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February 19, 2019

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:

DISH's criticism¹ of a report submitted by Cornerstone Research in support of this proposed merger has produced two attempts by Cornerstone to rebut it: a reply submitted by the Applicants on December 14, 2018 (Cornerstone's "First Reply"); and a reply submitted by the Applicants on February 7, 2019 (Cornerstone's "Second Reply").² In this letter, DISH responds to Cornerstone's First Reply and preliminarily responds to the Second Reply.

¹ See Further Reply Declaration of Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Attachment A to letter from Pantelis Michalopoulos, Counsel to DISH Network Corp., to Marlene Dortch, Secretary, FCC, WT Docket No. 18-197 (Dec. 4, 2018) ("Brattle Cornerstone Report").

² John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Response to DISH and CWA Comments*, Attachment A to Letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, Secretary, FCC, WT Docket No. 18-197 (Dec. 18, 2018); John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Response to DISH Comments Regarding Diversion Ratios*, Attachment A to Letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (Feb. 7, 2019).

DISH has denoted with **{{BEGIN HCI END HCI}}** information that is deemed to be Highly Confidential Information pursuant to the *Protective Order* and denoted with **{{BEGIN NRUF/LNP HCI END NRUF/LNP HCI}}** information that is deemed to be Highly Confidential Information pursuant to the *NRUF/LNP Protective Order*. A public, redacted version of this filing is being filed with the Commission. Applications of T-Mobile US, Inc. and
(Continued...)

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I. SUMMARY

Neither of Cornerstone's submissions change a fundamental fact about this merger: using Cornerstone's *own* assumptions about quality improvements and Cornerstone's *own* estimates of consumer willingness to pay for these assumed improvements, most consumers would be unwilling to pay for the price increases that would flow from this transaction.

First Reply. There is a simple reason why Brattle did not use the Applicants' claimed 5G marginal cost savings to offset the price increases for LTE service projected by Cornerstone: even if they were accurate, an LTE consumer can find no price relief in the savings of her next-door neighbor (or future neighbor) who uses 5G service.

In addition, Cornerstone ignores the fact that the Applicants' engineering model does incorporate claimed LTE marginal cost savings. For argument's sake, Brattle has assumed these claimed savings are accurate, has subtracted them from the Cornerstone-projected price increases, and then applied Cornerstone's estimated willingness to pay for the assumed quality improvements. The conclusion is the same: most consumers would be unwilling to accept the price increases.

Cornerstone criticizes Brattle's separate conclusion that, by aggregating its results, Cornerstone obscures the dire effect of the merger on lower income customers. Cornerstone speculates that lower income customers may be proportionately *more* willing to pay more for better service than higher income customers because they may not be able to afford wireline broadband and therefore need mobile broadband more. But this argument shows how elastic Cornerstone's willingness-to-pay concept is: it encompasses not only the genuine willingness borne out of choice but also the so-called willingness borne out of need and *lack of choice*. Harming the poor is not a legitimate justification for this proposed merger. Nor is Cornerstone correct when it counts a consumer as better off when she is hit with a higher price merely because she now has a higher-quality option, whether or not she exercises it.

Second Reply. In its Second Reply, Cornerstone essentially admits that the aggregate diversion ratios produced by its analysis match market shares almost perfectly, even as it attempts to mask this admission behind an ostensible denial and seeks to draw a meaningless distinction between the aggregate and individual levels. Hard as it tries, Cornerstone cannot explain away the Applicants' internal documents unveiled by DISH that prove the Applicants' extensive reliance on porting. Many of these documents use porting exclusively, not as one of several indicators. And Brattle discusses an additional flaw behind Cornerstone's counter-

Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *Protective Order*, WT Docket No. 18-197, DA 18-624 (June 15, 2018); 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).

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intuitive finding that prepaid customers who leave their brand flock in unnaturally large numbers to postpaid brands such as AT&T and Verizon: Cornerstone uses median zip code level income. But the majority of Nielsen Mobile Performance (“NMP”) respondents have actually reported income information. Use of that information produces more credible diversion results. Brattle has implemented Cornerstone’s merger simulation using reported income information and found it would predict price increases for prepaid services that are *more than triple* those originally predicted by Cornerstone.

II. UNDER CORNERSTONE’S OWN METHOD, MOST CONSUMERS ARE SHOWN TO BE UNWILLING TO PAY FOR THE PRICE INCREASES THIS MERGER WOULD PRODUCE

For the most part, Cornerstone does not even attempt to refute Brattle’s showing that most consumers would be unwilling to pay for the price increases produced by this merger. Cornerstone’s objection is encapsulated in just one sentence from its 22-page First Reply: “[r]ather than examining the range of scenarios we consider in our initial white paper, [Brattle] only present analyses where the proposed merger either (a) leads to no marginal cost reduction whatsoever or (b) leads to no network quality improvement whatsoever.”³ In fact, Brattle accepted all the network quality improvements used by Cornerstone, even though these improvements were assumed as a “scenario”—Cornerstone’s “best of both” the relevant “scenario”—and not supported by any evidence.⁴ What Cornerstone is complaining about is that Brattle did not offset the price increases with the marginal cost savings claimed by Compass Lexecon for 5G service. According to Cornerstone, this would have reduced the price increases and would have made them easier for consumers to stomach.

But Brattle did not offset the Cornerstone LTE price increases with the Compass Lexecon 5G marginal cost savings for a good reason: higher prices for LTE service *cannot* be offset by claimed marginal cost savings for a 5G service.⁵ An LTE consumer facing a price increase gets no relief from a cost saving enjoyed by her neighbor who subscribes to 5G service today or who may subscribe to 5G service in the future. Notably, while Cornerstone lodges this complaint

³ First Reply ¶ 51.

⁴ Cornerstone describes its “best of both” scenario as “a scenario where the merging party brands narrow or close the coverage and speed network quality gap they experience with Verizon[.]” John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Economic Analysis of the Proposed Sprint/T-Mobile Merger* ¶ 89, Attachment A to Letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (Nov. 6, 2018) (“Cornerstone Report”).

⁵ Of course, DISH has shown elsewhere that these 5G marginal cost saving claims are themselves wildly exaggerated.

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against Brattle, Cornerstone does not even try to show that offsetting LTE price increases with 5G cost saving claims is somehow appropriate.

Cornerstone never explains why it did not use projected LTE marginal cost savings in its analysis. The engineering model used by Compass Lexecon did reflect claimed LTE marginal cost savings alongside the 5G marginal cost savings that Cornerstone used. Brattle has taken the LTE savings into account in the attached report.⁶ Brattle’s analysis demonstrates that, even if the model’s LTE benefit claims were assumed to be entirely correct, they would still be woefully inadequate because: (1) they would not be enough themselves to offset the price increases predicted by Cornerstone for the majority of subscribers; and (2) Cornerstone’s estimate of customers’ willingness to pay for the quality improvements assumed by Cornerstone would still fall short of justifying the price increases, even after offsetting them with these LTE cost saving claims. Specifically, an astonishing {{BEGIN HCI END HCI}} of consumers would be unwilling to pay the price increases Cornerstone predicts. The following table from Brattle’s report illustrates the inadequacy of the Applicants’ own predicted LTE cost savings to convert the merger into a public good.

**Table 1: Estimated Price Changes vs WTP for Quality Improvements with LTE Efficiencies
from Compass Lexecon under Cornerstone’s “Best-of-Both” Scenario**
{{BEGIN HCI

END HCI}}

Sources and Notes: Cornerstone Backup Materials, Compass Lexecon Backup Materials.
Combined prices are the averages of the brands weighted by their subscriber shares.

⁶ Coleman Bazelon, Jeremy Verlinda, and William Zarakas, *Reply to Cornerstone’s Response to DISH and CWA Comments* at 9-10 (Feb. 19, 2019), attached as Attachment A (“Brattle Cornerstone Reply”).

Brattle’s analysis has also uncovered another consumer harm that will result from this transaction: Cornerstone obscures the fact that the burden of the merger’s price increases would fall disproportionately on the poor. Cornerstone does this by estimating willingness to pay at an aggregate level across brands and across income levels. Brattle’s analysis shows that, when broken down by income group, the willingness to pay of medium data users turns out to be **BEGIN HCI** **END HCI** in the top than in the bottom income quartile **BEGIN HCI** **END HCI**.⁷ Cornerstone criticizes Brattle for “conjectur[ing]” that consumers with lower income may be less willing to pay for network quality[.]”⁸ This criticism is both irrelevant and wrong.

But equally important, the idea that poor people are less willing to pay more for supposed quality improvements ought not to be controversial. The fact that the Applicants' experts need to attack it illustrates the lengths to which they go to obscure the merger's harms. And Cornerstone makes matters even worse for the Applicants by questioning the common-sense proposition that the poor can afford less and are especially unwilling to pay more. Instead, according to Cornerstone:

In other words, in Cornerstone's view, poor consumers may depend on mobile broadband more because they cannot afford to pay for wireline broadband. This sheds light on Cornerstone's concept of "willingness" to pay: the willingness can be of a rather reluctant kind. A consumer

⁸ Cornerstone First Reply ¶ 57.

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forced to pay more for a supposed quality improvement because of lack of choice counts as “willing” to pay in Cornerstone’s column.

But this means that, under Cornerstone’s rationale, the merger should be approved not because prices will not rise for low-income customers, and not because low-income customers will gladly pay these higher prices, but rather because low-income customers will be forced to pay them. Such a justification is not in the public interest and cannot be credited by the Commission.

An additional serious flaw in Cornerstone’s First Reply is that Cornerstone views subscribers as better off despite a price increase just because another brand has risen in quality, even if the customer’s current brand does not improve, and even if the customer does not switch to that improved brand. Cornerstone states that “individual quality and fiercer competition from New T-Mobile means that consumers are frequently just as well off or better off switching to their previously second-best option[.]”⁹ What this omits is that Cornerstone assumes such consumers are as well off or better off whether they switch to the previously second-best option or not. As Brattle explains, this is because of the probabilistic nature of Cornerstone’s discrete choice analysis. Under that analysis, the supposed option of switching to a brand that has now supposedly improved its service counts as a plus for a consumer’s welfare even if the consumer does not exercise that option. Under this theory, a Verizon subscriber hit with a price increase as a result of this merger is presumed to be more content than before because she has the theoretical option of switching to a theoretically better quality New T-Mobile, even if she does not change carriers. Cornerstone’s model does not attach appropriate weight to that subscriber’s original preference for Verizon.

IV. CORNERSTONE’S ANALYSIS PRODUCES DIVERSION RESULTS ALMOST IDENTICAL TO MARKET SHARES AND IS INFERIOR TO THE USE OF PORTING DATA

In its Second Reply, Cornerstone sets three tasks for itself: (1) to disprove Brattle’s observation that the diversion shares that flow from Cornerstone’s model are almost perfectly aligned to the four carriers’ market shares; (2) to dispute that porting data (which provide information on actual subscriber moves between carriers) are a good way to determine future subscriber moves and therefore price increases; and (3) to explain away the damning internal documents that show the Applicants rely on porting data as the best proxy of customer moves between carriers. DISH will respond more fully to these arguments in a future filing, but offers a preliminary response here.

It is little surprise that the Applicants dislike porting data in their advocacy—their data show that each is the other’s fiercest competitor, and that the merger will eliminate this

⁹ Cornerstone First Reply ¶ 54.

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competition. The Applicants have now been confronted with a wealth of internal documents demonstrating that, in the ordinary course of business, both companies rely on porting data to assess competition, including competition between the two Applicants themselves. These documents were unaccounted for in the Applicants' original attack against the reliability of porting data. Cornerstone makes a strained effort to reconcile this uncomfortable contradiction: the documents, Cornerstone says, merely "confirm that executives use porting data directionally, as one of several indicators to gauge the state of competition."¹⁰ But this attempt flies in the face of reality: many documents cited by DISH use porting as the *only* indicator to gauge the state of competition, not as "one of several" indicators. These include, most notably, emails of the two companies' top executives assessing competition {{BEGIN HCI

END HCI}}¹¹ Even more tellingly, the focus of these emails is about competition *between* the Applicants themselves. And porting data are similarly used as the only indicators in the numerous and widely distributed examples of {{BEGIN HCI END HCI}} that DISH has referenced.¹²

In the attached report, Brattle also offers a preliminary response to the Second Reply on the question of diversion ratios proportional to market shares. Cornerstone disputes Brattle's showing that Cornerstone's estimates of diversion rates are "merely assumed values that effectively reproduce diversion in proportion to share."¹³ But while it twice decries this showing as "categorically false,"¹⁴ its own submission effectively admits that Cornerstone's estimated diversion ratios, when "present[ed]...across all consumers as a group" are comparable to "what would be predicted from each brand's KPMG/Sprint market area subscriber shares."¹⁵

¹⁰ Cornerstone Second Reply ¶ 6.

¹¹ See TMUS-FCC-02376783 at 02376784 {{BEGIN HCI
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¹² See e.g., {{BEGIN HCI

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¹³ Second Reply ¶ 4.

¹⁴ *Id.* ¶¶ 4, 8.

¹⁵ Second Reply ¶ 10.

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Cornerstone only claims that the comparison is “misleading” and “misrepresents [Cornerstone’s] analysis,” because the “key contribution” of that analysis is that it demonstrates that “quality is inherently individualized,” and “individual-level” diversion ratios are variable.¹⁶

Cornerstone has stated almost a dozen times that its analysis is based on “rich” data about consumer behavior and individualized quality.¹⁷ But Cornerstone does not explain why this supposedly rich data adds up to diversion ratios that conform to the carriers’ market shares (as Cornerstone now admits). Brattle has explained the flaws in Cornerstone’s modeling that permit this result,¹⁸ and discusses an additional flaw in the attached report.¹⁹

Specifically, the Cornerstone model estimates that customers of prepaid services move to and from their brand to one of the postpaid brands in proportions that approximate each of the post-paid carriers’ shares of the overall subscriber numbers. For example, as many as **{{BEGIN HCI END HCI}}** of the customers leaving Boost are predicted to land in Verizon, and as many as **{{BEGIN HCI END HCI}}** of the customers leaving MetroPCS are projected to join AT&T. That result appears counter-intuitive, since one would normally expect other prepaid brands to be overrepresented in a prepaid customer’s diversion decision, and postpaid brands to be conversely underrepresented in that decision. Brattle investigated this disconnect and discovered one of the reasons for it: for all of its emphasis on the supposed richness of its individual data, Cornerstone used a cookie-cutter approach to income—it simply ascribed the census median income for the entire zip code to *all* individuals in that zip code. Anyone who has walked the streets of Manhattan—or any city—knows that this assumption ignores enormous differences within a zip code.

As it happens, the majority of the users covered by the NMP data did report their actual, individual income. In its report, Brattle used that reported income information instead of the cookie cutter median number used by Cornerstone. This substitution leads to diversion ratios that mirror more accurately the intuitive expectation that prepaid customers leaving their brands go to other prepaid brands in greater proportions than overall shares suggest. This is illustrated by Figures 1 and 2, which compare Cornerstone’s use of census median income with Brattle’s use of actual NMP income, and synthesized in Figure 3 below.

¹⁶ *Id.* ¶¶ 9-11.

¹⁷ *See, e.g.*, Cornerstone Second Reply ¶ 24 (“Our analysis is grounded in rich, detailed data on consumer behavior...”); Cornerstone First Reply ¶¶ 1, 3, 22, 25, 74; Cornerstone Report ¶¶ 2, 18, 23, 29, 48, 79, 98, 151.

¹⁸ Coleman Bazelon, Jeremy Verlinda, and William Zarakas, *Response to Applicant Filings on Diversion Ratios*, Attachment A to letter from Pantelis Michalopoulos to Marlene Dortch, FCC, WT Docket No. 18-197, at 22 (Jan. 28, 2019).

¹⁹ Brattle Cornerstone Reply at 21-28.

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**Figure 1: Census Median Income Distributions for
NMP Respondents Who Reported Income by Brand Category**
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**Figure 2: NMP Reported Income Distributions for
NMP Respondents Who Reported Income by Brand Category**
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**Figure 3: Diversion Ratios with Income Estimated from NMP Responses
Plotted Against Diversion Ratios with Median Income from Census
{{BEGIN HCI**

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Sources: Brattle calculations, NMP Survey Data, and Cornerstone backup materials

Brattle has applied Cornerstone's model using reported income data and found that the model predicts price increases of **{{BEGIN HCI END HCI}}** for Boost and **{{BEGIN HCI END HCI}}** for MetroPCS, more than three times the price increases Cornerstone had predicted originally.²⁰

²⁰ Brattle Cornerstone Reply at 28 and 33, Tables 4 and 5.

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V. CONCLUSION

Cornerstone's method is fraught with errors; Cornerstone's defense of that method is unavailing.

Respectfully submitted,

_____/s
Pantelis Michalopoulos
Counsel to DISH Network Corporation

Attachment A

Reply to Cornerstone “Response to Dish and CWA Comments”

Coleman Bazelon

Principal, The Brattle Group

Jeremy Verlinda

Principal, The Brattle Group

and

William Zarakas

Principal, The Brattle Group

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I. Introduction and Summary

We have previously submitted declarations that discuss the analyses submitted by Cornerstone¹ which purport to estimate wireless subscriber demand and the potential effects of the Sprint/T-Mobile merger.² In those declarations, we demonstrated that Cornerstone’s demand model predicts significant price effects arising from the merger. We also showed that even when we add in the effects of unsubstantiated merger efficiencies in the provision of LTE service, the majority of the Applicants’ subscribers are harmed by price increases resulting from the merger. Furthermore, we also demonstrated that the harm falls disproportionately on low-income subscribers.

¹ See Economic Analysis of the Proposed T-Mobile/Sprint Merger by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, Attachment A to Letter from T-Mobile US, Inc., *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”). This model is further discussed in Additional Information Regarding the Estimation of Diversion Ratios by 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, December 14, 2018 (henceforth “Compass Lexecon Diversion White Paper”).

² See Further Reply Declaration of Coleman Bazelon, Jeremy Verlinda, and William Zarakas, *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, December 4, 2018 (henceforth “Brattle Further Reply”).

Other filings in this proceeding include: 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 1”); Reply Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Exhibit 1 to Reply Comments by 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”); Network Engineering Model’s Sensitivity to Millimeter Wave Adjustments by Coleman Bazelon, Jeremy Verlinda, William Zarakas, Attachment A to Letter by 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, February 4, 2019 (henceforth “Brattle Millimeter Wave White Paper”).

In our Brattle Diversion Response, we further demonstrated that the Cornerstone model likely underestimates harm resulting from the merger because of its methodological design and the data it employs. The diversion ratios from the model do not meaningfully deviate from the base assumption of share-proportionality.³ Moreover, internal assessments of the degree to which the Applicants' brands are close substitutes directly contradict the estimated diversion ratios produced by the Cornerstone demand model.⁴

Cornerstone provided further comments and criticism of our declarations and reports in its "Response to Dish and CWA Comments."⁵ Counsel for DISH has requested that we review Cornerstone's response. We address Cornerstone's various criticisms of our declaration below, and show that the criticisms raised are misguided and do not affect our conclusions concerning the merger related consumer harm. In addition, we preliminarily respond to a second response submitted by Cornerstone,⁶ which criticizes our analysis of the diversion ratios flowing from Cornerstone's model.

Cornerstone's First Reply raised three primary areas of criticism.

First, Cornerstone claims that we neglected to appropriately combine its claimed merger related prices effects, cost efficiencies, and quality improvements into a merger simulation. This claim is misguided, as is the assertion that doing so would have "meaningful implications for the bottom line conclusions."⁷ In its initial report, Cornerstone conducted a merger simulation which

³ Response to Applicant Filings on Diversion ratios by Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Attachment A to Letter from 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, January 28, 2019 (henceforth "Brattle Diversion Response").

⁴ See Brattle Diversion Response, at pp. 13-14.

⁵ Response to Dish and CWA Comments by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, Attachment A to Supplemental Response to Information Request by T-Mobile US, Inc., *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, December 18, 2018 (henceforth "First Reply").

⁶ Response to DISH Comments Regarding Diversion Ratios by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, Attachment A to Letter from T-Mobile US, Inc., *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, February 6, 2019 (henceforth "Second Reply").

⁷ First Reply at ¶ 51.

incorporated claims (made by Compass Lexecon) concerning 5G related marginal cost savings into its demand model for LTE wireless service. Contrary to Cornerstone’s assertion, mixing 5G marginal cost savings with an LTE demand model, let alone further combination with hypothetical LTE quality improvements, produces meaningless results that are impossible to interpret.

Since Cornerstone claims that its main contribution to this merger review concerns its use of Nielsen Mobile Performance (“NMP”) data summarizing LTE network experiences, any marginal cost savings must also be considered in relation to LTE services. Notwithstanding our prior discussions regarding the unreliability of the Compass Lexecon marginal cost savings model,⁸ that model also contains claimed LTE cost savings (in addition to its estimates for the Applicants’ future 5G networks). In developing its merger simulation, Cornerstone indeed consulted the Compass Lexecon model, but it ignored the LTE marginal cost savings in favor of the larger, but irrelevant, 5G cost savings. Applying Compass Lexecon’s LTE marginal cost savings to Cornerstone’s merger simulation shows results that are contrary to Cornerstone’s assertions: roughly {{BEGIN HCI END HCI}} of subscribers across the Applicants’ brands would face price increases that exceed the value of the merger’s hypothetical quality improvements.

Second, apart from the price impacts, Cornerstone criticizes our analysis of the allocative effects associated with the proposed merger.⁹ Specifically, Cornerstone takes issue with our finding that the willingness to pay (“WTP”) of lower income customers for the hypothetical network quality improvements would fail to offset the projected price increases resulting from the merger. Cornerstone claims that our methodology for estimating income effects was “inconsistent” with the academic literature¹⁰ and “entirely non-standard.”¹¹ This is not true. Not only does the result hold under the original Cornerstone demand specification, but our adjustment to allow for

⁸ See *HBVZ 2* at pp. 22-46 and Brattle Millimeter Wave White Paper.

⁹ First Reply at ¶¶ 57-64.

¹⁰ First Reply at ¶ 57.

¹¹ First Reply at ¶ 60.

income to influence price sensitivity is common in the seminal texts on discrete choice analysis.¹² Our approach is far from theoretical and is hardly unorthodox.

Third, Cornerstone contends that we neglected to account for consumer choice in our analysis of consumer harm.¹³ Yet, Cornerstone's model clearly identifies wireless subscribers who will be harmed by the merger and, under certain hypothetical scenarios, identifies subscribers who could potentially benefit. The error in Cornerstone's proposed welfare analysis is that it relies upon aggregation to offset harm to well-identified subscribers with lower or negative harm (*i.e.*, benefits) to others. This approach misses a key point of our analysis: that there are distinct subscriber segments who are disproportionately harmed by the merger. Furthermore, the Compass Lexecon and Cornerstone models suggest patently implausible welfare results that are driven by peculiarities of the discrete brand choice methodology. For example, the proposed merger standard would imply that subscribers who experience a price increase but do not switch brands are somehow better off, and therefore have increased their consumer welfare. By Cornerstone's logic, this is because these subscribers are somehow better off because they have the option to switch to a higher quality network, irrespective of whether they exercised this option or not, and without regard to their revealed brand preferences. Cornerstone's welfare standard should not be used as the sole or even primary criterion for merger review.¹⁴

In its Second Reply, Cornerstone disputes our observation that its analysis is only able to produce share-proportional diversion ratio estimates. In the process of emphasizing its model's ability to distinguish aggregate versus individual subscriber-level preferences, Cornerstone essentially admits that its model only produces aggregate diversion ratios that replicate the assumption of

¹² See Train, Kenneth E., *Discrete choice methods with simulation*, Cambridge University Press, 2009. See also Ben-Akiva, Moshe E., and Steven R. Lerman, *Discrete choice analysis: theory and application to travel demand*, Vol. 9. MIT Press, 1985.

¹³ First Reply at ¶¶ 53 – 54, 71-73.

¹⁴ These results arise in discrete choice models, such as the logit models used by the Applicants' economists, because subscriber demand is specified to be probabilistic and, in expectation, subscribers respond to price and quality changes not with discrete selection of a given product but with changes in the probabilities of choosing each of the products in the choice set. In such models, welfare increases with improvements in the choice *set*, regardless of whether individual subscribers in the real world choose a product with the supposed improvement.

share-proportionality.¹⁵ Moreover, it implies that the persistently high diversion to the largest carriers was not the result of the share-proportionality assumption, but instead reflects an absence of identifiable (based on the data used) subscriber segments with strong preferences for specific brands or brand types.¹⁶ We have examined the inputs to the Cornerstone demand model in greater detail in an effort to better understand why its estimated substitution patterns at the aggregate brand level are so at odds with the Applicants' own ordinary course business analyses, and preliminarily address these criticisms in this report.

Part of the answer may lie in Cornerstone's demographic data. Cornerstone has emphasized that its use of individual subscriber-level data provides more meaningful information about subscriber preferences than does an analysis focused on aggregate data. However, Cornerstone's data set is much less individualized than it represents. The NMP data used in the Cornerstone demand model is a cross-section of brand choices and *contains no observed switching behavior that might inform substitution patterns*. The Cornerstone demand model is further handicapped by reliance on census demographic information that is insufficiently disaggregated.

As just one example, the census income data employed by Cornerstone exhibits only minimal differences in zip code median incomes between premium- and non-premium-brand subscribers.¹⁷ Alternatively, a significant fraction of NMP respondents provided **{{BEGIN HCI**
END HCI}} income information as part of the survey.¹⁸ These data reveal that premium-brand subscribers have significantly higher incomes than non-premium-brand subscribers. The attenuation of income differences in the zip code level data restricts the degree of market segmentation that the Cornerstone model is able to estimate. We show that using actual subscriber incomes in the Cornerstone demand model would likely indicate significantly greater segmentation between premium- and non-premium brands, much higher diversion ratios among the non-premium brands, and significantly higher price increases from the merger. Cornerstone's use of census data, which lacks information on individual subscribers and fails to

¹⁵ See Cornerstone Diversion Reply at pp 5-8.

¹⁶ Second Reply at ¶ 17.

¹⁷ Premium brands are AT&T, Verizon, Sprint, and T-Mobile.

¹⁸ The NMP survey data is briefly mentioned in footnote 121 of the Cornerstone Report. Cornerstone ignores the NMP survey data, **{{BEGIN HCI**

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truly capture “rich” individual characteristics, likely underestimates the substitutability between the Applicants’ brands, thereby underestimating the harm from the merger.

II. The Brattle Analysis of the Cornerstone Model Correctly Identifies Harm to Subscribers Resulting from the Merger

In the Brattle Further Reply, we showed that the Cornerstone model predicted significant harm to subscribers as a result of the proposed T-Mobile/Sprint merger. We respond to the criticisms raised in Cornerstone’s First Reply below.

A. Combining 5G marginal cost savings with 4G quality improvements into a single merger simulation would produce meaningless and misleading results

Cornerstone claims that we misrepresented the impact of quality improvements and marginal cost savings on merger-related predicted price increases by not combining these two into a single merger simulation.¹⁹ Cornerstone is correct that we did not combine these into a single merger simulation, but its conclusion is wrong. We did not combine their claims concerning marginal cost savings and quality improvements into a single merger simulation for good reason—it would be a mathematical undertaking with no underlying logical rationale. We have previously shown that the Cornerstone and Compass Lexecon claims about the value of quality improvements and 5G cost efficiencies are overstated.²⁰ However, beyond this lies a further critical flaw: Compass Lexecon’s estimated marginal cost savings for 5G service are incompatible with the Applicants’ costs of providing LTE service. Cornerstone makes a material error by combining Compass Lexecon’s 5G-based efficiency claims with its own LTE-based demand estimation and quality improvement values. They do not belong in the same merger simulations.

¹⁹ First Reply at ¶ 51.

²⁰ See *HBVZ 2* at pp. 31-37, Table 9. See also Brattle Millimeter Wave White Paper.

Additionally, notwithstanding our criticisms of Compass Lexecon’s modified Ray Network Engineering Models,²¹ Cornerstone extracts the claimed 5G marginal cost savings from that model while ignoring the LTE marginal cost savings that are also in these models. It is particularly important to note that Compass Lexecon’s estimated LTE marginal cost savings are just a fraction of its claimed 5G marginal cost savings. Specifically, Compass Lexecon’s 5G network marginal cost savings used by Cornerstone are {{BEGIN HCI END HCI}} for the Sprint brands and {{BEGIN HCI END HCI}} for the T-Mobile brands. In contrast, the LTE network marginal cost savings from the Compass Lexecon model are {{BEGIN HCI END HCI}} for the Sprint brands and {{BEGIN HCI END HCI}} for the T-Mobile brands.²² If Cornerstone had used the Compass Lexecon network model’s LTE marginal cost savings instead, its merger simulation model would show significant price increases resulting from the merger.

Table 1, below, provides Cornerstone merger simulation price increases under various marginal cost savings hypotheses, ranging from no efficiencies, 100% and 50% of Compass Lexecon’s 5G marginal cost savings, and 100% and 50% of Compass Lexecon’s LTE marginal cost savings.

²¹ See *HBVZ 2*, at pp. 45-62. See also Compass Lexecon Declaration. See also Ray Network Engineering Models.

²² Specifically, Cornerstone uses the Compass Lexecon “maintain usage restrictions” scenario for 2021, see Cornerstone Report Exhibit 26 at p. 58. Inclusive of non-network and roaming cost savings, the associated cost savings used by Cornerstone are: {{BEGIN HCI END HCI}} for Sprint postpaid; {{BEGIN HCI END HCI}} for Sprint prepaid (i.e., Boost/Virgin); {{BEGIN HCI END HCI}} for T-Mobile postpaid, and {{BEGIN HCI END HCI}} for T-Mobile prepaid (i.e., MetroPCS). The LTE cost savings from the Compass Lexecon model are, instead: {{BEGIN HCI END HCI}} for Sprint postpaid; {{BEGIN HCI END HCI}} for Sprint prepaid; {{BEGIN HCI END HCI}} for T-Mobile postpaid; and {{BEGIN HCI END HCI}} for T-Mobile prepaid.

**Table 1: Cornerstone Merger Simulation Price Changes (%)
under Various Compass Lexecon Estimated Efficiencies and No Quality Improvements
{{BEGIN HCI**

END HCI}}

Source: Cornerstone Report Backup Materials and Compass Lexecon Declaration Backup Materials.

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

As shown in the table, the Cornerstone merger simulation model predicts that prices will increase for the Sprint brands in every scenario. For the T-Mobile brands, too, prices will increase in every scenario except the 100% of Compass Lexecon’s 5G efficiencies scenario. To put that in perspective, prices would still increase under both Cornerstone’s and Compass Lexecon’s analyses even if: one assumes that all of the Applicants’ 5G claims were accurate; one were to accept the multi-year ramp (through 2024) that the Applicants claim they need; and one were to ignore the additional price increases due to coordinated effects that would result from the merger. Moreover, under the LTE marginal cost savings scenario, the price increases would apply to all of the Applicants’ brands and they would be even more pronounced. If 100% of Compass Lexecon’s LTE marginal costs savings are considered, then price increases range from approximately {{BEGIN HCI END HCI}} on average for the premium brands to approximately {{BEGIN HCI END HCI}} on average for the non-premium brands. When 50% of Compass Lexecon’s LTE marginal costs savings scenario is considered, the model predicts price increases ranging from approximately {{BEGIN HCI END HCI}} on average for the premium brands to approximately {{BEGIN HCI END HCI}} on average for the non-premium brands.

Combining the LTE based marginal cost savings with subscribers’ estimated WTP for the alleged quality improvements estimated in Cornerstone’s own model produces equally alarming results. It shows that this combined effect is insufficient to offset the harm arising from the merger’s price increases.²³ The total price effects after combining Compass Lexecon’s LTE cost efficiencies with Cornerstone’s “best of both” network quality scenario are shown in Table 2, below.

Table 2: Estimated Price Changes vs WTP for Quality Improvements with LTE Efficiencies from Compass Lexecon under Cornerstone “Best-of-Both” Scenario

{{BEGIN HCI

END HCI}}

Sources and Notes: Cornerstone Report Backup Materials, Compass Lexecon Declaration Backup Materials.

Combined prices are the averages of the brands weighted by their subscriber shares.

As shown in the table, a merger simulation that includes both LTE based marginal cost savings and Cornerstone’s “best of both” network quality improvement scenario predicts price increases that exceed the levels shown under the “LTE-100%” scenario in Table 1. Specifically, the table indicates that predicted price increases range from approximately {{BEGIN HCI

END HCI}} on average for the premium brands to approximately {{BEGIN HCI
END HCI

END HCI}} on average for the non-premium brands.

These price increases are much higher than the median WTP for the Applicants’ subscribers, which range from approximately {{BEGIN HCI
END HCI}} on average for the premium brands to approximately {{BEGIN HCI
END

²³ This is true under no modifications to the Cornerstone model. *See* Brattle Further Reply Table 8 at p. 28. When price-sensitivity income effects are directly incorporated into the demand model, we see a further widening across low and high-income subscribers of the gap between price increases and WTP for the alleged LTE quality improvements (*see* Brattle Further Reply Table 14 at p. 39).

HCI}} on average for the non-premium brands. In other words, in a hypothetical scenario where Cornerstone’s “best of both” network quality improvements are combined with Compass Lexecon’s LTE marginal cost savings, the majority of the Applicants’ subscribers would be harmed from the merger, with WTP values for the network quality improvements failing to offset the merger’s increased prices for {{BEGIN HCI END HCI}} of subscribers.

B. Cornerstone’s representation that Brattle used an “entirely non-standard” methodology to estimate income effects is inaccurate and misleading

Cornerstone criticizes our analysis of the allocative effects associated with the proposed merger,²⁴ taking issue with our finding that the WTP of lower income subscribers for network quality improvements would fail to offset the projected price increases resulting from the merger. Specifically, Cornerstone claims that the methodology that we used to estimate income effects is “inconsistent” with the academic literature and “entirely non-standard.”²⁵ This claim is false. Not only is our adjustment to the Cornerstone model well established in the academic literature, but it is also theoretically similar in its implication to Cornerstone’s own “residual income” adjustment in its Response. Furthermore, Cornerstone’s claim that our adjustment is a “very rigid and specific relationship between income and price sensitivity”²⁶ is particularly surprising, given that the original Cornerstone model placed even more rigid restrictions on the relationship between income and price. In its original model, Cornerstone simply assumed that there is no interaction between price and income at all.

Our adjustment to Cornerstone’s original model shifts the inclusion of brand price and the calibration of the price sensitivity parameter to the brand/income interaction terms, and ultimately describes price as a proportion of income as a variable in the utility function. With this adjustment, we end up with a utility specification that is found in a widely cited text on discrete choice modelling.²⁷ This text plainly explains how including socio-demographic

²⁴ First Reply at ¶¶ 57 – 64.

²⁵ First Reply at ¶¶ 57, 60.

²⁶ First Reply at ¶ 60.

²⁷ See Train, Kenneth E., *Discrete choice methods with simulation*, Second Edition, Cambridge University Press, 2009, at pp. 9-33.

variables such as income in discrete choice models yields the precise specification that we used in adjusting the Cornerstone model, allowing for direct inclusion of income effects into the price sensitivity of demand.²⁸

Cornerstone also claims that it implemented a more “standard” approach to adjust its model to allow for interacted price and income effects. Specifically, Cornerstone introduces a variable describing “residual income”, which is sometimes employed when modeling demand for products that represent a potentially large fraction of income.²⁹ However, Cornerstone’s representation that its approach for specifying income effects is more appropriate than ours is without basis, and in any event, Cornerstone’s approach is not the “standard.” Alternative specifications are routinely observed in academic contexts. For example, in his influential 2001 paper on breakfast cereal demand, Professor Aviv Nevo includes income and price interactions in the demand model by multiplying price against both income and squared income, not as residual income.³⁰

Furthermore, the theoretical difference between the residual income approach and our adjustment is de minimis. Regardless of the specification, the values calculated for WTP, merger simulation prices, and consumer welfare each depend on the marginal utility of a price change, *i.e.* the derivative of utility with respect to price. It is straightforward to show that the marginal utility values are numerically approximately the same under both the residual income approach

²⁸ Similar examples of such utility specifications can be seen in Ben-Akiva, Moshe E., and Steven R. Lerman, *Discrete choice analysis: theory and application to travel demand*. Vol. 9. MIT press, 1985, at p. 158. *See also* Berry, Steven, James Levinsohn, and Ariel Pakes, “Voluntary export restraints on automobiles: Evaluating a trade policy,” *American Economic Review* 89, no. 3 (1999): 400-430; McFadden, Daniel, and Kenneth Train, “Mixed MNL models for discrete response,” *Journal of applied Econometrics* 15, no. 5 (2000): 459. The latter has a slightly different specification but implies behavior that is similar to our adjusted specification.

²⁹ The natural logarithm of income minus price captures income effects. *See* Berry, Steven, James Levinsohn, and Ariel Pakes, “Automobile prices in market equilibrium,” *Econometrica: Journal of the Econometric Society* (1995): 841-890.

³⁰ *See* Nevo, Aviv, “Measuring market power in the ready-to-eat cereal industry,” *Econometrica* 69, no. 2 (2001): 307-342

described by Cornerstone and when price is presented as a fraction of income, as in our specification.³¹

In addition, our approach allowing for income effects is considerably more flexible than the restricted manner in which Cornerstone considers residual income. Our modification allows the effect of the price/income interaction to vary across brands beyond just the price element. That is, our approach allows the effect of income to be decomposed into a linear function where the effect of price can be estimated from supply-side information in a manner similar to Cornerstone's original model, a capability that is not present in Cornerstone's residual income specification.

Finally, Cornerstone claims that model fit is worse under the Brattle modification versus its original model, but fails to conduct any statistical tests to support this point.³² More importantly, both Cornerstone's original model as well as our adjustment of that underlying model struggle to explain the brand choices of the survey respondents in the NMP data. The reported McFadden's pseudo R^2 value for both models is {{BEGIN HCI END HCI}}.³³ McFadden writes that a discrete choice model with a McFadden's pseudo R^2 value of between 0.2 and 0.4 is a model with good fit,³⁴ suggesting that the Cornerstone model has only mediocre performance in explaining

³¹ In the residual income variant, marginal utility with respect to price is calculated as $\frac{\partial U^{\text{Cornerstone}}}{\partial p} = \frac{\alpha}{\text{Income} - \text{Price}}$, where α is the coefficient on residual income. When instead we specify utility as depending on price as a fraction of income, the marginal utility with respect to price is calculated as $\frac{\partial U^{\text{Brattle}}}{\partial p} = \frac{-\alpha}{\text{Income}}$, where $-\alpha$ is the coefficient on the price-income ratio. In the context of wireless services, where price is relatively small compared to income, these two calculations will be very similar in magnitude apart from the estimated coefficient, which will calibrate accordingly as all scale comparisons do in regression analysis.

³² Any statistical comparison of log-likelihood values for these models would need to address the non-nested nature of the relevant hypothesis test, which Cornerstone has not presented in either its report or its Backup Materials.

³³ Cornerstone Report Exhibit 5 at p. 26; Brattle Further Reply Table 10 at p. 35.

³⁴ See McFadden, Daniel, *Quantitative methods for analyzing travel behavior of individuals: some recent developments*, Institute of Transportation Studies, University of California, 1977, at pp. 34-35

choice probabilities. Claiming superiority of model fit given such lackluster predictive power in the underlying model is misleading.³⁵

C. Cornerstone's claim that residual income is not a factor in wireless subscriber purchase decisions is incorrect and, in any event, does not materially affect merger simulation results

Continuing its objections to our results that show lower income subscribers would be disproportionately harmed by the merger, Cornerstone implies that wireless subscribers assess prices and brands irrespective of their income level. In order to discredit the potential for price sensitivity to depend on income, Cornerstone presents a strawman argument by introducing the concept of “residual income,” which it claims is the “standard” formation in the academic literature to assessing income effects. While “residual income” specifications have been employed in certain analyses, particularly those where the purchase is large,³⁶ the suggestion that residual income is the “right way” to assess the effect of income on wireless subscriber price sensitivity is ill founded and hyperbolic.

Consider the classic example of consumption for certain consumer staples (e.g., potatoes), the consumption of which may be highly sensitive to income level. Importantly, the effect of income on price sensitivity for goods that are a relatively small fraction of total income may be difficult to determine under a residual income approach because the dominant variation in residual income will arise from changes in income, swamping the influence of changes in price.³⁷ In

³⁵ Cornerstone claims that their model has a higher log-likelihood and uses this to claim that their model fit is superior. While the log-likelihood for the original model is higher than our adjusted model **{{BEGIN HCI** **END HCI}}**, Cornerstone presents no evidence that this difference is statistically significant.

³⁶ First Reply at ¶ 62.

³⁷ For example, Cornerstone specifies residual income as $\log(\text{Income}_i - 12 \times \text{ARPU}_b)$. At income values of approximately \$50,000 and ARPU values of approximately \$45, we have approximate baseline levels of $\log(49,460) = 10.8089$. Consider the effect of 10% increases in income versus price (such range values are common for both income and price in Cornerstone's data). A 10% increase in income changes residual income to $\log(54,460) = 10.9052$. A 10% increase in price changes residual income to $\log(49,406) = 10.8078$. As both variables vary across subscribers and brands in the data, it is clear

contrast, our specification, which includes income effects separately for each brand, is sufficiently flexible such that it can capture the influence of income on wireless subscriber price sensitivity.

Furthermore, Cornerstone mistakenly concludes that wireless subscribers do not care about residual income. Cornerstone tests this by simply adding the residual demand variable to its original demand specification, which already includes income effects separately for each brand. Finding the coefficient on this additional variable to be statistically insignificant, Cornerstone concludes that wireless subscriber price sensitivity is not affected by income.

Cornerstone's statistical test for "residual income" is redundant and its conclusion incorrect. First, the original demand model contains median income and "brand dummy" interactions, which Cornerstone summarized in its original submission.³⁸ These variables reveal a statistically significant relationship between brand choice and income in the NMP data. Second, it is entirely expected that, as implemented, the new variable added by Cornerstone will be statistically non-significant because the residual income as defined in Cornerstone's adjustment contains the same information and variation as the median income and brand interaction variables. In other words, because price only varies by brand, adding residual income in this way is redundant to the variation in brand choice probabilities already captured by the brand dummies. This can be seen simply by observing the updated regression results in First Reply Backup Materials.³⁹ With the inclusion of the new variable, the magnitudes of the coefficients on the median income and brand dummy interactions become lower while the new variable is insignificant. This is expected when two dependent variables are providing strongly correlated variation to the model being estimated.

We have re-estimated the regression in the First Reply, in which we remove the income-brand interactions and preserve the "residual income" variable. When we do so, we find that the

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that any influence of price on choice probabilities will be completely overwhelmed by the influence of income in this calculation.

³⁸ Cornerstone Report at ¶ 61. **{{BEGIN HCI**
END HCI}}

³⁹ See First Reply Backup Materials for footnote 42.

“residual income” variable is highly statistically significant.⁴⁰ However, in this instance, the available “residual income” information is serving little more than as a proxy for pure income. Nonetheless, even under Cornerstone’s interpretation of this variable, one would conclude that wireless subscribers apparently indeed care about residual income when making brand choices.

D. Cornerstone relies upon a measure of consumer welfare that understates harm from the merger

Cornerstone contends that we neglected to account for consumer choice in our analysis of the merger related consumer harm.⁴¹ We find this claim to be without merit. Cornerstone’s use of average “compensating variation” hides the harm suffered by some of the Applicants’ subscribers, even though its model clearly identifies wireless subscribers who would in fact be harmed by the merger. Cornerstone’s approach is wholly inappropriate for merger review.

Specifically, Cornerstone claims that the merger analysis in our Further Reply (wherein we explicitly compare Cornerstone’s price increases against the allegedly offsetting WTP values for hypothetical quality increases) “fails to allow for consumer choice.”⁴² Cornerstone implies that our failure to incorporate this consumer choice leads us to overstate the merger’s harm. That is, because brands with a large price increase compete with the non-merging parties’ brands, the “expected” harm would be lower than the merger’s predicted price increases. Such a conclusion relies upon an analytical perspective where welfare calculations are carried out in a hypothetical setting in which subscribers have yet to make a brand choice, ignoring the revealed brand preferences of observed subscribers. While it is not uncommon to see *ex ante* welfare analysis in certain policy settings, it understates the harm to specific subscriber segments and is inappropriate for merger review. In fact, the antitrust agencies have a track record of challenging mergers that lead to price increases for well-defined sets of customers.⁴³

⁴⁰ See our Backup Materials.

⁴¹ See First Reply at ¶¶ 53 – 54, 71 – 73.

⁴² First Reply at ¶ 71.

⁴³ For example, the court sided with the FTC in Staples/Office Depot regarding targeted customer segments, finding that “antitrust laws exist to protect competition, even for a target group that represents a relatively small part of an overall market.” See *FTC v. Staples, Inc., et al.*, 44, 15-cv-02115 (D.D.C. May 17, 2016). The FTC also successfully blocked the Sysco/US Foods transaction, arguing that the merger would specifically harm “broadline” food-service distributors. See Complaint at 4-5,

Like Compass Lexecon, Cornerstone assesses the welfare effects of the merger by calculating the common monetary payment, or “compensating variation” (CV), that must be paid to every wireless subscriber in the market (including those of the non-merging parties) such that, on average across all subscribers, there would be no aggregate reduction in expected “consumer utility.” However, as is well-understood, such an approach leads to “winners” and “losers”, where the “losers” are not made entirely whole in the event that they were paid this common CV,⁴⁴ irrespective of the fact that merger approval would not obviously lead to any monetary payments to the harmed subscribers.⁴⁵

In discrete choice analyses such as the conditional logit and nested logit models that the Applicants’ economists rely upon, *ex ante* calculation of the CV reflects that each subscriber’s demand for wireless brands is probabilistic in expectation, not deterministic. Subscribers are modeled to act as if they effectively purchase a slice of each brand equal to the probability of choosing that brand. As a result, harm from the merger is approximately a weighted average of the merger’s effects on each brand. For example, Cornerstone calculates a common CV across subscribers of {{BEGIN HCI}} END HCI}},⁴⁶ while the same merger simulation predicts price increases for Sprint and T-Mobile of more than twice this value, ranging from {{BEGIN HCI}} END HCI}}. The common CV is just a fraction of the

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FTC v. Sysco Corporation, et al., 1:15-cv-00256 (Feb. 20, 2015). One of the Applicants’ economists, Dr. Mark Israel, provided expert testimony for the FTC in Sysco/US Foods. And in its challenge of the GE/Electrolux merger (which the parties terminated during the trial), the DOJ and its expert, Dr. Michael Whinston, explained that specific customer segments (including separate contract and retail channels) would face targeted price increases following the merger, and described harm from the merger arising from price effects specific to the merging brands. For example, the DOJ complaint alleges that “[t]he proposed acquisition likely would lead Electrolux to profit by, among other things, raising the prices of major cooking appliances above pre-acquisition levels.” See Complaint at 28, *U.S. v. AB Electrolux, Electrolux North America, Inc., and General Electric, Co.*, Case No. 15-01039-EGS (D.C. 2015), See also Trial exhibit of Michael Whinston in *U.S. v. AB Electrolux, Electrolux NorthAmerica, Inc., and General Electric, Co.* Public version. <https://www.justice.gov/atr/file/ge-px02015/download>.

⁴⁴ See McFadden, Daniel, *Foundations of Welfare Economics and Product Market Applications*, No. w23535, National Bureau of Economic Research, 2017, at p. 43.

⁴⁵ In the Cornerstone and Compass Lexecon welfare analyses, merger approval is apparently encouraged if the CV is negative, supposedly indicating that the merger on average benefits subscribers.

⁴⁶ Cornerstone Report Exhibit 13 at p. 42.

price increases because the price changes are effectively “weighted” by subscribers’ brand choice probabilities. This *ex ante* welfare approach ignores important information revealed by the subscriber brand choices observed in the real world.

Cornerstone’s criticism that we “fail to allow for consumer choice” betrays the fact that Cornerstone would have us ignore the harm that arises in its model to well-identified sets of subscribers.⁴⁷ For example, we have previously explained that low-income subscribers bear a disproportionate share of merger harm in Cornerstone’s modeling of hypothetical quality improvements. Moreover, as we elaborate further in Section III, additional information on subscriber income indicate significant segmentation between premium and non-premium brands on the basis of income. With this information, we show that the Cornerstone model would predict much larger price increases on non-premium brands, which appear disproportionately chosen by lower-income subscribers.

In addition, Cornerstone understates harm to the *inframarginal* subscribers of the Applicants’ brands, i.e., those who do not switch post-merger and stay with their original brand choice. Absent any quality improvements, harm to subscribers is the price change for as long as they remain with the brand – nothing more and nothing less.⁴⁸ To the extent that there may be merger-related quality improvements, if the WTP for those quality improvements fails to offset the magnitude of the price increase, then those inframarginal subscribers continue to be harmed. As we have shown in our analysis, this is the case for the majority of the Applicants’ current subscribers.

E. The Additional Criticisms in Cornerstone’s First Reply are Without Merit

Cornerstone also criticizes our work in other areas, which we summarize and respond to below.

- Cornerstone claims that our analysis of income effects is incomplete, and argues that we did not appropriately update the merger simulation to reflect the modified demand

⁴⁷ First Reply at ¶ 71

⁴⁸ See Cameron, A. Colin, and Pravin K. Trivedi, *Microeconometrics: methods and applications*, Cambridge University Press, 2005, at p. 507.

specification with income effects.⁴⁹ Cornerstone claims to have incorporated these income effects itself, but its implementation is incorrect. When implemented correctly, we see that there is no material difference in the predicted price effects under the modified demand model.⁵⁰ Our conclusions therefore remain unchanged: low-income subscribers of a given brand face the same price increases as high-income subscribers, but they value any alleged quality improvements far less than the high-income subscribers. Low-income subscribers therefore bear a far greater portion of the harm resulting from the merger. Further details and the actual predicted prices under this simulation are presented in the Appendix.

- We have reviewed Cornerstone’s suggested modifications to Table 15 of our Further Reply and observe that they have no effect on our conclusion that {{BEGIN HCI

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- The other “error” that Cornerstone claims is that we did not update Cornerstone’s merger simulation under the modified demand specification with alternative income effects. But, again, there is no material difference in the predicted price effects under the modified demand model, leaving our conclusions about relative harm to low- and high-income subscribers unchanged.
- Cornerstone claims that it used T-Mobile’s margins to estimate the price sensitivity parameter in order to be “conservative” and that the use of Sprint margins would lead to lower merger induced price increases.⁵¹ It also claims that we had not run a merger simulation to test the Sprint margin scenario. Cornerstone misses the point that its WTP estimates are highly sensitive to the choice of which margin is used, and that its choice leads to a much higher WTP estimate. We have calculated the price increases and WTP

⁴⁹ First Reply at ¶ 63.

⁵⁰ This is to be expected due to the absence of price discrimination in the model, where common pricing across subscribers means that a given brand will approximately set prices based on the price sensitivity on average across its subscriber base.

⁵¹ First Reply at ¶¶ 68-70. We made a similar point in footnote 22 of our Further Reply.

under that scenario, and find that using Sprint's margin reduces both the willingness to pay and the price effects but that the majority of consumers are harmed under this scenario.⁵²

- Finally, Cornerstone criticizes our assessment of the effect on WTP calculations of aggregate “heavy” data users.⁵³ Cornerstone claims that our initial criticism on this issue only reinforced its results regarding critical marginal cost reductions: that they are approximately the same even when data use types are further disaggregated. However, Cornerstone's response misses our point entirely and is irrelevant to our criticism. Our finding was that the arbitrary categorization of all subscribers using more than **BEGIN HCI END HCI** GB/month into a single “heavy” data group causes Cornerstone to significantly overstate the WTP for nearly half of the “high data users.” Cornerstone is correct that the price effects (and therefore the calculated critical cost efficiencies) are little affected by the disaggregation that we explored in our report. However, the relevant point is that the gap between the price increase and WTP for any alleged quality improvements is even greater for these subscribers than was suggested in Cornerstone's report.

III. The Data Cornerstone Uses for its Demand Estimation Restricts the Extent of Estimated Market Segmentation and Understates Merger Harm

Cornerstone disputes our observation that its estimates of diversion ratios are “merely assumed values that effectively reproduce diversion in proportion to share.”⁵⁴ Nevertheless, Cornerstone essentially admits that, when “present[ed]...across all consumers as a group”, the brand-level diversion ratios are comparable to “what would be predicted from each brand's KPMG/Sprint

⁵² The supporting calculations are included in the backup materials for this report.

⁵³ First Reply at ¶¶ 65-67.

⁵⁴ Second Reply ¶ 4.

market area subscriber shares.”⁵⁵ But, Cornerstone claims that the comparison is “misleading” and “misrepresents [Cornerstone’s] analysis,” because the “key contribution” of that analysis is that it demonstrates that “quality is inherently individualized,” and “individual-level” diversion ratios are variable.⁵⁶ However, Cornerstone obscures the point that carriers make their pricing decisions at an aggregate level – not at the individual subscriber level – and these decisions are informed by aggregate brand substitution patterns. The results of the Cornerstone model differ so markedly from the carriers’ internal ordinary course business analyses because Cornerstone’s demand model fails to capture the very market segmentation that the Applicants actually use in making pricing decisions.

In its Second Reply and throughout its previous submissions, Cornerstone references the “richness” of the NMP data and explicitly states that its model “directly incorporates consumers’ sensitivity to price.”⁵⁷ However, Cornerstone’s representations are an overstatement at best, and more likely are incorrect. This is mainly because prices are not observed and are therefore excluded from Cornerstone’s demand model. Additionally, as discussed in our filing on diversion ratios, the claimed attractiveness of Cornerstone’s model—that it is an individual-level logit demand model based on detailed data—is negated by its limited ability to identify switching behavior other than in proportion to the carriers’ shares.⁵⁸ Although Cornerstone in its Second Reply presents individual-level diversion ratios, the associated exhibits reinforce the fact that brand-level diversions (on which actual pricing decisions are determined) merely recover share-proportionality.⁵⁹

Moreover, Cornerstone states that its model and data allow it to assess consumer responses by key demographics, suggesting that the resulting estimates would reflect realistic segmentation. However, the model estimates substitution patterns from the NMP and Census data that

⁵⁵ Second Reply ¶ 10.

⁵⁶ *Id.* ¶ 9.

⁵⁷ First Reply at ¶ 22.

⁵⁸ See Brattle Diversion Response at pp. 4-5.

⁵⁹ Specifically, the central tendency across individuals are all at the share-proportional diversion levels. See Second Reply at pp. 5-8, particularly Exhibit 1. If the demand model were capturing meaningful segmentation, then the distribution of diversion ratios for a given brand and/or geographic market would not be centered at share-proportional diversion.

contradict the Applicants' own internal business decision documents.⁶⁰ In its Second Reply, Cornerstone further asserts that there are no "identifiable segments of consumers that are likely to be harmed", noting that, based on census data used in the analysis, "AT&T and Verizon are critical competitors for all segments."⁶¹ However, Cornerstone ignores the self-reported income data in the NMP survey.⁶² Review of these data reveals that the NMP respondents' income distribution is drastically different from the distribution of median incomes for these same respondents at the zip code level, causing a strong attenuation of income differences across brands. Specifically, we find that premium-brand subscribers have significantly higher incomes than non-premium-brand subscribers for this set of respondents. In contrast, the census median income data used by Cornerstone shows only a slight difference in income between premium- and non-premium-brand subscribers. Figure 1 and Figure 2 highlight the significant differences in the two income variables. Census median income fails to capture the large differences in income between premium and non-premium brands from the reported income in NMP. The associated attenuation of income differences prevents the Cornerstone analysis from finding any meaningful market segmentation.

⁶⁰ See Brattle Diversion Response at pp. 13-14.

⁶¹ Second Reply at ¶ 17.

⁶² Around {{BEGIN HCI END HCI}} of panelists appearing in the original Cornerstone demand model reported their income in the NMP survey data. While the panelists for whom we do not have NMP income measures may not be missing at random, we find that the median census income distributions do not materially vary between the two groups. See the Appendix for the distribution of median income for unmatched observations.

**Figure 1: Census Median Income Distributions for
NMP Respondents Who Reported Income by Brand Category**
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Backup Materials.

As shown in Figure 1, when considering census median income information, non-premium brand subscribers are shown to have only modestly lower incomes than premium brand subscribers. In contrast, Figure 2 shows that the reported income of NMP survey respondents is significantly lower for non-premium brand subscribers than for premium brand subscribers. For example, the summary of the NMP survey data suggests that almost **{{BEGIN HCI END HCI}}** of non-premium subscribers have an income below **{{BEGIN HCI END HCI}}**, while the income distribution of premium brand subscribers is spread out more evenly across income levels. Additionally, the distribution of census median incomes for these respondents, shown in Figure 1, is such that non-premium brands are **{{BEGIN HCI END HCI}}** more likely to have incomes below **{{BEGIN HCI END HCI}}** as premium-brand subscribers. In contrast, as shown in Figure 2, the distribution of reported incomes is such that

non-premium brands are {{BEGIN HCI END HCI}} more likely than premium-brand subscribers to have incomes below {{BEGIN HCI END HCI}}.

**Figure 2: NMP Reported Income Distributions for
NMP Respondents Who Reported Income by Brand Category
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Backup Materials.

Because Cornerstone’s model assigns the same median income to individuals in the same zip code, no matter what brand the individual chooses, the model misses an important driver of brand choice. This oversight results in a significant understatement of market segmentation between the premium and non-premium brands. In order to explore the potential effect of this issue, we consider a sensitivity analysis in which we estimate a regression model of panelists’ reported income as a function of other information observed across the Cornerstone sample.⁶³

⁶³ NMP panelist reported income is recorded as income intervals {{BEGIN HCI END HCI}}, necessitating use of interval regression techniques for the income estimation model.

We then use the regression results to estimate income for all panelists.⁶⁴ We then re-estimate Cornerstone's demand model, replacing census median income information with predicted panelist income while preserving all other variables in the original Cornerstone report. The resulting diversion ratio estimates are drastically different from those of the original Cornerstone model, as shown in Figure 3, below.

⁶⁴ Variation in survey response rates across brands about income may indicate that survey nonresponses could be nonrandom. However, nonrandom nonresponse is of minimal concern for purposes of assessing the influence of attenuation of income differences across brands on the Cornerstone model's estimation of diversion ratios.

**Figure 3: Diversion Ratios with Income Estimated from NMP Responses
Plotted Against Diversion Ratios with Median Income from Census
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Report Backup Materials.

Specifically, the figure plots diversion ratio estimates between brand pairs, comparing the estimates from the original Cornerstone model to those that are estimated from the model where census median income is replaced with panelist-level income. A point above the 45-degree line illustrates a diversion ratio (e.g. Boost to MetroPCS) that has a higher value under the model with estimated incomes than under the model using census median incomes. Likewise, a point below the line has a lower diversion ratio under the model with estimated incomes, and any

points that lie close to the 45-degree line reflect diversion ratio estimates that are approximately similar under the two estimates.

As mentioned previously, the estimated diversion ratios under the estimated income information exhibit significant market segmentation between premium and non-premium brands, while no such market segmentation is apparent in Cornerstone's original model. For example, the diversions from non-premium brands to premium brands are significantly greater in the original model than in the model with estimated panelist income. Similarly, the diversions from non-premium brands to non-premium brands are significantly lower in the original model than in the model with estimated panelist income.⁶⁵

The failure of the Cornerstone demographic information to show meaningful market segmentation has strong implications for this merger review. As shown above, Cornerstone's income information fails to capture the fact that subscriber incomes vary widely across brands. Such differences alone may be sufficient to explain the apparent contradiction between Cornerstone's estimated diversion ratios and the Applicants' internal assessments of brand preferences. This further demonstrates the unreliability of Cornerstone's model and data to predict meaningful diversion, especially for non-premium brands. Such mismeasurement of subscriber brand preferences has significant implications for not only the assessment of how close the Applicants subscribers view the brands to be, but also the estimated price increases that would result from the merger. We implemented Cornerstone's merger simulation using the demand and diversion estimates from the panelist income information. The simulation results show that the merger would lead to price increases for Boost and MetroPCS of approximately {{BEGIN HCI END HCI}}, respectively. These changes are more than *three times* the price increases predicted under the original Cornerstone model.⁶⁶

⁶⁵ As a robustness check, we also calculated the diversion ratios using only the NMP respondents who reported their income. We find similar market segmentation patterns for the matched sample and the full sample with imputed income. The supporting calculations are included in the backup materials for this report.

⁶⁶ See Appendix, Tables 4 and 5.

Appendix

A. Comparison of merger simulation price increases with and without TBG income effects modification

Cornerstone claims to have run a full merger simulation under our variant of the model.⁶⁷ Cornerstone does this incorrectly. Instead of adjusting the coefficient on the median income and brand interaction terms as outlined in Appendix VI.A of the Brattle Further Reply, Cornerstone adjusts the brand and location fixed effects as in its original formulation. We have corrected this mistake and run the merger simulation with the proposed changes to the demand model.⁶⁸

We find that the predicted price effects from the Cornerstone model remain effectively unchanged. As shown in the figures below, the post-merger prices absent any efficiencies are virtually identical between the original Cornerstone demand model and under the Brattle modification with explicit income effects.

⁶⁷ First Reply at ¶ 63.

⁶⁸ In our technical appendix, we provided a decomposition of the brand-specific income effect as $\gamma_b^{Inc} = \xi_{lb} + \delta p_b$. The correct decomposition is $\gamma_b^{Inc} = \xi_b + \delta p_b$

**Figure 4: Post-Merger Price Forecasts (\$/sub-month)
Original Cornerstone Model (w/o income effects) vs TBG Modification (w/ income effects)
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Sources: Brattle calculations and Cornerstone Report Backup Materials.

**Figure 5: Price Effect Differences from Merger Model
Original Cornerstone Model (w/o income effects) vs TBG Modification (w/ income effects)**
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Sources: Brattle calculations and Cornerstone Report Backup Materials.

- B. Cornerstone merger simulation price increases under best-of-both quality improvement scenario, across various marginal-cost efficiency scenarios

Table 3: Cornerstone Merger Simulation Price Changes (%) Best-of-Both
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Source: Cornerstone Report Backup Materials and Compass Lexecon Declaration Backup Materials.

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

C. Cornerstone model diversion ratios and merger simulation price increases using estimated NMP income

Table 4: Diversion calculated from Cornerstone model under estimated NMP income
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Source: Brattle calculations and Cornerstone Report Backup Materials.

**Table 5: Cornerstone Merger Simulation Price Changes
No Efficiencies, Estimated Income from NMP Survey Responses**
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Report Backup Materials.

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

**Table 6: Amended Brattle Further Reply 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
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Report Backup Materials.

E. Distribution of Census Median Income for NMP Respondents that Did Not Report Income

**Figure 6: Distribution of Census Median Income for
NMP Respondents that Did Not Report Income by Brand Category**
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Sources: Brattle calculations, NMP Survey Data, and Cornerstone Backup Materials.