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On "Competition and Consumer Protection in the 21st Century Hearings,

Project Number P181201"

August 20, 2018

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I. QUALIFICATIONS

1. My name is Allan L. Shampine. I am an Executive Vice-President of Compass Lexecon, an economic consulting firm. I received a B.S. in Economics and Systems Analysis *summa cum laude* from Southern Methodist University in 1991, an M.A. in Economics from the University of Chicago in 1993, and a Ph.D. in Economics from the University of Chicago in 1996. I have been with Compass Lexecon since 1996.

2. I specialize in applied microeconomic analysis with a particular focus on technological innovation. I am the editor of the book Down to the Wire: Studies in the Diffusion and Regulation of Telecommunications Technologies, a contributor to the Telecom Antitrust Handbook and The Cambridge Handbook of Technical Standardization Law, and have published a variety of articles on the economics of telecommunications and network industries, as well as patents, technology diffusion and antitrust issues and remedies. I am an editor of the American Bar Association journal Antitrust Source.

3. I have worked on telecommunications matters throughout my career, and have submitted testimony concerning mergers, antitrust concerns and regulation of telecommunication and broadband networks in multiple countries. I have previously provided economic evidence to the United States Federal Communications Commission, International Trade Commission, state public utility commissions, Federal Maritime Commission, United States district courts, European Commission, Korean Fair Trade Commission, Chinese National Development & Reform Commission, Info-Communications Development Authority of Singapore, and the Australian Competition & Consumer Commission. A copy of my curriculum vitae is included as Appendix A.

II. DISCUSSIONS ABOUT ELIMINATING COMPETITORS FROM THE UNITED STATES SHOULD INCLUDE CONSIDERATION OF THE ECONOMIC COSTS

4. The Federal Communications Commission ("FCC") and legislators are contemplating actions that would exclude firms like Huawei from competing for the business of carriers in the United States based on national security concerns. I have been asked by counsel for Huawei to discuss the potential economic costs of the proposed actions and the likely impact on

competition. I have submitted two declarations in the FCC's proceeding,[1] and have been asked to comment as part of the Federal Trade Commission's ("FTC") examination of competition in networked industries.

5. The U.S. Department of Justice ("DOJ") and FTC Horizontal Merger Guidelines state that when there are only a few, large competitors (i.e., a market is highly concentrated) then the elimination of a competitor is presumed to increase market power of the remaining firms, resulting in higher prices or other harm to consumers.[2] Mergers are nonetheless often permitted by regulators because of the expectation that they will produce offsetting benefits. Here, however, regulators and legislators are discussing the effective exclusion of one or more competitors by regulatory fiat without any offsetting merger efficiencies. Rather, the claimed benefits relate to national security. Given the likely competitive effects of such regulatory intervention, the costs and benefits should both be considered. That is, while determining whether there is a significant national security concern, it is also important to determine what the likely costs are of proposed policies to address that concern, and whether there are less costly ways to do so.

6. As an economist who has worked on telecommunications, competition and regulatory issues for more than 20 years, I am concerned when governments exclude significant competitors from their markets without due consideration of the economic burdens such exclusion can create. The FTC has significant experience at evaluating the costs and benefits of changes in the competitive landscape due to regulatory intervention or merger, and of crafting remedies to address potential concerns while still allowing creation of the benefits. The FTC's guidance could be of great benefit on this topic.

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1. Declaration of Allan L. Shampine, WC Docket No. 18-89, May 30, 2018, and Reply Declaration of Allan L. Shampine, WC Docket No. 18-89, June 29, 2018.

2. U.S. Department of Justice and the Federal Trade Commission, Horizontal Merger Guidelines, August 19, 2010, https://www.justice.gov/atr/horizontal-merger-guidelines-08192010, §§1, 2.1, 5.3, 6.

III. TELECOMMUNICATIONS INFRASTRUCTURE SALES IN MANY SEGMENTS ARE MORE CONCENTRATED IN THE U.S. THAN THE REST OF THE WORLD

7. People not familiar with the telecommunications industry may be surprised at how concentrated sales are in a variety of segments, including, in particular, wireless network infrastructure (often referred to as radio access network infrastructure, or "RAN"). I examine concentration in various segments of the industry using the Herfindahl-Hirschman Index ("HHI"), a standard measure of concentration which is simply the sum of the squared shares of the firms involved. This can run from close to zero (a large number of firms with very small shares of sales) to 10,000 (a single firm makes all sales). The Horizontal Merger Guidelines classify how concentrated markets are based on the HHI, and a market with an HHI above 2,500 is considered "Highly Concentrated" by the DOJ and FTC.[3]

8. As of 2015, market research firm Infonetics reported U.S. wireless infrastructure sales shares of 33 percent for Ericsson, 27 percent for Alcatel-Lucent, 20 percent for Nokia and 11 percent for Samsung.[4] Subsequently, Alcatel-Lucent and Nokia merged,[5] which yields shares of 47 percent for the merged Nokia, 33 percent for Ericsson, and 11 percent for Samsung – three firms becoming responsible for 91 percent of sales. The HHI for wireless infrastructure sales in the United States after the Alcatel-Lucent/Nokia merger based on these shares would be above 3,400.[6]

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3. U.S. Department of Justice and the Federal Trade Commission, Horizontal Merger Guidelines, August 19, 2010, https://www.justice.gov/atr/horizontal-merger-guidelines-08192010, §5.3.

4. Simon Zekaria, "Merger of Nokia with Alcatel-Lucent Could Put Pressure on Prices," Dow Jones Institutional News, April 14, 2015.

5. Nokia Press Release, "Nokia finalizes its acquisition of Alcatel-Lucent, ready to seize global connectivity opportunities," November 2, 2016.

6. 47^2 + 33^2 + 11^2 = 3,419. I treat the remaining 9 percent of sales as comprised of 1 percent firms, yielding a total HHI of 3,419 + 9 = 3,428. The Chinese Ministry of Commerce ("MOFCOM") and the European Commission ("EC") both examined RAN products as a product market when evaluating the Alcatel-Lucent/Nokia transaction. PaRR, "MOFCOM conditionally clears Alcatel/Nokia deal with behavioral remedies (full translation)," October 19, 2015, §§3.1.A, 4. European Commission, Case No COMP/M.7632 – Nokia / Alcatel-Lucent, Regulation (EC) No 139/2004 Merger

9. Worldwide, wireless infrastructure sales are substantially less concentrated than in the United States, largely due to the presence of Huawei and ZTE. For example, the market research firm IHS reports mobile infrastructure shares in 2017 of 28 percent for Huawei, 27 percent for Ericsson, 23 percent for Nokia, 13 percent for ZTE, and 3 percent for Samsung.[7] These shares correspond to an HHI of below 2,300, substantially lower than that calculated above for the United States.[8] Similarly, the European Commission in evaluating the Alcatel-Lucent/Nokia transaction reported market shares for overall RAN equipment in Europe of 30-40 percent for the merged Nokia, 30-40 percent for Ericsson, 30-40 percent for Huawei, and 0-5 percent for both ZTE and Samsung.[9] Assuming 30 percent each for Nokia, Ericsson and Huawei, and 5 percent each for ZTE and Samsung yields an HHI of 2,750, again substantially lower than that calculated above for North America.[10]

10. With respect to the Alcatel-Lucent/Nokia merger, the European Commission apparently viewed the merger as going from six credible alternatives to five (or fewer, depending on the segment), noting that post-merger, Ericsson, Huawei, ZTE and Samsung would remain as credible alternatives for customers of RAN equipment. The European Commission specifically cited Huawei as one of the "main competitors … already able to offer RAN, CNS and routing and switching solutions to [Nokia and Alcatel-Lucent's] customers."[11] China's Ministry of Commerce applied similar logic, noting that for 4G LTE RAN equipment, for example, Huawei, ZTE and Ericsson "are all strong rivals, among which the first two companies' respective market

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Procedure, Article 6(1)(b) Non-Opposition, July 24, 2015, document number 32015M7632, http://ec.europa.eu/competition/mergers/cases/decisions/m7632_788_2.pdf, ("EC Nokia/Alcatel Decision"), §§4.1, 5.2.

7. Stéphane Téral, "Global mobile infrastructure market down 14 percent from a year ago," IHS, March 13, 2018, https://technology.ihs.com/600864/global-mobile-infrastructure-market-down-14-percent-from-a-year-ago.

8. 28^2 + 27^2 + 23^2 + 13^2 + 3^2 + 6 = 2,226. As before, I assume the 6 percent of "Other" sales are made by 1 percent firms.

9. EC Nokia/Alcatel Decision, ¶ 82.

10. 30^2 + 30^2 + 30^2 + 5^2 + 5^2 = 2,750.

11. EC Nokia/Alcatel Decision, ¶¶ 85, 210.

shares are larger than that of Nokia post-merger, so the competition dynamics will be maintained."[12] The U.S. DOJ did not provide any public analysis of the transaction.

11. I have calculated HHIs for 2017 sales for a variety of industry segments for the United States and the rest of the world by analyzing data from various industry research firms.[13] Most of the segments have HHIs in the United States of greater than 2,500 and are generally higher in the United States than the rest of the world, often by more than 1,000. As discussed above, the difference in concentration is related in large part to the presence, or absence, of Huawei.

12. PaRR, "MOFCOM conditionally clears Alcatel/Nokia deal with behavioral remedies (full translation)," October 19, 2015, §4.1.

13. IDC, Dell'Oro and Ovum.

Table 1: 2017 HHIs by Type of Telecommunications Infrastructure

Segment	USA	Rest of the World
Wireless LAN, Enterprise Class, Controller/Router/Switch Products	5,811	3,397
Digital Subscriber Line ("DSL") + Gfast[1]	3,511	3,009
Router, Enterprise Deployment		
Total of High-End, Low-End, and Mid-Range Products	8,010	4,643
High-End Products	3,812	3,542
Low-End Products	9,718	4,811
Mid-Range Products	9,319	5,118
Radio Access Network ("RAN")[1]		
Total of GSM, CDMA, WCDMA, and LTE	4,493	2,563
GSM	5,992	3,197
CDMA	4,828	3,214
WCDMA	5,945	3,453
LTE	4,486	2,401
Ethernet Switch		
Total of Layer 2 and Layer 3	4,580	2,531
Layer 2	7,653	2,371
Layer 3	4,161	2,610
Passive Optical Networking ("PON")[1]	4,622	2,797
Optical Networking[1]		
Total of Aggregation, Access Wavelength Division Multiplexing ("WDM"), Metro WDM, Backbone WDM, SLTE WDM, and Amplifiers/Wet plant	1,745	1,782
Backbone WDM	3,571	2,506
Metro WDM	1,937	2,033
Handsets[2]		
Total of Ultra High-End, High-End, Mid-Range, Low-End, and Ultra Low-End Smartphone Classes	4,503	1,650
Ultra High-End and High-End Smartphone Classes	5,512	3,571
Mid-Range Smartphone Classes	1,957	1,401
Low-End and Ultra Low-End Smartphone Classes	2,255	954

Sources: Analyses of IDC, Dell'Oro and Ovum data.

Notes: Unless otherwise noted, HHIs are based on 2017 "vendor revenue" share, by company. Share of "Others" assumed to consist of firms with 1 percent shares.

1. HHIs for USA are calculated using North American revenues.
2. HHIs based on "value" shares.

12. A news report from GlobalData indicates that operators are attempting to address concentration in infrastructure vendors by combining equipment from multiple vendors within a single deployment, even though there are costs and inefficiencies associated with that strategy, and that U.S. operators are at the forefront because with "meaningful access to Huawei and ZTE blocked for political reasons – [U.S. operators] face the fewest options for RAN gear."[14] The report also states that "[a] sign of how serious U.S. operators are on this topic came in the form of Samsung's announcement during [Mobile World Congress, the telecom industry's largest annual trade show,] that it had won its first contract to provide Verizon with LTE macrocell baseband and radio units. … With the Samsung deployment, Verizon is demonstrating that pairing one vendor's BBU with another vendor's RU is possible but not that it is quick and easy (among the reasons it's not: variability in each vendor's implementation of the CPRI fronthaul technology that connects BBUs and RUs). This hurdle would be even higher in virtual RAN networks because different vendors may not have the same division of functions between baseband and radio."[15] Additionally, operators have created groups "aimed at disaggregating the elements of the RAN to foster more flexible network architectures and a more competitive RAN vendor ecosystem. … The creation of these groups is in part a reaction by operators to a consolidated RAN vendor landscape...."[16]

13. I discuss the potential benefits from increased competition from the presence of Huawei in more detail below. Various parties have indicated that having Huawei present and competing for business has benefited carriers through both lower prices and better service. For example, the Chief Technical Officer of the Canadian carrier Telus has stated that "One of the great things about Huawei being in the market is they have dropped prices by 15% at least. … They forced the Ericssons and Nokias to follow suit."[17] Similarly, a declaration by James Valley

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14. Ed Gubbins, "MWC18: The Radio Access Network Roundup – As 5G Dawns, Integrating Massive MIMO & Breaking Up the RAN," GlobalData, March 7, 2018.

15. Ed Gubbins, "MWC18: The Radio Access Network Roundup – As 5G Dawns, Integrating Massive MIMO & Breaking Up the RAN," GlobalData, March 7, 2018.

16. Ed Gubbins, "MWC18: The Radio Access Network Roundup – As 5G Dawns, Integrating Massive MIMO & Breaking Up the RAN," GlobalData, March 7, 2018.

17. Iain Morris, "Telus CTO: NFV Burden May Cripple Telcos," LightReading, May 14, 2018, https://www.lightreading.com/carrier-sdn/nfv-(network-functions-

Telecommunications as part of the FCC proceedings indicated that Huawei's bid was 40 percent below competing offers.[18] My own analysis of concentration and prices for RAN equipment generally and for LTE base stations specifically (evolved NodeBs, or eNodeBs) is consistent with these conclusions. For example, industry concentration in LTE is higher in North America than elsewhere in the world, and average selling prices per LTE base station (whether overall, or by pico, micro and macro individually) are higher in North America than in other regions of the world.[19]

III. HUAWEI IS A SIGNIFICANT COMPETITOR

14. Huawei is a large firm offering many different kinds of telecommunications infrastructure, equipment and services and competing throughout the world for carriers' business. It also has a history of significant investment in research and development.

A. Huawei has a history of significant investment in research and development

15. Over the past decade, Huawei has invested roughly $62 billion in research and development, including $34 billion between 2012 and 2016 and $14 billion in 2017.[20] To put those figures into context, between 2012 and 2016 Nokia is reported to have spent roughly $17 billion on research and development and Ericsson spent roughly $23 billion. While Huawei and Nokia have been increasing their expenditures, Ericsson decreased its expenditures from 2014 to

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virtualization)/telus-cto-nfv-burden-may-cripple-telcos/d/d-id/743076.

18. Declaration of James Groft, James Valley Telecommunications, attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶ 3.

19. Based on analysis of data from market research firms Infonetics, IHS, and Dell'Oro, news reports, and the European Commission and MOFCOM.

20. Huawei Investment & Holding Co, Ltd. 2017 Annual Report, http://www-file.huawei.com/-/media/CORPORATE/PDF/annual-report/annual_report2017_en.pdf?la=en, p. 50, reporting 2017 research and development expenditures of CNY89,690,000,000 and expenditures over the last decade of CNY394,000,000,000. Values above use exchange rate of 6.38 CNY per dollar, per Bloomberg, as of May 15, 2018. https://www.bloomberg.com/quote/USDCNY:CUR. Jamie Davies, "Ericsson is losing the R&D game and that needs to change," telecoms.com, June 5, 2017, http://telecoms.com/482479/ericsson-is-losing-the-rd-game-and-that-needs-to-change/.

2016. In 2015 and 2016, Huawei spent more than Ericsson and Nokia combined. See **Table 2** below.

Table 2: Research & Development Investment ($ Millions)[21]

Year	Ericsson	Nokia	Huawei
2012	$ 4,852	$ 3,961	$ 4,283
2013	$ 4,932	$ 2,616	$ 4,417
2014	$ 5,315	$ 2,591	$ 5,881
2015	$ 4,134	$ 2,359	$ 8,583
2016	$ 3,702	$ 5,428	$ 11,000

B. Huawei is one of the largest vendors of telecommunications equipment worldwide

16. Huawei is one of the largest vendors of radio access network or RAN equipment worldwide and, in particular, in Europe. The European Commission reports that in 2014, Huawei had between a 20 percent and 30 percent share of RAN equipment sales globally and between 30 percent and 40 percent in Europe.[22] That remains true today. According to market research firm Dell'Oro, Huawei had 32 percent of global RAN sales as of 4Q 2017, followed by Ericsson with 30 percent and Nokia with 25 percent.[23] In 2017, the industry consulting firm GlobalData ranked Huawei's Mobile Access infrastructure business as "Very Strong" or "Leader" in all seven of the ranked aspects in its Competitive Index. In particular, GlobalData ranked Huawei's 2G/3G and LTE RAN product portfolios as "Leaders" in the market, citing "a broad radio unit portfolio and spectrum support" and "advanced antenna solutions."[24]

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21. Jamie Davies, "Ericsson is losing the R&D game and that needs to change," telecoms.com, June 5, 2017, http://telecoms.com/482479/ericsson-is-losing-the-rd-game-and-that-needs-to-change/.

22. EC Nokia/Alcatel Decision, ¶ 82.

23. Eric Auchard & Sijia Jiang, "China's Huawei set to lead global charge to 5G networks," Reuters, February 23, 2018, https://www.reuters.com/article/us-telecoms-5g-china/chinas-huawei-set-to-lead-global-charge-to-5g-networks-idUSKCN1G70MV.

24. Ed Gubbins, "Huawei – Mobile Access," GlobalData, November 15, 2017.

17. Huawei and Ericsson built the first commercial LTE networks in the world in 2009 (for TeliaSonera in Norway and Sweden, respectively).[25] As of 2016, Huawei supplied over half of the 4G and 4.5G networks globally, and has Memorandums of Understanding to trial 5G equipment with many operators, including BT in the United Kingdom, Bell Canada in Canada, Deutsche Telekom in Germany, Orange in France, and Vodafone.[26] Huawei has also previously been called upon to modernize networks in, for example, European countries. For example, Huawei was engaged in 2013 by the Danish telecommunications company TDC to modernize and manage its mobile network, including leveraging LTE, and completed that upgrade in 2015.[27] TDC then engaged Huawei to upgrade its landline hybrid fiber-coaxial cable network to support 1Gbps download speeds.[28] Similarly, Bouygues Telecom in France, citing "past common success" working with Huawei, is deploying its first 5G network trial in Bordeaux with Huawei.[29] Huawei also unveiled a 5G base station and the "world's first 5G commercial

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25. TeleGeography, "TeliaSonera launches world's first commercial LTE networks in Sweden and Norway," December 19, 2009, https://www.telegeography.com/products/commsupdate/articles/2009/12/14/teliasonera-launches-worlds-first-commercial-lte-networks-in-sweden-and-norway/.

26. Eric Auchard & Sijia Jiang, "China's Huawei set to lead global charge to 5G networks," Reuters, February 23, 2018, https://www.reuters.com/article/us-telecoms-5g-china/chinas-huawei-set-to-lead-global-charge-to-5g-networks-idUSKCN1G70MV.

27. TeleGeography, "Huawei completes modernisation of TDC network," June 3, 2015, https://www.telegeography.com/products/commsupdate/articles/2015/06/03/huawei-completes-modernisation-of-tdc-network/. TDC was originally the government-owned incumbent operator in Denmark, but the last state-owned shares were sold in 1998. Anders Henten, "Telecoms in Denmark: Investment, Performance and Regulation," in Stimulating Investment in Network Development: Roles for Regulators, A.K. Mahan and W.H. Melody (eds.), World Dialogue on Regulation for Network Economics, 2005, p. 330.

28. TeleGeography, "Huawei to upgrade TDC's HFC network to 1Gbps," January 28, 2016, https://www.telegeography.com/products/commsupdate/articles/2016/01/28/huawei-to-upgrade-tdcs-hfc-network-to-1gbps/.

29. TeleGeography, "Bouygues, Huawei to trial 5G in Bordeaux," February 28, 2018, https://www.telegeography.com/products/commsupdate/articles/2018/02/28/bouygues-huawei-to-trial-5g-in-bordeaux/.

chipset."[30] The European Commission specifically called out Huawei as a "credible alternative" for customers for 4G and 5G equipment when evaluating the Alcatel-Lucent/Nokia merger.[31]

18. Huawei also sells a wide range of other telecommunications infrastructure and services, including all the segments listed in the prior section: wireless handsets, wireless local area networks, passive optical networking, DSL equipment, routers, Ethernet switches, and backbone WDM equipment.[32] Firms offering a wide range of equipment and services may be particularly important competitors in some circumstances. To see why, consider the FTC's challenge of the US Foods and Sysco merger. This was a merger of two foodservice distribution companies. As the two companies pointed out, there are a huge number of companies distributing food, and those companies collectively have sales much larger than the two parties attempting to merge.[33] However, the FTC responded, and the District Court agreed, that suppliers can differ in important ways beyond just their product offerings. Specifically, the District Court had to define a "product market," which in economic terms means defining the products and firms that are sufficiently close competitors that they constrain one another's pricing. The "product" need not be a discrete good for sale.[34] The FTC claimed, and the District Court agreed, that the relevant product market was "broadline" food distribution – characterized by "a vast array of product offerings, private label offerings, next-day delivery, and value-added services" with "geographically dispersed distribution centers" where customers can "make purchases under a single contract that offers price, product, and service consistency across all facilities," with

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30. Light Reading, "Huawei Unveils 5G-Ready Base Station, New Massive MIMO AAU," November 20, 2017, https://www.lightreading.com/mobile/5g/huawei-unveils-5g-ready-base-station-new-massive-mimo-aau/d/d-id/738338. Arjun Kharpal, "Mobile World Congress – Huawei unveils its first 5G chip in a challenge to Qualcomm and Intel," CNBC, February 25, 2018, https://www.cnbc.com/2018/02/25/huawei-unveils-5g-chipset-at-mobile-world-congress.html.

31. EC Nokia/Alcatel Decision, ¶ 85.

32. See generally Huawei Investment & Holding Co, Ltd. 2017 Annual Report, http://www-file.huawei.com/-/media/CORPORATE/PDF/annual-report/annual_report2017_en.pdf?la=en.

33. United States District Court for the District of Columbia, Memorandum Opinion, Federal Trade Commission, *et al.*, v. Sysco Corporation, *et al.*, Civil No. 1:15-cv00256 (APM), June 29, 2015 ("FTC Sysco Opinion"), p. 19.

34. FTC Sysco Opinion, p. 21.

contracts awarded "through a request for proposal or bilateral negotiations."[35] The District Court found that although there was no question that smaller firms, niche firms, regional firms, and other types of firms also provided food distribution services, those other firms nonetheless did not constrain the prices of the "broadline" food distributors – that is, they were not in the same relevant economic market.[36]

19. Thus, for customers that particularly desire, or need, one-stop shopping for telecommunications equipment and services, there may be a relatively limited number of firms with appropriately broad portfolios and excluding such a firm may therefore have a disproportionate impact on the competitive landscape. For example, the Gartner Group's analysis of LTE network infrastructure lists four firms as having a combination of ability to execute and completeness of vision – Ericsson, Nokia, Huawei and ZTE. By contrast, Gartner notes that while Cisco provides some RAN equipment, its portfolio does not include macrocell/microcell base stations, and it cannot fulfill providers' requirements there.[37]

V. ALLOWING HUAWEI TO COMPETE MORE FREELY IN THE UNITED STATES COULD CREATE SIGNIFICANT CONSUMER BENEFITS

20. The general economic proposition that increased competition benefits consumers is not controversial. Indeed, it is at the heart of the FTC's mission, and FTC guidance to legislators and others on how best to preserve or increase competition while addressing any relevant national security concerns would be helpful. Consumer benefits from increased competition can be particularly large in highly concentrated industries. The question here is how significant are the benefits likely to be if Huawei were permitted to compete for the business of U.S. carriers, or, conversely, how significant is the impact of excluding a competitor from the U.S. by regulatory fiat.

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35. FTC Sysco Opinion, pp. 18-19, 41.

36. FTC Sysco Opinion, pp. 18-41.

37. Kosei Takiishi, Sylvain Fabre, Peter Liu, Frank Marsala & Jessica Ekholm, "Magic Quadrant for LTE Network Infrastructure," Gartner, July 31, 2017, pp. 1-3.

A. Bidding by Huawei has brought down prices in areas where it is allowed to compete

21. Huawei currently has low sales shares in the United States. However, it is not necessary for Huawei to gain significant sales in order to benefit consumers in the United States. As the European Commission has noted, given large contracts, firms can provide competitive benefits even if they have low shares of sales, simply because they provide credible alternatives and participate in the bidding process.[38] Anecdotally, prior to the 2012 House report on Huawei and ZTE, Huawei's presence in the bidding process provided competitive pressure that helped U.S. carriers obtain better terms from Ericsson and Alcatel-Lucent.[39]

> Over the last few years, U.S. mobile industry has undergone a big transformation, building its next generation of LTE mobile networks. … Huawei bid on all of those [U.S.] contracts, but except for a WiMAX deal with Clearwire and a few minor networks with regional providers, it failed to win any of them. Every analyst and industry insider I've talked to, however, said that Huawei's presence was felt during those negotiations. Established vendors were forced to underbid Huawei or risk losing key contracts. A deal with a nationwide U.S. operator is a marquee deal, involving billions of dollars and tens of thousands of cellsites. To lose a nationwide U.S. contract to Huawei would be a major black eye for an Ericsson.

22. The Chief Technical Officer of the Canadian carrier Telus recently made the same point, stating that "One of the great things about Huawei being in the market is they have dropped prices by 15% at least. … They forced the Ericssons and Nokias to follow suit."[40] Such a result would not be surprising in a highly concentrated industry. That is, given a small number of credible alternatives for carriers to purchase telecommunications infrastructure from, the addition of one or more new credible alternatives can be expected to improve competition. Conversely, excluding one or more of a small number of credible alternatives from a market can be expected

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38. EC Nokia/Alcatel Decision, ¶¶ 18, 87, 96.

39. Kevin Fitchard, "Why the US needs Huawei more than Huawei needs the US," GigaOm, May 31, 2013, https://gigaom.com/2013/05/31/why-the-us-needs-huawei-more-than-huawei-needs-the-us/.

40. Iain Morris, "Telus CTO: NFV Burden May Cripple Telcos," LightReading, May 14, 2018, https://www.lightreading.com/carrier-sdn/nfv-(network-functions-virtualization)/telus-cto-nfv-burden-may-cripple-telcos/d/d-id/743076.

to reduce competition – as noted above, there is a presumption in the Horizontal Merger Guidelines that such effects will occur in a concentrated market.

B. Small U.S. carriers that use Huawei have reported obtaining better service and lower prices

23. Although large national carriers such as AT&T and Verizon could benefit from increased competition in mobile infrastructure, Huawei has also been serving dozens of small and rural carriers who could lose access to its equipment and services as a result of the FCC proceeding or legislation.[41] The Wall Street Journal reports that "many regional American providers of wireless, TV and internet services have flocked to Huawei, attracted by what they say are Huawei's cheaper prices, quality products and attentive customer service."[42] For example, Huawei upgraded Union Wireless's Rocky Mountain based territory to LTE. Union Wireless reported that Huawei's "smooth upgrade, upgraded service offering and Huawei support [were] key to Union's success."[43]

24. Further evidence is provided in declarations submitted by rural carriers noting in the FCC proceeding that their networks are comprised largely or entirely of equipment purchased from Huawei, and that if they lost access to that vendor they would have to "rip and replace" the network. Indeed, one of the commenting rural carriers notes that the only vendor that responded

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41. Phil Goldstein, "Huawei exec: We treat Tier 3 U.S. carriers like they're the 'belle of the ball,'" FierceWireless, March 27, 2015, https://www.fiercewireless.com/wireless/huawei-exec-we-treat-tier-3-u-s-carriers-like-they-re-belle-ball.

42. Drew Fitzgerald and Stu Woo, "In U.S. Brawl With Huawei, Rural Cable Firms Are an Unlikely Loser," The Wall Street Journal, March 27, 2018, https://www.wsj.com/articles/caught-between-two-superpowers-the-small-town-cable-guy-1522152000.

43. RCR Wireless News, "Case study: Huawei enables rural carriers to compete," September 22, 2016, https://www.rcrwireless.com/20160922/carriers/case-study-huawei-enables-rural-carriers-compete.

to its request for proposal for its network was Huawei.[44] And they all note that they received better terms and service as a result of Huawei's bidding for their business.[45]

- SI Wireless states that the majority of its network has been constructed with Huawei equipment, chosen because of its cost-effectiveness, excellent quality, and excellent customer service, and that prohibiting Huawei equipment and services would require SI Wireless to replace that network at a cost of $40 to $60 million.[46]

- NE Colorado Cellular states that roughly 80 percent of equipment in its network comes from Huawei, chosen because it was the most cost-effective option with the most reliable product and had excellent customer service. Prohibiting Huawei equipment and services would require NE Colorado Cellular to "rip and replace" much of its network at a cost of more than $400 million. NE Colorado Cellular also noted that it would expect additional and ongoing servicing costs from installing inferior equipment with less responsive customer service from other equipment manufacturers.[47]

- James Valley Telecommunications states that 100 percent of its wireless core network and wireless radios are from Huawei, that it obtained 40 percent savings relative to the next most cost-effective option, and that prohibiting Huawei equipment and services would require replacement equipment of roughly $5,000 per customer. Given roughly 10,000 predominantly rural customers, all of whom James Valley Telecommunications provides LTE service to using Huawei equipment, that yields $50 million in replacement costs.[48]

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44. Declaration of Eric J. Woody, Union Telephone Company, attached to Comments of Competitive Carriers Association, June 1, 2018, ¶ 3.

45. CCA Comments, WC Docket No. 18-89, June 1, 2018, attached declarations.

46. Declaration of Michael Beehn, SI Wireless LLC, attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶¶ 4-5.

47. Declaration of Frank DiRico, NE Colorado Cellular, attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶¶ 3-4.

48. Declaration of James Groft, James Valley Telecommunications, attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶¶ 2-4.

- United Telephone Association states that its wireless network consists primarily of Huawei equipment, which was technically superior to other options and was "by far" the most cost effective.[49]

- Nemont Telephone Cooperative states that over 70 percent of its wireless network comes from Huawei, and that it chose Huawei because of its technical capabilities, customer support, and cost effectiveness. Prohibiting Huawei equipment and services would require it to undertake network replacements costs of around $57 million, and there would likely be higher costs of materials, support and upgrades going forward.[50]

- Union Telephone Company states that roughly 75 percent of its network equipment comes from Huawei. It also states that Huawei was the only vendor to respond to its request for proposal after the previous vendor was found to be unsatisfactory, and that Huawei is highly cost-effective and provides excellent customer service. Union Telephone Company estimates the costs of the FCC's proposed rule to be around $340 million in direct, "start-up" costs, with ongoing higher service costs and decreased quality.[51]

C. Increased competition in telecommunications infrastructure would benefit the U.S. economy

25. Increased competition to provide equipment can provide many benefits to U.S. carriers and to U.S. consumers generally, including lower prices, higher quality and greater innovation. Indeed, basic economics teaches that increased competition to supply inputs such as telecommunications infrastructure will increase investment in such infrastructure.[52]

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49. Declaration of Todd Houseman, United Telephone Association, Inc., attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶ 3.

50. Declaration of Michael Kilgore, Nemont Telephone Cooperative, Inc., attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶¶ 2-3.

51. Declaration of Eric Woody, Union Telephone Company, attached to CCA Comments, WC Docket No. 18-89, June 1, 2018, ¶¶ 3-5.

52. That is, demand curves are assumed to slope downwards, so if increased competition reduces quality-adjusted prices for infrastructure equipment, carriers will purchase more

26. The benefits to the broader economy of increased investment in telecommunications infrastructure can be enormous. The GSM Association, for example, has estimated that the direct economic contribution of the mobile ecosystem to GDP globally for 2017 was roughly $1.1 trillion, the indirect impact was roughly $0.5 trillion and the productivity impact was roughly $2 trillion, contributing, in total, roughly 4.5 percent of global GDP.[53] The FCC's National Broadband Plan notes that, "[l]ike electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. It is enabling entire new industries and unlocking vast new possibilities for existing ones." However, the Plan also notes that "broadband in America is not all it needs to be," and discusses ways to improve investment, including reforming "current universal service mechanisms to support deployment of broadband…."[54] Policy makers should take note of the potential impact on infrastructure costs of excluding significant competitors from the U.S. market. The Wall Street Journal, for example, reports that Huawei "has been actively courting small-town internet companies that wanted to replace old-fashioned landlines with high-speed internet connections—no small feat in a country where most rural residents are stuck with dial-up speeds. … Many of these customers now worry the new heat over Huawei in Washington may rob them of what has so far been an important alternative to Western suppliers. Others worry that if Huawei exits the U.S. completely, it will leave them without the customer and technical support they need to maintain the Huawei hardware they already own."[55] Deloitte has recently issued a white paper claiming that the U.S. is lagging behind other countries in 5G deployment due in part to "higher costs relative to other countries." Deloitte calls for policy makers to consider ways to reduce those costs, which would contribute to "help[ing] remove a major obstacle to network densification

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of it.

53. GSM Association, "The Mobile Economy 2018," https://www.gsma.com/mobileeconomy/wp-content/uploads/2018/05/The-Mobile-Economy-2018.pdf, pp. 27-28.

54. Federal Communications Commission, "Connecting America: The National Broadband Plan," March 17, 2010, https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf, pp. xi, 9.

55. Drew Fitzgerald and Stu Woo, "In U.S. Brawl With Huawei, Rural Cable Firms Are an Unlikely Loser," The Wall Street Journal, March 27, 2018, https://www.wsj.com/articles/caught-between-two-superpowers-the-small-town-cable-guy-1522152000.

and allow[ing] carriers to add desperately needed low-cost capacity to our nation's wireless networks."[56]

27. Economists have also studied the impact of faster or slower deployment of telecommunications technologies. For example, Robert Crandall and Charles Jackson have evaluated the impact on the U.S. economy of faster roll-out of broadband access, including both wireless and landline, and concluded that the benefits are enormous.

> Although it will take many years, the widespread adoption of broadband access service will bring enormous economic benefits to our economy. No doubt many of the impacts cannot be foreseen. But some benefits can. … A faster rollout of high-speed access services gives us these benefits earlier. Under optimistic – but still reasonable – scenarios the net present value of a faster rollout of high-speed access could be as high as $700 billion, and a mid-range estimate of the value of faster rollout is $500 billion.[57]

28. The general proposition that delaying the introduction of new goods or services can be very costly to consumers and the economy is well accepted in economics. Jerry Hausman has analyzed the impact of FCC regulatory delays on the introduction of cellular service in the first place, stating that the FCC did not adequately consider the costs to consumers in its proceedings.

> The consumer welfare cost of holding up the introduction of a new good is much larger than the effects of higher prices or other regulatory effects on demand… Looked at another way, the introduction of cellular has created significant value for consumers. Thus, new telecommunications services can improve consumer welfare by very large amounts. Regulatory delay can therefore have potentially large negative effects on the U.S. economy.
>
> Again the possible question arises of why the FCC created such a large amount of harm to U.S. consumers and the U.S. economy. The FCC was confronted with a very difficult decision with respect to cellular. Delaying a difficult decision appeared to be the FCC's chosen response. Losses in consumer welfare arising

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56. Dan Littmann, Phil Wilson, Craig Wigginton, Brett Haan and Jack Fritz, "5G: The chance to lead for a decade," Deloitte, 2018, https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf, p. 9.

57. Robert Crandall and Charles Jackson, "The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access," in Down to the Wire: Studies in the Diffusion and Regulation of Telecommunications Technologies, Allan Shampine (ed.), Nova Science Publishers, 2003, p. 184.

> from the regulatory delay did not appear to be involved in the FCC's regulatory approach. Indeed, if cellular service had not begun in other countries, which helped create pressure for the FCC to finally come to a decision, it is quite likely that the advent of cellular telephone service would have delayed for an even greater period in the U.S.[58]

29. Five members of the Competitive Carriers Association discussed above estimated that those five alone would face costs around $900 million if Huawei were excluded entirely from competing in the United States. They were commenting in the FCC proceeding, but their concerns were about the exclusion of their chosen vendor from the U.S. generally. They also all note that they received lower prices because of Huawei's competing for their business. One reported a 40 percent reduction in prices.[59] The GSM Association estimates carrier capital expenditures in North America for 2017 to 2020 to reach around $136 billion.[60] A 15 percent savings on that total from allowing Huawei to compete freely would amount to $20 billion. Note that this is just for wireless infrastructure. Huawei is also a significant provider worldwide in other areas that are highly concentrated in the United States, including smartphones, wireline infrastructure, and enterprise equipment and services, and increased competition in these other areas would create additional benefits.

30. Given the prospect of massive 5G investment and deployment over the next few years, additional competition in the provision of 5G infrastructure equipment could be a benefit to both U.S. carriers and U.S. consumers. Policy makers should consider carefully the costs of excluding significant global competitors from the U.S. market, global competitors that have helped build, and are continuing to supply, telecommunications carriers throughout the rest of the world, including throughout Canada and Europe. FTC guidance to legislators and others on how to craft remedies to preserve competition while addressing any relevant national security concerns would be helpful.

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58. Jerry Hausman, "Mobile Telephone," in Handbook of Telecommunications Economics, Vol. 1, Martin Cave, Sumit Majumdar and Ingo Vogelsang (eds.), North-Holland, 2002, p. 591.

59. See ¶ 24, *supra*.

60. GSM Association, "The Mobile Economy North America 2017," https://www.gsmaintelligence.com/research/?file=b0cf4f71cb2d035f429d9de8ca4fc72e&download, p. 6.