ATTACHMENT A

Before the CALIFORNIA PUBLIC UTILITIES COMMISSION

In the Matter of the Joint Application of Sprint Communications Company L.P. (U-5112) and T-Mobile USA, Inc., a Delaware Corporation, For Approval of Transfer of Control of Sprint Communications Company L.P. Pursuant to California Public Utilities Code Section 854(a).

Application 18-07-011

And Related Matter.

Application 18-07-012

Supplemental Declaration

of

LEE L. SELWYN

on behalf of the

Public Advocates Office at the California Public Utilities Commission

[PUBLIC VERSION]

April 26, 2019

REDACTED FOR PUBLIC INSPECTION

SURREBUTTAL TESTIMONY OF LEE L. SELWYN

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SUPPLEMENTAL DECLARATION OF LEE L. SELWYN

- 1 I, Lee L. Selwyn, declare as follows:
- 2

3 Introduction

4

I am the same Lee L. Selwyn who submitted direct testimony in this proceeding on
January 7, 2019. The purpose of my additional testimony at this time is to respond to certain
matters that were discussed in the testimony and documents that were submitted by the Joint
Applicants on January 29, 2018.

9

10 2. On February 4, 2019, the Public Advocates Office submitted a Motion to Amend and Supplement Testimony and for Additional Hearings. On February 26, 2019, the ALJ issued a 11 12 ruling granting, in part, the Public Advocates Motion. The ALJ concluded "that, regardless of 13 whether Joint Applicants' rebuttal testimony contains new evidence and arguments, the sheer 14 volume of the material together with the complexity of the subject matter has worked a disadvantage to Cal Advocates that requires a remedy" He ruled that "the schedule in this 15 16 proceeding will be adjusted by moving the date for submission of opening briefs to March 29, 17 2019" and that "additional evidence and arguments responsive to the rebuttal testimony of Joint Applicants may be included in [the Public Advocates Office's] opening brief."¹ 18 19

^{1.} A.18-07-012, Administrative Law Judge's Ruling Denying in Part and Granting in Part the Motion of the Public Advocates Office to Amend and Supplement Testimony and for Additional Hearings; and Revising the Schedule of this Proceeding, February 26, 2019, at 3.



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1	3. In its February 4 Motion, the Public Advocates Office had identified several Joint
2	Applicant witnesses who had included extensive volumes of new material in their January 29
3	rebuttal submission. I have been asked to prepare responsive evidence, in the form of this expert
4	declaration, addressing certain portions of the rebuttal submissions of Mark A. Israel and the
5	Declaration of Mark A. Israel, Michael Katz and Bryan Keating ("IKK") that Dr. Israel has
6	provided as Attachment B to his rebuttal testimony ("IKK FCC Declaration"). The IKK FCC
7	Declaration had been submitted on September 17, 2018 by the Joint Applicants to the FCC in
8	WT Docket No. 18-197, and to the U.S. Department of Justice ("DOJ"). I have also been asked
9	to address testimony offered by T-Mobile witness Neville Ray, in which he had argued that
10	approval of the proposed merger would assure expansion of near-universal 5G coverage
11	throughout most rural areas in California, in light of recent responses to Public Advocates Office
12	Data Requests that T-Mobile has been directed by the ALJ to provide
13	
14 15 16 17	The Israel/Katz/Kearing ("IKK") Model confirms that prices that will be charged by post- merger New T-Mobile will be higher than the prices that the two standalone firms will charge absent their merger.

In his January 29, 2019 Rebuttal Testimony, Dr. Mark Israel states that he and two
 colleagues, Michael Katz and Bryan Keating ("IKK"), had analyzed the proposed merger of
 T-Mobile and Sprint, and had submitted their results to the FCC and to the U.S. Department of
 Justice ("DOJ"). Dr. Israel provides, as Attachment B to his testimony, a copy of the declaration
 that IKK had submitted in FCC WT Docket No. 18-197 on September 17, 2018 ("IKK FCC



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Declaration").² Among other things, the IKK FCC Declaration provides a rebuttal to a
 declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda and William Zarakas
 ("HBVZ") submitted in the same FCC docket by DISH Network Corporation ("DISH") in
 support of its August 27, 2018 Petition to Deny.

5

6 5. In that Declaration, HBVZ present an econometric merger simulation model whose 7 results indicated, among other things, that if the merger is allowed to take place, the prices that 8 consumers will pay New T-Mobile for both postpaid and prepaid services will be higher than 9 those that would prevail for the two companies standing alone, that as a result of the higher post-10 merger prices both AT&T and Verizon would also increase their prices, that New T-Mobile's 11 market share would be less than the combined market shares of the two companies standing 12 alone, and that consumer surplus – a key indicator of consumer welfare – would be diminished 13 relative to the levels that would prevail absent the merger.

14

6. The IKK FCC Declaration, while challenging certain of HBVZ's methodology and assumptions, did not refute any of these key HBVZ conclusions. Like HBVZ, IKK also concluded that, post-merger, prices for both postpaid and prepaid services will be higher, both AT&T and Verizon would also increase their prices, New T-Mobile's market share would be less than the combined market shares of the two companies standing alone, and that consumer surplus would be diminished. However, IKK argue that a focus upon the dollar prices that consumers would pay is misplaced because it fails to account for the substantial improvements



^{2.} Rebuttal Testimony of Mark A. Israel, at 2.

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in service quality that the Joint Applicants ascribe as a key merger benefit. According to IKK,
 even though the absolute dollar price levels would be higher, what they refer to as "quality adjusted prices" would be lower with the merger than in its absence.

4

7. From my review of the IKK model, I conclude that post-merger prices will be higher than
those that would prevail without the merger. There does not appear to be any dispute or
disagreement among HBVZ, IKK or myself on this point.

8

9 8. In his January 7, 2019 rebuttal testimony, Dr. Israel concedes that the proposed merger will "eliminate a competitor" and that this "may result in less intense competition with respect to 10 price and quality, potentially resulting in higher quality-adjusted prices."³ He explains that "the 11 12 merger will bring T-Mobile and Sprint into common ownership, and, therefore, will internalize 13 the value of sales diverted from one to the other that otherwise would have been viewed as lost sales by each separate firm, putting upward pressure on prices"⁴ However, he goes on to argue, 14 such upward pressure on prices will, in the specific case of the T-Mobile/Sprint merger, "lower 15 16 the combined firm's marginal costs of serving additional customers relative to the marginal costs facing the standalone firms, creating incentives to cut prices and expand output" and "improve 17

- 3. *Id.*, at 6.
- 4. *Id*.



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the quality of service, at any given price, that the combined firm will offer relative to what the
standalone firms would offer."⁵

3

Dr. Israel's and IKK's contention that post-merger prices will be lower is driven by the
notion that certain "quality adjustments" will be viewed by consumers as overcoming
the actual increase in the dollar amounts they will be required to pay for mobile
wireless services post-merger.

9 9. But in these references to "price," Dr. Israel is *not* referring to the dollar amount of the 10 bill that consumers would receive or the amounts on the checks that these consumers would 11 write in payment of those invoices. In fact, for any of several reasons – including the 12 productions made by the IKK model itself – the "bottom line of the bill" sent to the merged 13 company's customers will almost certainly be higher than the payments that they currently make 14 and that they would otherwise be making to the two standalone firms absent the merger. In 15 describing the putatively "lower" post-merger "price" that would be less than what consumers 16 would otherwise be charged by either of the two firms operating on a standalone basis absent the merger, Dr. Israel qualifies the term "price" by preceding it with the adjective "quality-17 18 adjusted." In fact, the phrase "quality-adjusted price" appears no less than seven (7) times in Dr. 19 Israel's rebuttal testimony, and ten (10) times in the September 17, 2018 IKK FCC Declaration. 20 21 10. Changes in the quality of a product or service may make the product or service more, or

10. Changes in the quality of a product or service may make the product or service more, or
less, valuable to the consumer. In the classic example of the "shrinking Hershey bar," the
nominal "price" of the bar of chocolate was not changed but the quantity of chocolate in the bar

5. *Id*.



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was reduced. The effect was, of course, a price increase. An improvement in a product, such as
increasing the processor speed of a personal computer or the storage capacity of a hard disk
drive, when viewed by consumers on a quality-adjusted basis, might in some instances be seen
as a price decrease, even if the nominal dollar price remains the same or even goes up.
However, if the dollar price does go up, consumers will still have to pay more more for the
product, any "quality adjustment" notwithstanding.

7

11. Accounting for product or service quality improvements has become a routine exercise 8 9 in assessing inflation rates and other forms of price adjustments over time. Generally referred to 10 as "hedonic adjustments," agencies such as the US Bureau of Labor Statistics, which maintains the Consumer Price Index ("CPI"), undertake to factor in non-price changes in the nature of 11 12 individual products so as to adjust nominal prices for quality or other changes in product or 13 service attributes. Some of these types of hedonic adjustments are fairly straightforward: For 14 example, when packages of coffee beans on many supermarket shelves were reduced from one 15 pound to only 12 ounces (a 25% decrease in quantity), the price of a package of coffee is easily 16 adjusted by proportionately reflecting the change in contents. But many other types of product 17 quality or attribute adjustments are far less straightforward. When airlines shrunk the width and 18 legroom of their coach seats, the "value" of their service was undeniably diminished. However, 19 it would be difficult to claim that the "value" of an airline ticket was diminished by the 20 percentage reduction in seat size and/or legroom. Translating a modification in product or 21 service quality into a price that customers may be willing to pay is complex and requires a far



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more detailed type of analysis than the one that IKK has pursued for this purpose. I will come to
this point later in this testimony.

3

12. Over the years, major technological innovations in the telecommunications and 4 5 information technology fields have produced significant quality improvements and, in many 6 cases, lower nominal dollar prices as well, as competition in these markets forced manufacturers 7 and service providers to adopt the new technologies and to flow through their benefits in their 8 products and prices. The downward trend that has existed for a number of years in wireless 9 service prices, including hedonic effects like increases in wireless download speeds, increased 10 usage allowances including the expansion of "unlimited" or pseudo-unlimited service plans, and the addition of various other new features, all reflect these underlying technological changes. 11 12 The presence of four or more wireless firms has fostered a market environment that is 13 sufficiently competitive so as to compel each incumbent to flow such technological 14 improvements through to their customers.

15

16 13. But translating changed in "quality" into quantifiable changes in "value" is, by its 17 nature, a complex undertaking. Individual consumers may place widely varying incremental 18 values on specific improvements in quality. Yet in order to assert that the merger will result in 19 lower "quality-adjusted prices," these quality improvements that would purportedly arise under 20 the merger must first be monetized in some defensible manner. For example, one could readily 21 conclude that a decrease in the size of a chocolate bar from 5 oz. to 4 oz. would constitute a 25% 22 price increase, in that one would now need to purchase five 4-oz. bars to obtain the same amount



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of chocolate (20 oz.) that could have been obtained, prior to the size reduction, by purchasing 2 four 5-oz. bars. But would a 10% *increase* in the nominal dollar price of the service that is 3 accompanied by a 20% improvement in transmission speed (data rate) be seen by consumers as a net *decrease* in the quality-adjusted price of the service? There is no simple answer to that 4 5 question, and in any event the perception will vary widely from one consumer to the next.⁶ 6 7 If the Joint Applicants' claims as to the service quality gains they ascribe to the merger were actually to materialize, one is compelled to conclude, with near-certainty, that the 8 9 nominal *dollar* prices of New T-Mobile's services will be higher than what standalone 10 Sprint and T-Mobile would charge if the merger is not allowed to go forward. 11 12 14. Widely-accepted scientific methods for quantifying the monetary value of quality 13 changes in products and service do exist, but these were not used by IKK. Instead. Dr. Israel alludes to "Evidence from Consumer Surveys" and "Evidence from Network Operators' Pricing 14 Decisions" as the basis for the specific "quality adjustments" that IKK make to post-merger New 15 T-Mobile prices.⁷ Dr. Israel states that "[b]oth Sprint and T-Mobile conduct surveys of new and 16 17 deactivating customers to discern information about what aspects of service quality are important to them." However, he then goes on to admit that the types of "consumer surveys" 18

19 that have been conducted by the Joint Applicants "do not allow one to estimate a precise dollar

^{7.} Declaration of Compass Lexecon Mark Israel, Michael Katz, and Bryan Keating, September 17, 2018, FCC WT Docket 18-197, Appendix F to Joint Applicants' Appendix F to Joint Applicants' September 17, 2018 FCC submission, Attachment B to the Rebuttal Testimony of Mark A. Israel on Behalf of Joint Applicants, January 29, 2019, at 90, 94.



^{6.} Even in the case of the Hershey bar, the reduction in size from 5 oz. to 4 oz. would have no effect upon a consumer, and would not be perceived as a price increase by a consumer, who did not intend to eat more than 4 oz. of chocolate in the first place.

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value of specific dimensions of network quality," only that they support the utterly unremarkable
conclusion "that consumers place substantial value on network quality."⁸ The point is, surveys
of this type are simply incapable of supporting a claim that an increase in the nominal dollar
price coupled with some level of "improvement" in "service quality" (however it may be defined
for this purpose) constitutes a net decrease in the "quality-adjusted price."

6

7 15. With respect to "Evidence from Network Operators' Pricing Decisions," Dr. Israel suggests that "[t]he fact that mobile wireless network operators charge substantially higher 8 9 prices for higher quality plans further confirms that many consumers place high value on 10 network quality today" and that "[t]his follows because network operators' pricing decisions 11 reflect their estimates of consumers' valuation of product quality: the more highly consumers 12 value a dimension of network quality, the more firms will optimally charge for that dimension of quality."⁹ But once again, Dr. Israel admits that "although firms' pricing decisions alone cannot 13 14 be used to determine consumer willingness to pay for specific aspects of product quality, they do 15 provide useful guidance regarding what network operators believe customers will pay for greater network quality."¹⁰ Thus, and by his own admission, *neither of the two approaches suggested by* 16 Dr. Israel support a quantifiable monetization of the types of "service quality" gains that he and 17 the Joint Applicants seek to ascribe to the merger. 18

19

- 9. *Id.*, at 94.
- 10. Id., at 94-95.



^{8.} Id., at 90, emphasis supplied.

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1 16. There is, however, one key conclusion that can be drawn from Dr. Israel's suggestion 2 that consumers are willing to pay more for higher quality service: If the Joint Applicants' claims 3 as to the service quality gains they ascribe to the merger were actually to materialize, we are compelled to conclude, with near-certainty, that the nominal dollar prices of New T-Mobile's 4 5 services will be higher than what standalone Sprint and T-Mobile would charge if the merger is 6 not allowed to go forward. And that conclusion is supported by the results of both the HBVZ 7 and IKK models: If the merger happens, dollar prices will rise. As consistently documented in the annual FCC Wireless Competition Reports and as I have discussed in my January 7, 2019 8 testimony,¹¹ prices for equivalent service plans being offered by Sprint and T-Mobile are 9 consistently, and significantly, lower than the prices being charged by AT&T and Verizon.¹² 10 11 Consumers perceive AT&T and Verizon as providing service of a superior quality to those being 12 offered by Sprint and T-Mobile, forcing the latter to discount their prices relative to those of the 13 "big two" Mobile Network Operators ("MNOs"). While Dr. Israel posits that consumers will 14 pay more for superior service quality, the pricing behavior of these four firms actually confirms 15 the *inverse* of Dr. Israel's contention – i.e., *consumers are willing to purchase a service offering* less functionality or fewer features as long as the price differential is large enough. 16

- 17
- 18

^{12.} Selwyn January 7, 2019 Declaration, at 70, para. 60. See also FCC Seventeenth CMRS Report, p. 20, Table II.D.1; *Nineteenth CMRS Report*, p. 24, Table II.E.1.



^{11.} Declaration of Lee L. Selwyn on behalf of California Public Advocates Office, January 7, 2018, at 81, para. 70 and Table 12.

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If there were any merit to Dr. Israel's contention that the purportedly lower marginal costs
 that New T-Mobile will experience post-merger will create incentives for New T-Mobile to
 cut prices and expand output, then AT&T and Verizon, which already enjoy lower
 marginal costs, would already be doing just that – except that they are not.

6 17. So let's return for a moment to one of Dr. Israel's core arguments – that "the merger will lower the combined firm's marginal costs of serving additional customers relative to the 7 8 marginal costs facing the standalone firms, creating incentives to cut prices and expand output; 9 and [i]n addition, the merger will improve the quality of service, at any given price, that the 10 combined firm will offer relative to what the standalone firms would offer." Dr. Israel attempts 11 to argue that these two *positive* effects of the merger will more than offset the one *negative* effect 12 - the elimination of a competitor. But here he is wrong. In fact, these two supposedly *positive* 13 effects actually work at cross-purposes.

14

15 18. If, in fact, New T-Mobile is able to improve service quality to the point where it narrows 16 or eliminates the service quality gap vis-à-vis AT&T and Verizon, New T-Mobile would have no 17 reason to maintain the existing pre-merger price differentials that currently prevail with respect 18 to these two higher-quality providers – especially since, post-merger, Sprint and T-Mobile will 19 no longer be competing against each other. As noted above, Dr. Israel states that "network 20 operators' pricing decisions reflect their estimates of consumers' valuation of product quality: the 21 more highly consumers value a dimension of network quality, the more firms will optimally 22 charge for that dimension of quality." Thus if, as Dr. Israel suggests, consumers are willing to 23 pay more for higher quality service and if the post-merger New T-Mobile is actually able to 24 deliver the higher quality level of service that the two standalone companies are unable to



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achieve, New T-Mobile would be leaving large amounts of money "on the table" if it failed to
"optimally charge for that dimension of quality" by increasing its dollar price levels up to those
being charged by AT&T and Verizon. And as for New T-Mobile's claimed "incentive" to attract
additional customers to fill up the additional capacity that the merger is claimed to provide, this
can be accomplished through aggressive marketing and by offering up-front price and non-price
promotions without having to reduce recurring monthly service and usage prices. In fact, and as

7 I will discuss in detail below, the IKK model projects a HIGHLY CONFIDENTIAL <

8 > END HIGHLY CONFIDENTIAL for the merged entity relative to the
9 two companies standing alone. Additionally, *the "Evidence from Network Operators' Pricing*10 Decisions" to which Dr. Israel avers compels no other conclusion.

11

12 19. Despite the competition from the lower-priced Sprint and T-Mobile, Verizon and AT&T 13 have been highly successful in maintaining their higher prices *precisely because they offer* 14 *higher service quality than their two smaller rivals*. If New T-Mobile is able to eliminate any 15 service quality gap relative to Verizon and AT&T, it can read precisely the same pricing tea 16 leaves to which Dr. Israel refers and know *with certainty* that it will be able to sustain the same 17 higher price levels as are being charged by the "big two" MNOs. And in that event, the merged 18 company will *not* be applying any downward pricing pressure to either Verizon or AT&T at all.

19

20 20. Nevertheless, Dr. Israel posits that the merged company's reduced marginal cost would 21 actually "creat[e] incentives to cut prices and expand output," effectively dismissing the oppor-22 tunity that the purported improvements in service quality would afford New T-Mobile to raise its



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prices toward or to the AT&T/Verizon level. If there were any substance to the contention that lower marginal cost "creat[e] incentives to cut prices and expand output," then why aren't AT&T and Verizon already doing exactly those same two things right now? After all, each of these two firms would still be larger overall than the combined Sprint and T-Mobile. Is there any reason to believe that the post-merger New T-Mobile would experience marginal costs materially *below* those of AT&T or Verizon?

7

21. In their August 27, 2018 declaration, HBVZ provided calculations of "long run 8 9 incremenal costs" expressed on a per-subscriber per month basis for each of Sprint, T-Mobile, 10 AT&T and Verizon based upon publicly available financial data. HBVZ state that these are "all-11 in" costs that include a monthly amortization of the incremental capital cost, plus the "additional 12 operating costs, costs to acquire those subscribers and replace subscribers who leave through normal churn, and increased general and overhead costs."¹³ For convenience, I have reproduced 13 14 in Figure 1 below the HBVZ long run incremental cost calculations, which appear at Table 12 in 15 their August 27, 2018 FCC Declaration:



^{13.} HBVZ August 27, 2018 FCC Declaration, at 33-34.

Table 12: Long-Run Incremental Costs, Margins, and Implied Elasticities by Wireless Provider, 2017					
	Monthly			Implied	
Wireless Providers	Marginal Cost	ARPU	Margin	Elasticity	
[A]	[B]	[C]	[D]	[E]	
AT&T	\$18.01	\$52.51	66%	-1.52	
Verizon	\$19.07	\$43.45	56%	-1.78	
Sprint	\$23.49	\$46.14	49%	-2.04	
T-Mobile	\$21.16	\$46.97	55%	-1.82	

Sources & Notes:

[B]: Present value of the incremental costs per connection of adding one million connections. See Appendix A.

[C]: Verizon Postpaid ARPU is calculated by dividing Average Revenue Per Account, not including recurring device payment billings (ARPA) by retail Postpaid connections per account. T-Mobile and U.S. Cellular ARPU calculated by dividing postpaid revenues by number of months in the given period (12). AT&T ARPU is based on its quarterly earnings statements based on reported values for "Postpaid ARPU (Historical Accounting Method)". Sprint value is based on its quarterly earnings statements based on reported values for "Nine Months Ended December 31, Postpaid ARPU".

[D]: ([C] - [B]) / [C]. [E]: -1 / [D].

Figure 1. HBVZ Long Run Incremental Cost, monthly per subscriber.

- 1 From these calculations, AT&T enjoys the highest *existing* gross profit margins between ARPU
- 2 and long run marginal cost at 66%; Verizon comes in second at 56%.
- 3
- 4 22. In fact, Joint Applicant witnesses Asker, Bresnahan and Hatzitaskos, in their November
- 5 6, 2018 FCC Declaration ("Cornerstone Declaration"), provide estimates of the current marginal



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1 costs being experienced by AT&T and Verizon along with their pre- and post-merger marginal cost estimates for T-Mobile and Sprint and the two companies' respective prepaid brands.¹⁴ 2 3 Cornerstone's results are derived from propritary, rather than public, data sources, and the Cornerstone "marginal cost" figures are **BEGIN HIGHLY CONFIDENTIAL < > END** 4 5 **HIGHLY CONFIDENTIAL** than those developed by HBVZ. In addition to their reliance upon 6 different data, the two models also employed different methodologies. Accordingly, I am not able to determine the extent to which any differences in the two sets of results are attributable to 7 data or methodological differences. In particular, it is unclear as to how the Cornerstone group 8 9 developed or came up with marginal cost estimates for AT&T and Verizon, and no specific data 10 source or other explanation appears to have been provided in their Declaration. Indeed, it is 11 extremely unlikely that these cost figures could have come from AT&T and Verizon themselves; 12 as such, they must be viewed with extreme skepticism. Notably the Cornerstone marginal cost 13 estimates for AT&T and Verizon of **BEGIN HIGHLY CONFIDENTIAL** < 14 > END HIGHLY CONFIDENTIAL, respectively, are BEGIN HIGHLY CONFIDENTIAL 15 < > END HIGHLY CONFIDENTIAL pre-merger marginal cost estimates that are given for Sprint and T-Mobile.¹⁵ While the Cornerstone group predicts 16 17 fairly large decreases in post-merger marginal costs for both Sprint and T-Mobile, it assumes no change at all in marginal cost for either AT&T or Verizon at a comparable post-merger time 18

15. *Id*.

^{14.} Rebuttal Testimony of Timothy F. Bresnahan, January 29, 2019, Attachment A,"John Asker, Timothy Bresnahan, and Kostis Hatzitaskos, "Economic Analysis of the Proposed T-Mobile/Sprint Merger," November 6, 2018 ("Cornerstone decl."), at Exhibit 36.

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period. I addressed this same point in my January 7 testimony,¹⁶ to which Dr. Bresnahan 1 2 responded that "[i]t is standard in merger analysis to look at the improvements in the efficiency of the merging firms relative to other competitors."¹⁷ But even if Cornerstone's intention was to 3 portray the condition of both AT&T and Verizon on a ceteris paribus (i.e., all else equal) basis, 4 5 it is difficult to imagine that, if actually confronted with decreases in their rival's psot-merger 6 marginal cost of the magnitude that the Cornerstone group suggests, AT&T and Verizon would nevertheless sit on their hands and take no responsive initiative. Indeed, Dr. Bresnahan even 7 concedes that such responses are in fact likely to occur.¹⁸ In any event, even by Cornerstone's 8 9 entirely unexplained and certainly unsupported speculations as to the AT&T and Verizon marginal costs, it is noteworthy that under Cornerstone's post-merger projection, Srpint's post-10 merger marginal cost of **BEGIN HIGHLY CONFIDENTIAL <** 11 > END HIGHLY 12 **CONFIDENTIAL** would still *exceed* Cornerstone's assessment of Verizon's *pre-merger* 13 marginal cost of **BEGIN HIGHLY CONFIDENTIAL** < \$ > END HIGHLY 14 **CONFIDENTIAL.** Thus, if there were any substance to Dr. Israel's theory that the merged 15 company's reduced marginal cost would actually "creat[e] incentives to cut prices and expand 16 output," we should already be seeing that precise conduct by the two largest incumbents. Nowhere does Dr. Israel explain why New T-Mobile's pricing and output decision should or 17 18 would differ so dramatically from those of AT&T and Verizon insofar as the price/marginal cost 19 relationship is concerned.

- 16. Selwyn January 7, 2019 testimony, at 100-101, para. 96.
- 17. Bresnahan decl., at 24.
- 18. *Id*.



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1 23. The IKK model's projection of the merger-driven drop in both Sprint's and T-Mobile's 2 marginal cost results from a complex and largely opaque "merger simulation analysis" that, 3 according to IKK, "account[s] not only for any adverse unilateral competitive effects that would occur absent efficiencies, but also for the efficiencies that the merger will generate in the form of 4 lower marginal costs and higher quality."¹⁹ IKK state that their model was developed in 5 response to, and is a modification of the HBVZ model submitted by DISH.²⁰ Following IKK's 6 7 Response, HBVZ on October 31, 2018 submitted a Reply Declaration addressing certain criticisms of their original (August 27) model that raises serious concerns about IKK's approach. 8 9 But even if one were to accept the IKK Model's projection of the merger-driven drop in both 10 Sprint's and T-Mobile's marginal cost, the notion that the merged company's reduced marginal 11 cost would actually "creat[e] incentives to cut prices and expand output" is critically dependent 12 upon IKK's attempt to monetize the "service quality" improvements that *the Joint Applicants*, 13 and not IKK themselves, ascribe to the merger. In fact, IKK's assessments as to decreases in 14 "quality-adjusted prices" are critically dependent upon the manner in which these purported 15 quality improvements are transformed into pseudo-dollar values. The specific methodology that 16 IKK has employed to accomplish this is overly simplistic (because it focuses narrowly upon only a single dimension of "quality") and relies upon a wholly inapposite analysis of fixed wired 17 18 broadband Internet access service that was based upon 2012 data. IKK's projected reductions in 19 post-merger "quality-adjusted prices" are pure speculation, and such speculation cannot

^{20.} Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Exhibit B to Petition to Deny of DISH Network Corporation, *I/M/O Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, August 27, 2018.



^{19.} IKK FCC Decl., at para. 3.

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overcome or offset the "eliminat[ion of] a competitor" that will result from the merger, which
 Dr. Israel has himself conceded "may result in less intense competition with respect to price and
 quality, potentially resulting in higher quality-adjusted prices."²¹

4

The IKK model actually projects that the merger will result in *increases* in the dollar prices of both Sprint and T-Mobile prepaid and postpaid services.

8 24. Despite their continued conversation about "quality adjusted prices," the IKK model 9 actually projects *substantial increases* both in prepaid and in postpaid post-merger New 10 T-Mobile dollar prices that will be charged to consumers relative to the prices that would 11 otherwise be charged by standalone Sprint and by standalone T-Mobile. IKK utilized two 12 alternative "demand simulations" – the Antitrust Logit Model ("ALM" or "logit") and the 13 Proportionally Calibrated Almost Ideal Demand System ("PC-AIDS"), two commonly used 14 calibrated demand simulation models. As summarized on Table 1 below, without the downward price adjustments that IKK seek to ascribe to "service quality" improvements, the IKK model 15 using the ALM demand simulation actually projects price *increases* for Sprint postpaid service, 16 going from **BEGIN HIGHLY CONFIDENTIAL <** \$ > pre-merger > END HIGHLY 17 **CONFIDENTIAL** to **BEGIN HIGHLY CONFIDENTIAL** <\$ 18 > END HIGHLY 19 **CONFIDENTIAL** post merger. For T-Mobile, postpaid prices are projected by IKK to rise 20 from **BEGIN HIGHLY CONFIDENTIAL < \$** > END HIGHLY CONFIDENTIAL 21 pre-merger to **BEGIN HIGHLY CONFIDENTIAL <S > END HIGHLY** 22 **CONFIDENTIAL** post-merger.



^{21.} Israel rebuttal decl., at 6.

1	BEGIN HIGHLY CONFIDENTIAL <					
2	Table 1					
3						
4 5		POST-MERGER IKK MODEL PROJECTED MERGER-DRIVEN POSTPAID PRICE AND MARKET SHARE CHANGES				
6	(ALM Demand Model)					
7			ARPU	Marko	et Share	
8	Carrier	Pre-merger	Post-merger	Pre-merger	Post-merger	
9	AT&T					
10	Verizon					
11	Sprint					
12	T-Mobile					
13	US Cellular					
14	Source: Replication	of HBVZ ALM.xlsx, Sh	<pre>neet "postpaid_outcome"</pre>			
15	> END HIGHLY	CONFIDENTIA	L			
10						
17	25. For prepaie	25. For prepaid services (Table 2), the IKK model using the ALM demand simulation also				
18	projects price <i>increases</i> for Sprint, going from BEGIN HIGHLY CONFIDENTIAL < \$					
19	> END HIGHLY CONFIDENTIAL pre-merger to BEGIN HIGHLY CONFIDENTIAL <					
20	Sevent Sector Sect					
21	HIGHLY CONFIDENTIAL < S > END HIGHLY CONFIDENTIAL pre-merger to					
22	BEGIN HIGHLY CONFIDENTIAL < > END HIGHLY CONFIDENTIAL post-					
23	merger.					



1	BEGIN HIGHLY CONFIDENTIAL <					
2	Table 2					
3						
45			E AND MARKET S	HARE CHANGES		
6		()	ALM Demand Mode	el)		
7		AF	RPU	Marke	et Share	
8	Carrier	Pre-merger	Post-merger	Pre-merger	Post-merger	
9	AT&T					
10	Verizon					
11	Sprint					
12	T-Mobile					
13	Tracfone					
14	Other MVNOs					
15	Source: Source: Rep	CONFUENTIAL	klsx, Sheet "prepaid_ou	tcome"		
10	> END HIGHLY	CONFIDENTIAL				
1,						
18	26. Figures 2 a	nd 3 below reprodu	ice the IKK model of	output from which T	Tables 1 and 2 were	
19	created. These show the IKK and HBVZ model results for Prepaid and Postpaid, respectively,					
20	using the ALM demand model, and the differences in the results for the two models. Notably,					
21	IKK's modifications to HBVZ and the original (unmodified) HBVZ results are quite similar					
22						
23	27. The same post-merger upward pricing trend seems to prevail in IKK's results when					
24	using the PC-AIDS demand assumption. Moreover, it is also clear that IKK's "replication" of					
25	the HBVZ model yielded very similar results - significant price increases post-merger, as shown					
26	in Figures 4 and 5 below, which reproduce IKK model output.					



> END HIGHLY CONFIDENTIAL

Figure 2. IKK Comparison of HBVZ and IKK Model results - ALM Demand Model; Postpaid Services. Source: "Replication of HBVZ ALM.xlsx" Tab "Postpaid Results"



> END HIGHLY CONFIDENTIAL

Figure 3. IKK Comparison of HBVZ and IKK Model results - ALM Demand Model; Prepaid Services. Source: "Replication of HBVZ ALM.xlsx" Tab "Prepaid Results"



> END HIGHLY CONFIDENTIAL

Figure 4. IKK Comparison of HBVZ and IKK Model results - PC-AIDS Demand Model; Postpaid Services Source: "Replication of HBVZ ALM.xlsx" Tab "Postpaid"



> END HIGHLY CONFIDENTIAL

Figure 5. IKK Comparison of HBVZ and IKK Model results - PC-AIDS Demand Model; Prepaid Services Source: "Replication of HBVZ ALM.xlsx" Tab "Prepaid"



While claiming that the merger will be "consumer welfare enhancing," the IKK model projects that the merger will result in net losses in consumer surplus, a key quantitative measure of consumer welfare.

5 28. Economic theory holds that the maximum amount that a consumer would be willing to pay for one additional unit of any given product or service is the additional value or, more 6 7 formally, the "marginal utility" that the consumer derives from the acquisition/consumption of that additional unit of the product or service.²² For example, if a product costs \$50 but the 8 9 additional value (marginal utility) that a particular consumer expects to derive from that product 10 is only \$40, the purchase will not be made. On the other hand, if the consumer's marginal utility 11 from the purchase of the product is \$80, the purchase will be made. In that case, the consumer 12 will have realized something akin to a "profit" – more formally, a net gain in the consumer's 13 total utility – of 30 - i.e., 80 - 50. This gain is known as "consumer surplus" and it arises 14 because, in this example, the consumer has given up only \$50 in purchasing power in exchange 15 for \$80 in increased value. That gain in value has increased the consumer's overall welfare by 16 \$30. If the price for the proudct were to increase to \$60, the purchase would still be made (because \$80 is greater than \$60), but the consumer surplus, or welfare gain, would have been 17 18 diminished from its former \$30 level to only \$20. If, due to a service quality improvement, the 19 value (marginal utility) of the product were to increase from \$80 to \$85 but the price were to 20 increase from \$50 to \$60, the purchase would still be made, but the gain (consumer surplus) 21 arising from that purchase would have been diminished from its earlier level of \$30 to only \$25 22 (i.e., \$85–\$60). In that case, the combination of the service quality improvement and the price

^{22.} See, generally, Case, Karl E., Ray C. Fair and Sharon M. Oster, *Principles of Microeconomics*, 11th ed., Prentice-Hall (2014), at 88-92.



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1

2 some consumers the marginal utility of the product was only \$53 to begin with. At the \$50 3 price, the purchase would still be made, but for those consumers the gain (consumer surplus) would be only \$3. If the price were to increase to \$60, these consumers would not make the 4 5 purchase at all, and the prior \$3 in consumer surplus would be eliminated. These examples have 6 focused upon an individual consumer. In aggregate, consumer surplus is the sum of the indi-7 vidual consumer gains (i.e., willingness-to-pay – price). Expressed more formally, total 8 consumer surplus is the area between the demand curve and the prevailing market price. 9 10 29. In their rebuttal to HBVZ, IKK in multiple places claim that the merger would be "consumer welfare enhancing."²³ In their model, HBVZ undertook to develop specific projec-11 12 tions of the effect of the merger upon consumer surplus (a quantification of consumer welfare) 13 separately for postpaid and for prepaid services. Figures 2 and 3 above are taken from an IKK 14 Model Output spreadsheet, Replication of HBVZ ALM.xlsx. Using the ALM Demand Simulation 15 model, HBVZ projected the merger to result in a decrease of **BEGIN HIGHLY** 16 CONFIDENTIAL <\$ > END HIGHLY CONFIDENTIAL for postpaid services 17 (Figure 2) and **BEGIN HIGHLY CONFIDENTIAL** < > END HIGHLY 18 **CONFIDENTIAL** for prepaid services (Figure 3), for a total merger-driven net loss in 19 consumer surplus of **BEGIN HIGHLY CONFIDENTIAL** < > END HIGHLY 20 CONFIDENTIAL. The September 21 IKK replication/modification of the HBVZ model did

increase would result in a diminution of consumer welfare overall. Finally, suppose that for

21 not include corresponding consumer surplus calculations for the PC-AIDS demand model.



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^{23.} IKK FCC Decl., at paras. 50, 109, 115, 117, 125, 149, 150.

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1 Notably, however, with respect to the ALM demand model, it appears that IKK have actually

2 projected a greater merger-driven decrease in consumer surplus than had HBVZ, specifically,

3 BEGIN HIGHLY CONFIDENTIAL <\$ (IKK) vs. \$ (HBVZ) >

4 **END HIGHLY CONFIDENTIAL** for postpaid services post-merger – a consumer surplus loss

5 that is some **BEGIN HIGHLY CONFIDENTIAL** < **\$** > **END HIGHLY**

6 **CONFIDENTIAL** than the corresponding HBVZ projection. (The HBVZ and IKK consumer

7 surplus loss projections for prepaid services are quite similar, with IKK's loss projection being

8 slightly less.) Table 3 below summarizes the ALM-based consumer surplus loss projections as

9 produced by the original HBVZ and modified (IKK) merger simulations.

10

11 BEGIN HIGHLY CONFIDENTIAL <

12		Table 3			
13 14 15 16	POST-MERGER	CONSUMER WELFAR HBVZ AND IKK MO (ALM Demand Mo	RE LOSS DELS del)	PROJECTIONS	
17	Post-Merger Consumer Surplus Loss				
18	Service Category	HBVZ		ikk	
19	Postpaid	\$		\$	
20	Prepaid	\$		\$	
21	Total	\$		\$	
22	Source:	•			
23	> END HIGHLY CONFIDEN	TIAL			

24

25 30. For whatever reason, the IKK model output using the PC-AIDS demand model (Figures

26 4 and 5) does not provide a corresponding consumer surplus calculation. However, the larger

27 price increases that the IKK model projects using the PC-AIDS demand model will result in an

28 even smaller consumer benefit. As a result, the consumer surplus loss projections using PC-



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AIDS are likely to be even worse than for ALM. Thus, despite IKK's repeated assurances that
 the merger is "consumer welfare enhancing" and as such will result in net consumer benefits,
 IKK's own model confirms HBVZ's conclusion that the merger will be harmful to consumers
 overall.

5

6 31. The theory upon which IKK bases its contention that the merger would be "welfare enhancing" appears to look to the combined effects upon both consumer surplus and producer 7 surplus. "Producer surplus" is the excess of producer revenues over costs. An increase in prices 8 9 and/or a decrease in operating costs will boost producer surplus. The combination of consumer 10 surplus plus producer surplus constitutes the total value added by the economic activity – the production of wireless telecommunications services in this instance. In highly competitive 11 12 markets, the producer surplus component of the total welfare gain is limited by competition, and 13 consumers realize the bulk of the total value added. In more monopolistic markets, producers 14 are able to capture the lion's share of the total welfare gain. However, from IKK's standpoint, as 15 long as the gain in producer surplus exceeds the loss in consumer surplus, the merger could 16 argulably be deemed "welfare enhancing" in a macroeconomic sense, even if consumers are 17 made worse off as a result. Based upon IKK's projection of post-merger consumer surplus in 18 the postpaid market, IKK has actually shown that this merger would be even worse for 19 consumers than HBVZ had initially predicted.

20

32. The upward pricing effects of the merger persist throughout the various IKK demand
simulations. When using the PC-AIDS demand simulation, IKK projects that the price of Sprint



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prepaid services will increase from **BEGIN HIGHLY CONFIDENTIAL** < \$ 1 to \$ 2 END HIGHLY CONFIDENTIAL and postpaid services will increase from **BEGIN HIGHLY** 3 CONFIDENTIAL < \$ to \$ > END HIGHLY CONFIDENTIAL. In addition, IKK projects the prices of T-Mobile prepaid services to increase from **BEGIN HIGHLY** 4 5 CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL pre-merger to BEGIN 6 HIGHLY CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL post-merger, while the postpaid service price will increase from **BEGIN HIGHLY CONFIDENTIAL** < \$ 7 > END HIGHLY CONFIDENTIAL.²⁴ These price increases are notably even larger 8 to \$ 9 than under the ALM demand simulation. This is most likely the reason that when using the PC-10 AIDS demand, consumer surplus numbers are not reported. 11 12 33. Economists tend to talk about "total welfare" as a singular object as if trade-offs between 13 consumers and producers make no difference, but it is important to realize that harm to the 14 consumer is the object of this analysis, and gains to the merging companies at the expense of 15 consumers is not an acceptable basis for assessing consumer benefit. 16 The putative "service quality" improvements that form the basis for IKK's "quality 17 adjusted prices" are primarily confined to increases in download speeds, yet this particular 18 service attribute receives little to no attention in any of Sprint's or T-Mobile's marketing 19 and advertising. 20 21 22 34. From a customer's perspective, the "quality" of their wireless service has multiple 23 dimensions – the handset, coverage area, data usage allowance, overage charges or other

^{24.} Replication of HBVZ PCAIDS.xlsx, Sheet "postpaid_outcome" & Sheet "prepaid_outcome"



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1	restrictions that may kick-in once the usage allowance has been reached, the download and				
2	upload data rates, and other service features, such as international voice and/or data roaming,				
3	included video streaming services (e.g., Netflix, Hulu, Amazon Prime), and even in-flight use,				
4	among others. For example, as described on T-Mobile's website (see Figure 6 below),				
5	"T-Mobile ONE" service includes the following features: "Unlimited talk, text, and data;				
6	Standard Netflix included; Taxes & fees included; Texting & data abroad; Free stuff every week;				
7	Free texting from Gogo when you fly; Talk, text & data in Mexico & Canada; Mobile hotspot				
8	data included." ²⁵ And among the "Free stuff every week" that is included in the T-Mobile ONE				
9	feature package is this one:				
10 11 12 13 14	a "Free taco. Anytime. Customers get a free Taco Bell taco every week, at any time, with the T-Mobile Tuesdays app. Whether crunchy or soft, we know one thing's certain—tacos are life." ²⁶				
15	Notably, the single product attribute – download transmission speed (data rate) – that is the				

16 central focus of the IKK Model and the basis for its claim that the merger will result in an
17 increase in service quality for which customers will be willing to accept an increase in the dollar
18 price of their service, *is not even included in the feature list for T-Mobile ONE service*.

19

20

^{26. (}accessed 3/18/19) https://www.t-mobile.com/offers/t-mobile-tuesdays?icid=WMM_TM_SB53_EFKLZSREC55SVD9J916174_HP



^{25.} https://www.t-mobile.com/cell-phone-plans?icid=WMM_TM_DEVITO_T7OK1SN9U14432 (accessed 3/18/19).

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Figure 6. T-MobileONE service features (accessed 3/25/19).

1 35. For products and services like mobile wireless that involve multiple product attributes, 2 identifying the specific incremental value that can be ascribed to any one of them, such as 3 download speed (the focus of the IKK Model), requires complex analysis. There are, in fact, 4 well-known and widely accepted statistical and analytical techniques for teasing out or 5 quantifying the specific incremental "value" of individual service quality attributes such as download speed. However, IKK have not chosen to employ any of these methods in their 6 7 attempt to monetize, in post-merger New T-Mobile's "quality-adjusted" prices, the effect of any 8 specifically merger-driven download speed improvement that would putatively become available 9 only with the merger.

10



IKK's attempt to monetize the purported "service quality improvements" that the Joint Applicants attribute to the merger is based upon an inapposite study of fixed wired broadband rather than upon widely-accepted techniques for performing this type of analysis.

5

36. Turning back to the matter of monetizing the purported "quality" improvements that are 6 7 being ascribed to the merged New T-Mobile, Dr. Israel utilized a methodology adapted from a 8 2016 study of *wired* broadband service quality that was based upon 2012 data the study's authors 9 had obtained from an unidentified fixed wired broadband Internet Service Provider (ISP). What 10 Dr. Israel and his colleagues have done is to essentially ignore all product attributes other than monthly usage allowance and download speed (data rate), and to apply an analytical approach 11 12 adapted from a 2016 paper that examined consumer willingness-to-pay with respect to two 13 specific product attributes of *fixed wireline broadband Internet access* -(1) usage allowance (gigabytes (GB) per month) and download speed (megabits (Mb) per second).²⁷ The data that 14 the authors had utilized was from 2012, and encompassed only fixed wired broadband Internet 15 16 access services and no mobile broadband services at all. The authors explain that "[a]t the core 17 of the paper is a data set we secured from an Internet Service Provider (ISP). The data include 18 information on hour-by-hour Internet usage for roughly 55,000 subscribers facing different price 19 schedules. We also know plan-specific variables (speed, prices, etc.)²⁸ The authors do not identify the ISP, nor do they offer any basis for assuming that the particular unidentified ISP 20 21 from which they had obtained their data is representative of the fixed wired broadband market

^{27.} Aviv Nevo, John L. Turner, and Jonathan W. Williams, "Usage-Based Pricing and Demand for Residential Broadband," *Econometrica*, Vol. 84, No. 2 (March, 2016), at 411–443 (hereinafter, *Nevo et al.*).

^{28.} Id., at 412.
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1	nationally, other than offering a passing observation that "[t]he residents of these four markets
2	had per-capita income of \$47,592 in 2011, relative to \$45,222 for residents in all U.S.
3	metropolitan markets." ²⁹ Among the things that the authors do not disclose (if they had even
4	bothered to find out) is the technology being utilized by this unidentified ISP – DSL, hybrid
5	fiber/copper, hybrid fiber/coax, FTTN, FTTP – to provide its broadband Internet access service.
6	The authors also fail to disclose the four specific markets from which their data had been
7	obtained, the number of competing broadband service providers in each of these four markets,
8	the penetration rate of the unidentified ISP's service in each of these markets, or any other
9	service or market attributes that should have been controlled for in any "study" of this nature.
10	
11	37. Despite these obvious shortcomings of the Nevo et al "study," IKK seek to dismiss the
12	inapplicability of this clearly inapposite and, by current technology standards, ancient data by
13	suggesting – but with absolutely no support – that their
 14 15 16 17 18 19 20 21 22 23 	quantification of valuations of quality improvements developed from <i>Nevo et al.</i> is likely quite conservative for at least three reasons. First, <i>Nevo et al.</i> 's results are based on data from 2012 and, thus, likely do not capture the continuing increase in consumer valuation of higher network speeds even as of today, let alone for 2021-2024. This problem is partially ameliorated by the fact that the paper analyzed wired broadband networks, which have much higher levels of speed and per-subscriber usage than do mobile wireless networks today. As a result, valuations based on wireline networks may capture some of the increased benefits on speed on future wireless networks. But given that <i>Nevo et al.</i> 's findings are based on data that are now several years old, and given the huge
24	increases in network performance associated with 5G, these estimates are still likely to





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underestimate the valuation that consumers in future years, with a more developed
 application ecosystem, will place on the proposed merger's throughput increases.³⁰

38. What is far more "likely" is that IKK's "quantification of valuations of quality improvements developed from *Nevo et al.*" is simply wrong. This overly simplistic notion that a study based upon 2012 data from an identified wired broadband ISP provides a *conservative* assessment of 2021-24 conditions in the *mobile wireless* broadband market is fundamentally wrong on a number of levels:

9

10 First, IKK's extrapolation overlooks in its entirety the fundamentally different uses that consumers make of their wired and wireless broadband services. Wired broadband service is 11 12 shared among all household members. If several users in the household are concurrently 13 engaged in downloading videos or in other high-bandwidth-using activities such as online 14 games or video chats, the available upload and download speed capacity is divided up among 15 them. For the typical data rates available for wired broadband in 2012 (which Nevo et al. put at 15 Mb/s).³¹ these multiple concurrent uses would frequently result in deterioration in the 16 user experience, as interruptions and "buffering" messages would occur when bandwidth was 17 18 not sufficient to support total combined household demand. In the case of mobile services, 19 while family members may share the total usage allowance for the family plan, they do not 20 compete with each other for concurrent download capacity. Hence, the download speed

- 30. IKK FCC Decl., at para. 134.
- 31. Nevo et al., at 412.



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requirements of a single wireless handset will be less than the concurrent wired broadband
 download capacity needed for a family of users.

3

Second, fixed broadband services – moreso today than in 2012 – are used most heavily for 4 5 streaming video-on-demand ("VOD") servides from such providers as Netflix, Hulu, 6 Amazon Prime, YouTube and others, as customers migrate away from cable-based linear 7 video and over to VOD streaming. Demand for high-data rate fixed wired broadband has 8 been driven by the proliferation of large flat-screen TVs, including 1080p HDTV and most 9 recently, 4K sets with sizes ranging to 60 inches or more. Mobile handsets – even the largest 10 ones such as the iPhone XS Max with a screen size of just under 16 square inches – are a minuscule fraction of the size of a flat screen TV. For example, Apple's iPhone XC Max, a 11 12 6.5-inch mobile handset, has a viewable surface area of roughly 15.9 square inches. A 60-13 inch flat screen TV has a total viewable surface area of approximately 1,536 square inches – 14 nearly 100 times as large. In terms of what is "likely" – to use IKK's term – it is far more 15 likely that users of fixed wired broadband would place far greater value upon download 16 speed to provide high-quality video on large screen 4K TVs than would mobile users with small screen handsets ascribe much incremental value in order to achieve marginal 17 improvement in image quality that might theoretically come from faster downloads. 18

19

Third, for the vast majority of consumers, mobile broadband is an adjunct to their fixed in home wired broadband Internet access service. Unlike the case of voice telephone service,
 where large numbers of consumers have "cut the cord" with respect to their landline service



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1		and rely solely upon mobile wireless for voice communication, there is no evidence of any
2		consequential "cord-cutting" of household fixed wired broadband Internet access in favor of
3		mobile. According to the most recent FCC data, the overall adoption (subscription) rate for
4		fixed terrestrial broadband services with advertised speeds of at least 10 Mbps download/1
5		Mbps upload had increased from 43.1% in 2012 to 63.2% by 2016. ³² Over that same period
6		of time, the FCC cites CTIA estimates of total mobile wireless connections in the US as
7		increasing from 326.5-million in 2012 to 395.9-million in 2016. ³³ Since most, perhaps
8		nearly all, households that subscribe for fixed wired broadband Internet access also subscribe
9		for mobile wireless service, it is more than just "likely," it is a near certainty, that these
10		services perform decidedly different – and complementary – functions for their users. Users
11		have no expectation – nor do they have any requirement – that their mobile broadband
12		provide download speeds that are comparable to what is available with fixed wired
13		broadband.
14		
15	•	Fourth, whether or not Nevo et al.'s focus upon consumer responses to usage caps is 2012
16		(the time period of the data that formed the basis of their analysis) was reflective of actual
17		conditions extant at that time, it is certainly not applicable today. As I mentioned earlier, the
18		authors offer no evidence or other bases demonstrating that the particular unidentified ISP

^{32.} FCC, *I/M/O Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, *2018 Broadband Deployment Report*, Rel. February 2, 2018, atTable 11, p. 40.

^{33.} FCC, *I/M/O Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, WT Docket No. 17-69, *Twentieth Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Rel. September 27, 2017. Chart II.B.1, Total Mobile Wireless Connections 2008-2016, at p. 12.



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1 and the four unidentified markets from which the data for the Nevo et al. study had been 2 obtained was actually representative of the national broadband market in 2012 or, for that 3 matter, even today or in 2021-24. And there is a strong basis to conclude that it was anything but representative. According to *Nevo et al.*, "approximately eighty percent of subscribers" 4 5 have a positive probability of incurring overage charges and would be willing to pay to increase their allowance if given the opportunity."³⁴ This conclusion is so far-fetched that it 6 7 raises serious questions as to the credibility and relevancy of the dataset upon which the *Nevo et al* study was based. *Nevo et al.* report that, according to the data they studied, "[t]he 8 median household uses 24 GB of data per month."³⁵ ARS Technica recently reported that 9 "Comcast imposed 300GB data caps in 2012, and raised the monthly cap to a terabyte in 10 11 2016. Customers who go over 1TB are charged \$10 for each additional block of 50GB, up to 12 a maximum of \$200 a month. Comcast lets customers avoid overage fees by purchasing unlimited data for an extra \$50 a month."³⁶ Moreover, the same article notes that "Comcast 13 14 says that 'more than 99 percent of our customers do not use 1 terabyte of data³⁷ and hence 15 do not incur any overage charges. *Nevo et al.* state that 80% of the subscribers whose data 16 they analyzed incurred overage charges, whereas Comcast – the largest ISP in the US – says 17 that less than 1% of its customers incur overage charges. The assumption that 80% of

37. Id.



ata-cap-fees/ (accessed 3/25/19)

^{34.} Nevo, at 434.

^{35.} Id., at 413.

^{36.} Jon Brodkin, "Terabyte-using cable customers double, increasing risk of data cap fees," *ars Technica*, 1/23/2019, https://arstechnica.com/information-technology/2019/01/terabyte-using-cable-customers-double-increasing-risk-of-d

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1 customers incur overage charges is fundamental to the entire Nevo et al. result that forms the 2 basis for IKK's extrapolation. *Nevo et al.* analyze consumer responses to what they refer to as "shadow" usage-sensitive prices that would be imposed once a fixed usage "cap" has been 3 exceeded. But if somewhere near 99% of customers do not exceed their data caps, the 4 5 "shadow price" for those customers is essentially zero. We do not know the source of the 6 *Nevo et al* data, but the notion that some 80% or more of broadband customers exceed their 7 monthly data caps compels a strong conclusion that either the authors' analysis of their data 8 is erroneous or that the dataset is grossly unrepresentative of reality. And *Nevo et al*'s 9 conclusion that "there is substantial variation in the preference for speed across consumers 10 [and that] [t]he willingness to pay to improve speed by 1Mb/s ranges from nearly zero to just over \$5; the average is 2.02 and the median is 2.48^{38} is hardly definitive of anything. 11

12

13 Finally, whether or not consumers of wireless broadband view download speed as a principal 14 component of value, wireless carriers themselves place little or no emphasis upon this 15 particular attribute in their marketing and advertising, as illustrated in Figure 6 above. As 16 Figures 7 and 8 below demonstrate, providers of fixed wired broadband Internet access 17 (Comast and Verizon in these examples) price their services in terms of download speeds, 18 not usage caps, and don't even mention data caps except perhaps in the "fine print." 19 Providers of wireless broadband Internet access services focus their marketing and 20 advertising on usage caps and a variety of other service features, not download speeds.



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^{38.} Nevo et al., at 434.

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1 39. IKK's misplaced reliance upon the Nevo et al. fixed wired broadband analysis is critical 2 to IKK's attempt to translate the increased download speeds that T-Mobile's engineering model 3 ascribes to the merger into a service quality adjustment to what would otherwise be price increases post-merger. Yet by basing their entire "quality-adjusted price" analysis upon an 4 5 entirely inapposite model, and by limiting their own focus upon "service quality" to essentially a 6 single – and not particularly important – product attribute, IKK's downward "quality-adjusted price" projections are utterly lacking in credibility. And in the absence of any sort of credible 7 demonstration that the merger will actually result in lower "quality-adjusted prices" that will be 8 9 perceived as such by consumers, the Joint Applicants' attempt to portray the merger as pro-10 competitive and pro-consumer must be rejected.

11

Widely-accepted scientific methods for quantifying or "monetizing" the value that consumers ascribe to individual product or service attributes do exist, but were not used by IKK in supporting their contention that post-merger increases in download speeds will be perceived by consumers as being greater in value than the dollar increases in price that they will be required to pay.

17

40. As I stated earlier (at para. 14), there are scientific analytical techniques for assessing the combined value of all service quality attributes, as well as isolating the specific effects of modifying (either improving or degrading) any one of them. However, Dr. Israel and his IKK collaborators did not utilize any of these widely accept analytical methods. Attachment A to this Declaration provides a summary of the two principal techniques – *Hedonic Regression Analysis* and *Conjoint Analysis*. Thus, instead of confining their analysis to only a single service attribute (download speed) whose importance to consumers is not affording much, if any, weight in their



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clients' marketing, advertising and pricing, Dr. Israel and his colleagues could have utilized
either or both of these two widely-accepted approaches to evaluating the numerous attributes of
wireless services and, in particular, to separate out the effects of different download speeds from
the various other price-influencing service attributes such as those I enumerated above. By their
failure to apply the correct analytical technique to the econometric problem they were seeking to
address, IKK has overstated the relative importance of download speed and, in so doing, has
attributed consumer and competitive benefits to the proposed merger that simply do not exist.

9 The county-level 5G deployment projections provided by Mr. Ray are not credible and 10 present a misleading and grossly exaggerated picture of the effects of the proposed merger 11 upon the availability of 5G service in rural areas in California. 12

13 41. The Commission has long been concerned about assuring the availability of state-of-the-14 art broadband services – both fixed and mobile – to the more sparsely populated rural communi-15 ties in California. Providing services to rural areas does present certain technical challenges, but 16 the principal impediments to ubiquitous rural service deployment are primarily economic in nature. Large expanses of sparsely populated land area – sometimes including mountainous 17 18 terrains – require large infrastructure investments whose costs are difficult to recover from the 19 relatively small populations that such infrastructure would serve. The investments required to 20 serve rural communities are thus far more difficult to justify on financial grounds than for the 21 more densely developed urban and suburban areas. In many cases, the potential revenues that 22 might be generated in rural areas are simply insufficient to permit the carrier to recover its up-23 front capital outlays and ongoing operating expenses. And even where such an investment might 24 be marginally profitable, the potential return on comparable infrastructure builds in more densely



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populated areas are far greater and will be afforded greater priority by the carrier when
evaluating competing construction proposals. Despite their rhetoric regarding plans to extend
5G service to rural areas, the Joint Applicants have failed to provide any demonstration that the
fundamental economics of such undertakings, except perhaps at the margins, will be materially
altered by the proposed merger .
42. In his January 29, 2019 Rebuttal Testimony, Mr. Ray asserts that

8 9 ... the benefits of New T-Mobile's 5G network in terms of coverage, speed, and capacity 10 - and all the potential consumer uses which depend on those metrics - are simply not possible without the combination of spectrum and other assets created by the merger. 11 12 T-Mobile and Sprint, as standalone entities, do not have the spectrum, the sites, or the 13 resources to create a network that would so significantly alter the wireless landscape as New T-Mobile. On its own, T-Mobile's 5G network would have good coverage but 14 relatively limited capacity, while Sprint's 5G network would have capacity but very 15 16 limited coverage. And neither company has a business case comparable to New 17 T-Mobile's to expand service to rural and less densely-populated areas because their 18 costs 1 for doing so would be much higher than New T-Mobile's and their customer base is much smaller.³⁹ 19

20

21	The term "business case" is generally understood to refer to a financial analysis whose purpose
22	is to determine that a proposed capital investment will be profitable, that the overall return on
23	that investment will be sufficient to achieve the firm's objective "hurdle rate" that will be
24	capable of fully recovering the capital investment and the firm's cost of capital as adjusted for
25	risk and illiquidity. Mr. Ray's explicit reference to New T-Mobile's "business case" prompted
26	the Public Advocates Office to propound the following data request:

39. Ray, Rebuttal testimony, at 3-4.



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1 Provide copies of all capital budgeting "business case" type analyses or studies that have 2 been undertaken in connection with the 5G coverage projections presented in Attachment 3 D to Mr. Ray's January 7, 2019 Rebuttal Testimony. Indicate, for each, the time frame(s) 4 for investment recovery that has been utilized in these capital budgeting "business case" 5 type analyses, the anticipated revenue flows over such time frame(s), the projected rate of 6 return on investment from each such undertaking, the minimum rate of return or "hurdle 7 rate" that the responding company requires for approval of such capital investments, and 8 all other relevant factors that enter into the capital investment approval process. 9 10 In its initial Response to this request, T-Mobile stated multiple objections, among which was the 11 claim that "this Data Request ... seeks information which does not exist. ... T-Mobile does not project capital expenditure at this level or even on a basis that aligns with state boundaries" 40 – a 12 13 remarkable claim that cannot be squared with the highly detailed and specific coverage projections that were testified to by Mr. Ray. Following ALJ Bemesderfer's March 25, 2019 14 15 ruling granting Public Advocates Office's Motion to Compel, T-Mobile issued a Supplemental 16 Response in which in stated that: 17 18 ... T-Mobile responds that it does not have capital budgeting "business case" type 19 analyses or studies that have been undertaken in connection with the 5G coverage 20 projections presented in Attachment D to Mr. Ray's January 7, 2019 Rebuttal Testimony. 21 22 In one sense, this response, while remarkable in light of Mr. Ray's testimony and the extra-23 ordinary specificity that he has provided in his Attachment D 5G coverage maps, is hardly 24 surprising. The merger cannot and will not overcome the economic challenges to rural 25 deployment. T-Mobile's failure to develop business case capital budgeting analyses to demonstrate that such deployment will be financially feasible, or its continued refusal to provide 26

^{40.} T-Mobile Response to Public Advocates Office DR 11-1, dated April 5, 2019.



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any such analyses, compels no conclusion other than that there is no business case that could
 support the kind of 5G coverage that Mr. Ray's maps are intended to "illustrate," merger or no
 merger.

4

43. In its Supplemental Response to Public Advocates Office Data Request 11, T-Mobile
has provided what it describes as "a directional estimate of standalone T-Mobile's projected cell
site-related network capital expenditures at the county level for California for the periods
2019-2021 and 2022-2024" and has explained that "[t]his estimate was created based on known
site upgrades and estimates of additional capital expenditures using drivers of those investments."⁴¹ Figure 9 reproduces T-Mobile's DR 11-1 Response, showing its projected merged and
stand-alone T-Mobile cell site investments by county through 2024.

12

13 44. Mr. Ray's Attachment D also included county-level maps purporting to show 5G 14 coverage projections for stand-alone Sprint for 2021 and 2024. No Sprint witness was offered to 15 sponsor those maps. In Data Requests 11-3 and 11-4, T-Mobile was asked to "[p]rovide the 16 dollar amount of the investment that standalone Sprint projects it will make in 5G facilities to 17 achieve the 5G coverage shown on the map for each California county through and including the time frame identified as "2021" [Request 11-3] and "2024" [Request 11-4]. T-Mobile's 18 19 Supplemental Response to both Data Requests was that "to the extent such information exists, it 20 does not have the requested information."

^{41.} T-Mobile Supplemental Response to Public Advocates Office Data Request 11-1, dated April 5, 2019.



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Figure 9, page 1. T-Mobile Response to Public Advocates Office DR-11. HIGHLY CONFIDENTIAL



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Figure 9, page 2. T-Mobile Response to Public Advocates Office DR-11. HIGHLY CONFIDENTIAL



1

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1 45. Using the projected investment data provided by T-Mobile, I have tabulated on Table 4 2 below the projected 2024 T-Mobile post-merger cell site investments for the 30 least populous 3 California counties. For these 30 counties which collectively represent 46.8% of the total land area of California and 5.24% of the state's population, New T-Mobile projects cell site capital 4 5 investments through 2024 at **BEGIN HIGHLY CONFIDENTIAL < \$** , about 6 %> END HIGHLY CONFIDENTIAL of the statewide total projected 5G investment. On 7 Table 5, I have tabulated the projected 2024 T-Mobile post-merger cell site investments for the 28 largest (by population) California counties. For these 28 counties which collectively 8 9 represent 53.2% of the total land area of California and 94.8% of the state's population, New T-10 Mobile projects cell site capital investments through 2024 at **BEGIN HIGHLY** 11 CONFIDENTIAL < \$, representing %> END HIGHLY CONFIDENTIAL of the

12 projected statewide total 5G cell site investment.



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Table 4

NEW T-MOBILE PROJECTED 2019-2024 COUNTY-LEVEL INVESTMENT IN 5G COVERAGE 30 SMALLEST COUNTIES (BY POPULATION)

		Percent of		Percent of	New T-Mobile	Percent of Total
COUNTY	POPULATION	Total State	AREA	Total State	5G Investment	Investment
Alpine	1,120	0.003%	738	0.473%		
Sierra	2,999	0.008%	953	0.611%		
Modoc	8,859	0.022%	3,918	2.513%		
Trinity	12,709	0.032%	3,179	2.039%		
Mono	14,168	0.036%	3,049	1.956%		
Mariposa	17,569	0.044%	1,449	0.930%		
Inyo	18,026	0.046%	10,181	6.531%		
Plumas	18,742	0.047%	2,553	1.638%		
Colusa	21,805	0.055%	1,151	0.738%		
Del Norte	27,470	0.069%	1,006	0.645%		
Glenn	28,094	0.071%	1,314	0.843%		
Lassen	31,163	0.079%	4,541	2.913%		
Amador	38,626	0.098%	595	0.382%		
Siskiyou	43,853	0.111%	6,278	4.027%		
Calaveras	45,670	0.116%	1,020	0.654%		
Tuolumne	54,248	0.137%	2,221	1.425%		
San Benito	60,310	0.153%	1,389	0.891%		
Tehama	63,926	0.162%	2,950	1.892%		
Lake	64,246	0.162%	1,256	0.806%		
Yuba	77,031	0.195%	632	0.405%		
Mendocino	88,018	0.223%	3,506	2.249%		
Sutter	96,648	0.244%	602	0.386%		
Nevada	99,814	0.252%	958	0.615%		
Humboldt	136,754	0.346%	3,568	2.289%		
Napa	140,973	0.357%	748	0.480%		
Kings	150,101	0.380%	1,389	0.891%		
Madera	156,890	0.397%	2,137	1.371%		
Shasta	179,921	0.455%	3,775	2.422%		
Imperial	182,830	0.462%	4,177	2.680%		
El Dorado	188,987	0.478%	1,708	1.096%		
5G Investment not s	separately stated					
TOTALS	2,071,570	5.24%	72,941	46.79%		
CALIFORNIA	39,536,653	100.00%	155,879	100.00%		

Source: T-Mobile Supplemental Response to Public Advocates Office DR-11.

NOTE 1: T-Mobile Investments in these nine counties were not separately stated, but were combined on line captioned "5G investment not separately stated."

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Table 5

NEW T-MOBILE PROJECTED 2019-2024 COUNTY-LEVEL INVESTMENT IN 5G COVERAGE 28 LARGEST COUNTIES (BY POPULATION)

		Percent of		Percent of	New T-Mobile	Percent of Total
COUNTY	POPULATION	Total State	AREA	Total State	5G Investment	Investment
Yolo	219,116	0.554%	1,015	0.651%		
Butte	229,294	0.580%	1,636	1.050%		
Marin	260,955	0.660%	520	0.334%		
Merced	272,673	0.690%	1,935	1.241%		
Santa Cruz	275,897	0.698%	445	0.285%		
San Luis Obispo	283,405	0.717%	3,299	2.116%		
Placer	386,166	0.977%	1,407	0.903%		
Monterey	437,907	1.108%	3,381	2.169%		
Solano	445,458	1.127%	822	0.527%		
Santa Barbara	448,150	1.134%	2,735	1.755%		
Tulare	464,493	1.175%	4,824	3.095%		
Sonoma	504,217	1.275%	1,576	1.011%		
Stanislaus	547,899	1.386%	1,495	0.959%		
San Joaquin	745,424	1.885%	1,391	0.892%		
San Mateo	771,410	1.951%	448	0.287%		
Ventura	854,223	2.161%	1,843	1.182%		
San Francisco	884,363	2.237%	47	0.030%		
Kern	893,119	2.259%	8,132	5.217%		
Fresno	989,255	2.502%	5,958	3.822%		
Contra Costa	1,147,439	2.902%	716	0.459%		
Sacramento	1,530,615	3.871%	965	0.619%		
Alameda	1,663,190	4.207%	739	0.474%		
Santa Clara	1,938,153	4.902%	1,290	0.828%		
San Bernardino	2,157,404	5.457%	20,057	12.867%		
Riverside	2,423,266	6.129%	7,206	4.623%		
Orange	3,190,400	8.069%	791	0.507%		
San Diego	3,337,685	8.442%	4,207	2.699%		
Los Angeles	10,163,507	25.707%	4,058	2.603%		
TOTALS	37,465,083	94.76%	82,938	53.21%		
CALIFORNIA	39,536,653	100.00%	155,879	100.00%		

Source: T-Mobile Supplemental Response to Public Advocates Office DR-11.

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The level of rural 5G coverage that T-Mobile claims it will provide if the merger is approved will require far more capital investment than T-Mobile has projected, and is unlikely to be pursued because it is unlikely to be profitable with or without the merger.

5 46. T-Mobile has indicated that it does not have any sort of county-specific business case capital budgeting analyses. However, it is possible to develop a rough estimate of the potential 6 7 profitability of providing the rural 5G coverage that Mr. Ray has projected. In its Supplemental 8 Response to Public Advocates Office DR-11 (reproduced in Figure 9 above), T-Mobile has 9 provided county-specific cell site capital investment projections both for post-merger New T-10 Mobile and for no-merger stand-alone T-Mobile. In his rebuttal testimony, Mr. Ray provides an 11 example of the type of rural 5G coverage that he asserts would be forthcoming if the merger 12 goes forward. For this he has selected Kings County, which has a total area of 1,389 square 13 miles and a population of about 150,000. According to Mr. Ray's 2024 5G coverage maps for 14 Kings County (reproduced below in Figure 10), New T-Mobile projects near-100% mid-band 5G 15 coverage in Kings County by 2024 – actually, mostly by 2021. Without the merger, stand-alone 16 T-Mobile would provide only low-band and no mid-band 5G coverage at all in Kings County.



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1 47. Mr. Ray testifies that the 5G propagation radius around a cell site for mid-band spectrum is four (4) miles.⁴² The area of a circle with a 4-mile radius can be calculated by the formula 2 $A=\pi r^2$). However, because circles must necessarily overlap so as to avoid any gap in coverage, a 3 4 more accurate measure of effective coverage per cell site is the area of a hexagon drawn within 5 the circle of 4-mile radius. This is calculated by the formula $A=s(3\sqrt{3})/2$, where s is the length 6 of a side of the hexagon, 4 miles in this case. From this, we can estimate the effective non-7 overlapping coverage per mid-band cell site at 41.57 square miles, which implies that full wallto-wall mid-band 5G coverage of Kings County requires approximately 33.4 cell sites (i.e., 1,389 8 9 / 41.57).

10

48. Public Advocates Office witness Cameron Reed advises that T-Mobile and Sprint 11 currently maintain **BEGIN HIGHLY CONFIDENTIAL < and > END HIGHLY** 12 13 **CONFIDENTIAL** cell cites, respectively, in Kings County. If the merger is approved, **BEGIN HIGHLY CONFIDENTIAL <** > END HIGHLY CONFIDENTIAL of these sites will be 14 decommissioned, and the merged New T-Mobile will retain a total of **BEGIN HIGHLY** 15 **CONFIDENTIAL** < > END HIGHLY CONFIDENTIAL cell sites in the County.⁴³ 16 However, these cell sites are in no sense uniformly distributed. A number of them have been 17 placed along the I-5 corridor, and others are concentrated in the principal population centers of 18 19 Lemoore and Hanford. Additionally, while Mr. Ray states that mid-band cell sites are able to

43. C. Reed Suppl. Decl., Att. 5, at 59-60.



^{42.} Ray rebuttal, at 13.

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1	cover a radius of 4 miles and low-band sites can reach as much as 18 miles or more, ⁴⁴ the
2	existing cell sites in Kings County – the ones that would be retained following the merger – are
3	considerably closer – in some cases as close as 4-5 miles – suggesting an actual coverage radius
4	of approximately 2 to 2.5 miles. Figure 11 below provides a map of Kings County with the
5	locations of the BEGIN HIGHLY CONFIDENTIAL < > END HIGHLY
6	CONFIDENTIAL cell sites that would be retained by a merged New T-Mobile.
7	
8	49. It is not at all clear how this on-the-ground reality squares with Mr. Ray's testimony
9	regarding cell site coverage distances. As is evident from Figure 11, there are vast portions of
10	Kings County that fall well outside of the coverage ranges of these existing cell sites. I have
11	calculated the combined coverage areas of these cell sites at approximately 360 square miles. ⁴⁵
12	This leaves 1,029 out of the 1,389 square mile total Kings County area unserved. Thus, an
13	additional 24.75 cell sites would still be needed (again, based upon a 4-mile coverage radius
14	providing 41.57 square miles of coverage) to achieve the wall-to-wall 5G mid-band coverage
15	being promised by Mr. Ray if the merger goes forward.
16	

17

^{45.} This calculation assumed coverage ratios sufficient to achieve continuous coverage with adjacent cell sites up to a maximum propagation radius of 4 miles. Thus, if two cell sites were 3 miles apart, the coverage area calculation was based upon a propagation radius of 1.5 miles. For cell sites further than 8 miles apart, I used Mr. Ray's 4-mile radius, which resulted in coverage gaps. Overlaps in coverage among adjacent cells were subtracted from the total to avoid double-counting.



^{44.} Ray rebuttal, at 13.

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Figure 11. Locations of existing Sprint and T-Mobile Kings County, California cell sites to be retained by New T-Mobile post-merger.

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1 50. In a December 18, 2018 written *ex parte* submission to the FCC, counsel for T-Mobile 2 provided certain unit Capex and Opex cost estimates for various network upgrade components both for a stand-alone and for a merged T-Mobile.⁴⁶ This submission provides unit capital 3 investment costs for 5G and mid-band upgrades for existing cell sites, and for "Cell Splits w/ 4 2.5G and 600M plus AWS/PCS." A "cell split" is basically an additional cell site located nearby 5 an existing cell site that provides additional capacity when needed due to traffic demand. Cell 6 7 splitting is not common in rural areas due to the limited capacity demands, so if anything the 8 "cell split" cost understates the cost of creating a new cell site that does not presently exist. 9 MNOs typically do not own the towers, choosing instead to lease space on towers owned by 10 third-party companies such as American Tower Corp. that specialize in building and leasing 11 towers and tower space to mobile carriers. The T-Mobile FCC document puts the unit cost of a 5G/mid-band upgrade at **BEGIN HIGHLY CONFIDENTIAL <** \$ 12 > END HIGHLY 13 **CONFIDENTIAL** and for a 5G "cell split" capable of supporting both 600 MHz and 2.5 GHz spectrum at **BEGIN HIGHLY CONFIDENTIAL** < \$ 14 > END HIGHLY **CONFIDENTIAL** plus **BEGIN HIGHLY CONFIDENTIAL** < 15 and \$ > END HIGHLY CONFIDENTIAL in annual operating expenses, respecitvely.⁴⁷ Thus, in order to 16 serve Kings County as Mr. Ray has projected, New T-Mobile would need to invest some 17 18 **BEGIN HIGHLY CONFIDENTIAL < \$** > END HIGHLY CONFIDENTIAL to 19 upgrade existing cell site to 5G/mid-band plus **BEGIN HIGHLY CONFIDENTIAL <** §

^{47.} The capex for stand-alone T-Mobile is slightly higher, at **BEGIN HIGHLY CONFIDENTIAL** < \$371,600 > **END HIGHLY CONFIDENTIAL**. Also not specified in the T-Mobile submission, the Opex likely includes annual payments for leased tower space and for backhaul facilities leased from other telecommunications carriers.



^{46.} December 18, 2018 letter to Marlene H. Dortch, Secretary, Federal Communications Commission from Nancy Victory, counsel for T-Mobile, at Tables 1 and 2.

END HIGHLY CONFIDENTIAL on additional 5G cell sites, for a total of BEGIN HIGHLY CONFIDENTIAL < > > END HIGHLY CONFIDENTIAL in Kings County by 2024. 51. Using this data together with public companywide data from T-Mobile USA's 2017

- 6 Annual Report, I have developed a simplified business case type of analysis for the purpose of
- 7 assessing the relative profitability (or, in this case, a lack thereof) of a **BEGIN HIGHLY**
- 8 **CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL** investment in Kings
- 9 County. This is summarized in Table 6 below:



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Table 6								
KINGS COUNTY 100% 5G COVERAGE								
SIMPLIFIED BUSINESS CASE ANALTSIS								
Line Description A B C Source								
1	T-Mobile 2017 companywide Service revenues					\$	30,160,000,000	2017 Annual Report, p. 24
2	Cost of service excl depre & amort			ŝ	(6,100,000,000)	Ť		2017 Annual Report p. 24
3	Sales, General and Administrative (SG&A) expenses			s	(12,259,000,000)	\vdash		2017 Annual Report p. 24
4	Equipment sales revenues	\$	9.375.000.000	Ť	(12,200,000,000)	-		2017 Annual Report, p. 24
5	Cost of equipment sold	\$	11,608,000,000					2017 Annual Report, p. 24
6	Net loss on sales of equipment			s	(2.233.000.000)			L4A - L5A
				Ť	(_,,	\vdash		
7	Depreciation and Amortization - assets other than cell sites			\$	(3,880,386,080)			L19B
8	Total service-related expenses					\$	(24,472,386,080)	L8B + L9B + L12B + L13B
9	Net operating income from services before Int & Taxes					\$	5,687,613,920	L1C + L8C
10	Total T-Mobile USA Customer connections 2017				72,585,000			2017 Annual Report, p. 24
11	Kings County, CA population 2017				150,000			US Census Bureau
12	Assume 30% New T-Mobile market penetration				45,000			L11B x 30%
	Percent of total T-Mobile companywide customers in Kings							
13	County, CA			<u> </u>	0.0620%	┡		L12B / L10B
	Kings County share of annual T-Mobile companywide						0 500 100	
14	operating income					\$	3,526,109	L9B X L13B
15	Gross T-Mobile depreciable assets	\$	46,518,209,000					2017 Annual Report, p. 76
16	2017 Depreciation expenses	\$	(5,984,000,000)					2017 Annual Report, p. 24
17	Effective average annual depreciation rate				-12.86%			L16A / L15A
18	Assets other than cell sites	\$	30, 165, 209, 000					Note 1
19	Depreciation expense, assets other than cell sites			\$	(3,880,386,080)			L17A x L18B
	Number of Sprint + T-Mobile cell sites currently in operation							C. Reed Suppl. Decl., Att. 5
20	In Kings County requiring 5G/Mid-Band upgrades					<u> </u>		at 59-60.
21	Unit Capex per 5G/Mid-Band upgrade							Note 2
22	Capital investment required for 5G/Mid-Band upgrades							L20A x L21A
23	Area of Kings County (square miles)		1,389					
04	Coverage area of existing T-Mobile and Sprint cell sites to I							0
24	be retained following merger					⊢		See para. 49
25	Currently unserved area within Kings County							1 224 - 1 234
20	Additional number of cell towers required for full 5G mid-					⊢		
26	band coverage beyond coverage of existing cell sites							L25A / 41.57
27	Unit Capex per new Mid-Band 5G cell site							Note 2
28	Capital investment required for new Mid-Band 5G cell sites							L26A x L27A
29	Total Capex for Kings County wall-to-wall 5G coverage							L22B + L28B
30	Annual depr expense on Kings County 5G plant							L17B x L29B
31	Annual Opex per upgraded 5G/Mid-Band cell site							Note 2
32	Annual Opex per new 5G Mid-Band cell site			-		-		Note 2
	Additional annual operating expenses for upgraded and							
33	33 new cell sites							
34	Total annual additional expense for Kings County							L30C + L33C
35	Net income (loss) before cost of money and taxes			⊨				140+1340
- 55								
NOTE 1: Since this model includes a depreciation expense charge associated with the Kings County 5G cell site investment, it was necessary to exclude the depreciaion expense for all T-Mobile cell sites when calculating average per-customer earnings in order to avoid double-counting. The 2017 Annual Report (p. 76) gives gross Wireless Communications Systems investment at								

\$32.706-billion. 1 have assumed that 50% of this gross plant is associated with cell sites, with the remainder associated with other equipment and facilities, such as switching systems, long-haul transport, and backhaul, among other things. Therefore, only \$16.353-billion of non-cell site Wireless Communications Systems assets are included in developing the estimate of companywide non-cell site depreciation expenses. NOTE 2: Source: December 18, 2018 letter to Marlene H. Dortch, Secretary, Federal Communications Commission from Nancy Victory, counsel for T-Mobile, at Table 2.

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As shown in Table 6, I calculated T-Mobile's companywide annual operating income (before 1 2 depreciation, interest and taxes) – a rough equivalent of EBITDA – by starting with its 2017companywide "Service Revenues" and then subtracting from this the identified service-related 3 4 operating costs as well as companywide Sales, General and Administrative ("SG&A") expenses. 5 T-Mobile's Annual Report also provides wireless equipment sales revenues and costs, and shows 6 a net loss from the sale of wireless equipment of \$2.23-billion. Since the purpose of selling (and 7 losing money on) wireless equipment is to induce customers to subscribe for service, I have 8 attributed this loss as an additional cost of service.

9

10 52. The population of Kings County is approximately 150,000. I assumed for this exercise 11 that New T-Mobile would capture 30% of the County's residents (probably an excessive 12 assumption, since the 150,000 includes infants and young children who are certainly less likely, 13 if not unlikely, to have a cell phone of their own). Applying the 30% factor, this puts 14 T-Mobile's potential Kings County customer base at about 45,000, which would then represent 15 approximately 0.062% of T-Mobile's 72.6-million customers nationwide. Multiplying total 16 service-related operating income by the percentage attributable to Kings County customers, I 17 calculated potential Kings County operating income at \$3.526-million. 18

19 53. From this I subtracted an estimate of the annual depreciation expense on the Kings
20 County 5G investment by applying the ratio of total 2017 T-Mobile depreciation expenses to



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total gross depreciable assets⁴⁸ times the company's gross depreciable assets excluding an
estimate of investments associated with cell sites.⁴⁹ I also subtracted the annual operating
expenses associated with the required 5G upgrades and the additional cell sites needed to
provide the mid-band 5G coverage as portrayed on Mr. Ray's 2024 map. The result is a *net annual loss* before interest and taxes of **BEGIN HIGHLY CONFIDENTIAL < \$ END HIGHLY CONFIDENTIAL**

7

54. In evaluating capital projects, companies typically apply a target "hurdle rate" that 8 9 represents the minimum acceptable return on investment that the firm would require in order to 10 justify a capital outlay for a specific individual project. DR 11-7 had requested that T-Mobile 11 provide its "hurdle rate" for these types of investments, but the Company declined to furnish that information. Since the result of 5G investments of the type that would be required to provide 12 13 mid-band 5G coverage for Kings County would likely result in a net loss, the matter of the appropriate "hurdle rate" is not even reached. However, hurdle rates for individual capital 14 projects in the range of 25%-30% are not uncommon, so even if these types of projects were to 15 16 result in a small net profit before interest and taxes, it is extremely unlikely that such profits

^{49.} For this purpose, I assumed that 50% of the total Wireless Communications Systems investment was associted with cell sites, with the remainder being switches, long-haul transport, backhaul, and other items.



^{48.} At page 76 of T-Mobile USA's 2017 annual report, the expected service life of wireless communications systems is given as "up to 20 years." In view of the rapidity with which wireless technology is evolving, it is highly unlikely that 5G cell site plant will have a useful like that is anywhere close to this length. For this reason, I used the average depreciation rate calculated across all T-Mobile depreciable assets is an estimate.

1 would be sufficient to reach a hurdle rate of the magnitude that would be considered

- 2 acceptable.⁵⁰
- 3

4 55. Notably, instead of attributing anything close to the **BEGIN HIGHLY**

5 **CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL** cost of full mid-band

6 3G coverage of Kings County that I have estimated based upon T-Mobile's cell site costs,

7 according to T-Mobile's response to DR 11-1, merged New T-Mobile anticipates investing only

8 BEGIN HIGHLY CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL in

9 Kings County cell sites, whereas stand-alone T-Mobile would only invest **BEGIN HIGHLY**

10 **CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL**, i.e., a differential of

11 BEGIN HIGHLY CONFIDENTIAL < \$ > END HIGHLY CONFIDENTIAL.

12 Notably, according to Mr. Ray's maps, stand-alone T-Mobile would still be providing near 100%

13 low-band 5G coverage of Kings County. Given its relatively small population of about 150,000,

14 there is no basis to conclude that the additional mid-band 5G capacity would actually provide

15 any net benefit at all to consumers in this area. But most importantly, nowhere in Mr. Ray's or

16 T-Mobile's evidence is there any basis to conclude that a positive business case exists to support

- 17 the kind of 5G coverage that Mr. Ray has projected for Kings County *or any other rural county*
- 18 *in California*. Indeed, it is entirely likely that, had the company actually undertaken to develop a
- 19 business case for this Kings County 5G coverage investment, it would almost certainly have

^{50.} For example, based upon an initial investment of **BEGIN HIGHLY CONFIDENTIAL < \$ END HIGHLY CONFIDENTIAL**, a 25% hurdle rate would likely require an annual return on investment (net of accumularted depreciation) in the range of **BEGIN HIGHLY CONFIDENTIAL < \$** to \$ **END HIGHLY CONFIDENTIAL**, To reach this level, T-Mobile would need to generate **BEGIN HIGHLY CONFIDENTIAL < END HIGHLY CONFIDENTIAL** the \$3.53-million in revenue that would be available from Kings County based upon the County's share of the nationwide T-Mobile customer base.



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concluded that it cannot be justified on economic grounds. In other words, having chosen not to
 undertake any standard capital budgeting analysis to support the coverage projections being
 portrayed by Mr. Ray, there is simply no basis for the Commission to conclude that the merger
 will materially alter the existing lack of wireless coverage in rural California.

5

6 56. Finally, since most of the existing T-Mobile and Sprint cell sites in Kings County appear 7 to have propagation radii well short of the four miles indicated by Mr. Ray, I wanted to test the 8 sensitivity of these financial results to what might well turn out to be a lot closer to the signal 9 propagation distances that are more like those of the cell sites currently in operation in this area. 10 To do this, I re-did the same analysis using a 3-mile propagation radius instead of the 4 miles 11 that is reflected in the analysis presented in Table 6. Using this smaller coverage radius per cell 12 site, I determined that providing full mid-band 5G wall-to-wall coverage of Kings County would require approximately 44 additional cell sites, bringing the total required capital investment to 13 **BEGIN HIGHLY CONFIDENTIAL < \$** 14 > END HIGHLY CONFIDENTIAL, increasing the annual operating expenses including depreciation but before interest and taxes to 15 **BEGIN HIGHLY CONFIDENTIAL < \$** 16 > END HIGHLY CONFIDENTIAL, resulting in an annual loss in Kings County of **BEGIN HIGHLY CONFIDENTIAL** < 17 18 > END HIGHLY CONFIDENTIAL before interest and taxes. 19 20 57. While I have not undertaken to perform a similar financial analysis of the promised post-21 merger mid-band 5G coverage in other rural California counties, I believe that the economics of

22 providing the promised level of coverage in the other rural counties is similar to that of Kings



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County. Indeed, there are a number of counties with far smaller populations and even lower
 population densities. Serving these areas will, if anything, be even less economically feasible.

4 Conclusions

5

58. The IKK model, for all of its complexity, confirms the Public Advocates Office's 6 7 conclusion that the merger will result in less competition, higher prices, diminished consumer 8 welfare, and for all of those reasons should not be allowed to go forward. IKK's speculative and 9 certainly unscientific assessments of "quality" improvements that somehow overcome their own 10 (and HBVZ's) merger simulation projections of actual increases in prices to consumer cannot – 11 and certainly should not – negate their own model's results. IKK's reliance upon an out-of-date 12 and certainly unrelated examination of consumer responses to certain quality improvements in 13 the fixed wired broadband market cannot be extrapolated to wireless. Wired and mobile wireless 14 broadband are not substitutes; consumers consider and use mobile broadband as an adjunct to 15 their fixed cable or FTTP-based broadband Internet access service. Consumers do not have the 16 same expectations with respect to mobile services as they do for fixed wireline services, and use 17 their mobile services for entirely different purposes. Absent speculations regarding "quality-18 adjusted prices" that IKK see as overcoming the undisputed conclusion that post-merger prices 19 will rise, the IKK model, like the earlier HBVZ work, compels the conclusion that the merger is 20 decidedly not good for consumers, not good for competition, and not in the public interest.

21

59. The Joint Applicants' claims that the merger will bring coverage to rural areas – and
their attempt to buttress such claims with maps that purport to display projected coverage areas



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- 1 at the county level cannot be squared with the projected capital investments that a merged New
- 2 T-Mobile anticipates making in each California county through 2024 as provided in response to
- 3 Call PA DR 11. Rural areas are not served because they are costly to serve, and this funda-
- 4 mental economic reality is not materially changed by the merger. The maps and coverage area
- 5 projections advanced by T-Mobile in its rebuttal testimony are not credible and should be
- 6 afforded no weight by the Commission.



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DECLARATION

I declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information and belief, and if called to testify thereon I am prepared to do so.

hut

LEE L. SELWYN

Executed at Boston, Massachusetts this 26th day of April, 2019.



SUPPLEMENTAL TESTIMONY OF LEE L. SELWYN

ATTACHMENT A

METHODOLOGIES FOR ASSESSING THE IMPACTS OF MULTIPLE PRODUCT OR SERVICE ATTRIBUTES UPON CUSTOMER WILLINGNESS-TO-PAY

Hedonic regression analysis

1. One widely-used method that can reliably isolate the differential in price due solely to variations in one product attribute, such as download speed, is the econometric technique known as hedonic regression analysis. In general, regression analysis identifies and quantifies the relationship between or among two or more variables, and is used to identify the relationship between variations in the so-called "dependent variable" that can be "explained" by variations in an array of one or more "independent" or "explanatory" variables. The "dependent variable" here would be the total price of the service, and the independent or explanatory variables would be quantitative measurements of individual service attributes, such as the handset, the download and upload data rates, coverage area, data usage allowance, overage charges or other restrictions that may kick in once the usage allowance has been reached, and other service features, such as international voice and/or data roaming, included video streaming services (e.g., Netflix), and even in-flight use, among others.¹ Typically, many explanatory variables – in this example, measurable product attributes that may have some impact upon overall service quality - would be included in the regression model. The regression analysis can then identify both whether a particular effect is present (such as to confirm that download speed does increase the price of a product) and the overall amount of such an effect (by how much does download speed affect price).

2. Hedonic regression is an application of standard regression techniques that measures the incremental value of various product attributes. To use this technique, a sufficient number of products with varying mixes and levels of product attributes must exist in the market, with market prices for each such product/attribute set readily identified. Hedonic regression is based upon the concept that each product attribute has a different and measurable impact upon aggregate consumer utility, as reflected in market prices for each such product/attribute mix.

3. First detailed by Rosen in 1974,² hedonic regression is now widely used by economists.

^{1.} An error term, also called the "disturbance" term, captures the effects of chance events, unmeasured variables, and other residuals as calculated by the regression model.

^{2.} Rosen, Sherwin, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *The Journal of Political Economy*, **82**:1 (Jan -Feb 1974) ("Rosen").

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Indeed, there are numerous studies that apply the hedonic regression technique to a myriad of consumer products, and the practice has been adopted by statistical agencies with a focus on measuring consumer prices (e.g., the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, and as noted by Dr. Israel, the FCC).³ Hedonic regression also has a long history of use for determining damages in class action litigation that can be attributed to identifiable shortcomings in specific product attributes. Recently, various courts (including federal courts in California and New York) have found that hedonic regression analysis is a suitable method for determining class-wide damages (and specifically price premium damages) in consumer class action lawsuits.⁴

A review of sample literature

4. Hedonic regression is routinely used to calculate the value of individual product attributes. The hedonic regression model has been used to evaluate pricing in many different types of markets, but there is particularly extensive literature on this method in consumer product mass markets. Any variety of attributes can be studied, ranging from time/seasonality, geo-location/regional differences, brand, and product-specific attributes. There is a wealth of studies that confirm the ability of hedonic regression to determine the market value of product attributes.

5. For example, the U.S. Bureau of Labor Statistics ("BLS") published an article that uses the hedonic regression technique specifically on refrigerators for use in enhancing the calculation of the U.S. Consumer Price Index ("CPI").⁵ In the study, BLS examines the price premiums associated with various product attributes (such as brand, whether the refrigerator had an ice maker, etc.) in an effort to improve the CPI by adjusting the index for such attribute premiums. Another example is a study of the yogurt market that shows statistically significant

^{3.} The use of hedonic regression in individual studies is too widespread to exhaustively document in detail. See, e.g., The Expanding Role of Hedonic Methods in the Official Statistics of the United States, Moulton, Brent R., Bureau of Economic Analysis, U.S. Department of Commerce, June 2001.

^{4.} See, e.g., Anthony Belfiore v. The Procter & Gamble Company, 140 F. Supp. 3d 241, (E.D.N.Y. 2015); D. Joseph Kurtz v. Kimberly-Clark Corporation, 2015 WL 8481833, (E.D.N.Y.); Christopher Meta v. Target Corporation, 74 F. Supp. 3d 858, (N.D. Ohio 2015); Rohini Kumar v. Salov North America Corp., 2016 WL 3844334, (N.D. Cal. July 15, 2016); In re: Scotts EZ Seed Litigation, 304 F.R.D. 397, (S.D.N.Y. 2015); In re: ConAgra Foods Inc., 90 F. Supp. 3d 919, (C.D. Cal. 2015) aff'd, Briseno v. ConAgra, 2017 WL 53421, at *2 (9th Cir. Jan. 3, 2017); Dei Rossi vs. Whirlpool, 2015 U.S. Dist. LEXIS 55574, (E.D. Cal. April 28, 2015).

^{5.} Developing a Hedonic Regression Model For Refrigerators in the U.S. CPI, Shepler, Nicole, October 16, 2001,.

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price premiums associated with labeling claims such as "organic," "all natural" or "natural."6

6. Another study used hedonic regression to examine the attributes of retail eggs to determine whether "organic feeding" labeling had a positive price premium effect on the retail price of eggs.⁷ Another hedonic regression study examined the impact of "organic" labeling on Breakfast Foods. "Organic" was found to have a significant positive effect on the retail price of Breakfast Bars, Granola and Hot Cereals.⁸ Another study used hedonic regression to evaluate how consumers value nutrients in breakfast cereals including vitamins, fiber, and sodium. Results showed that vitamin content had a positive impact on the price of cereals.⁹

The hedonic model

7. The hedonic regression analysis is conducted using actual aggregated pricing and product attribute information. The hedonic regression function can be expressed as:

 $P_i(Z) = P_i(Z_1, Z_2, \dots, Z_N)$

In this function, P is the Price of product "*i*", each Z factor is a product attribute variable. Each product attribute Z factor can have either a positive, negative, or null effect on the total Price, P. This model can be used to determine the value of the specific attributes of various products. IKK could have utilized hedonic regression to separate out the quality-adjustment to the nominal dollar price that consumers are willing to pay for quality improvements in each identified product attribute.

8. The regression can be calculated in a variety of forms, including "linear" and "semi log." In a linear format, the regression will calculate the dollar component amount of each product attribute (the value of each attribute as expressed in dollars and cents). In the semi-log format,

http://ageconsearch.umn.edu/bitstream/50333/2/Manuscript_Value_of_Labeling_Statements_IAAE%20174.pdf

^{6.} Anstine, Jeffrey, "Organic and All Natural: Do Consumers Know the Difference?" *Journal of Applied Economics and Policy* **26**.1 (2007):15-27.

^{7.} Karipidis, Philippos I., et al, "Hedonic Analysis of Retail Egg Prices," *Journal of Food Distribution Research* **36**:3 (2005).

^{8.} The Value to Consumers of Health Labeling Statements on Breakfast Foods and Cereals, Muth, Mary K., et al Contributed Paper prepared for presentation at the International Associate of Agricultural Economists Conference, Beijing, China, August 2009, on behalf of RTI International and Food and Drug Administration, Center for Food Safety and Applied Nutrition. 10 March 2014.

^{9.} Hedonic Prices for a Nondurable Good: The Case of Breakfast Cereals. Stanley, L. R. and John T. Tschirhart, Review of Economics and Statistics 73.3 (1991):537-541.
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the use of natural logarithms¹⁰ allows the regression to calculate a percentage price increase or discount for each product attribute (the value of each attribute is expressed as a percentage of the price).

Conjoint analysis

9. As noted above, hedonic regression requires that market prices exist for a range of products offering different sets of attributes. However, if the objective is to predict *future* prices and price structures for various attribute sets where market prices do not currently exist, a technique known as "conjoint analysis" can be used for this purpose. Conjoint analysis is a tool that enjoys wide use and acceptance in the field of market research. It was introduced to the field of market research in 1971, and it is generally recognized by marketing science academics and industry practitioners to be the most widely studied and applied form of quantitative market value measurement.¹¹ Conjoint analysis is a representative survey technique that permits an economist to analyze the value of various product attributes.¹² The general idea behind conjoint analysis is that the market value of a particular product is driven by the collection of features embodied in that product. Customers are shown sets of product profiles made up of varying features ("choice sets") and are asked, as part of a series of "choice tasks," to indicate their preferred product profile among those shown. At no point are respondents asked to indicate directly how much they would pay; rather, the analysis is based on choices respondents make among alternatives.

10. Conjoint analysis is complex, but highly sophisticated software is available to support this technique. A leading source of conjoint analysis software is Sawtooth Software, Inc. Its premier product, *Lighthouse Studio*, supports choice-based conjoint analysis ("CBC") and is widely used by academics and business practitioners around the world. Conjoint analysis provides respondents with realistic choices among hypothetical products that vary on multiple feature categories. By randomizing the order and appearance of the features and levels in the survey helps keep the respondent from focusing on a single feature or attribute.

^{10.} The logarithm of a number is the exponent to which another fixed value, the base, must be raised to produce that number. This expression is often notated as $2\log_b(x)$. The natural logarithm has the number e (approx. 2.718) as its base. Natural logarithms are often notated without reference to the base as $\ln^2(x)$.

^{11.} Louviere, Jordan, "Conjoint Analysis Modelling of Stated Preferences: A Review of Theory, Methods, Recent Developments and External Validity," *Journal of Transport Economics and Policy: Stated Preference Methods in Transport Research*, **22**:1, Jan. 1988, at 93-119.

^{12.} Conjoint analysis as a discipline is quite broad, and can be used to facilitate many other sorts of research beyond the specific application that I discuss here.

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11. Conjoint analysis uses data from the survey on the feature levels of the product profiles that are presented to respondents, and the resulting choices of respondents are used to generate partial contributions of these feature levels ("partworths") to overall product utility or value. The partworths for feature levels are identified with the estimation methods so that the partworths best predict customers' choices from the survey. Conjoint analysis allows for the prediction of the probability that customers will choose any product profile that can be described by the feature levels and can do so for any competitive set of products. It is also possible to then simulate how choice shares would change in a market based upon a change in overall price. By making use of these capabilities, CBC would allow one to determine the change in market value (measured in dollars and/or percentage terms) that might be attributed to changes in the quality of, for example, mobile wireless service based upon the full array of service attributes.

12. Conjoint analysis is founded on rigorous statistical and economic principles, and is not required to be used as part of a traditional marketing program,¹³ and has been widely used in numerous judicial proceedings as a means for ascribing monetary values to specific product attributes as a basis for the calculation of damages in product liability litigation.¹⁴ In a typical conjoint analysis, survey panelists are confronted with various choices of product attributes, prices, and other alternatives, and are asked either to rank their preferences or to choose the most preferred attribute or combination thereof. By systematically varying the attributes of the product and observing how respondents react to the resulting product profiles, one can statistically deduce information about the individual attributes. Statistical methods (including regression analysis) are then applied to the survey responses to calculate attribute value.¹⁵

^{13.} See, e.g., Sawtooth Software technical papers, available online at

http://www.sawtoothsoftware.com/support/technical-papers; When "All Natural" May Not Be, Analysis Group Forum (Winter 2013) http://www.analysisgroup.com/forums/winter-2013/when-all-natural-may-not-be/ (last accessed August 1, 2016).

^{14.} See, e.g., Applying Conjoint Analysis to Legal Disputes: A Case Study, Wind, Yoram, et al.; See, e.g., Khoday v. Symantec Corp., 2014 WL 1281600, at *10 (D. Minn. March 13, 2014); Sanchez-Knutson v. Ford Motor Company, 310 F.R.D. 529, 538-39 (S.D. Fl. 2015); In re: Lenovo Adware Litigation, 2016 WL 6277245, at *21 (N.D. Cal. Oct. 27, 2016); Guido v. L'Oreal, USA, Inc., 2014 WL 6603730, at *5, *10-*14 (C.D. Cal. July 24, 2014); Brown v. Hain Celestial Group, Inc., 2014 WL 6483216, at *19 (N.D. Cal. Nov. 18, 2014); Microsoft v. Motorola, Inc., 904 F.Supp.2d 1109, 1119-20 (W.D. Wa. 2012); In re Scotts EZ Seed Litig., 304 F.R.D. 397, 413-15 (S.D.N.Y. 2015); Dzielak v. Maytag, 2017 WL 1034197, at *6 (D. NJ. March 17, 2017); TV Interactive Data Corp. v. Sony Corp., 929 F. Supp. 2d 1006, 1022 & n.6 (N.D. Cal. 2013); Briseno v. ConAgra Foods, Inc., 844 F.3d 1121 (9th Cir. 2017); Fitzhenry-Russell v. Dr Pepper Snapple Group, Inc., 2018 WL 3126385 (N.D. Cal. June 26, 2018); In Re Arris Cable Modem Consumer Litig., 2018 WL 3820619, at *25-*31 (N.D. Cal. Aug. 10, 2018); Hadley v. Kellogg Sales Co., 2018 WL 3954587, at *11-*16 (N.D. Cal. Aug. 17, 2018).

^{15.} See, e.g., Bryan K. Orme, Getting Started With Conjoint: Strategies for Product Design and Pricing Research, Third Edition, Manhattan Beach, CA, Research Publishers LLC, 2014.

ATTACHMENT B

[CONFIDENTIAL]