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February 7, 2018

VIA ECFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, DC 20554

REDACTED – FOR PUBLIC INSPECTION

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:

Pursuant to Section 1.1206(b) of the Commission's Rules, 47 C.F.R. § 1.1206(b), notice is hereby provided of a written *ex parte* presentation in the above-referenced docket. By this filing, T-Mobile US, Inc. ("T-Mobile") and Sprint Corporation ("Sprint") (collectively, "Applicants") hereby respond to DISH Network Corporation's ("DISH") January 28, 2019, letter.[1] In its filing, DISH disputes the conclusions reached in the Applicants' economic filings about diversion between the Applicants and also argues that the Applicants mischaracterized their use of porting data in the course of ordinary business in a December 18, 2018, *ex parte* filing.[2] In the attached response, submitted herewith as Appendix A, Drs. John Asker, Timothy Bresnahan and Kostis Hatzitaskos (ABH) address the arguments raised by DISH in its criticism of their findings and methodology. Also in the attached response, submitted herewith as Appendix B, Mark Israel, Michael Katz, and Bryan Keating (IKK) likewise respond to DISH's filing and its criticism of their work.

DISH's argument regarding the Applicants' use of porting data was addressed in the Applicants' December 14, 2018, *ex parte* filing. To the extent there remain any question about T-Mobile's

[1] Letter from Pantelis Michalopoulos, Counsel to DISH Network Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 18-197 (Jan. 28, 2019).

[2] Letter from Nancy J. Victory, Counsel to T-Mobile US, Inc., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 18-197 (Dec. 14, 2018); Mark Israel, Michael Katz, and Bryan Keating, *Additional Information Regarding the Estimation of Diversion Ratios* (Dec. 14, 2018).

and Sprint's views regarding porting data and how the companies use it, attached as Appendices C and D are declarations of Mark Roettgering, Senior Vice President of Commercial Strategy and Decision Analytics at T-Mobile, and Brandon "Dow" Draper, Chief Commercial Officer at Sprint. These declarations should make the Applicants' views and practices clear.

This filing, and the included USB drive with back-up materials from ABH and IKK, contain NRUF/LNP Confidential Information and information that is "Highly Confidential" pursuant to the Protective Order filed in WT Docket No. 18-197. Accordingly, pursuant to the procedures set forth in the Protective Order, a copy of the filing and the USB drive is being provided to the Secretary's Office. In addition, two copies of the Highly Confidential Filing and the USB drive are being delivered to Kathy Harris, Wireless Telecommunications Bureau. A copy of the Redacted Highly Confidential Filing is being filed electronically through the Commission's Electronic Comment Filing System.

Please direct any questions regarding the foregoing to the undersigned.

Respectfully submitted,

DLA Piper LLP (US)

/s/ Nancy Victory

Nancy Victory
Partner

cc: David Lawrence
Kathy Harris
Linda Ray
Kate Matraves
Jim Bird
David Krech

APPENDIX A

CORNERSTONE RESEARCH
ECONOMIC AND FINANCIAL CONSULTING AND EXPERT TESTIMONY

RESPONSE TO DISH COMMENTS REGARDING DIVERSION RATIOS

By John Asker,* Timothy F. Bresnahan,† and Kostis Hatzitaskos ‡

February 6, 2018

* John Asker is a Professor of Economics at the University of California at Los Angeles, where he holds the Armen A. Alchian Chair in Economic Theory.

† Timothy Bresnahan is a Professor of Economics at Stanford University, where he holds the Landau Professorship in Technology and the Economy.

‡ Kostis Hatzitaskos is a Vice President in the Chicago office of Cornerstone Research.

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1. Introduction and summary

1. We have been asked by counsel for the merging parties to respond to the latest economic white paper submitted by Coleman Bazelon, Jeremy Verlinda, and William Zarakas of the Brattle Group on behalf of DISH Network Corporation ("DISH").[1] The new Bazelon, Verlinda, and Zarakas white paper focuses on a particular aspect of economic modeling (diversion ratios) and follows another exchange we have had with the same authors on evaluating the likely competitive effects of the proposed merger.[2]

2. The ultimate goal of competitive effects analysis is to determine whether a proposed merger is likely to lessen or strengthen competition, and harm or benefit consumers. A key factor of such analysis in industries with differentiated products, such as wireless service, is the closeness of competition between the different merging party brands. There are multiple ways to evaluate and quantify closeness of competition.[3] A particular one is the "diversion ratio."[4]

3. There is no real debate that the best way of measuring closeness of substitution and diversion ratios is through an appropriately estimated, careful

[1] Coleman Bazelon, Jeremy Verlinda, William Zarakas, "Response to Applicant Filings on Diversion Ratios," January 28, 2019 ("Bazelon, Verlinda, and Zarakas January 28 Declaration").

[2] On November 6, 2018, we submitted an economic analysis of the proposed merger that empirically assessed its likely competitive effects using rich, present-day data. See John Asker, Tim Bresnahan, and Kostis Hatzitaskos, "Economic Analysis of the Proposed T-Mobile/Sprint Merger," November 6, 2018 ("Asker, Bresnahan, and Hatzitaskos White Paper"). We later discussed our analysis with Commission staff. See John Asker, Tim Bresnahan, and Kostis Hatzitaskos, "Economic Analysis of the Proposed T-Mobile/Sprint Merger: Presentation to Federal Communications Commission," December 3, 2018 ("Asker, Bresnahan, and Hatzitaskos Presentation to FCC Staff"). Among other things, our careful examination of the best available data on network quality and consumer choice today demonstrates that the two leading firms, AT&T and Verizon, are overall the two most important competitive constraints on the merging parties. See Asker, Bresnahan, and Hatzitaskos White Paper, § 3.2.2 and Exhibit 12. On December 4, Bazelon, Verlinda, and Zarakas submitted a declaration commenting on our analysis. See Coleman Bazelon, Jeremy Verlinda, William Zarakas, "Further Reply Declaration," December 4, 2018 ("Bazelon, Verlinda, and Zarakas December 4 Declaration"). On December 18, we submitted a response to their comment as well as comments from other parties. See John Asker, Tim Bresnahan, and Kostis Hatzitaskos, "Response to DISH and CWA Comments," December 18, 2018 ("Asker, Bresnahan, and Hatzitaskos Response to DISH and CWA"). In that response we explained why our analysis was appropriate and why the technical critiques put forth by Bazelon, Verlinda, and Zarakas were incomplete and internally inconsistent, rejected by the data, and portray a fundamental misunderstanding of demand estimation and merger simulation methods. Asker, Bresnahan, and Hatzitaskos Response to DISH and CWA, §§ 2, 4.

[3] Jonathan B. Baker and Timothy F. Bresnahan, "Economic Evidence in Antitrust: Defining Markets and Measuring Market Power," in *Handbook of Antitrust Economics*, (MIT Press, 2008), pp. 6, 9, 12, and 13, available at http://www-leland.stanford.edu/~tbres/research/buccirossi_01_ch01_001-042.pdf, accessed February 5, 2019.

[4] The diversion ratio is "the fraction of unit sales lost by the first product due to an increase in its price that would be diverted to the second product." See U.S. Department of Justice and Federal Trade Commission, *Horizontal Merger Guidelines*, August 19, 2010, available at https://www.justice.gov/sites/default/files/atr/legacy/2010/08/19/hmg-2010.pdf ("Guidelines"), p. 21.

examination of consumer demand. Bazelon, Verlinda, and Zarakas do not dispute this point.[5]

4. What Bazelon, Verlinda, and Zarakas primarily offer are two critiques by which they attempt to dismiss our results. First, they claim that our empirical estimates of diversion ratios are "merely assumed values that effectively reproduce diversion in proportion to share."[6] We show below that this is categorically false. Our analysis estimates substitution patterns that reflect the characteristics of each consumer as well as the individualized network quality different brands offer to each consumer. Contrary to the assertions of Bazelon, Verlinda, and Zarakas, these patterns plainly and sharply deviate from diversion proportional to share (see § 2).

5. Second, they claim that our demand model is "incapable of finding meaningful market segmentation."[7] Aside from their (plainly false) argument that our model assumes diversion according to share, their only basis for this argument is that our analysis finds that the merging party brands do not compete as closely with one another relative to what one might have assumed based on porting data.[8] Porting data are a particular type of switching data, which track only those consumers who switch wireless brands and choose to port their numbers when they do so. We explain below that switching data in general and porting data in particular are recognized (including by the FCC) to be at best imperfect proxies for diversion ratios.[9] When switching data disagree with the results of a rigorous evaluation of consumer demand, as they do here, the idea that one should disregard the econometric evidence in favor of the switching data is without support in agency practice or in the academic literature (see § 3).

6. Additionally, Bazelon, Verlinda, and Zarakas cite multiple internal merging party documents that they assert as support for the idea that porting data are a reliable source of information *on diversion*. The documents do no such thing. We explain below that the documents confirm that executives use porting data directionally, as one of several indicators to gauge the state of competition.

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[5] Bazelon, Verlinda, and Zarakas January 28 Declaration, pp. 22–23.

[6] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 23.

[7] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 28.

[8] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 29.

[9] For more discussion of porting data and the potential issues with using it as a proxy for diversion ratios, see Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating, September 17, 2018 ("Israel, Katz, and Keating Declaration"), Appendix I.C.3; and Mark Israel, Michael Katz, and Bryan Keating, "Additional Information Regarding the Estimation of Diversion Ratios," December 14, 2018.

These documents do not support any view that the parties use porting to predict diversion. Moreover, the documents show that porting data do not necessarily correspond to consumer switching in response to price changes, reinforcing our prior statement: that we are not aware of any price promotion that can be used to reliably study closeness of competition (see § 4).

7. Finally, Bazelon, Verlinda, and Zarakas do not show that any of the points they raise would have any impact on the bottom line conclusions of our analysis: that the proposed merger is likely to strengthen competition and benefit consumers (see § 5).

2. Our analysis estimates substitution patterns at the individual level, reflecting consumer characteristics and individualized network quality, and which, contrary to DISH's assertions, sharply deviate from diversion proportional to share

8. Bazelon, Verlinda, and Zarakas argue that our demand model's diversion ratio estimates are "merely assumed values that effectively reproduce diversion in proportion to share."[10] This is categorically false.

9. We repeatedly explained in our initial white paper that a key contribution of our analysis is that it demonstrates that network quality is inherently individualized.[11] Accordingly, we also explained that while measures of competitive pressure can be summarized in the aggregate, our model measures

[10] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 23. First, in motivating their incorrect assertion that our analysis assumed diversion ratios are proportional to share, Bazelon, Verlinda, and Zarakas offer numerous equations in both their main text and an accompanying technical appendix. Since this may not be clear to the lay reader, we clarify here that this technical discussion has no bearing on the validity of our analysis. They refer to a "'fixed effects only' version of the Cornerstone model," which is *not* our model but rather a simplified version of our model that they have put forth and whose properties do not apply to our model. Moreover, on p. 25 they offer an equation that can be used to calculate diversion ratios at the *aggregate* (not individual) level and then list ways in which the equation they wrote down "is notable." None of these constitute valid criticisms of our analysis. First, they claim that the equation that they wrote down "does not depend on the model estimates for the effects of brand characteristics." This is incorrect. Their equation includes the probability that any given individual chooses a particular brand, which *does* depend on the model estimates for the effects of brand characteristics, including individualized network quality. Second, they argue that aggregate diversion does not depend on the reason subscribers change brand (e.g., price or quality). This is not a criticism of our model, but rather a feature of all discrete choice models used in competition analysis more generally across the practice of the antitrust agencies and the academic literature. Third, they offer a simplified formula for a model (the antitrust logit model) that is *not* the model we use. This is unrelated to our model and irrelevant, and they offer no reason to conclude otherwise. Finally, they note that if individual choice probabilities from our model are aggregated in a given geographic area, they reproduce the brand shares in that area. This is as it should: it would be surprising if we estimated demand using present-day data, including present-day shares, and the model then predicted a different set of shares than those observed in the data. Yet this is also a red herring. Matching shares in a geographic area does not detract from the fact that the model calculates choice probabilities and substitution patterns at the individual level, which reflect what the granular NMP data tell us about how individual consumers make wireless service choices.

[11] See Asker, Bresnahan, and Hatzitaskos White Paper, § 2.2.3. See also the backup to our initial white paper, namely "merger_simulation.m" and "calculate_shares.m" under the "programs\macro\matlab\" subfolder.

substitution patterns at the individual level, taking into account product and consumer characteristics, including the individualized quality each brand offers to particular consumers given their individual usage patterns.[12]

10. Despite having our initial white paper as well as its underlying calculations and data since November 8, 2018, Bazelon, Verlinda, and Zarakas choose to ignore this fundamental aspect of our analysis. They instead present diversion ratios only across all consumers as a group and compare them to what would be predicted from each brand's KPMG/Sprint market area subscriber shares.[13] This is misleading and misrepresents our analysis on multiple counts.

2.1. Our analysis estimates diversion ratios at the individual level that deviate sharply from share-based diversion

11. In Exhibit 1 we reproduce Bazelon, Verlinda, and Zarakas Figure 3, but use the full range of individual diversion ratios our analysis *actually generates* for diversion from Sprint to T-Mobile, based on individual substitution patterns. Put differently, instead of representing diversion from Sprint to T-Mobile with a single averaged point, as they have done in their chart, we present one point for each of the [redacted] consumers in our demand estimation analysis. It is immediately apparent that our analysis produces individual-level diversion ratios that deviate sharply from diversion proportional to share.

12. The y-axis represents the individual-level diversion ratio our analysis generates. The x-axis represents the diversion ratio from Sprint to T-Mobile that we would expect based on the subscriber shares of these brands in each KPMG/Sprint market area. Observe that the individual points are generally arrayed in vertical lines. This is because our demand estimation analysis includes 79 KPMG/Sprint market areas, and each only has one share-based diversion ratio. Within each KPMG/Sprint market area, each individual has a unique individual-level diversion ratio based on their individual characteristics and usage patterns.

13. For Bazelon, Verlinda, and Zarakas to be correct in their criticism, we would expect all [redacted] points to lie on the 45-degree line. This is simply not true. Instead, there is tremendous variation across our estimates of diversion for individuals within the same KPMG/Sprint market. Consider the individuals

[12] Asker, Bresnahan, and Hatzitaskos White Paper, ¶ 77 and Exhibits 8–12.

[13] Bazelon, Verlinda, and Zarakas January 28 Declaration, Figure 3.

that make up the last vertical line to the right. This corresponds to the LA Metro KPMG/Sprint market area, where share-based diversion is the highest – nearly [redacted] percent. However, our analysis estimates that [redacted] percent of individuals in the LA Metro area would divert from Sprint to T-Mobile with a probability of less than 20 percent, while [redacted] percent of individuals within the same area would divert from Sprint to T-Mobile with a probability of more than 60 percent.[14]

EXHIBIT 1
Individual-level diversion ratio, Sprint to T-Mobile

[redacted]

14. To more clearly demonstrate how much our estimates differ from share-based diversion, in Exhibit 2 we present the percentage difference between the individual-level diversion our analysis generates and what one would expect were diversion assumed to be according to share, as Bazelon, Verlinda, and

[14] See our workpapers.

Zarakas claim. Moreover, we have set every KPMG/Sprint market area on a separate column, so that we can study the dispersion in each one separately.

15. Were Bazelon, Verlinda, and Zarakas correct in their criticism, every point on this chart should be on the horizontal line (at zero), indicating that the individual-level diversion ratio is equal to that predicted by share. Instead, Exhibit 2 makes clear that we estimate wide dispersion in individual-level diversion ratios across every KPMG/Sprint market area.[15]

EXHIBIT 2
Percent difference between individual-level diversion and share-based diversion from Sprint to T-Mobile by KPMG/Sprint market area

[redacted]

16. These figures therefore demonstrate the exact opposite of what Bazelon, Verlinda, and Zarakas assert. Our flexible model of consumer demand does not assume that diversion ratios are proportional to share. Instead, it lets the data

[15] We routinely estimate that particular individuals would substantially deviate from share-based diversion. For example, more than 27 percent of consumers are more than a third less likely to divert from Sprint to T-Mobile than would be expected by share. See our workpapers.

speak to each individual's diversion based on multiple factors, including granular information about their usage patterns, the individualized network quality each brand offers to the consumer, as well as consumer characteristics such as zip code income, credit score, and race and ethnicity.[16] In the appendix, we show that the same is true examining diversion in the other direction, from T-Mobile to Sprint.[17]

2.2. Our analysis indicates that consumers in lower income, lower credit score, and more diverse zip codes are more likely to benefit from the proposed merger

17. It is important to note that Bazelon, Verlinda, and Zarakas have not shown that there are any identifiable segments of consumers that are likely to be harmed. Indeed, the data show that AT&T and Verizon are critical competitors for all segments.

- **Low credit score areas:** AT&T, Verizon, and Cricket account for a [redacted] percent collective share of subscribers in areas in the bottom quartile by zip code average credit score; MVNOs and other non-merging party brands account for another [redacted] percent,[18]
- **Low income areas:** AT&T, Verizon, and Cricket account for a [redacted] percent collective share of subscribers in areas in the bottom quartile by zip code median income; MVNOs and other non-merging party brands account for another [redacted] percent,[19]
- **More racially and ethnically diverse areas:** AT&T, Verizon, and Cricket account for a [redacted] percent collective share of subscribers in areas in the top quartile by zip code share of consumers who are African-American or Hispanic; MVNOs and other non-merging party brands account for another [redacted] percent.[20]

18. Moreover, the data also demonstrate that (a) heavy data users value network quality increases more than other users, and thus are more likely to benefit from the proposed merger, and (b) heavy data users are *more* likely to

[16] Asker, Bresnahan, and Hatzitaskos Presentation to FCC Staff, pp. 18, 24, 28, and 35.
[17] See § 6.1, "Individual-level vs. share-based diversion ratios from T-Mobile to Sprint."
[18] Asker, Bresnahan, and Hatzitaskos White Paper, ¶ 77 and Exhibit 8.
[19] Asker, Bresnahan, and Hatzitaskos White Paper, ¶ 77 and Exhibit 9.
[20] Asker, Bresnahan, and Hatzitaskos White Paper, ¶ 77 and Exhibit 10.

be consumers in areas that are lower credit score, lower income, and have a higher share of African-American or Hispanic consumers.[21]

19. This latter finding from the Nielsen Mobile Performance ("NMP") data we use is consistent with other publicly available data. For example, surveys from Pew Research demonstrate that consumers who are low-income, African-American, or Hispanic are more likely to use smartphones but not use home broadband.[22]

2.3. Our conclusions are robust to allowing for products to be closer substitutes based on unobservable correlation in consumer preferences

20. As we explained in our initial white paper, our analysis is rooted in rich, present-day data on individualized network quality and consumer behavior.[23] Our examination of demand controls for a wide range of observable consumer and product characteristics, which allow for the data to speak to the extent that some products are closer substitutes to one another for different groups of individuals.[24]

21. Bazelon, Verlinda, and Zarakas are therefore wrong to argue that our demand model does not allow for segmentation.[25] They have not shown that our modeling omits any elements that might change our bottom line conclusion that the proposed merger is likely to be procompetitive.

22. Economists have developed demand estimation models that allow the data to speak to whether particular consumers are more likely to view groups of options as closer substitutes to one another than one might expect based on observable characteristics.[26] In the appendix we explain that our existing model

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[21] Asker, Bresnahan, and Hatzitaskos Presentation to FCC Staff, pp. 28–32.

[22] Pew Research conducted surveys that find that the share of consumers who own smartphones but do not use broadband at home are 14, 24, and 35 percent for White, Black, and Hispanic individuals, respectively; and 31, 22, 14, and 9 percent for income below $30,000, from $30,000–49,999, from $50,000–74,999, and over $75,000, respectively. Pew Research Center, "Internet/Broadband Fact Sheet," February 5, 2018, available at http://www.pewinternet.org/fact-sheet/internet-broadband/, accessed January 25, 2019.

[23] Asker, Bresnahan, and Hatzitaskos White Paper, § 2.

[24] Asker, Bresnahan, and Hatzitaskos White Paper, § 3.

[25] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 28.

[26] For example, see Steven T. Berry, "Estimating discrete-choice models of product differentiation," *The RAND Journal of Economics*, 25(2), 1994, pp. 242–262.

is sufficiently rich that the data either reject such models or demonstrate that they make no qualitative difference to our conclusions (see § 6.2).

2.4. Our analysis appropriately accounts for price sensitivity using methodologies that are standard in the practice of the antitrust agencies, the academic literature, and the FCC

23. Bazelon, Verlinda, and Zarakas further claim that our analysis does not "directly" estimate diversion ratios because it does not incorporate "high-frequency information on product-level prices."[27] This argument is wrong in at least two ways.

24. First, even if they were right that the way that we account for price makes our estimated diversion ratios "indirect" in some way (which it does not), it simply does not logically follow that it is preferable to use porting data (which do not account for price at all) to evaluate the likely competitive effects of the proposed merger. Our analysis is grounded in rich, detailed data on consumer behavior and individualized network quality and provides the best available granular, direct evidence on closeness of substitution. The porting data, as explained in prior submissions and again in the next section, are at best a deeply problematic proxy for the switching behavior of a subset of consumers.

25. Second, we explain in our initial white paper how our analysis uses fixed effects to account for the effect that price has on consumer choice.[28] The first order approach we use to estimate the remaining latent variable, whether price sensitivity or marginal costs, is completely standard in the practice of the antitrust agencies,[29] the academic literature,[30] and the FCC.[31]

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[27] Bazelon, Verlinda, and Zarakas January 28 Declaration, pp. 22–23.

[28] Asker, Bresnahan, and Hatzitaskos White Paper, ¶¶ 51–52 and §§ 3.2.2, 5.3.2.

[29] For example, a library of merger simulation tools published by two economists at the DOJ's Economic Analysis Group uses the same methodology we use to estimate price sensitivity. See Charles Taragin and Michael Sandfort, "The antitrust Package," June 9, 2018, available at https://cran.r-project.org/web/packages/antitrust/antitrust.pdf, p. 64, accessed February 4, 2019 ("Using product prices, quantity shares and all of the product margins from at least one firm, logit is able to recover the price coefficient and product mean valuations in a Logit demand model. Logit then uses these calibrated parameters to simulate a merger between two firms.").

[30] See, for example, Steven Berry, James Levinsohn, and Ariel Pakes, "Automobile prices in market equilibrium," *Econometrica*, 63(4), 1995, pp.841–890, and Aviv Nevo, "Mergers with differentiated products: the case of the ready-to-eat cereal industry," *The RAND Journal of Economics*, Vol. 31, No. 3, 2000, pp. 395–421.

[31] Federal Communications Commission, "Memorandum Opinion and Order," *In the Matter of Applications of AT&T Inc. and DirecTV*, July 24, 2015, Appendix C, ¶¶ 29–30 and fn 62.

2.5. While our analysis does not assume that diversion ratios are proportional to share, it is wrong to discount the competitive information that shares convey

26. As explained above, Bazelon, Verlinda, and Zarakas are wrong to assert that our analysis assumes diversion ratios are proportional to share. However, it is important to note that they are also wrong to discount the competitive information that shares convey. As noted above, shares overall and within granular consumer segments demonstrate that AT&T and Verizon are important competitive constraints for the merging firms.

27. The share of sales that a brand captures reflects the brand's ability to outcompete its alternatives. To win and keep business, a brand needs to offer consumers a product that represents better value, whether that value comes in the form of lower pricing, more valuable features, or some combination thereof. The fact that AT&T and Verizon capture and retain such high shares, not just nationally but also on a more granular basis, is a direct result of their competitive significance in today's wireless industry.

3. It is inappropriate to use porting data as proxies for diversion ratios when our analysis provides direct measures of diversion ratios based on granular real-world data

28. As we have explained in our prior submissions,[32] the switching behavior that is relevant to assessing the competitive effects of a proposed merger is not the switching that is observed today, which may be driven by many factors unrelated to price and irrelevant to competitive effects. This is what porting data measure.[33] Instead, the switching that is relevant to competitive effects is the switching that would result from a brand increasing price or decreasing quality. This is what the diversion ratios that result from our analysis measure. Should the two differ, it would be inappropriate to use porting data rather than our estimates.

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[32] Asker, Bresnahan, and Hatzitaskos Response to DISH and CWA, § 2.1; and Asker, Bresnahan, and Hatzitaskos Presentation to FCC Staff, pp. 40–41.

[33] For additional discussion of the problems with using porting data as a proxy for diversion ratios, see Mark Israel, Michael Katz, and Bryan Keating, "Additional Information Regarding the Estimation of Diversion Ratios," December 14, 2018.

3.1. When results from an appropriately estimated demand system differ from the diversion ratios implied by switching data, economists recognize, and Bazelon, Verlinda, and Zarakas do not dispute, that the former are more appropriate inputs in competitive effects analysis

29. Economists recognize that given sufficient data and time, the ideal approach to measuring closeness of competition and diversion ratios is through a careful examination of consumer demand. This is a standard position among economists, academics, and practitioners alike.[34] Bazelon, Verlinda, and Zarakas do not dispute this.[35]

30. As we described in our initial paper, this is exactly the approach that we have taken in our analysis: to estimate a rigorous model of consumer demand using the NMP data, which provide unparalleled detail on consumer behavior and individualized network quality.[36]

31. Unlike the present case, there are other instances where the data or time to rigorously estimate demand are not available. To deal with these situations, economists have developed a number of shortcuts to more complete analysis. The purpose of these shortcuts is to do the best possible job in informing policy given a set of constraints, not to replace careful analysis. For example, antitrust agencies take shortcuts in order to decide whether to issue second requests, but they then use the data and time the second request makes available to conduct a more thorough analysis.[37]

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[34] For example, see Elizabeth M. Bailey, Gregory K. Leonard, G. Steven Olley, and Lawrence Wu, "Merger Screens: Market Share-Based Approached Versus 'Upward Pricing Pressure,'" *Antitrust Source*, February 2010, available at https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Feb10_Leonard2_25f.pdf, p. 6 ("Similarly, the most reliable ways of estimating diversion ratios—based on empirical analysis of consumer demand—are data and time-intensive. … As an alternative to these methods, diversion ratios can be estimated from survey data or win/loss reports that are kept by firms in the ordinary course of business. … In addition, survey data and win/loss reports that exist as part of the ordinary course of business often do not directly address the question of how consumers would switch in response to a price increase."). See also Jerry Hausman, "2010 Merger Guidelines: Empirical Analysis," *Antitrust Source*, October 2010, available at https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Oct10_Hausman10_21f.pdf, p. 3 and fn. 11 ("The diversion ratio is the key empirical factor needed in the 2010 Guidelines approach. I have significant concerns how this factor will be estimated by the Agencies. A risk exists that the Agencies' estimates will be 'guesstimated' from a few of the merging firms' documents or customer interviews, or that an assumption equivalent to the IIA assumption will be used. In my view, an econometric demand model should be used to estimate the diversion ratio whenever possible. Of course, if an econometric demand model had already been estimated, there seems little reason not to perform a merger simulation rather than an upward pricing pressure calculation.").

[35] Bazelon, Verlinda, and Zarakas January 28 Declaration, pp. 22–23.

[36] Asker, Bresnahan, and Hatzitaskos White Paper, §§ 2–3. See also Appendix § 5.

[37] For example, economists sometimes use the Upward Pricing Pressure ("UPP") screen in the early stages of investigations, but follow that screen with a more rigorous analysis of competitive effects. See Serge Moresi, "The Use of Upward Price Pressure Indices in Merger Analysis," *Antitrust Source*, February 2010, available at https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Feb10_Moresi2_25f.pdf, p. 6

32. One such shortcut is to approximate diversion ratios using switching data rather than estimate them using an econometric model of consumer demand.[38] Given a lack of data in prior merger reviews in the wireless services industry, the FCC has previously used porting data to proxy for diversion ratios, while recognizing that they have important limitations.[39]

33. Now that the FCC has access to the NMP data and our careful examination of consumer demand, it is no longer necessary to rely on the porting data. Moreover, our analysis demonstrates that porting data overstate the closeness of competition between the merging parties.[40] To the extent that our results differ from what the porting data imply, our rigorous analysis should be given more weight than the inherently imperfect shortcut. In the next subsections we provide further detail on the shortcomings of the porting data and why they could mislead in evaluating the competitive effects of the proposed merger.

3.2. Porting data capture only a fraction of the choices consumers make in a given year

34. Porting data only capture a fraction of the choices consumers make in a given year. In 2017, only [redacted] million consumers chose to switch brands and port their numbers. This is less than half of the 69.9 million of gross additions that we observe in the industry in the same year.[41] Gross addition statistics account for consumers who switch and port, consumers who switch but do not port, as well as any new connections that do not represent switches. As Israel, Katz, and Keating have previously explained, the fraction of consumers who port is not a random sample of all new gross additions.[42] That is, porting data reflected the choices of a selected sample of consumers.

35. Moreover, and related to the point that shares convey critical competitive information, focusing on switching data of any sort fails to recognize that many millions more consumers each year make the choice to stay with their current

(“Failing the UPP test is relevant ‘circumstantial’ evidence of adverse unilateral effects. It is not a proof that the proposed merger likely would lead to a substantial lessening of competition. … The UPP test, therefore, is a useful screen and might be used as supporting evidence, but it is not a complete analysis of all the relevant factors.”).

[38] Switching data are frequently collected during the ordinary course of business and may be readily available in the early stages of an investigation.

[39] Federal Communications Commission Staff Analysis and Findings in AT&T/T-Mobile, November 29, 2011, Appendix C, ¶¶ 8–10 and fns. 9 and 10. For other examples of porting data being used to review wireless telecom mergers, see Israel, Katz, and Keating Declaration, fn. 172 on p. 126.

[40] Asker, Bresnahan, and Hatzitaskos White Paper, § 3.2.2.

[41] See our workpapers.

[42] See Mark Israel, Michael Katz, and Bryan Keating, “Additional Information Regarding the Estimation of Diversion Ratios,” December 14, 2018, pp. 4 and 5.

carrier. In 2017, there were 295.8 million subscribers in the industry. Driven by T-Mobile's un-carrier initiatives, the industry in the last few years has shifted away from contracts, allowing consumers to switch carriers at any time.[43] Even if consumers only consider their choice of brand once every couple of years, there are *more than five times* as many consumers choosing to stay with their current brand every year than there are consumers who port their number.[44] Any competitive analysis of the proposed merger has to take into account these millions of choices that the porting data do not account for.

3.3. Porting data include people who switch for reasons unrelated to changes in price or quality

36. Porting data suffer from serious flaws that make them an inappropriate source for measuring diversion ratios and closeness of competition. One important reason is that porting data do not distinguish people who switch for reasons other than changes in the price or quality of an offering.[45]

37. As one analogy for why switching data can be misleading if used as a proxy for diversion ratios when switching is mostly driven by factors other than price or quality changes, consider that the largest destination for individuals leaving Texas in 2017 was California.[46] Many of the individuals moving from Texas to California presumably moved for personal reasons, such as job relocations, to be closer to family, or for the weather. The destination of individuals who move for personal reasons is not necessarily a good predictor of the destination of individuals who move because of changes in prices. For example, imagine that Texas increased its marginal state income tax rate from zero to one percent.[47] Any individuals leaving Texas because of this tax increase rather than for other personal reasons may be unlikely to move to California, where state taxes are substantially higher.[48]

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[43] Public Interest Statement, pp. 15, 121–122.

[44] See our workpapers.

[45] Similarly, porting data may reflect consumers responding to the relative competitive offers of different competitors. Again, this is at odds with the thought experiment that diversion ratios are supposed to measure, where one brand raises price or decreases quality while competitors hold prices constant.

[46] See U.S. Census Bureau, "State-to-State Migration Flows: 2017," available at https://www2.census.gov/programs-surveys/demo/tables/geographic-mobility/2017/state-to-state-migration/State_to_State_Migrations_Table_2017.xls, accessed February 1, 2019.

[47] Texas currently does not have state income taxes. See Tax Foundation, "State Individual Income Tax Rates and Brackets for 2018," March 5, 2018, available at https://taxfoundation.org/state-individual-income-tax-rates-brackets-2018/, accessed February 2, 2019.

[48] Marginal state income taxes in California range from 1.0 to 13.3 percent. See Tax Foundation, "State Individual Income Tax Rates and Brackets for 2018," March 5, 2018, available at https://taxfoundation.org/state-individual-income-tax-rates-brackets-2018/, accessed February 2, 2019.

38. One way to see that consumers in wireless switch for reasons unrelated to price and quality changes is that consumers simultaneously switch in both directions (e.g., from T-Mobile to Verizon and vice versa). If porting data were driven by supplier behavior, i.e., changes in the price or quality of a particular brand, then we would expect switchers to only move in one direction at any given point in time: away from the brand that raised quality-adjusted prices or towards the brand that lowered them.

39. Instead, we routinely see sets of consumers porting in both directions at the same time, which is inconsistent with switching behavior driven exclusively by supply shocks, such as a price change. For example, in Exhibit 3 we present monthly porting from T-Mobile to Verizon (gray bars) and from Verizon to T-Mobile (black bars) in 2017. In January, for instance, [redacted] thousand consumers ported their number from Verizon to T-Mobile while [redacted] thousand ported from T-Mobile to Verizon, for a net porting rate of [redacted] thousand from Verizon to T-Mobile.

EXHIBIT 3
Monthly porting between T-Mobile and Verizon, 2017

[redacted]

Source: LNP Porting Data

Notes: This exhibit shows the number of ports, in thousands, from Verizon to T-Mobile and from T-Mobile to Verizon. Data labels at the ends of bars show carrier ports, in thousands. Data labels in the middle show net ports, in thousands (T-Mobile ports less Verizon ports).

40. Over 2017, a total of [redacted] numbers were ported between the two brands. Of that total porting in either direction, [redacted] percent were ported from T-Mobile to Verizon, while [redacted] percent went in the other direction. The net porting over this time period was small relative to the overall movements between the two brands: just [redacted] from Verizon to T-Mobile, only [redacted] percent of total porting between the two brands.[49]

41. Even if one were to focus on the total net porting observed over the course of a year between any pair of carriers as indicative of direction in any sense,[50] it would represent only [redacted] percent of all porting behavior, which in turn represents only [redacted] percent of gross additions, which in turn reflect only [redacted] percent of total subscribers.

42. In effect, once one appreciates the informational content of switching behavior, even in the interpretation most favorable to the argument that Bazelon, Verlinda, and Zarakas may be making, they suggest that it is appropriate to use the switching behavior of a *selected* one percent of consumers ([redacted] percent of [redacted] percent of [redacted] percent) as the appropriate way to judge the competitive impact of the proposed merger on the remaining 99 percent.[51] Even if the various critiques offered by Bazelon, Verlinda, and Zarakas had any foundation, which they do not, it would be wrong to discount the critical competitive information that is conveyed by the shares across brands of these remaining 99 percent.

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[49] See our workpapers.

[50] To be clear, even this interpretation of porting data is likely problematic. For further discussion of this point, see § 4, "The internal documents cited by Bazelon, Verlinda, and Zarakas do not demonstrate that porting data are reliable proxies for diversion ratios."

[51] See our workpapers.

3.4. The academic literature recognizes that when consumer switching is unrelated to price or quality changes, switching data can be biased and incorrectly identify closest competitors

43. In a co-authored paper published in 2016, Marius Schwartz, a professor of economics at Georgetown and former chief economist of the FCC,[52] explains that "It is widely recognized, of course, that [switching rates] and diversion ratios can differ depending on the specific reasons for churn…."[53]

44. The paper explains that when switching is unrelated to changes in price or quality, using switching data as a proxy for diversion ratios can overstate the degree of substitution between two products, even to the point of erroneously identifying them to be closest competitors when they are not.[54]

45. The paper offers two different types of scenarios that can be understood to drive switching due to changing consumer preferences, i.e., switching that is unrelated to price or quality changes. First, changes in one's personal circumstances that lead consumers to make a very different choice than the one they had made before.[55] The second scenario involves consumers learning more about product quality while using the product, leading one to change their mind about their prior choice.[56] They note that either type of scenario may "lead to substantial switching between relatively distant substitutes."[57]

46. Both scenarios likely characterize some of the switching observed in wireless service. To see how that may be, in Exhibit 4 we reproduce a map from

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[52] Beyond his role at the FCC, Professor Schwartz also served as acting deputy assistant attorney general for economics and economics director of enforcement in the antitrust division of the DOJ. See Marius Schwartz, "Curriculum Vitae," available at http://mariusschwartz.com/Home/documents/SchwartzCV_015.pdf, accessed February 5, 2019.

[53] Yongmin Chen and Marius Schwartz, "Churn Versus Diversion in Antitrust: An Illustrative Model," *Economica*, 2016, pp. 564–583 ("Chen and Schwartz (2016)"), at p. 565. The paper uses "churn" to refer to the rate of observed, not necessarily price- or quality-based switching between two products. In the wireless industry, churn is commonly used to refer to the share of a carrier's subscribers that discontinue service. To minimize the risk for confusion, we adjust references of "churn" in the paper to "switching," which is the vernacular that we have followed in this and other submissions.

[54] Chen and Schwartz (2016), pp. 565–566 ("In Section III we analyse [switching rates] due to changing preferences…. We provide analytic conditions under which the [switching rate] between a pair of firms overstates or understates the corresponding diversion ratio (Proposition 3). Relatedly, we show that the churn ratio from firm 1 to, say, firm 2 can be higher than to firm 3 even though firm 3 is the closer competitor to firm 1 (Proposition 4), and discuss scenarios where this wrong ranking may arise in practice.").

[55] Chen and Schwartz (2016), p. 574 ("One involves changes in personal circumstances. A sports car driver with young children may well switch to a minivan rather than another sports car, and switch back to a sports car when the children are grown; consumers whose incomes rise over the lifecycle often migrate from lower-quality versions of a product instead of switching among lower-quality versions.").

[56] Chen and Schwartz (2016), p. 574 ("A second scenario involves learning about product attributes. A driver who discovers that the sports car's low ride is more terrifying than expected on highways, or that the cargo room is simply too small, is more likely to switch to a different car segment than to another sports car.").

[57] Chen and Schwartz (2016), p. 574.

our initial white paper.[58] This map presents the average standardized delivered speeds the four premium brands offer in different geogrids across the greater Des Moines, Iowa area. Lighter shades represent slower speeds and darker shades represent higher speeds.

EXHIBIT 4
Network quality across different networks: standardized speeds in Des Moines, Iowa

[redacted]

Source: Nielsen Mobile Performance Data

47. Consider a consumer in Des Moines that lives downtown and has chosen Sprint. That consumer may switch for a variety of reasons that are entirely driven by changes in personal circumstances. For example:

- The consumer may move homes to another location downtown where Sprint has poor in-building coverage, leading her to switch to a brand that offers better in-building coverage with decent quality downtown.
- The consumer may switch jobs and start commuting to another part of greater Des Moines where the Sprint network performs poorly.
- A family member may move from Des Moines, leading the family to switch the family plan to a brand that offers better quality in both areas.
- The consumer may get married and join her partner's family plan on another carrier.[59]

48. Alternatively, finding out more about network quality can also drive switching. The consumer who lives in downtown Des Moines may have decided to try Sprint because she has a neighbor who is happy with the network quality he receives from Sprint. After making the switch, however, she may have

[58] Asker, Bresnahan, and Hatzitaskos White Paper, Exhibit 3.

[59] See SPR-FCC-02425213 at SPR-FCC-02425238. For example, for consumers that cannot be persuaded to remain with Boost Mobile, approximately one-third said they moved to a friend or family member's plan.

realized that her usage patterns are sufficiently different from her neighbor's that she routinely encounters network issues. After a few months of disappointing network experiences, she may decide to switch to another carrier. This pattern of switching has nothing to do with Sprint making any changes in price or quality. It is merely the particular consumer finding out more about the individualized network quality Sprint offers to her that is driving her behavior.

3.5. Individualized network quality explains why switching may differ from diversion in wireless

49. Our findings that network quality is individualized suggest that both changing personal circumstances and learning are likely to affect switching behavior in the wireless service industry. This is especially true of the merging party brands, and particularly Sprint's. A network that offers more variable performance is more likely to lead to performance issues for consumers who change their habits or who experience the network in more locations over time.[60] As recognized by the literature, such switching will not necessarily be predictive of how consumers will respond if they are faced with a price increase or degradation of network quality, and may well overstate the closeness of competition between the merging parties.

50. In contrast, long-term diversion ratios will be driven by actual network quality, which suggests that there are many consumers for whom the merging parties are distant substitutes. For example, in Exhibit 5 we present the localized network quality a particular NMP consumer can expect from the AT&T, Sprint, T-Mobile, and Verizon brands based on his or her individualized usage patterns. This is a T-Mobile consumer who appears to reside in Reading, Pennsylvania and receives competitive network quality from his or her brand of choice: T-Mobile's average standardized delivered speed offered to this individual is [redacted] Mbps, compared to [redacted] and [redacted] for AT&T and Verizon, respectively. In contrast, Sprint offers this consumer just [redacted] Mbps.

51. The thought experiment involved in calculating a diversion ratio is that T-Mobile increases its price and this consumer considers which of the three alternatives he or she would divert to. Given in part that Sprint offers this consumer much poorer network speeds than AT&T and Verizon do, our

[60] In our initial white paper, we demonstrated that brands tend to offer better network quality to consumers who choose the brand relative to the quality they offer to consumers who do not. This difference is more pronounced for the merging parties and particularly for Sprint. See Asker, Bresnahan, and Hatzitaskos White Paper, Exhibits 60 and 61.

analysis estimates a diversion ratio from T-Mobile to Sprint for this particular individual that is particularly low: less than ten percent of what one might expect were diversion proportional to share in the Philadelphia Metro KPMG/Sprint market area.

EXHIBIT 5
Average standardized delivered speeds offered to a particular T-Mobile consumer

[redacted]

52. The consumer in Exhibit 5 is not an isolated example. In Exhibit 2 above we saw that there are many consumers who would divert from Sprint to T-Mobile at a rate much lower than that expected by share. For example, that rate is more than 20 percent lower than share-based diversion for almost 41 percent of consumers. Nearly 13 percent of consumers are less likely to divert from Sprint to T-Mobile by more than *half* of what one might expect from share.[61]

53. These large discrepancies from share-based diversion suggest that differences in the local performance of the merging party networks make the two more distant competitors for many consumers.

4. The internal documents cited by Bazelon, Verlinda, and Zarakas do not demonstrate that porting data are reliable proxies for diversion ratios

54. Bazelon, Verlinda, and Zarakas discuss multiple merging party documents regarding the use of porting data in the ordinary course of business. While they suggest that these documents demonstrate that porting data provide reliable information on diversion,[62] the documents do no such thing. Instead, the documents demonstrate that porting data are used by the merging parties directionally and not as an estimate of diversion ratios.

55. DISH further claims in its cover letter that these documents show that porting is well correlated with pricing. As we explain below, the documents it cites to make this claim suggest the opposite conclusion and serve to underscore the difficulties rather than the opportunities in studying diversion using promotions.

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[61] See our workpapers.

[62] Bazelon, Verlinda, and Zarakas January 28 Declaration, p. 5 (“II. Porting Data Provides Reliable Information on Switching Behavior and Diversion”).

4.1. Bazelon, Verlinda, and Zarakas make flawed logical leaps in equating the accuracy of porting data in measuring porting with its ability to measure diversion ratios

56. Bazelon, Verlinda, and Zarakas cite to multiple documents that validate one type of porting data by comparing it to another type of porting data. In particular, several of the documents they cite find that industry porting data (which may rely on surveys but cover porting to and from all brands) closely match the internal porting data of the merging parties (which is accurate but covers only consumers who choose their brand).[63]

57. This validation may be important to the merging parties in using the porting data in the ordinary course of business, but it is irrelevant to the analysis of the likely competitive effects of the proposed merger. The question at hand is not whether one type of porting data closely matches another type of porting data, but whether there is any evidence that porting data closely match diversion. Bazelon, Verlinda, and Zarakas provide no evidence that this is true.

4.2. Internal merging party documents demonstrate that executives use the porting data directionally rather than as precise predictors or measures of diversion ratios

58. Regarding how the merging parties use the porting data, the documents Bazelon, Verlinda, and Zarakas cite confirm our earlier understanding that the merging parties use porting data as directional, qualitative measures. The merging parties do not focus on the specific levels or treat them as reliable measures of diversion. Consider the following examples:

> "We are going to get these port ratios with Sprint back into positive territory."[64]

> "TMO (and Metro, interestingly) have really ramped up starting first week of December and are taking it from VZ (others are flatter)."[65]

[63] For some examples, see Bazelon, Verlinda, and Zarakas January 28 Declaration, fn. 10, and DISH's January 28 cover letter to the FCC ("DISH January 28 cover letter"), fns. 27 and 29.

[64] See TMUS-FCC-02376783.

[65] See TMUS-FCC-00215242, discussing porting numbers in Virginia.

> "Given our port-in rate without fee is still climbing rapidly (hasn't stalled), I'd be careful about squandering cash since there is no baseline port rate yet."[66]

59. These documents do not convey an attempt to carefully analyze the porting data or to predict the effects of future pricing promotions. Rather they reflect the executives treating porting data as a gauge that they can consult in near real-time to understand whether they are doing better or worse in competing, e.g., whether current promotions are resonating with consumers.

4.3. The documents that DISH and Bazelon, Verlinda, and Zarakas cite demonstrate that porting data are but one measure the merging parties use in the ordinary course in order to qualitatively gauge competition

60. Porting data are not the only measure of competitive outcomes that the merging parties regularly review to gauge competition. Indeed, several documents suggest that reviewing porting data alone would provide an incomplete and biased assessment of competition.

61. For example, net porting is only one of eight metrics Sprint analyzes in its regular marketing updates, along with qualitative discussions of the competitive landscape, details on current offers and media, gross adds/performance, credit apps/traffic, performance of promos, deactivation performance, and base ABPU (average billings per user) evolution.[67]

62. Similarly, in its high frequency sales reporting, Sprint considers trends in both net additions and porting. The net addition figures are frequently much larger than the porting figures. The net additions and porting trends are not closely correlated.[68]

63. In addition, in the ordinary course documents that DISH and Bazelon, Verlinda, and Zarakas cite, the merging parties recognize that porting data comprise a selected sample that likely leads to bias. For example, Sprint surveys show that consumers who port-out are higher-income than those who leave but

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[66] See TMUS-FCC-00215242, discussing the possibility of setting up an incentive agreement with Ntelos.

[67] See SPR-FCC-04362565 at SPR-FCC-04362567.

[68] See SPR-FCC-00002998–SPR-FCC-00003003. We calculate the correlation coefficient for Sprint between net additions by month in the KPMG data and net ports (subtracting port-outs from port-ins) in the LNP data for each month in 2017 to be just 0.13. See our workpapers.

do not port their numbers,[69] while T-Mobile data show that customers who port their numbers are a minority of switchers but account for a disproportionately larger share of revenue.[70]

4.4. DISH is wrong to claim that porting correlates closely to price changes

64. We previously stated that we are not aware of any promotions that can reliably be used to study diversion ratios.[71] An internal T-Mobile document that DISH discussed in its cover letter to the Bazelon, Verlinda, and Zarakas comments serves as a good demonstration of why we believe it is challenging to reliably study diversion based on promotions.[72]

65. In Exhibit 6 we reproduce the document DISH cites. It is an internal T-Mobile chart that presents, for the span of a little more than a year, the 7-day rolling average share of postpaid port-ins for Verizon (gray), T-Mobile (magenta), AT&T (blue), and Sprint (yellow). T-Mobile heavily annotates the chart with promotions each of the four brands offered at the time. We have also highlighted and circled some text that we discuss in the rest of this subsection.

66. Examining the chart it becomes apparent that:

- Many promotions and price changes appear to have been ineffective at influencing porting (see text highlighted in yellow in Exhibit 6),
- Port-ins frequently varied without any changes to promotions or pricing (e.g., see middle red circle in Exhibit 6), and
- Brands are often running many promotions simultaneously, making it difficult to reliably isolate a causal relationship between a pricing or promotion event and subsequent porting.

[69] See SPR-FCC-04301172 at SPR-FCC-04301176 and SPR-FCC-02425213 at SPR-FCC-02425216.

[70] See TMUS-FCC-00206649 at TMUS-FCC-00206651.

[71] Asker, Bresnahan, and Hatzitaskos Response to DISH and CWA, ¶ 18.

[72] DISH January 28 cover letter, p. 6, citing TMUS-FCC-01648593 at TMUS-FCC-01648600.

EXHIBIT 6
Nationwide postpaid share of port-ins and competitive events, reproduced from cover letter to Bazelon, Verlinda, and Zarakas

[redacted]

67. To make the above more concrete, consider the following three examples, which we have circled in red in Exhibit 6:

- On 9/15/17, Verizon offered up to $300 off the iPhone 8 or 8 plus to those who would switch. Yet Verizon appears to not have gained substantial port-ins during this time.
- On 09/18/17, Sprint offered $0/month financing to customers who traded in for an iPhone 8 64GB. Yet after this promotion, Sprint appears to have lost port-ins, while AT&T, which does not appear to have offered a new promotion, begins gaining port-ins.
- Between 10/01/17 and around 10/20/17, AT&T's port-ins almost steadily increased, even though AT&T does not appear to have offered any new promotions during this period.

68. That port-ins appear to vary even without promotions means that studying diversion ratios based on promotions would require one to disentangle changes in porting driven by promotions from those driven by unrelated factors. One would also need to disentangle the changes in porting driven by the promotions

a given brand implements from the promotions that other brands are running at the same time. The need to do both things is clear from the fact that, as we explained above, consumers tend to be switching in both directions at any given point in time and for any given pair of brands (e.g., see Exhibit 3).

69. Finally, the fact that promotions are overlapping also suggests that at least some of them may be reactive, making it difficult to determine the direction of causality. In other words, when evaluating the relationship between price promotions and porting, the analysis would need to determine how to reliably account for brands offering price promotions because they are facing adverse movements in porting (driven by price promotions by a competing brand or by other factors).

70. For all of these reasons, demonstrated so well in the internal T-Mobile document that DISH cited, we stand by our prior assessment: we are not aware of any promotions that can reliably be used to study diversion ratios.

5. Conclusion

71. The latest comments from Bazelon, Verlinda, and Zarakas do not make any substantive critiques of our analysis. They argue that porting data should be used instead of our diversion estimates because, they claim, our analysis produces diversion ratios that are equal to share-based diversion. As we have demonstrated above, this is categorically false. They also cite multiple internal merging party documents, but these documents reinforce our assessment that there are multiple difficulties with using porting data to study closeness of competition.

72. Importantly, despite having our data and code since November 8, 2018, what Bazelon, Verlinda, and Zarakas have *not* done is offer any critiques that they show would have any quantitative impact to the bottom line conclusions of our analysis: that the proposed merger is likely to strengthen competition in wireless services and benefit consumers.

6. Appendix: additional results and analysis

6.1. Individual-level vs. share-based diversion ratios from T-Mobile to Sprint

73. In Exhibit 7 and Exhibit 8 we present the analysis we previously presented in Exhibit 1 and Exhibit 2, but for diversion from T-Mobile to Sprint rather than for diversion from Sprint to T-Mobile.

EXHIBIT 7
Individual-level diversion ratio, T-Mobile to Sprint

[redacted]

EXHIBIT 8
Percent difference between individual-level diversion and share-based diversion from T-Mobile to Sprint by KPMG/Sprint market area

[redacted]

6.2. Nested logit specification and results

74. The standard statistical package that we used to estimate demand in our initial white paper allows for the estimation of nested logit models.[73] These models allow the econometrician to group brands into "nests" and then let the data speak to whether individual consumers appear to have stronger or weaker preferences for all brands within a nest (or group) of brands.

75. Each nest is assigned a "nesting parameter" that varies between zero and one. One indicates that there is no nesting and consumers behave in the same way as the logit model in our initial white paper. Values close to zero indicate that there is very strong nesting, which implies that the second choice of a

[73] Stata, "Nested logit regression," available at https://www.stata.com/manuals13/rnlogit.pdf, accessed February 5, 2019.

consumer choosing a brand within a nest is very likely to be another brand within the same nest. Not all nesting structures are reasonable. The estimation can also lead to nesting parameter estimates above one, which indicates that the data reject the proposed nesting structure.[74]

76. To fit a nested logit model, we first specify four potential nesting structures that we will test using the data:

- {AT&T, Sprint, T-Mobile, Verizon} as one nest and {Boost/Virgin, MetroPCS, Cricket, Other} as another nest.
- {AT&T, Verizon} as one nest, {Sprint, T-Mobile} as another nest, and {Boost/Virgin, MetroPCS, Cricket, Other} as a third nest.
- {AT&T, Verizon} as one nest, {Sprint, T-Mobile, Boost/Virgin, MetroPCS, Cricket}, and {Other} as a third nest.
- {AT&T, Verizon, Cricket, Other} as one nest, {Sprint, T-Mobile} as another nest, and {Boost/Virgin, MetroPCS} as a third nest.

77. For each of these specifications, we report the nesting parameter estimates in Exhibit 9. Two of the four potential nesting structures are rejected by the data as inconsistent with the underlying random utility model (they generate nesting parameter that are statistically significant and above one). A third potential nesting structure cannot be statistically distinguished from our underlying baseline conditional logit model specification, which we discussed in our initial white paper (it generates nesting parameters that are not statistically significantly below one).

78. For the two specifications that are not inconsistent with the random utility model, we run the merger simulation scenario where Sprint closes the gap with T-Mobile on coverage and T-Mobile closes the gap with Sprint on speeds, assuming the full Israel, Katz, and Keating marginal cost reductions. As we show in Exhibit 10, the bottom line conclusions of our analysis do not change.

79. The diversion ratios that these two nested logit models generate are also minimally different from the diversion ratios generated by our baseline specification. We present these diversion ratios in Exhibit 11.

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[74] David A. Hensher, D. A., J. M. Rose, and W. H. Greene. *Applied Choice Analysis*. New York: Cambridge University Press, 2015, Second Edition, § 14.3.

80. To conclude, given the richness of our data on network quality and consumer behavior, we find that our standard conditional logit model of brand choice already captures much of the relationship between brands. Any additional correlation introduced from implementing a nested logit specification has only marginal impacts on results.[75]

EXHIBIT 9
Nesting parameters from nested logit demand model

[redacted]

[75] Since the standard conditional logit model of brand choice with rich data on network quality and consumer characteristics already explains substantial correlation between brands, the likelihood function for the nested logit requires significant computational resources to solve the optimization problem and converge to a solution.

EXHIBIT 10
Merger simulation detail, scenario conservatively capturing some of the speed and coverage benefits that Sprint and T-Mobile expect to realize from combining their complementary spectrum assets, and the marginal cost reductions estimated by Israel, Katz, and Keating with nested logit demand model

[redacted]

EXHIBIT 11
Estimated pre-merger diversion ratios between brands, with nested logit demand model

[redacted]

APPENDIX B

PORTING DATA ARE BIASED AND INFERIOR TO BOTH SURVEY DATA AND STRUCTURAL DEMAND ESTIMATION AS A MEANS OF ESTIMATING DIVERSION RATIOS

Mark Israel, Michael Katz, and Bryan Keating

February 7, 2019

1. Introduction

We previously explained that diversion ratios estimated from porting data without adjusting for the source's inherent weaknesses are doubly unreliable:[1]

- First, record evidence demonstrates that diversion ratios estimated solely from porting data are inferior to diversion ratios estimated from HarrisX or other survey data because: (a) porting data yield biased estimates of overall diversion; (b) an economic mechanism recognized by industry participants gives rise to this bias; and (c) the Parties have concluded in the ordinary course of business that porting data are unreliable as measures of overall patterns and levels of customer switching among brands.
- Second, the diversion ratios that John Asker, Tim Bresnahan, and Kostis Hatzitaskos ("ABH") estimate are far superior to estimates derived from porting or survey switching data. This is because, to be relevant for merger analysis, diversion ratios need to measure accurately the degree to which buyers would purchase substitute products *in response to a price or quality change,* whereas switching rates capture all consumer movements between products, including those that have nothing to do with price or quality changes. By using a structural model of demand to calculate diversion ratios, ABH avoid the confounding effects of switches unrelated to price and quality changes.

In this submission, we respond to an *ex parte* letter filed by DISH[2] that includes a supplemental economic analysis by Coleman Bazelon, Jeremy Verlinda, and William Zarakas ("BVZ")[3] in which DISH counsel and BVZ attack our conclusions and attempt to justify the estimation of diversion rates based solely on porting data. We begin by providing additional evidence that switching customers who port their numbers behave very differently from switching customers who do not port their numbers, which means that porting data—which do not cover the latter type of customers—are insufficient for determining switching rates for customers overall. Next, we show that the switching patterns in the porting and HarrisX survey data can be reconciled by recognizing that the porting data represent only a subset of switching customers while the

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1 Mark Israel, Michael Katz, and Bryan Keating, "Additional Information Regarding the Estimation of Diversion Ratios," December 14, 2018 (hereinafter *Diversion Ratio Analysis*).

2 Letter from Pantelis Michelopoulos to Marlene Dortch, Re: 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 (hereinafter *DISH Diversion Letter*).

3 Coleman Bazelon, Jeremy Verlinda, and William Zarakas, "Response to Applicant Filings on Diversion Ratios," January 28, 2019 (hereinafter *BVZ Diversion Supplement*).

HarrisX survey data are drawn from a pool of all switching customers. Finally, we respond to BVZ's and DISH counsel's arguments, explaining that they are unsound and do not establish any reason to base diversion ratio estimates entirely on switching patterns in porting data when more complete data and better methods are available.

2. Additional Information Demonstrating the Superiority of Survey-Based Switching Measures to Porting-Data-Based Measures

We begin by providing further evidence—consistent with the discussion in our *Diversion Ratio Analysis*—that switch-out rates from Sprint brands to T-Mobile are substantially higher among porting customers than among non-porting customers. Specifically, the first row of numbers in Table 1 reports switch-out rates of *porting* customers using Sprint's *porting data,*[4] while the second row reports the switch-out rates of *non-porting* customers leaving the Boost and Virgin brands as reported in ordinary course Sprint *survey* data.[5]

Table 1: Boost/Virgin Switch-Outs to T-Mobile by Porting and Non-Porting Customers

[redacted]

4 Sprint also has surveys of customers who port their numbers when switching. The porting data and survey data yield very similar switching rates for customers who port their numbers. The Boost-to-T-Mobile/MetroPCS figures are [redacted]% using the porting data and [redacted]% using the survey data, while the corresponding figures for switching from Virgin to T-Mobile/MetroPCS are [redacted]% and [redacted]%. (SPR-FCC-02425213. See backup materials for calculations.)

5 SPR-FCC-04301172. We are unaware of any similar surveys for the Parties' other brands.

Any proper analysis of the proposed merger's effects must account for both porting and non-porting customers or it will generate misleading results. The third row of numbers in Table 1 reports the estimated average switch-out rates across all customers using Sprint deactivation data to determine—separately for Boost and Virgin—the percentages of customers who port their numbers when they depart the brand. Comparing the first and third rows of numbers demonstrates that an analysis based solely on porting data will substantially overstate the degree to which customers leaving these Sprint brands go to T-Mobile.

These calculations also demonstrate the reliability of the HarrisX data (on which we relied in our initial declaration) as a source of switching rates.[6] In the fourth row of numbers, we report average switch-out rates in the HarrisX data, which cover both porting and non-porting switchers.[7] Critically, these average rates in the HarrisX data are consistent with the overall averages in the Sprint data (reported in the third row of numbers in Table 1). In fact, as can be seen by comparing the third and fourth rows of numbers in Table 1, the overall switch-out rates to T-Mobile from the two Sprint brands, as reported in Sprint data, are close to but lower than the corresponding measures in HarrisX, meaning that use of the HarrisX survey values instead of the Sprint survey values is conservative for evaluating the proposed merger (i.e., estimates greater upward pricing pressure from the merger).

In summary, this analysis provides further evidence that relying solely on porting data to compute proxies for diversion ratios between Sprint and T-Mobile would overstate the degree to which the proposed merger would put upward pressure on prices, all else equal. However, once one accounts for the fact that porting customers are just one subset of departing customers, and one combines data regarding porting customers with data regarding non-porting customers to compute an overall average (either explicitly computing an average for the two groups or using a data source that reflects switching by both porters and non-porters), an accurate overall measure of switching can be derived and used as a proxy for diversion ratios (although one that is inferior to the estimates of actual diversion ratios generated by ABH's structural analysis).

3. Responses to Specific Claims Made by BVZ and DISH Counsel

In this section, we address several arguments put forth by BVZ and DISH counsel attacking our conclusions regarding diversion ratios and attempting to justify the estimation of diversion rates based solely on porting data.[8]

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6 Mark Israel, Michael Katz, and Bryan Keating, "Reply Declaration of Mark Israel, Michael Katz, and Bryan Keating," September 17, 2018, WT Docket No. 18-197 (hereinafter *IKK Declaration*), Appendix I.C.3.

7 The HarrisX data do not report separate porting and non-porting switching rates.

8 DISH counsel also makes other claims regarding our analyses (e.g., that we have mischaracterized T-Mobile's use of HarrisX data) that we do not bother to refute given their irrelevance and/or lack of substance. Our silence here should not be mistaken for agreement with DISH counsel.

3.1 The Parties' Limited Business Use of Porting Data Does Not Imply That Porting Data Are Valid Measures of Diversion

Both BVZ and DISH counsel claim that, because the Parties use porting data for certain purposes in the ordinary course of business, it follows that such data provide reliable estimates of diversion ratios to use in analyzing the merger's competitive effects. Their claim fails to recognize the fundamental differences between the use of porting data in these particular ordinary course analyses (for which the data are used to make assessments of the directional impact of promotions or other events) and the use of porting data to calculate diversion ratios to project the competitive effects of a proposed merger (for which it is important that the data provide accurate measures of levels).

Both BVZ and DISH counsel correctly observe that the Parties examine porting data as part of tracking the effects of price promotions. However, BVZ and DISH counsel then leap to the conclusion that porting data are a sound basis for computing diversion ratios.[9] A more careful examination of the ordinary course use of these data reveals why this conclusion is unfounded. Specifically, it is our understanding that the Parties use porting data for "real-time" analyses, such as seeing the directional effect of a particular promotion on porting behavior, not for estimating overall switching rates to other brands.[10] And they do so because "porting data are the only data that are available with a short enough lag after an event to provide T-Mobile with quick feedback on the effects of various initiatives."[11] Whether a price promotion leads to a decrease in port-outs may provide a quick sense of whether the promotion has an effect, but it does not follow that porting rates on their own can be used to measure overall diversion ratios, which depend on the reactions of both porters and non-porters to price promotions.[12] Indeed the same documents that indicate the Parties use porting data in these specific ways also show that the Parties recognize its shortcomings and do not believe it provides a reliable indicator of overall switching rates.[13]

9 *BVZ Diversion Supplement,* § II.A; *DISH Diversion Letter*, pp. 5-6.

10 Declaration of Brandon "Dow" Draper, Chief Commercial Officer, Sprint Corporation, February 6, 2019 (hereinafter *Draper Declaration*), ¶ 2; Declaration of Mark Roettgering, Senior Vice President of Commercial Strategy and Decision Analytics at T-Mobile US, Inc., February 6, 2019 (hereinafter *Roettgering Declaration*), ¶¶ 2-3.

11 *Roettgering Declaration*, ¶ 2. See also *Draper Declaration*, ¶ 2.

12 A quick assessment of a promotion may rely on the fact that reactions of consumers who port and those who do not generally are positively correlated, so that a promotion that is successful with porting customers is also likely to be successful with non-porting customers. But it does not follow that the magnitudes of the switching or even the patterns across brands will be the same for the two groups—requirements that would be necessary for porting data to serve as an unbiased source for estimating diversion ratios for merger analysis.

13 *Diversion Ratio Analysis,* pp. 4-6. Because of this limitation in porting data, in the ordinary course both Sprint and T-Mobile make use of broad-based survey data regarding switching behavior that covers both porting and non-porting customers. (*Draper Declaration*, ¶ 4; *Roettgering Declaration*, ¶ 4.)

BVZ also mischaracterize a T-Mobile document, claiming:[14]

> Internal documents describe [Comlink porting] data as providing {{BEGIN HCI [redacted] END HCI}}; and an {{BEGIN HCI [redacted] END HCI}}.

However, the cited document merely states that Comlink is an accurate source of *porting data*. The fact that Comlink porting data generates similar results to other sources of porting data does not provide any support for the claim that porting data should be used to infer diversion ratios. In fact, the same document explicitly lists [redacted] and [redacted] as limitations of the porting data.[15] Both of these statements about the Comlink data are fully consistent with the analysis of porting-data bias that we presented in our earlier *Diversion Ratio Analysis.*

3.2 BVZ's Comparison of Porting Data to KPMG Switching Metrics Does Not Address the Relevant Question for Merger Review

BVZ argue in favor of the use of porting data based on several comparisons among shares based on porting data, HarrisX data, KPMG data, and T-Mobile's estimates of deactivations and gross additions.[16] Critically, the various comparisons made by BVZ are at the level of the *industry overall* and thus do not answer the relevant question for merger review, which is whether porting data provide accurate measures of switching *between specific carriers in response to a price or quality change*. For example, BVZ compute Sprint's share of switch-ins from all carriers as a single number, rather than separately calculating Sprint's share of switch-ins from specific carriers such as AT&T or T-Mobile. The analyses that we describe above and in our *Diversion Ratio Analysis* demonstrate that porting data alone do not provide accurate measures of switching between specific carriers by customers overall.

Moreover, the analysis on which BVZ rely is substantially affected by the treatment of MVNOs, which varies by data source, rendering this type of comparison less probative regarding the relative merits of different data sources than the other approaches described above and in our *Diversion Ratio Analysis*. For example, BVZ include Assurance Wireless and Sprint Resellers as Sprint brands in their calculations.[17] Calculations based on internal Sprint data show that only [redacted] percent of Assurance Wireless deactivations port their numbers.[18] Because Assurance Wireless customers are extremely unlikely to port their numbers, they are unlikely to show up to any material degree in the LNP data to which BVZ compare their estimates. Similarly, MVNO

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14 *BVZ Diversion Supplement*, p. 7, citing TMUS-FCC-01909049 at TMUS-FCC-01909051.

15 TMUS-FCC-01909049 at TMUS-FCC-01909051.

16 *BVZ Diversion Supplement*, pp. 8-10.

17 BVZ did not submit backup analyses with their paper. However, we have replicated BVZ's KPMG-based metrics. This reverse engineering shows that they have include Assurance Wireless and Sprint Resellers as Sprint brands in their calculations.

18 See backup materials.

customers, including those of Sprint Resellers, are generally less likely to port their numbers.[19] Thus, inclusion of such customers in the KPMG-based gross adds calculations renders the comparison of the KMPG-based gross adds data to the LNP data apples to oranges. When Assurance Wireless and Sprint Resellers are excluded from the KPMG share calculations, Sprint's KPMG share is smaller than its share of port-outs, and similar to its share of deactivations computed using T-Mobile's estimates—the opposite of BVZ's claims.[20]

3.3 The Fact That, Their Limitations Notwithstanding, Porting Data May Have Been Informative in Past Proceedings Does Not Change the Fact That Better Estimates of Diversion Ratios Are Now Available

BVZ points to Dr. Israel's use of porting data in his assessment of the AT&T/Leap merger apparently to support its use in the present proceeding.[21] However, as BVZ acknowledge, Dr. Israel identified in that proceeding the same limitations of porting data that have been identified in the present proceeding.[22] And, although he determined that "[d]espite these limitations, porting data provide[d] a useful indicator of the degree of substitution between providers" in that proceeding,[23] he also stated that such data "are imperfect and need to be evaluated in the context of other qualitative evidence… and other empirical work."[24] In the present proceeding, we have been able to identify better sources for estimating diversion ratios, some of which were not available at the time Dr. Israel and the Commission evaluated the AT&T/Leap merger.

3.4 Once the Errors in BVZ's Analyses of Boost and MetroPCS Survey Data Are Corrected, These Analyses Refute Rather Than Support BVZ's Claims

BVZ make several incorrect claims regarding the Sprint survey data. First, BVZ assert that Boost surveys indicate more switching from Boost to T-Mobile than the ABH model indicates.[25] Although we do not dispute the survey data generally imply higher diversion ratios than those more appropriately estimated based on the ABH model, there are several errors in BVZ's

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19 *Diversion Ratio Analysis,* pp. 4-5.

20 For calculations, see backup materials.

21 *BVZ Diversion Supplement,* pp. 10-11.

22 *BVZ Diversion Supplement,* p. 11, citing *In the Matter of Applications of Cricket License Company, LLC, et al., Leap Wireless International, Inc., and AT&T Inc. for Consent To Transfer Control of Authorization,* WT Docket No. 13-193, "An Economic Analysis of Competitive Effects and Consumer Benefits from the Proposed Acquisition of Leap Wireless by AT&T," Mark A. Israel, August 9, 2013 (hereinafter *Israel Cricket Declaration*), ¶ 26.

Specifically, Dr. Israel stated that porting data capture "only a subset of switchers," and that, rather than focus solely on those who switch due to changes in quality-adjusted prices, these data "includes people who switch for any reason." (*Israel Cricket Declaration*, ¶ 26.)

23 *BVZ Diversion Supplement,* p. 11, quoting *Israel Cricket Declaration*, ¶ 27.

24 *BVZ Diversion Supplement,* pp. 10-11, quoting *Israel Cricket Declaration*, ¶ 26.

25 *BVZ Diversion Supplement,* p. 12.

calculations.[26] These errors cause them to conclude that the switching rate from Boost to T-Mobile/MetroPCS in the Boost survey data is [redacted] percent (which is above the HarrisX estimate) when it is actually [redacted] percent[27] (which is below the HarrisX estimate of [redacted] percent).[28] Because we have previously demonstrated that the merger is procompetitive if one uses diversion ratios derived from HarrisX data, it would also be found procompetitive if one used the corrected BVZ estimate of [redacted] percent.[29]

Second, BVZ assert that survey data from Boost and MetroPCS indicate that switching rates between Sprint and T-Mobile are higher among those switchers who change carriers for price-related reasons than among all switchers.[30] BVZ further assert that such information "provides a proxy for diversion in response to price insofar as it isolates the switching reason from other reasons to switch, such as network quality."[31] These assertions, too, do not survive scrutiny: To the extent that BVZ are claiming that relevant diversion can be only in response to relative price changes and not in response to relative quality changes, such a claim is incorrect. Both price and quality are important dimensions of competition and the Commission has previously recognized that switching in response to both price and quality is relevant for assessing the competitive effects of mergers.[32]

Extending BVZ's analysis to include customers who switched due to "coverage or network quality" yields a combined total of [redacted] percent of customers who switched for reasons based on quality-adjusted price choosing Sprint or Boost, which is nearly identical to the overall percentage of customers who switched and chose Sprint and Boost ([redacted] percent), thus reversing

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26 First, they assume that [redacted] percent of Boost deactivations port their numbers. In fact, internal Sprint data show that only [redacted] percent of Boost deactivations port their numbers. (See backup to Table 1.) Second, they assume that [redacted] percent of Boost deactivations do not port their numbers. This appears to be a mathematical error; the percent of Boost deactivations who do and do not port their numbers should sum to 100 percent rather than [redacted] percent. BVZ use these erroneous numbers to calculate weighted averages, which thus are erroneous as well.

27 See backup to Table 1.

28 In addition, although BVZ assert that "Compass also overstates the conclusion that T-Mobile documents show 'even lower switching rates between Sprint and T-Mobile than do the HarrisX data,'" (*BVZ Diversion Supplement,* p. 12) they ultimately appear to agree with our conclusion, calling it "approximately true." (*Id.*)

29 *IKK Declaration*, § VI.

30 *BVZ Diversion Supplement,* pp. 14-16.

31 *BVZ Diversion Supplement,* p. 14.

32 Staff Analysis and Findings, *In the Matter of Applications of AT&T Inc. and Deutsche Telekom AG for Consent to Assign or Transfer Control of Licenses and Authorizations*, WT Docket 11-65, rel. November 29, 2011 (hereinafter *AT&T/T-Mobile Commission Staff Report*), Appendix C, ¶ 10.

BVZ's claim of higher switching rates among those switching for price-based reasons once network-quality-based switching is also appropriately included.[33]

Notably, both the [redacted]- and [redacted]-percent switching rates are overestimates. This conclusion follows because BVZ inappropriately omit former MetroPCS customers that switch to Xfinity Mobile or "Other" carriers, which together account for over [redacted] percent of the overall respondents to the survey still using a wireless carrier other than T-Mobile.[34] This omission substantially inflates the share of switches to Sprint and Boost. Once one properly accounts for switches to wireless carriers omitted in BVZ's calculation, the overall switching share of Sprint and Boost falls from [redacted] percent to [redacted] percent.

3.5 DISH Counsel Attacks a Straw Man and Fails to Address the Documented Bias in Porting Data

DISH counsel presents evidence that changes in the rates of porting are associated with price changes.[35] Even taken at face value, the claims made by DISH counsel address only one of two potential sources of bias in porting data previously identified by the Commission and others. Specifically, Commission staff previously recognized that (a) customers may port their numbers for reasons that are not responses to price or quality changes;[36] and (b) only a subset of switching customers port their numbers and thus appear in the porting data.[37] The evidence presented by DISH counsel addresses only bias from source (a). Critically, our conclusion that porting data provide unreliable estimates of diversion ratios in the present matter is based entirely on bias from source (b).[38] The evidence cited by DISH counsel does nothing to address the bias in porting data that we document in Section 2 above and examine in greater detail in our earlier

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33 The overall switching rate also reflects switching for customer services and billing reasons, although each accounts for a very small share of the total responses.

34 See TMUS-FCC-07675268 at TMUS-FCC-07675289. Unfortunately, the reasons these consumers switched carriers are not reported in the source document.

35 *DISH Diversion Letter,* pp. 5-7.

36 *AT&T/T-Mobile Commission Staff Report*, Appendix C, ¶ 10.

This fact matters because diversion ratios measure the degree to which buyers would substitute to other products in response to a price or quality change but porting data capture consumer movements between products for all reasons, including those that have nothing to do with price or quality changes.

37 *AT&T/T-Mobile Commission Staff Report*, Appendix C, ¶ 10.

38 In fact, in an earlier submission, we stated that "porting rates following pricing promotions by Sprint and T-Mobile (which should be influenced by price changes) generally are similar to the porting rates immediately before the promotions (which are not influenced by price changes)." (*IKK Declaration,* ¶ 174.) Although such a finding does not prove that porting data are free of type-(a) bias, the finding is the reason that we did not claim that such bias is a problem with using porting data in the present proceeding. The ABH results, which were not available at the time of the *IKK Declaration*, now demonstrate that it is, in fact, a problem.

Diversion Ratio Analysis, and that bias alone is sufficient to render porting data less reliable than ABH's estimates.

3.6 BVZ's Claims Regarding the Implications of Differences Between Urban and Non-Urban Subscribers Are Incorrect

BVZ assert that the analysis we reported in our *IKK Declaration* is somehow flawed because HarrisX data show higher switching between Sprint and T-Mobile in urban areas than non-urban areas.[39] Contrary to their assertion, our model appropriately treats geographic variation. First, because Sprint and T-Mobile set prices nationally, we focus on nationwide diversion rates, which are the ones relevant to assessing nationwide pricing incentives.[40] Second, to the extent that certain brands are disproportionately represented in certain geographies, our model appropriately accounts for this fact by calculating brand-level diversion ratios. Specifically, our model calculates nationwide diversion ratios for specific brands and calibrates those diversion ratios to match the predicted average diversion ratio between Sprint postpaid and T-Mobile postpaid products and the predicted average diversion ratio between Sprint prepaid and T-Mobile prepaid products.[41]

3.7 BVZ's Critiques of ABH's Model Are Flawed

BVZ criticize ABH's estimates of diversion ratios.[42] We understand that ABH will respond directly to BVZ's claims about ABH's model. Nonetheless, we note here three fundamental flaws in BVZ's arguments.

First, BVZ assert that the ABH model does not provide a "direct" estimate of diversion ratios because they lack "high-frequency information on product-level prices and quantity sales."[43] Although BVZ are correct that the ABH model does not make use of such "high-frequency" data, that fact does not invalidate ABH's approach, which instead relies on extremely detailed, individual-level data on quality of network experiences. The variation inherent in these data provides ABH with a theoretically sound mechanism by which to estimate diversion ratios.

Second, although BVZ assert that ABH's "demand model is built on an underlying assumption of share-proportional diversion,"[44] BVZ's own Figure 3 (reproduced below) demonstrates that the diversion ratios estimated by the ABH model are not equal to share-proportional diversion

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39 *BVZ Diversion Supplement,* § III.B.

40 *In the Matter of Communications Marketplace Report*, GN Docket No. 18-231, Report, December 26, 2018, ¶ 14 ("We note first that mobile service providers offer nationwide pricing plans throughout their service areas, with little disparity in monthly recurring charges between rural and non-rural markets.").

41 *IKK Declaration*, ¶ 40.

42 *BVZ Diversion Supplement,* § IV.

43 *BVZ Diversion Supplement,* pp. 22-23.

44 *BVZ Diversion Supplement,* § IV.A.

ratios.[45] This result indicates that ABH's model does not impose an assumption of share proportionality; instead, the data's substitution patterns generate diversion ratios. The degree to which these diversion ratios are similar to or different from share-proportional ratios depends on consumer substitution patterns as reflected in the data.

Figure 1: Replication of BVZ Figure 3

[redacted]

Third, BVZ assert that "[t]he Cornerstone demand model is incapable of capturing market segmentation that would allow for subsets of products to be closer substitutes than their aggregate wireless shares."[46] As evidence in support of this conclusion, BVZ state that switching data yields higher diversion rates than does the ABH model.[47] This argument is circular. As a matter of logic, the fact that the resulting diversion rates differ from each other implies that the models are different—this fact does not imply that estimates based on switching data are correct and those based on the ABH model are incorrect. As summarized above, there

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45 We understand that ABH will demonstrate that individual-level diversion ratios exhibit even more divergence from share-proportional diversion ratios.

46 *BVZ Diversion Supplement,* § IV.B.

47 *BVZ Diversion Supplement,* pp. 28-29.

are strong reasons to conclude that the ABH model generates better estimates of diversion ratios than does BVZ's analysis of switching data.

4. Conclusion

The arguments made by BVZ and DISH's counsel are fatally flawed and do nothing to undermine the conclusions that: (a) porting data do not provide reliable measures of diversion ratios unless steps are taken to correct the inherent bias, and (b) better data and methods for estimating diversion ratios are now available. Economic models that make use of these better data and methods demonstrate that the merger is procompetitive.

APPENDIX C

DECLARATION OF MARK ROETTGERING

Senior Vice President of Commercial Strategy and Decision Analytics at T-Mobile US, Inc.

DECLARATION OF MARK ROETTGERING

Senior Vice President of Commercial Strategy and Decision Analytics at T-Mobile US, Inc.

1. My name is Mark Roettgering. I am a Senior Vice President of Commercial Strategy and Decision Analytics at T-Mobile US, Inc. ("T-Mobile"). In that role, I oversee a team that collects and analyzes competitive intelligence data, including both porting data and survey data regarding customer switching behavior.

2. T-Mobile regularly uses porting data obtained from Comlink to assess certain questions relevant to T-Mobile's business. For example, T-Mobile uses porting data to conduct "near-real-time" assessments of the directional effects of pricing promotions. The primary advantage of porting data relative to other sources of switching data is that porting data are the only data that are available with a short enough lag after an event to provide T-Mobile with quick feedback on the effects of various initiatives.

3. Although T-Mobile uses porting data for some purposes, T-Mobile generally does not consider porting data alone to be a reliable basis for decision making because these data provide a noisy signal of switching rates, do not cover the majority of switches that occur, and provide an incomplete and biased view of marketplace flows and trends. A principal problem is that only a minority of customers port their numbers when switching carriers, and T-Mobile has found that the behavior of porting customers differs substantially from the behavior of non-porting customers. For example, T-Mobile has found that porting data oversamples prime versus sub-prime customers and that porting data are much less accurate as an indicator of marketplace performance for prepaid products than for postpaid products. Additionally, porting behavior has shown extreme susceptibility to manipulation by carrier promotions (e.g. "$150 off a phone if you port your number") and thus requires significant post-processing and contextualization in

order to correctly interpret day-to-day variations in porting flows. T-Mobile recognizes that porting data provide only a partial view of the marketplace and for this reason constantly seeks to identify better sources of data.

4. T-Mobile also makes use of broad-based market surveys in the ordinary course of business. The primary broad-based market survey on which T-Mobile relies is the HarrisX Mobile Insights survey. These survey panel data are available on a monthly basis. Among the survey sample are customers who have switched carriers in the trailing 12 months. These survey data contain information on both switchers who port their numbers and switchers who do not port their numbers. Because survey data are available only with a much longer lag than are porting data, T-Mobile uses survey data on customer switching patterns primarily for medium- to long-term business planning. For example, T-Mobile used HarrisX Mobile Insights data to inform its decisioning on the 55+ and military rate plans.

5. I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed on February 6, 2019.

Mark Roettgering
Senior Vice President of Commercial Strategy
and Decision Analytics
T-Mobile US, Inc.

APPENDIX D

DECLARATION OF BRANDON "DOW" DRAPER
Chief Commercial Officer, Sprint Corporation

1. My name is Brandon "Dow" Draper, Chief Commercial Officer for Sprint Corporation ("Sprint"). My background and qualifications are described in my declaration attached to the Public Interest Statement supporting the pending transaction, filed on June 18, 2018.

2. Sprint uses porting data in the ordinary course of business in order to provide directional insight as to how Sprint is performing in the short term and to try to understand the effects of promotions or changes in the market. Porting data are often used in this way because they are readily available on a nearly real-time basis, unlike survey data that typically take longer to collect and process. However, porting data comprise only one of the tools that Sprint uses to analyze the market and do not provide a comprehensive view of customer trends. In my experience, porting data provide an incomplete view of the world and do not accurately represent the totality of competitive switching behavior among wireless customers.

3. A key limitation of porting data is the fact that the data cannot account for customer switching events where customers do not port their phone numbers. Porting data only account for a customer changing carriers when the customer actively decides to bring along an existing phone number. However, a large percentage of customers switch service providers without porting their phone numbers. In particular, within certain sales channels such as third-party national retailers or multi-carrier dealers, customers are less likely to port their phone numbers than customers in other sales channels. Porting data are also a poor measure of the overall picture of customer

switching because porting data get distorted by the fact that customers may be driven to port a number in order to take advantage of particular promotions that require them to port in order to qualify for the offer. Relatedly, some carriers, in particular MVNOs, tend to make less use of port-in promotions than others, which undermines the reliability of porting data as a predictor of overall customer switching behavior. Porting data do not account for the many, many instances of customer switching where a customer makes a switch to another carrier in order to get a better offer or receive better network quality but chooses not to port an existing phone number.

4. Because porting data provide a very incomplete picture of customer movement among carriers, Sprint uses surveys to better understand competitive customer switching decisions. Unlike porting data, survey data can provide insight into the particular reasons why customers decide to switch carriers and are not limited to only those customers that actively decide to move their phone numbers to another carrier. Survey data enhance Sprint's understanding of how customers make decisions and inform Sprint's strategic decisions about how to market our services and develop new offers.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed on February 6, 2019.

Brandon "Dow" Draper
Chief Commercial Officer
Sprint Corporation