicants Have Not Proven

The Cornerstone Report relegates to a footnote a revelation that has significant consequences for the Report’s methodological quality and reliability: the Compass Lexecon analysis “focuses on the effects of 5G improvements, while our work focuses on network quality improvements within the range observed in present-day, LTE-era data.”¹⁹ But these LTE network quality achievements are assumed, not proven. Even if Cornerstone were correct that heavy data users are so eager for {{BEGIN HCI END HCI}} of extra speed they will pay {{BEGIN HCI END HCI}} for it, they would pay for this improvement *only if* they receive it. But, the Applicants have not submitted any meaningful evidence that their LTE services will improve.²⁰

Cornerstone specifically makes the following alternate assumptions, which it calls “scenarios” consistent with their fictional and unproven nature:

- The proposed merger will increase LTE speeds by 10%.

¹⁸ See *id.* ¶ 14 (“We find that consumers who today choose brands on the Sprint or T-Mobile networks tend to be consumers who use their phones in locations where these networks offer quality that is stronger than their average.”).

¹⁹ *Id.* ¶ 12 n. 11.

²⁰ Mr. Ray’s Declaration states that, “[f]ollowing the merger, more than 20 million Sprint customers will have expeditious access to the New T-Mobile LTE network that will provide improved LTE coverage and services,” and that “[i]mprovements in capacity and coverage for existing subscribers will occur, on a market-by-market basis, in the near term due to the increases in cell sites and spectrum resources brought by the transaction.” Reply Declaration of Neville Ray ¶ 4. And that is all the Applicants say on the subject. No basis is offered for these conclusory statements.

- The proposed merger will increase speeds by 0.1 Mbps.
- T-Mobile's LTE speeds will increase to Sprint levels, and Sprint's LTE coverage will increase to T-Mobile's levels.
- The combined company's speed and coverage will rise to Verizon levels.²¹

All of these numbers are unsupported and seemingly picked out of thin air: they are not based on testimony or evidence of any kind. All that Cornerstone can muster by way of explanation is that one of these scenarios—where the merged company achieves the best of the two applicants' worlds on speed and coverage in each "geogrid"—is "consistent with the merger rationale."²² It is not. The merger's purported rationale is that T-Mobile will benefit from Sprint's speed and Sprint will benefit from T-Mobile's coverage *in the provision of 5G service*.²³ When it comes to LTE, Cornerstone's scenario is actually contradicted by evidence submitted by the Applicants elsewhere in this proceeding.

Specifically, the Ray engineering model provided by the Applicants shows that Sprint's LTE subscribers that use the 2.5 GHz band will be transitioned to T-Mobile spectrum to allow the refarming of the 2.5 GHz band to 5G.²⁴ According to the model, this will occur regardless of whether it results in a better or worse customer experience. Put simply, Sprint's LTE users will

²¹ See Cornerstone Report ¶ 89.

²² *Id.*

²³ See Public Interest Statement at 19 ("On a standalone basis, T-Mobile would be capacity constrained and Sprint lacks coverage.").

²⁴ Reply Declaration of Neville Ray ¶¶ 18-19 ("We. . . were able to more rapidly refarm spectrum from LTE to 5G for standalone T-Mobile").

be moved to T-Mobile's spectrum notwithstanding whether the speed and coverage they will receive as a result will be better or worse.²⁵

Cornerstone's scenarios also go against industry experience and common sense. All transitions in the space, whether necessitated by mergers, technological change, or both, have one thing in common: early pain is likely necessary for later gain.²⁶ Because the Applicants (and indeed the industry) are working to transition to 5G, the pain is bound to fall disproportionately on 4G LTE users, with most of any benefits to be reaped disproportionately by 5G users.

Other than this general mention of the merger's rationale, Cornerstone cites to no evidence of LTE quality improvements from the material previously submitted by the Applicants. The reason? There is none. Cornerstone also does not rely on any evidence of marginal cost savings associated with the combination of the Applicants' LTE networks because there is no such evidence. And, Cornerstone does not even make assumptions on this subject. Rather, Cornerstone relies on the marginal cost reductions Compass Lexecon has "estimated will arise from the network integration."²⁷ Cornerstone concludes that, "for the proposed merger to be competitively neutral, the merging parties need marginal cost reductions that are within the

²⁵ *Id.* ¶ 42 ("All Sprint customers should be fully migrated to the New T-Mobile network within three years after completion of the transaction.").

²⁶ Marguerite Reardon, *Broken Connection for Sprint Nextel*, C-net (Jan. 29, 2007), <https://www.cnet.com/news/broken-connection-for-sprint-nextel> ("After Sprint merged with Nextel Communications, Leigh Elliott noticed that her Nextel phone started dropping calls in places where it used to get coverage just fine. 'On my 20-minute drive to and from work everyday, I'd lose a call up to five times,' the 35-year-old New Hampshire resident said. 'This never happened before the Sprint-Nextel merger.'").

²⁷ Cornerstone Report ¶ 90.

range of [these estimates.]”²⁸ But, the problem is that the marginal cost reductions that Compass Lexecon expects to arise from network integration are reductions in the cost of providing 5G service, not LTE service. The Ray engineering model, on which Cornerstone relies, concerns itself exclusively with 5G costs. These reductions have nothing to do with the cost of providing 4G LTE. Cornerstone thus improperly mixes and matches: it estimates price increases for 4G LTE services, then claims that they will be offset by a reduction in the cost of providing 5G service.

This approach is wrong for a number of reasons. First, it is econometrically unsound to offset the increase in the price of one service with the reduction in the cost of providing an entirely different service. Second, the time period and metrics Cornerstone uses are also inconsistent. Not only does Cornerstone examine a different network technology in a different time period (today, not in 3-5 years), but, as Brattle aptly observes, it also introduces a new measure of user experience:

The Ray model reported offered traffic (what the network model was designed to make available), carried traffic (what the network model was designed to deliver), and theoretical calculated user throughput (the speeds it is designed to deliver). In contrast, the Cornerstone model measures actual user experiences, an entirely different measure from the theoretical throughput reported by Ray.²⁹

The point here is not which of the two measures is accurate. That is a question that can be debated between the Applicants’ two economic teams. Rather, the point is that conclusions as to price effects based on user experience cannot be counterbalanced by cost savings using a completely different set of assumptions.

²⁸ *Id.*

²⁹ Brattle Further Reply at 10 n. 9.

Even if there were evidence of LTE quality improvements, and even if they were correctly gauged against LTE users' willingness to pay for them (both of which are absent here), Cornerstone's conclusions cannot be transplanted to New T-Mobile's purported 5G services. For an LTE user receiving 1 Mbps, a speed increase of {{BEGIN HCI END HCI}} would matter little; to a 5G user receiving already a throughput speed of 100 Mbps, it would not matter at all.

Finally, even if it were methodologically appropriate, this mixing and matching would be another example of robbing Peter to pay Paul—a phenomenon, further discussed below, that characterizes all of the Applicants' strained attempts at showing the merger's effects are neutral or procompetitive. Cornerstone's attempt to offset the LTE price impact with 5G cost savings sacrifices LTE users, who will be harmed, on the altar of 5G users, who will supposedly benefit. While many 4G LTE users likely will one day become 5G users, and will thus be on both sides of the ledger, not all will. And because underprivileged citizens tend to be late adopters of new technologies,³⁰ they will be disproportionately harmed by this proposed merger in the near term.

C. Cornerstone's Model Estimates Diversion Results That Contradict Its Thesis

The integrity of Cornerstone's method is further impeached by its own contradictory findings. On the one hand, Cornerstone concludes that consumers perceive Sprint and T-Mobile as closer in quality to each other than to either AT&T or Verizon. Thus, for example,

³⁰ See Monica Anderson, *Digital Divide Persists Even as Lower-Income Americans Make Gains in Tech Adoption*, Pew Research Center (Mar. 22, 2017), <http://www.pewresearch.org/fact-tank/2017/03/22/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption> ("Roughly three-in-ten adults with household incomes below \$30,000 a year don't own a smartphone. Nearly half don't have home broadband services or a traditional computer. And a majority of lower-income Americans are not tablet owners. By comparison, many of these devices are nearly ubiquitous among adults from households earning \$100,000 or more a year.").

Cornerstone finds that many consumers would experience a “reduction in network quality... if they were to use the Sprint or T-Mobile brands today.”³¹ Yet, Cornerstone estimates diversion rates between T-Mobile and Sprint that {{BEGIN HCI

END HCI}}³²

Cornerstone estimates a diversion rate from Sprint to T-Mobile {{BEGIN HCI
END HCI}} but Cornerstone understates share-based diversion through omission of the carrier’s non-premium brands. In fact, using Cornerstone’s own share data, the share-based diversion from Sprint to T-Mobile would be {{BEGIN HCI
END HCI}} In any event, the {{BEGIN HCI
END HCI}} diversion ratio estimated by Cornerstone is less than a half of the {{BEGIN NRUF/LNP
END NRUF/LNP HCI}} share shown by porting data.³³ This is impossible if Cornerstone is correct that consumers view Sprint and T-Mobile as closer in quality to each other than to Verizon or Sprint.

In a related vein, Cornerstone assumes without basis that {{BEGIN HCI
END HCI}}³⁴ But what if porting data show a Verizon subscriber switching to Sprint or T-Mobile in such an area after all? Cornerstone does

³¹ See Cornerstone Report ¶ 19.

³² See *id.* ¶¶ 76-78.

³³ Compass Lexecon Declaration ¶ 178, Table 28.

³⁴ Cornerstone Report ¶ 21.

not state it has performed such a cross-check. In fact, Brattle has examined porting diversion data in the areas defined by Cornerstone as ones where Verizon customers would experience a {{BEGIN HCI END HCI}} or more loss in average speed if they were to switch to T-Mobile. As shown in Table 15 of the Further Brattle Report, for the 12 KPMG market areas in which Verizon's LTE speeds are at least {{BEGIN HCI END HCI}} faster than T-Mobile, T-Mobile still has commanded between {{BEGIN NRUF/LNP HCI END NRUF/LNP HCI}} of Verizon's port-outs.

III. EVEN TAKEN AT FACE VALUE, CORNERSTONE'S METHOD SHOWS PRICE INCREASES FOR TENS OF MILLIONS OF AMERICANS

Even setting aside the debilitating flaws of the Cornerstone Report, and even without correcting the willingness to pay calculations, Cornerstone *still* finds that this transaction would lead to price increases. For the most part, Cornerstone obfuscates these increases by aggregating different categories of users (Sprint vs. T-Mobile customers) and different submarkets (postpaid vs. prepaid). The Commission, however, does not accept this "no-harm-on-average" approach.³⁵

³⁵ See Applications of Cricket License Co., LLC, Leap Wireless International, Inc., and AT&T Inc. for Consent to Transfer Control of Authorizations Applications of Cricket License Co., LLC and Leap LicenseCo Inc. for Consent to Assignment of Authorization, *Memorandum Opinion and Order*, 29 FCC Rcd. 2735, 2798 ¶ 146 (2014) ("Based on the current record, we are largely unable to verify AT&T's claims that the proposed transaction would lead to the enhancement of its provision of LTE services to consumers, in particular Leap customers."); *id.* at 2799 ¶ 148 ("The disruption to Leap customers who will lose their current service and be forced to arrange for alternative service will reduce any net benefit resulting from some Leap and AT&T customers receiving an enhanced network experience from AT&T."); *id.* at 2801 ¶ 156 ("We find that the transaction as proposed has the potential to cause some competitive and other public interest harms in several local markets, as well as to value-conscious consumers generally."); see also Applications of Charter Communications, Inc., Time Warner Cable Inc., and Advance/NewHouse Partnership for Consent to Assign or Transfer Control of Licenses and Authorizations, *Memorandum Opinion and Order*, 31 FCC Rcd. 6327, 6369 ¶ 85 (2016) ("[S]ubscribers who rely on their BIAS as the primary means for consuming online video often

Just as important, these data show substantial port-outs from Verizon to T-Mobile regardless of whether the speed differential is above or below {{BEGIN HCI END HCI}}³⁶ And, in any event, disaggregation of the numbers calculated by Cornerstone is possible, and shows the full extent of the price increases that would result for huge groups of consumers.

Thus, before taking into account any claimed 5G cost savings and quality improvements, Cornerstone's own method predicts price increases of as much as {{BEGIN HCI END HCI}} (for Sprint's prepaid brands Boost and Virgin) and {{BEGIN HCI END HCI}} for Sprint's postpaid customers.³⁷

Table 1: Cornerstone Merger Simulation Price Changes with No Efficiencies
{{BEGIN HCI

END HCI}}

must curtail their video usage or pay more than those subscribers that rely primarily on traditional MVPD service to consume video.”).

³⁶ Further Brattle Report at 8 and Table 15 at 40.

³⁷ *Id.* at 23 and Table 5.

Likewise, even after taking into account Compass Lexecon’s estimate of 5G marginal cost reductions, Sprint postpaid customers will see a price increase of {{BEGIN HCI END HCI}} and Boost/Virgin customers will suffer an even greater price hike – {{BEGIN HCI END HCI}} using again Cornerstone’s own method.³⁸

Table 2: Cornerstone Merger Simulation Price Changes under IKK Efficiencies
{{BEGIN HCI

END HCI}}

And even the hypothesized and unsupported LTE quality improvements would be insufficient to offset the likely price increases. As Brattle demonstrates, under Cornerstone’s own “best-of-both” scenario, and without adjusting Cornerstone’s calculations of willingness to pay, prices would go up by {{BEGIN HCI END HCI}} for Sprint postpaid services and {{BEGIN HCI END HCI}} for T-Mobile postpaid services. For Sprint (Boost/Virgin) and T-Mobile (MetroPCS) prepaid services, the increases would be {{BEGIN HCI

³⁸ *Id.* at 25 and Table 6.

END HCI}} respectively. Across all brands, price increases would be likely to exceed the median consumer's willingness to pay by {{BEGIN HCI END HCI}} or more than half of the price increase. All in all, the majority, or {{BEGIN HCI END HCI}} of all consumers, will not welcome the price hikes with which they will be hit.³⁹

Table 3: Corrected Quality Improvements WTP Comparison with Merger Price Effects
{{BEGIN HCI

END HCI}}

What is more, Brattle has also adjusted Cornerstone's calculation of willingness to pay to reflect sensitivity to income. This adjustment shows that the excess of price increases over willingness to pay is {{BEGIN HCI END HCI}} for low-income Sprint subscribers than for high-income Sprint subscribers, and more than {{BEGIN HCI END HCI}} for low-income T-Mobile subscribers than for high-income T-Mobile subscribers.⁴⁰ The proposed transaction would therefore be especially disastrous for low-income consumers.

³⁹ These results obtain even without adjusting Cornerstone's willingness to pay calculations to reflect sensitivity to income.

⁴⁰ Further Brattle Report at 30 and Table 9.

IV. THE RISK OF PRICE INCREASES IS FURTHER SUBSTANTIATED BY A RECENT STUDY

The likelihood of price increases is not only confirmed by application of the very method used by the Applicants' own new economists, it is also buttressed by additional recent evidence. A report from Rewheel Research, released on October 28, 2018 confirms, reinforces, and further substantiates the conclusion of prior studies that prices have risen in other countries following 4-to-3 mergers in the mobile voice/broadband market.⁴¹ In aggregate, gigabyte prices in markets with three mobile operators are 81% higher than markets with four mobile operators.⁴² The Austrian market, where prior studies had seen steep price hikes after a 4-to-3 reduction, "fell further behind" in the second half of 2018—"in December 2012, just before the [merger], Austria was the 3rd most competitive market among EU countries. In October 2018 it has fallen in the 18th place."⁴³ Conversely, the Rewheel Report confirms the extent to which the addition of a fourth competitor helps: Italian gigabyte prices fell 70% following Iliad's launch as a fourth mobile operator.⁴⁴

As for the United States, the Rewheel Report examined wireless plans in 41 countries and found that Americans already pay high prices: "the US has the 5th highest gigabyte prices in smartphone plans and is the most expensive market in mobile broadband among the 41 EU28 &

⁴¹ Rewheel Research, *The State of 4G Pricing - 2H2018* at 2 (Oct. 28, 2018), http://research.rewheel.fi/downloads/The_state_of_4G_pricing_DFMonitor_10th_release_2H2018_PUBLIC.pdf ("Rewheel Report").

⁴² *Id.* at 1.

⁴³ *Id.* at 2.

⁴⁴ *Id.*

OECD countries.”⁴⁵ The Rehweel Report highlights the following stark comparisons between the U.S. and other countries, concluding that the U.S. already has prices that are more typical of markets with three mobile network operators (“MNOs”):

- The median gigabyte price of smartphone plans in the U.S. is four times higher than in the EU’s 4-MNO markets;
- The median gigabyte price in the U.S. is 16 times higher than in a competitive 4-MNO large European market;
- The U.S. market is “considerably less competitive” than the already consolidated 4-to-3 Austrian, Irish and German markets and “a universe apart” from the competitive Danish, French, UK, Dutch, Swedish and Italian 4-MNO markets.⁴⁶

Of course, the fact that U.S. prices are higher already than they are in other four-participant markets does not mean that all of the harm has been done. Just the opposite: American consumers cannot afford the increases that this merger will likely produce on top of these already high prices.

V. CONCLUSION

For the foregoing reasons, the Commission should deny the transaction as currently proposed.

⁴⁵ *Id.*

⁴⁶ *Id.* at 3.

Respectfully submitted,

/s/

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December 4, 2018

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I. Introduction and Overview of Declaration

With Professor Joe Harrington, we have previously submitted two declarations in this proceeding. In our first declaration,¹ we supplied: (a) an analysis of the merger’s likely competitive effects, finding that it would lead to large increases in upward pricing pressure and therefore will likely increase prices for both retail and wholesale customers, and that HHI screens indicated that the merger would be presumptively harmful; (b) an assessment of the network modeling presented by the Applicants, finding that the Applicants’ claims of large increases in offered capacity were significantly overstated; (c) an analysis of the merger’s potential to increase the likelihood of coordinated conduct, finding that T-Mobile would lose its incentives for maverick behavior and that the incentives to coordinate would increase, leading to large potential increases in prices; and (d) a spectrum screen evaluation of the merger, finding that New T-Mobile would exceed the spectrum screen in over {{BEGIN HCI END HCI}} of counties in the United States.²

We have also submitted a reply declaration³ to the Israel, Katz, and Keating (henceforth “IKK”) report.⁴ IKK claimed that our prior declaration ignored marginal cost efficiencies. IKK alleged that these marginal cost efficiencies were sufficiently large that, if properly accounted for, would neutralize the Applicants’ post-merger incentives to raise prices. They further claimed that, to the extent there was any residual upward pricing pressure caused by the merger, any potential

¹ Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Exhibit B to Petition to Deny of DISH Network Corporation, *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, August 27, 2018 (henceforth “HBVZ Declaration” or “HBVZ”).

² HBVZ Declaration Table 31, at p. 107.

³ Reply Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Exhibit B to Petition to Deny of DISH Network Corporation, *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, October 31, 2018 (henceforth “HBVZ Reply Declaration” or “HBVZ 2”).

⁴ Declaration of Compass Lexecon, Mark Israel, Michael Katz, and Bryan Keating, Appendix F to Joint Opposition of T-Mobile US, Inc. and Sprint Corporation, *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, September 17, 2018 (henceforth “IKK Declaration”).

harm from the resulting price increases would be more than offset by subscribers' valuations of the claimed improvements in network quality.

In *HBVZ 2*, we addressed IKK's criticism in several ways. First, we examined the disaggregated pricing forecasts and efficiency *thresholds* that are embedded in IKK's modeling, finding that IKK's own model predicted significant price increases, both with and without the threshold and the claimed efficiencies. Second, we evaluated the magnitude of the claimed marginal cost efficiencies, and found that adjusting the input assumptions to account for, among other things, spectrum asset holdings that the Applicants need and plan to acquire, substantially reduced the model's forecasts of marginal cost efficiencies. Finally, we examined the IKK estimates of consumer valuations of the claimed network quality changes, and found that they were irrelevant and, in any event, even as presented, insufficient to offset the harm from the merger's price effects. In addition to these findings, *HBVZ 2* highlighted that even without any corrections, IKK's claims of no consumer welfare losses from the merger were predicated on welfare cross-subsidies, where any predicted post-merger price decreases for some subscribers are offset by price increases to many others.

Counsel for DISH has asked us to review the report filed for the Applicants by John Asker, Timothy Bresnahan, and Kostis Hatzitaskos (henceforth "Cornerstone").⁵ In their report, Cornerstone presents an analysis of merger effects that is based on measured subscriber-level usage experiences in 2018. With today's networks this is primarily the users' LTE network experience.⁶ This information forms the basis of a model of subscriber demand for LTE service that Cornerstone seeks to use in order to assess consumer preferences for network quality (e.g., LTE speed and coverage). Cornerstone claims to find that the subscriber willingness to pay ("WTP") for modest (e.g., {{BEGIN HCI END HCI}}) improvements in network quality is sufficiently high that the improvements in network quality that arise from the merger need only

⁵ Economic Analysis of the Proposed T-Mobile/Sprint Merger by John Asker, Timothy F. Bresnahan, and Kostis Hatzitsaskos. *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, November 6, 2018 (henceforth "Cornerstone Report").

⁶ When an LTE signal is not available to a user, they will fall back on to the network operator's 3G or 2G network, if available. These older network technologies have much lower user throughput compared to LTE, holding congestion and other things equal. Throughout, when we refer to LTE (service, network, etc.) we are referencing the entire integrated network, including the 2G and 3G technologies that supplement the carrier's LTE network.

be minimal to offset any potential harm from price increases arising from the increase in market power associated with the merger. As demonstrated below, we strongly disagree.

We assess the findings of Cornerstone in the following ways: (1) we consider the relevancy of the Applicants' network quality and marginal cost efficiencies to the analysis performed by Cornerstone; (2) we explore the extent to which there is possible overstatement or bias in Cornerstone's calculations of the WTP for network quality improvements; (3) we examine the underlying increase in market power and the likely price increases that would result absent any marginal cost or network quality efficiencies; (4) we calculate the price effects under the inapposite (and, in any event, also overstated) 5G network marginal cost efficiencies estimated by IKK; (5) we compare the predicted price effects to the implied WTP under the (unsubstantiated) network quality improvements considered by Cornerstone; and (6) we consider the extent to which the Cornerstone Report, like the IKK Declaration, relies upon a similar extent of cross-subsidization of benefits to certain subscribers offsetting harm to other subscribers in its determination of consumer welfare effects.

II. Summary of Findings

The additional analyses undertaken and summarized in this declaration reinforce the main conclusions that we have presented in our prior declarations. A summary of our conclusions follows:

- Cornerstone's estimates of consumer preferences for LTE service cannot be combined with the Applicants' claims of quality and cost efficiencies for 5G service.
- Neither Cornerstone nor the Applicants provide testimony describing either (a) the network quality or (b) the network marginal cost efficiencies associated with merging Sprint and T-Mobile's existing LTE networks. Cornerstone presents hypothetical scenarios for quality improvements in New T-Mobile's LTE network, but these are not connected to any representations made by the Applicants. The primary testimony submitted by the Applicants regarding network efficiencies is the Ray Network model and the IKK adaptations of it, which is focused on the transition from LTE to 5G deployments over the 2021 to 2024 period, not on improvements in LTE quality in the near term as a goal in itself.

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- Because Cornerstone’s analysis is based solely on observations concerning existing LTE service, its estimates of WTP are not transferrable to an assessment of consumer preferences regarding 5G service. The level of incremental quality improvement used by Cornerstone to estimate WTP is miniscule when compared to 5G speed levels. The baseline of Cornerstone’s analysis is, on average, LTE networks providing service at {{BEGIN HCI END HCI}} throughput measured in 2018 – a stark contrast to the {{BEGIN HCI END HCI}} or more speeds that the Applicants claim will arise from the merger a few years in the future.
- Cornerstone errs in combining their analysis of consumer demand for LTE service with IKK’s estimates of 5G network marginal cost savings in their assessment of the merger’s effects on consumer welfare. Any consumer welfare or price forecasts that are based on these 5G network marginal cost efficiencies are irrelevant to the question of whether cost efficiencies in the provision of LTE service are sufficiently high to offset the merger’s upwards pricing for the Applicants’ LTE service plans.
- Cornerstone’s calculations of WTP for LTE service are incomplete and overstated.
- While Cornerstone considers the importance of consumer income in calculating network quality preferences across brands, they do not appropriately account for it in their calculation of what consumers would be willing to pay for improved quality of LTE service. When we correct the WTP calculation to account for income effects in the demand for LTE service, we find that the resulting WTP is considerably lower for tens of millions of the Applicants’ subscribers than the values presented by Cornerstone. Whereas in the Cornerstone Report a heavy LTE data user would be willing to pay {{BEGIN HCI END HCI}} more for a {{BEGIN HCI END HCI}} Mbps increase in speed, in our calculation these values shrink by as much as 15% on average for non-premium brands, and are approximately 30% lower for the bottom income quartile of subscribers.
- Cornerstone’s consumer demand model suffers estimation bias due to (a) omission of key decision variables, such as plan prices, quality choices, and other quality dimensions; and (b) an assumption of fixed, “exogenous” network quality. Because

the omitted plan and quality features are likely to be associated with both brand selection and speeds and data use, Cornerstone's estimates of WTP, particularly for "heavy" data users, are likely overstated. Additionally, Cornerstone fails to account for carriers' joint determination of network quality and other aspects of being a service provider that directly influence customer choices and preferences. For example, where a carrier advertises more heavily or has more retail outlets is likely related to where it has a higher quality network. Similarly, greater network and other investments will be made where an operator has, or expects to have, more customers to serve. Cornerstone ignores these interconnections and assumes that the network and other quality variables are independent of the number of subscribers being served. This inappropriate assumption also inflates Cornerstone's estimated WTP values.

- Cornerstone's WTP estimates are also inflated as a result of arbitrary segmentation of subscribers by data usage types. Their demand model shows that heavier data use is associated with greater valuation of network quality improvements. By aggregating approximately {{BEGIN HCI END HCI}} of subscribers into a data usage category that ranges from {{BEGIN HCI END HCI}} to more than {{BEGIN HCI END HCI}}, Cornerstone overstates the valuation of network quality improvements for lower data usage subscribers in that category. For example, approximately half of Cornerstone's "heavy data" subscribers use less than {{BEGIN HCI END HCI}}, and value network speed improvements {{BEGIN HCI END HCI}} less than subscribers above {{BEGIN HCI END HCI}}.
- Cornerstone presents diversion information as an output resulting from their demand modeling, which is based on survey information from Nielsen Mobile Performance ("NMP") data and KPMG StreamShare data. The resulting diversion ratio estimates between the Applicants' brands are significantly lower than those observed in national-level Local Number Portability ("LNP") (porting) data. To the extent that national porting data reflect the general pattern of actual subscriber switching behavior across the facilities-based carriers, the gap in estimated diversion ratios may suggest that the Cornerstone modeling, either methodologically or by virtue of the

underlying data, would be significantly understating consumer substitutability between the Applicants' brands.

- As shown in Table 15, porting data in KPMG geographic areas where NMP-recorded Verizon speeds exceed T-Mobile speeds show that T-Mobile accounts for a significant share of Verizon ports-out, regardless of whether the speed differential is above or below 10%.
- The Cornerstone model predicts significant price increases from the merger, and is consistent with the unilateral effects predicted by the IKK model.
 - Price increases are highest for Sprint subscribers and for prepaid subscribers.
 - Even if, in error, the 5G network marginal cost efficiencies in the IKK Declaration are applied to the Cornerstone model, Sprint and Boost/Virgin subscribers would continue to be harmed by the merger. This is consistent with the findings regarding the IKK model described in *HBVZ 2*.
 - Under Cornerstone's "Best-of-Both" scenario for network quality improvements, the estimated median WTP (for those service quality improvements) is insufficient to offset the price increases forecasted for each of the Applicants' brands. Furthermore, at the individual subscriber level, the forecasted price increase exceeds the estimated WTP for **{{BEGIN HCI END HCI}}** of all of the Applicants' subscribers.
 - After adjusting the Cornerstone WTP estimates to reflect income effects in the estimates of price sensitivity, we discover that the gap between predicted price increases and WTP is considerably larger for lower income subscribers in comparison to high-income subscribers. This gap is more than **{{BEGIN HCI END HCI}}** for low-income versus high-income subscribers across each of the Applicants' brands.
- As in the IKK Declaration, Cornerstone presents a consumer welfare standard that would ignore harm to a significant fraction of wireless subscribers by aggregating welfare losses and gains across all subscribers, including even those of the non-merging parties. For example, in both the Cornerstone Report and in the IKK

Declaration, cost efficiency scenarios are presented where Sprint and prepaid subscribers face price increases while T-Mobile subscribers face price decreases, with Cornerstone and IKK both arguing that the merger should not be blocked so long as aggregate welfare is not reduced by the merger. This standard effectively advocates for a wealth transfer from some customers to others, and to the extent that the benefitting subscribers may be higher income and heavier data users, while harmed subscribers may be lower income and lower data users, such a wealth transfer may run counter to long-standing telecommunications and competition policies.

III. The Applicants' 5G Efficiencies Claims are Irrelevant to the Cornerstone Analysis

Cornerstone's estimates of WTP for network quality improvements are based on measured customer experience. Therefore, these estimates are applicable only to the networks currently operated by the Applicants, which predominantly offer 4G LTE service. Cornerstone's estimates of WTP cannot be used to predict consumer WTP for network improvements in the future 5G universe presented by IKK. Also, they cannot be combined with the 5G-based marginal cost savings calculated by IKK. Doing so would result in an apples-to-oranges comparison.⁷ The Applicants have not offered any forecasts in marginal costs savings for the current LTE networks under operation by Sprint and T-Mobile. Forcing a combination of marginal cost efficiencies derived from a network model specifically simulating 5G network upgrades and rollout with a merger simulation calibrated to demand estimates from LTE usage data is inaccurate and will lead to faulty conclusions.

Furthermore, Cornerstone did not provide support for the speed and coverage improvements assumed in a merged T-Mobile/Sprint combined LTE network, nor have the Applicants put forward a model of such quality improvements. Thus, there is no basis for any WTP or other welfare analyses for Cornerstone's network quality improvement scenarios. Cornerstone considers various ad-hoc hypothetical quality improvements⁸ and their estimates are completely

⁷ Cornerstone Report Exhibits 26, 27, 28, 31, 32, 33, 36, 37.

⁸ Section 4.2.4 of the Cornerstone Report considers a scenario where Sprint's coverage improves to that of T-Mobile while T-Mobile's speeds improve to those of Sprint. Section 4.2.5 considers a scenario where the Applicants' speed and coverage are increased to the level of Verizon. Section 4.4 considers

irrelevant to the current merger at hand. As mentioned above, IKK's demand and network modelling envisions throughput improvements that are orders of magnitude larger than any of the improvements considered in the Cornerstone Report. Thus, it is inapposite to apply WTP valuations based on LTE speeds to a 5G universe. Cornerstone, itself, makes no such claim, and the Commission should resist taking any invitation to do so. Such an application would simply be erroneous. Multiplying Cornerstone's WTP estimates {{BEGIN HCI

END HCI}} by the Applicants' 5G network throughput increase claims (of {{BEGIN HCI
END HCI}} or more) would yield implausible estimates of the benefits subscribers would ascribe to the merger.

The Cornerstone model also introduces a completely different metric of user experience than those used by the Applicants.⁹ The Ray model reported offered traffic (what the network model was designed to make available), carried traffic (what the network model was designed to deliver), and theoretical calculated user throughput (the speeds it is designed to deliver). In contrast, the Cornerstone model measures actual user experiences, an entirely different measure from the theoretical throughput reported by Ray.

As an initial matter, the measured user experience reported by Cornerstone is conceptually very different from the theoretical throughput of the Ray model. The latter is what a model is designed to provide, abstracting from many specifics of user experience. For example, on the supply side, the Ray model does not address issues of terrain or reach of different frequencies. The estimated capacity of a node is simply the amount of spectrum deployed by its band-specific assumed efficiency (bits/hertz, second) and does not take into account such things as the terrain, building density or type or that the reach of signals of different frequencies will be different. On the demand side, the Ray model simply apportions expected national demand levels to individual nodes.

Continued from previous page

the network quality improvements from Section 4.2.4, plus the IKK marginal cost efficiencies. *See* Cornerstone Report, at pp. 48-56, 71-72.

⁹ That is, the Cornerstone analysis focuses on a different network technology (4G for Cornerstone vs. 5G for Ray and IKK) and a different time period (the recent past for the Cornerstone analysis vs. 2021-2024 for the Ray and IKK analyses).

In contrast, the Cornerstone analysis focuses on actual user experience and finds it at levels far below what the Ray model would predict, even for LTE. This is because of several reasons that are conflated in the measured user experience metric. A lack of coverage or reduction in throughput can happen for three distinct reasons. One is that the network is not designed to reach a given geographic spot with a sufficiently strong signal. This could be because the area is at the extensive edge of a node's coverage area or at the intensive edge deep inside a building or behind an obstruction. Another reason for degraded performance is congestion. Although the Ray model uses a stylized distribution of demand, actual demand is such that subscribers come onto the network in uneven amounts or physically move around the network. In addition, since the Cornerstone analysis is based on actual measured user experience it includes users who are not able to receive the LTE signal and are falling back on the carriers' 2G and 3G networks. There is no reason to believe that a combined network would be able to provide 5G services (and therefore negate the need to fall back on 2G or 3G networks), yet would somehow be unable to provide LTE services in those areas.

Finally, the gulf between the theoretical user experience and the actual user experience can be large. The Ray models predict an average user throughput level for LTE of {{BEGIN HCI
END HCI}} for Sprint, {{BEGIN HCI END HCI}} for T-Mobile, and {{BEGIN HCI
END HCI}} for New T-Mobile in 2021. In contrast, the Cornerstone modeling reports an average user throughput of approximately {{BEGIN HCI END HCI}} today.¹⁰ Although the Ray model does not allow us to estimate what the LTE user experience is modeled to be today, conservatively reducing the 2021 experience of {{BEGIN HCI END HCI}} for New T-Mobile to {{BEGIN HCI END HCI}} still suggests a fifty-fold increase in theoretical or planned user experience from actual user experience. The actual user throughput on which Cornerstone relies is much less than the theoretical user throughputs in the Ray models. In other words, the Cornerstone analysis is based on a level of throughput that does not remotely align with the level of throughput at which the Applicants claim there to be merger benefits.

¹⁰ See Applicants' Network Engineering Models for LTE average user throughputs. See Cornerstone Report, ¶ 131 for today's average experienced throughput.

IV. Willingness to Pay for Quality Improvement are Overstated in the Cornerstone Report

A. Cornerstone's Current Methodology Ignores Income Effects in their Willingness to Pay Calculations, Overstating the Benefits of Network Quality Improvements for Lower Income Subscribers

The Cornerstone Report includes estimated WTP for a hypothesized set of network quality improvements.¹¹ The calculation of WTP reflects the level of price increase that consumers would accept in order to receive a given change in quality of service and remain indifferent relative to the pre-change price and quality. In addition to the assumed level of quality improvement, the WTP calculation therefore requires two quantities of interest: the demand model coefficients on network quality (e.g., speed) and a parameter that scales consumer utility to currency. Cornerstone calculates the latter by making an assumption that price enters the utility function additively through the location-brand fixed effect and then calibrating the firm's (e.g., T-Mobile's) profit-maximizing condition (i.e., its "first order condition") to the estimated market shares and margins.¹² Cornerstone uses this calibrated coefficient¹³ to scale utility into dollars to calculate consumer WTP for quality improvements.

This approach, however, is accurate only under the assumption that there are not any income effects in the consumer's utility function.¹⁴ Despite the fact that Cornerstone explicitly incorporates such income effects into their demand model (and does so separately for each brand), their estimate of the price sensitivity parameter assumes that there is no interaction in

¹¹ Cornerstone Report Exhibit 6, at p. 27.

¹² See Cornerstone Report fn. 54 and Appendix 5.3.2, at pp. 27, 134-135.

¹³ This method obtains a price coefficient of approximately {{BEGIN HCI END HCI}}.

¹⁴ For example, Berry, Levinsohn, and Pakes allows for a certain type of income effect assuming Cobb-Douglas utility functions, where WTP is ultimately a function of the coefficient on the term $\ln(y-p)$, a function of both income and prices. Steven Berry, James Levinsohn, and Ariel Pakes, "Automobile Prices in Market Equilibrium," *Econometrica* 63, no. 4 (1995): 841-90. See also, Aviv Nevo, "A practitioner's guide to estimation of random-coefficients logit models of demand." *Journal of economics & management strategy* 9, no. 4 (2000): 518.

the relationship in subscriber price sensitivity and the subscriber's income.¹⁵ Such treatment is econometrically unsound: because Cornerstone allows income effects to differ across brands, the marginal utility of price cannot be backed out from the profit maximization condition without considering its relationship with the income effect. Cornerstone fails to consider this relationship.

Cornerstone's misapplication of the price sensitivity parameter in the WTP calculations raises concerns about their interpretation. We provide formal details of the modeling for how price sensitivity is a function of income in Appendix Section A, and incorporate income effects in the WTP calculation in the discussion that follows.

Table 1 provides the resulting WTP for speed improvements that reflect these income effects. The WTPs shown in the table can be directly compared to the WTP for speed improvements shown in Cornerstone's Exhibit 6.

**Table 1: WTP by Brand for Average Speed Improvement
of {{BEGIN HCI END HCI}} Adjusting for Income Effects
{{BEGIN HCI**

END HCI}}

Source: Adjusted Cornerstone Backup Materials. See Cornerstone Report Exhibits 5, 6, at pp. 26-27.

¹⁵ That is, income effects are lower for the carrier's flanker brands, Boost/Virgin, Cricket, and MetroPCS, than they are for the national postpaid brands, suggesting that lower-income individuals are more likely to choose a non-premium brand over a national postpaid brand.

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Note: WTP estimates are median values by consumer group.

As indicated earlier, Cornerstone reported WTP values at an aggregate level across brands and across income levels. In contrast, accounting for income effects leads to WTP values that vary across brands and across income groups. However, brand choice is highly correlated with income. For example, Cornerstone reports that the median income for Sprint and T-Mobile subscribers is approximately $\$24,000$, while median income is less than $\$15,000$ for these carriers' "non-premium" brands (MetroPCS and Boost/Virgin).¹⁶ Table 1 shows how income effects alter the median WTP by brand for a speed improvement of 10% . Table 1 demonstrates that, when the correlation in brand choice and income is incorporated into the WTP, there is a divergence in the WTP values among brands (e.g., "premium" vs. "non-premium" brands). For example, the table shows that medium data users of "premium" brands value the speed improvement at $\$1,200$, while "non-premium" brand medium data users value the speed improvement at $\$800$. This is in contrast to the Cornerstone WTP for medium data users, who value this speed improvement by $\$1,000$, regardless of income level or brand choice.¹⁷

We have also examined WTP by income group. Table 2 below presents WTP calculations for a speed improvement of $\{\text{BEGIN HCI} \quad \text{END HCI}\}$, separately by income quartile.¹⁸

Table 2: WTP by Income Group for Average Speed Improvement of {{BEGIN HCI}} to {{END HCI}} Adjusting for Income Effects

¹⁶ See Cornerstone Report, Exhibit 65, at p. 106. Income is recorded as the median income by zip code, and the values reported above are the median of median income values across zip codes within the respective brands.

¹⁷ See Cornerstone Report, Exhibit 6, at p. 27

¹⁸ Reported values for a given quartile are the within-quartile, within data usage type median of estimated WTP for the quality improvement.

END HCI}}

Source: Adjusted Cornerstone Backup Materials. See Cornerstone Report Exhibits 5, 6, at pp. 26-27.

Note: WTP estimates are median values by consumer group.

As shown in the table, WTP for this speed improvement is considerably lower for lower income groups compared to higher-income groups. For example, among medium data users, the WTP for a speed improvement of {{BEGIN HCI END HCI}} is approximately {{BEGIN HCI END HCI}} for the subscribers in the bottom income quartile, while medium data users in the subscribers in the top income quartile value the speed improvement at approximately {{BEGIN HCI END HCI}}. The WTP value for the bottom income quartile is approximately 30% lower than the value reported in the Cornerstone Report for medium data users.¹⁹ Likewise, the WTP for the bottom quartile of heavy data users is more than 30% lower than the value reported in the Cornerstone Report.²⁰ By failing to account for income effects in their WTP calculations, the Cornerstone Report overstates the value that lower-income subscribers assign to network quality improvements.

In addition, regardless of the fact that Cornerstone ignores income effects in its calculation of WTP, they also consider only the margin for the T-Mobile brands in their calculations. As a general rule, however, the profit-maximization condition implies an inverse relationship

¹⁹ Cornerstone Report Exhibit 6 shows that Medium Data users will value a unit speed increase at {{BEGIN HCI END HCI}}. See Cornerstone Report Exhibit 6, at p. 27.

²⁰ Cornerstone Report Exhibit 6 shows that Heavy Data users will value a unit speed increase at {{BEGIN HCI END HCI}}. See Cornerstone Report Exhibit 6, at p. 27.

between margins and the price sensitivity parameter. Cornerstone uses the T-Mobile margin, with an estimated margin of more than {{BEGIN HCI END HCI}} across its owned brands; had they considered a sensitivity analysis based on their estimated Sprint margin of approximately {{BEGIN HCI END HCI}}, they would have calculated a significantly larger price sensitivity parameter. We have revised the Cornerstone model to calculate the alternative price sensitivity parameter, and find that it increases to {{BEGIN HCI END HCI}}, from a value of {{BEGIN HCI END HCI}} under the T-Mobile margin. When used in place of the T-Mobile-based WTP calculations, Cornerstone's values would decline across the board by a factor of approximately {{BEGIN HCI END HCI}}. For example, Cornerstone reports that "heavy" data users would value a speed improvement of {{BEGIN HCI END HCI}} at {{BEGIN HCI END HCI}};²¹ had Cornerstone used the same methodology but relied upon their estimated Sprint margins instead, this value would have been reduced to {{BEGIN HCI END HCI}}.²²

B. Network Quality Parameters in the Cornerstone Model are Likely Biased to Overstate Subscriber Valuation of Network Quality Improvements

Cornerstone's demand estimates indicate that subscribers in the NMP data seem to account for network quality when choosing brands and are more likely to choose brands with higher network quality (all else equal). However, the estimated effects in the Cornerstone model are likely biased upwards. This upward bias arises from the omission of key variables that are positively correlated with network quality. For example, heavy data users may be more likely to choose unlimited data plans, which may be associated with faster speeds and/or better LTE coverage. Omission of plan choice would then confound the estimation of the parameters associated with network quality.

Moreover, it appears that, within the NMP data, T-Mobile, MetroPCS, and Sprint have outsized shares of the heavy data users in comparison to overall subscriber shares, further indicating likely upwards bias in the estimated value of network quality improvements in the Cornerstone

²¹ See Cornerstone Report Exhibit 6, at p. 27.

²² In addition to reducing the WTP for network quality improvements, using Sprint margins would also affect post-merger outcomes, including estimated price increases and required cost efficiencies (both lower).

model.²³ In addition to the omission of plan characteristics, such as unlimited data, these brands offer their unlimited plans at lower prices.²⁴ All else equal, heavy data users would choose T-Mobile over Verizon or AT&T because T-Mobile offers a lower-priced unlimited plan, such that their brand choice may be driven by lower prices, not higher quality. Omission of plan prices may therefore bias Cornerstone's valuation of network quality improvements upwards.

Consider that T-Mobile offers various value-add promotions that may be correlated directly with usage type and speed. For example, the T-Mobile ONE Plus upgrade allows HD streaming and mobile hotspots to connect other devices to the internet. This plan explicitly allows for higher throughput usage and is competitively priced, and therefore would be positively correlated with the quality variables in Cornerstone's estimation. This quality characteristic is omitted from the Cornerstone demand model.

C. The Segregation of Data Usage Types in the Cornerstone Report Leads to Overstatement of the Value of Network Quality Improvements for "Heavy" Data Users

Cornerstone selects thresholds for the segregation of subscribers by data usage intensity at {{BEGIN HCI}}. Little justification is provided for these threshold selections. The observed distribution of data usage shown in Figure 1 reveals that Cornerstone's "heavy" data user category contains a long tail far in excess of {{BEGIN HCI}}. As demonstrated below, this fact leads Cornerstone to overstate WTP for network quality improvements for more typical data users in Cornerstone's "heavy" data category. Such overstatement can arise to the extent that the high WTP estimates for the "heavy" data users are driven by a smaller fraction of subscribers at the very high end of the data usage distribution.

²³ See Cornerstone Exhibit 85, at p. 131. We can observe that T-Mobile has {{BEGIN HCI}} END HCI}} the number of heavy data users than light data users. For Verizon, in contrast, subscribers are {{BEGIN HCI}} END HCI}}.

²⁴ See HBVZ Declaration Table 10, at p. 30.

Figure 1: Density Histogram of Monthly Data Usage

$$\{\{ \text{BEGIN HCI}$$

END HCI}}

Source: Cornerstone Backup Material.

Notes: Weighted by Cornerstone's weights.

In Table 3 and Table 4 we re-estimate WTP based on the demand model above (with income effects), with an additional category of user type. We see that “very heavy” data users (more than `{{BEGIN HCI` `END HCI}}`) determine much of the calculated increase in WTP values in Cornerstone’s “heavy” data user category.

**Table 3: WTP by Brand for Average Speed Improvement
of {{BEGIN HCI END HCI}} Adjusting for Income Effects
(Separate Heavy and Very Heavy Data Usage)
{{BEGIN HCI**

END HCI}}

Source: Adjusted Cornerstone Backup Material to include an additional usage type.

Note: WTP estimates are median values by consumer group.

For example, Table 3 shows that only {{BEGIN HCI END HCI}} of subscribers would value the indicated increases in speed or LTE coverage by more than {{BEGIN HCI END HCI}}. In contrast, the Cornerstone cutoff implies that almost {{BEGIN HCI END HCI}} of subscribers would value a {{BEGIN HCI END HCI}} increase in speed at {{BEGIN HCI END HCI}}.²⁵ Similar conclusions hold for the improvement in LTE coverage.

²⁵ See Cornerstone Report, Exhibit 6, at p. 27.

Table 4: WTP by Income Group for Average Speed Improvement of {{BEGIN HCI END HCI}} Adjusting for Income Effects (Separate Heavy and Very Heavy Data Usage)

{{BEGIN HCI

END HCI}}

Source: Adjusted Cornerstone Backup Material to include an additional usage type.
Note: WTP estimates are median values by consumer group.

Similarly, Table 4 shows the breakdown by income group for the WTP of a speed improvement of {{BEGIN HCI END HCI}} after separating out heavy and very heavy data users. For lower income consumers (i.e., the first quartile in terms of income), the median WTP among Cornerstone’s “heavy” data users is {{BEGIN HCI END HCI}}. However, splitting these data users into “heavy” and “very heavy” categories shows that the WTP for users of between {{BEGIN HCI END HCI}} reduces to {{BEGIN HCI END HCI}}. Similar splits occur for the top income quartile of subscribers. The median WTP among Cornerstone’s “heavy” data users for this income group was {{BEGIN HCI END HCI}}. But when this group is split into “heavy” and “very heavy” data users, the WTP for data users of between {{BEGIN HCI END HCI}} drops down to {{BEGIN HCI END HCI}}.

V. Price Effects in the Cornerstone Model

In *HBVZ 2*, we explained that the demand modeling in the IKK Declaration predicted significant price increases from the Sprint/T-Mobile merger. We showed that IKK’s (5G network) marginal cost efficiencies were significantly overstated, and that the merger is likely to lead to price increases for Sprint subscribers - even if we accepted the inflated level of marginal cost savings claimed by IKK. Thus, any conclusions that IKK might draw from the modeling regarding the welfare effects of the merger were predicated on an assumption that the harm to Sprint

subscribers from these price increases could be offset by the claimed price decreases for T-Mobile subscribers.

The Cornerstone model predicts effects that are comparable in magnitude to those predicted by IKK. That is, although Cornerstone employs subscriber-level data, which they use in an attempt to estimate demand for LTE service as a function of service quality, the fundamental conclusions of their analysis are essentially the same.²⁶ Absent efficiencies, prices are predicted in the Cornerstone model to increase by more than {{BEGIN HCI END HCI}} for both T-Mobile and Metro PCS, and by more than {{BEGIN HCI END HCI}} for both Sprint and Boost/Virgin.²⁷ On average, the Cornerstone model predicts that the Applicants' subscribers would face price increases from the merger of more than {{BEGIN HCI END HCI}}.²⁸

As we explained in Section III, the Applicants have provided no support for any possible merger-related efficiencies for LTE service. IKK use the Applicants' 5G network model to forecast possible efficiencies in the provision of 5G service, but any values obtained from this, even if the forecasts were accurate, would be irrelevant with regard to LTE service. This is true of both estimates of marginal cost efficiencies as well as claims of improvements in network quality.

Despite this limitation, Cornerstone, inaccurately presents model forecasts for changes in welfare based on unsupportable efficiencies claims. For cost efficiencies, Cornerstone presents forecasted welfare effects under scenarios that are explicitly tied to the marginal cost efficiencies presented in the IKK Declaration (e.g., {{BEGIN HCI END HCI}} of the IKK efficiencies).²⁹ For network quality improvements, Cornerstone presents forecasted welfare effects under scenarios that are not supported by existing testimony, including arbitrary 10% increases in

²⁶ This can, in fact, be anticipated based on the cost efficiency welfare-neutral frontiers that both Cornerstone and IKK present. Specifically, Cornerstone Exhibit 14 provides the critical marginal cost efficiency frontier based on their demand estimation. This exhibit is directly comparable to Figure 2 in the IKK Declaration, and the range of efficiencies presented in the two frontiers are nearly the same. *See* Cornerstone Report Exhibit 14, at p. 43. *See also* IKK Declaration Figure 2, at p. 35.

²⁷ *See* Table 5.

²⁸ *See* Table 5.

²⁹ Cornerstone Report, pp.58-61

speed and a “Best-of-Both” scenario where T-Mobile speeds increase to Sprint levels and Sprint coverage improves to T-Mobile levels.³⁰

Although the Applicants have not provided testimony to support the applicability of these efficiency scenarios to the Cornerstone demand model for LTE service, we describe, below, the price effects associated with these claims. When the IKK 5G network marginal cost efficiencies are applied to the Cornerstone model, we find that, as with our review of the IKK demand model, prices still increase for Sprint (by more than {{BEGIN HCI END HCI}}) and Boost/Virgin (by more than {{BEGIN HCI END HCI}}).³¹ When the Cornerstone “Best-of-Both” scenario for network quality improvements is considered, we find that the WTP for the network quality improvements is exceeded by the predicted price increases for approximately {{BEGIN HCI END HCI}} of the Applicants’ subscribers.

A. The Cornerstone Model Predicts Significant Price Effects from the Merger

Using the backup materials provided for the Cornerstone Report, we have replicated the results of the Report. The Cornerstone model estimates subscriber demand for wireless service based on NMP data, supplemented by KPMG StreamShare data (for subscriber shares by geographic area), which is predominantly service provided with LTE technology.³² Cornerstone uses these demand estimates to estimate changes in consumer welfare from the merger, associated critical cost and quality efficiency thresholds that would leave aggregate welfare unchanged, under various scenarios. The model also predicts price changes by brand for any given scenario, which is the underpinning of Cornerstone’s consumer welfare effects in those scenarios. In Table 5, below, we present the model’s price forecasts under the base scenario, with no marginal cost or network quality efficiencies.

³⁰ Cornerstone Report, at p. 40.

³¹ See Table 6.

³² See Cornerstone, at pp. 72-136.

Table 5: Cornerstone Merger Simulation Price Changes with No Efficiencies

{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Materials.

As shown in the table, Cornerstone’s demand modeling from the NMP/KMPG data results in a significant price increase for each of the Applicants’ brands. Among the “premium” brands, prices are expected to increase by {{BEGIN HCI END HCI}} for Sprint subscribers, by {{BEGIN HCI END HCI}} for T-Mobile subscribers, and by {{BEGIN HCI END HCI}} on average across the two “premium” brands. Among the “non-premium” brands, prices are expected to increase by {{BEGIN HCI END HCI}} for Boost/Virgin subscribers, by {{BEGIN HCI END HCI}} for Metro PCS subscribers, and by {{BEGIN HCI END HCI}} on average across the two sets of “non-premium” brands. On average, across all of the Applicants’ brands, prices are forecasted in the Cornerstone model to increase by {{BEGIN HCI END HCI}}. These values are roughly comparable to the price increases that we reported in *HBVZ 2* as arising from the IKK model.³³

³³ See HBVZ Reply Declaration, Table 1, at p. 13.

B. The IKK 5G Network Marginal Cost Efficiencies, Even if Relevant, Would be Insufficient to Offset the Price Effects of the Merger

The Cornerstone Report conditions its final aggregate consumer welfare results from the merger on the marginal cost efficiencies that IKK presents in their declaration. As we have indicated above, even if these claimed efficiencies were accurate,³⁴ they are derived from the Applicants' future 5G network modeling and are irrelevant with regard to possible marginal cost efficiencies for today's 4G LTE service. Nevertheless, we have examined the Cornerstone model's price forecasts under a scenario where the Applicants achieve the IKK level of efficiencies for their LTE networks. When we include IKK efficiencies in the Cornerstone merger simulation, we still observe that the merger increases prices. The IKK efficiencies only offset the upwards pricing pressure for T-Mobile and MetroPCS subscribers.³⁵ However, the IKK efficiencies are not sufficient to offset price increases for Sprint and Boost/Virgin subscribers. Table 6 below shows the price effects for the Applicants' brands.

³⁴ In *HBVZ 2* we demonstrated that IKK's claimed network marginal cost savings were significantly overstated. See HBVZ Reply Declaration, Table 9, at p. 35.

³⁵ This is because the IKK efficiencies are disproportionately larger for T-Mobile and MetroPCS relative to the Sprint and Boost/Virgin efficiencies.

**Table 6: Cornerstone Merger Simulation Price Changes
under IKK 5G Network Marginal Cost Efficiencies**

{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Materials and IKK Declaration.

Notes: “Combined” are averages of the brands weighted by subscriber shares.

As shown in the table, prices are expected to increase for Sprint and Boost/Virgin subscribers. The expected price increase for Sprint, even with the IKK efficiencies, is {{BEGIN HCI END HCI}}. On average there is an expected decrease in price for the “Premium Brands” of {{BEGIN HCI END HCI}}, due to T-Mobile having a relatively larger market share compared to Sprint. Among the “Non-Premium Brands,” Boost/Virgin prices are expected to increase {{BEGIN HCI END HCI}}. The price increase for Boost/Virgin is sufficiently large enough that prices for “Non-Premium Brands” subscribers, on average, are expected to increase by {{BEGIN HCI END HCI}}, despite the price decrease and larger market share for MetroPCS.

C. The Hypothesized LTE Network Quality Improvements would be Insufficient to Offset the Price Effects of the Merger

Cornerstone concludes that the Sprint/T-Mobile merger would improve consumer welfare by presenting a set of network quality improvement scenarios which are paired with the IKK marginal cost efficiencies. Specifically, they find that, across scenarios, any price increase effects

induced by the merger would be more than offset by wireless users' valuations of the network quality improvements. First and foremost, as we explained above, Cornerstone's conclusions are invalid because the future 5G network marginal cost efficiencies in the IKK Declaration are irrelevant to how the Applicants' LTE network marginal costs might change following the merger. We also noted that we are not aware of any testimony that the Applicants' have put forward that directly measures LTE network quality changes resulting from the merger. Nevertheless, we have considered the question of whether the network quality improvements described in the Cornerstone report are, as alleged, sufficient to offset the merger price effects predicted under the Cornerstone demand modeling. As demonstrated below, we find that they do not.

Table 7 shows the claimed quality improvements experienced by subscribers of the merging parties in Cornerstone's "One-sided Best-of-Both" quality improvement scenario.³⁶ This scenario considers a counterfactual quality improvement where T-Mobile network speeds are improved to match Sprint network speeds and Sprint's LTE coverage is improved to match T-Mobile's LTE coverage. The "Best-of-Both" scenario assumes that on average Sprint subscribers experience an increase in percentage of their time on LTE (in contrast to 2G and/or 3G) of {{BEGIN HCI
END HCI}} and Boost/Virgin subscribers will realize and increase of {{BEGIN
HCI
END HCI}}. The "Best-of-Both" scenario also assumes that network speeds for T-Mobile subscribers will increase by {{BEGIN HCI
END HCI}} and that for MetroPCS subscribers they increase by {{BEGIN HCI
END HCI}}.

Table 7a: Sprint Quality Improvements in the Cornerstone "Best-of-Both" Scenario
{{BEGIN HCI

³⁶ Cornerstone Report, Exhibits 36 and 37, at pp. 69-70, are focused on this scenario, augmented to include IKK 5G network marginal cost savings.

END HCI}}

Source: Cornerstone Backup Materials.

Table 7b: T- Mobile Quality Improvements in Cornerstone “Best-of-Both” Scenario

{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Materials.

Cornerstone describes this scenario as a way to “conservatively capture some of the speed and coverage benefits that Sprint and T-Mobile expect to realize from combining their complementary spectrum assets.”³⁷ However, the idea that this is a conservative scenario for how the LTE market will look post-merger is unfounded and, also, unrealistic. As the carriers transition and prepare for the 5G-enabled world, it is implied in the Applicants’ own network models³⁸ and internal documents that {{BEGIN HCI

END HCI}}. The reality where Cornerstone’s counterfactual scenario would be relevant is one where both firms continue to provide LTE services in the long-run with

³⁷ See Cornerstone Report, at p. 68

³⁸ See Ray Model outputs for New T-Mobile. See Applicants’ Network Engineering Models for LTE average user throughputs.

no consideration of reallocating their assets to transition into 5G. This reflects neither the current reality nor the Applicants’ own network modeling, and ultimately, the merger simulations under these quality claims are irrelevant.

Nonetheless, we have analyzed whether, under this “Best-of-Both” service quality improvement scenario, consumers would value higher LTE service quality more than the price increases predicted by the Cornerstone model, making no adjustments to the model. We find that this is generally not the case. Specifically, we find that consumer WTP values do not offset the predicted price effects of the merger for the vast majority of subscribers. Table 8 compares median WTP within brands for the “Best-of-Both” quality improvements against the price increases implied by Cornerstone’s merger simulation model (with no marginal cost efficiencies). The price effects in this scenario include the upward pressure from increased market power due to the merger plus increases in prices that are induced by the increased quality of the Applicants’ networks relative to the non-merging carriers.

**Table 8: Estimated Price Changes vs WTP for Quality Improvements
Under Cornerstone “Best-of-Both” Scenario**

[[BEGIN HCI

END HCI]]

Source: Cornerstone Backup Materials.

Notes: “Combined” are averages of the brands weighted by subscriber shares.

As shown in the table, all subscribers would experience a price increase as a result of the merger in Cornerstone’s own “Best-of-Both” scenario. Among the “premium” brands, prices would be expected to increase by [[BEGIN HCI END HCI]] for Sprint subscribers, by [[BEGIN HCI END HCI]] for T-Mobile subscribers, and by [[BEGIN HCI END HCI]] on average across the two “premium” brands. Among the “non-premium” brands, prices would be expected

to increase by {{BEGIN HCI END HCI}} for Boost/Virgin subscribers, by {{BEGIN HCI END HCI}} for MetroPCS subscribers, and by {{BEGIN HCI END HCI}} on average across the two sets of “non-premium” brands. On average, across all of the Applicants’ brands, prices would be predicted to increase by {{BEGIN HCI END HCI}}.

The table also compares the median WTP (across subscribers within a brand) for the “Best-of-Both” scenario quality improvements to the predicted price changes. Among the “premium” brands, price increases would be expected to exceed the median WTP for the network quality improvements by {{BEGIN HCI END HCI}} for Sprint subscribers, by {{BEGIN HCI END HCI}} for T-Mobile subscribers, and by {{BEGIN HCI END HCI}} on average across the two “premium” brands. Among the “non-premium” brands, price increases would be expected to exceed the median WTP for the network quality improvements by {{BEGIN HCI END HCI}} for Boost/Virgin subscribers, by {{BEGIN HCI END HCI}} for Metro PCS subscribers, and by {{BEGIN HCI END HCI}} on average across the two sets of “non-premium” brands. On average, across all of the Applicants’ brands, prices increases would be forecasted to exceed the WTP for the network quality improvements by {{BEGIN HCI END HCI}}, meaning that more than half of the forecasted {{BEGIN HCI END HCI}} price increase across the Applicants’ brands would not be offset by the increase in WTP.

Finally, Table 8 also shows the percentage of each brand’s subscribers who face a price increase that exceeds their individual WTP for the “Best-of-Both” scenario quality improvements.³⁹ Across brands, the percentage of “harmed” subscribers (where the price increase exceeds the WTP for the network quality improvements) ranges from {{BEGIN HCI END HCI}} for T-Mobile subscribers up to {{BEGIN HCI END HCI}} for Boost/Virgin subscribers. Across the Applicants’ brands, {{BEGIN HCI END HCI}} of subscribers would be predicted to have price increases that exceed the WTP for the network quality improvements.

While Table 8 is based on unadjusted WTP calculations, we have also considered how the adjustments to the WTP calculations—to reflect sensitivity to income and the distinction between heavy and very heavy data users—would affect the estimated harm from the merger

³⁹ In the Cornerstone “Best-of-Both” scenario, WTP for quality improvements varies across individual subscribers because each subscriber experiences a different quality improvement.

under the “Best-of-Both” scenario. We examine the WTP across income levels in Table 9.⁴⁰ The table provides a breakdown of these price effects and WTP values for the “Best-of-Both” scenario quality improvements, separately by brand and by level of income.

**Table 9: Estimated WTP versus Price Changes for Cornerstone “Best-of-Both” Scenario
by Income Level**
{{BEGIN HCI

END HCI}}

Source: Adjusted Cornerstone model.

As shown in the table, the gap between predicted price increases and WTP is considerably larger for lower income subscribers (i.e., those shown in the first income quartile) in comparison to subscribers in the top income quartile. For example, for Sprint subscribers the median WTP for the bottom income quartile subscribers is {{BEGIN HCI END HCI}} and for top income quartile subscribers it is {{BEGIN HCI END HCI}}. And, regardless of income level, the forecasted increase in Sprint prices is {{BEGIN HCI END HCI}}, indicating that the gap between price increases and median WTP ranges from {{BEGIN HCI END HCI}} for low-income Sprint subscribers to {{BEGIN HCI END HCI}} for high-income Sprint subscribers. That is, the excess of price increase versus consumer WTP for network quality improvements for

⁴⁰ A reproduction of aggregate effects across brands, as in Table 8 but allowing for income effects in the WTP calculation, is presented in Appendix Section A.

low-income Sprint subscribers is {{BEGIN HCI END HCI}} the level that it is for high-income Sprint subscribers. This comparison is yet starker for T-Mobile subscribers, at more than {{BEGIN HCI END HCI}} greater harm for low-income versus high-income subscribers.⁴¹ These general patterns also hold for the non-premium brands as well. For Boost/Virgin, the difference in the gap between predicted price increases and median WTP is {{BEGIN HCI END HCI}} for low income customers than for high income ones, and for MetroPCS, the gap is approximately {{BEGIN HCI END HCI}} for low income vs. high income customers.⁴²

D. The “Consumer Welfare Standard” as Described in the Cornerstone Report Relies Upon the Same Cross-Subsidies as in the IKK Declaration

As in the IKK Declaration, the Cornerstone Report also presents aggregate consumer welfare as the proposed summary metric for assessing harm from the merger but nonetheless demonstrates significant cross-subsidy effects. For example, Exhibit 14 of the Cornerstone Report provides a marginal cost efficiency frontier where the indicated marginal cost efficiency savings for both the Sprint and T-Mobile networks (separately) are sufficient to leave aggregate consumer welfare unchanged from the merger.⁴³ Any combination of marginal cost efficiencies outside this frontier would increase aggregate consumer welfare, and any point below the frontier would decrease aggregate consumer welfare. (A similar marginal cost efficiency frontier was presented in the IKK Declaration.⁴⁴)

⁴¹ The gap in price versus median WTP is {{BEGIN HCI END HCI}} for high-income T-Mobile subscribers and {{BEGIN HCI END HCI}} for low-income T-Mobile subscribers.

⁴² The gap in price versus median WTP is {{BEGIN HCI END HCI}} for high-income Boost/Virgin subscribers and {{BEGIN HCI END HCI}} for low-income Boost/Virgin subscribers. The gap in price versus median WTP is {{BEGIN HCI END HCI}} for high-income MetroPCS subscribers and {{BEGIN HCI END HCI}} for low-income MetroPCS subscribers.

⁴³ Cornerstone Report, Exhibit 14, at p. 43.

⁴⁴ See IKK Declaration, at p. 35

Both Cornerstone and IKK argue that marginal cost efficiencies are either at or beyond the frontier, and therefore conclude that the merger is procompetitive.⁴⁵ The logic of this argument omits the fact that price increases are likely for large subsets of subscribers even when the marginal cost efficiencies are at or beyond the frontier. We demonstrated in *HBVZ 2* that IKK's model showed that prices for Sprint subscribers would increase at the claimed marginal cost efficiencies.⁴⁶ Above, we demonstrated that Sprint prices will increase, even if marginal cost efficiencies are (in error) applied to the Cornerstone model as an offset to price increases.

This pattern of price increases for subsets of subscribers can be seen even more broadly in Figure 2 below. In Figure 2, we reproduce the Cornerstone cost efficiency frontier, and overlay the direction and rough magnitude of price increases predicted from the Cornerstone model for both Sprint and T-Mobile brands across a broad range of (hypothetical) marginal cost efficiencies. The yellow (left) arrows show Sprint price changes for a given set of cost efficiencies and the magenta (right) arrows show the T-Mobile prices changes.

⁴⁵ In addition, both Cornerstone and IKK argue that, to the extent that marginal cost efficiencies might not be at or beyond the frontier, once quality improvements are accounted for, aggregate welfare will still increase.

⁴⁶ See *HBVZ Reply Declaration*, at p. 28

**Figure 2: Implied Price Effects in the Cornerstone Merger Simulation Model
as a Function of Cost Efficiencies**

{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Materials.

In the top-left quadrant of Figure 2 (i.e., the quadrant with relatively higher Sprint cost efficiencies and lower T-Mobile cost efficiencies), Sprint prices decline and T-Mobile prices increase. In the bottom-right quadrant, the opposite occurs. The cost efficiencies claimed by IKK would lie in the bottom-right quadrant – although, as explained above, they cannot and should not be applied to an analysis of the Applicants’ LTE network. However, if they were (inappropriately) applied, they would show that the Sprint-T-Mobile merger would lead to price increases for Sprint and decreases for T-Mobile.

In order for the Cornerstone model to predict that the merger would increase consumer welfare while not harming large customer segments, marginal cost efficiencies would need to occur in the upper-right quadrant and, in any event, would need to be substantially beyond the cost efficiency frontier. The Applicants have not addressed any cost efficiencies that may be expected to be realized in their provision of LTE services, and have not put forth any evidence that integrating their LTE networks will result in any marginal cost savings.

VI. Appendix

A. Adjustments to the Cornerstone Demand Model to Reflect Income Effects

Cornerstone estimates a consumer demand function for LTE service based on the following equation:⁴⁷

$$u_{itlb} = \alpha_{lb} + \alpha_{tb} + \beta_t x_{ib} + \gamma_b C_i + \varepsilon_{ib}$$

Among the individual characteristics, Cornerstone includes an income variable C_i^{Inc} that enters linearly. Cornerstone also considers price effects that enter at the brand level, which are described in the Cornerstone Report as a decomposition of the brand-location effects as $\alpha_{lb} = \xi_{lb} + \delta p_b$.⁴⁸ This particular decomposition ignores the presence of brand-level effects on income. In order to capture the potential for income effects interacting with price effects, we adjust the demand specification to have income enter linearly through its inverse, and then consider an alternative brand-effect decomposition on the inverse income variable as $\gamma_b^{Inc} = \xi_{lb} + \delta p_b$.

The effect of using inverse income on the Cornerstone demand system is presented below, whose corollary is Exhibit 5 in the Cornerstone Report.⁴⁹

⁴⁷ Cornerstone Report, at p. 22.

⁴⁸ Cornerstone Report, footnote 60, at p. 34.

⁴⁹ See Cornerstone Report, Exhibit 5, at pp. 26-27.

Table 10: Demand Model Estimates for Adjusted Cornerstone Model
{{BEGIN HCI

END HCI}}

Source: Adjusted Cornerstone model; Cornerstone Backup Materials.

With the exception of the coefficients on income, the results in the table above are close in value to those presented in the Cornerstone Report. For income, we also find qualitatively similar results, insofar as “premium” brands are more likely to be chosen when income is higher (i.e., when inverse income is lower) and “non-premium” brands are more likely to be chosen when income is lower.

The brand-effect decomposition implies that the derivative of utility with respect to price becomes $\delta \div C_i^{Inc}$. This, in turn, will lead to a WTP formula of $\Delta x_{ib} \times \beta_t \times \delta \div C_i^{Inc}$. That is, with estimates from the demand model for the coefficients β_t on network quality variables, the WTP can be calculated provided we have an estimate of the price sensitivity parameter δ . As in the Cornerstone Report, this parameter can be estimated from the profit-maximization condition.⁵⁰ In particular, we can use the first-order conditions as described in the Cornerstone Report, augmented to account for the revised derivative of utility with respect to price, $\delta \div C_i^{Inc}$.

We have adapted the Cornerstone code for estimating the price sensitivity parameter to account for this change, and estimate a value for δ of {{BEGIN HCI END HCI}}. This calculated value implies that, at the median income value of {{BEGIN HCI END HCI}} in the data, the derivative of utility with respect to price at median income is {{BEGIN HCI

END HCI}} which is approximately the same as the derivative estimated in the Cornerstone report of {{BEGIN HCI END HCI}}. In contrast, however, this derivative will change depending on the level of income. In the table below, we present a range of price sensitivity values across the median income values observed by brand and by data use category.

⁵⁰ Cornerstone Report, footnote 60, at p. 34. *See also* Cornerstone Report, at pp. 134-135

Table 11: Median Income and Effective Price Sensitivity by Brand and Data Usage Category
{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Material. See Cornerstone Report Exhibits 5, 6, at pp. 26-27.

Summaries of the results of the adjusted analysis are presented in Section IV. In addition, we calculate a breakdown of WTP for increases in LTE coverage, separately by brand and data use level, and separately by income group and data use level. These are presented below.

**Table 12: WTP by Brand for Average Time on LTE Improvement
of {{BEGIN HCI
END HCI}} Adjusting for Income Effects
{{BEGIN HCI**

END HCI}}

Source: Cornerstone Backup Material. See Cornerstone Report Exhibits 5, 6, at pp. 26-27.

**Table 13: WTP by Income Group for Average Time on LTE Improvement
of {{BEGIN HCI
END HCI}} Adjusting for Income Effects
{{BEGIN HCI**

END HCI}}

Source: Cornerstone Backup Material. See Cornerstone Report Exhibits 5, 6, at pp. 26-27.

We have also examined the difference in predicted price increases versus median WTP under Cornerstone’s “Best-of-Both” scenario. In Table 8 we examined these differences with no adjustments to Cornerstone’s WTP calculations. In Table 14, below, we examine these

differences after accounting for the income effect and data user type adjustments explained in Section IV.

**Table 14: Estimated Price Changes vs WTP for Quality Improvements
Under Cornerstone “Best-of-Both” Scenario, adjusted for income effects**
{{BEGIN HCI

END HCI}}

Source: Cornerstone Backup Materials.

Notes: “Combined” are averages of the brands weighted by subscriber shares.

B. T-Mobile Porting Shares for List of Top 25 KPMG Geographic Areas Where Verizon Speeds Exceed T-Mobile Speeds

Table 15: T-Mobile’s Share of Verizon Ports-Out in KPMG Geographic Areas Where Average Verizon NMP Speeds Exceed Average T-Mobile NMP Speeds

{{BEGIN NRUF/LNP HCI

END NRUF/LNP HCI}}