

Regulation in Financial Translation

Business data services: The potential harm to competitive facilities deployment

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Executive summary

The Federal Communication Commission (FCC) has proposed re-regulation of the business data services (BDS) market, with price-regulation in markets deemed “non-competitive” as the primary tool. Markets would be defined by geography, technology, and speed of transmission. We find that FCC- mandated price cuts on BDS are likely to damage the financial viability of both competitive and incumbent BDS providers, with facilities-based providers taking the greatest hit. At the same time, the FCC is unlikely to advance the migration from 4G to 5G, without even more devastating hits to providers. Thus, the FCC’s proposals will, in fact, frustrate two of the agency’s key objectives for this proceeding.

We model the effect of mandatory BDS price cuts on the free cash flows of BDS providers. We conclude that BDS rate-cuts are likely to do serious damage to the financials of competitive providers, i.e. non-incumbents, as well as incumbents who provide BDS infrastructure. Because company valuations reflect multiples of cash flow, decreases in cash flow are likely to result in lower valuations. The heaviest damage is likely to be to those who are primarily facilities-based, but the free cash flows and valuations of resellers are also likely to be harmed.

- Commenters have generally proposed an up-front price cut combined with additional annual cuts. We examine the effects of price cuts of 5%, 15%, and 25% on providers’ free cash flow.
- The effect of price changes on free cash flow will vary depending on the price elasticity of demand (demand elasticity) of BDS, because quantities purchased/produced will vary with price. As a result both revenues and costs are affected. We model the effect of the price cuts at BDS market demand elasticities of -0.5, -1.0, and -1.5.
- Many BDS providers purchase BDS as well as sell it, so that it is a cost as well as revenue to them and both will change as the price of BDS changes. Therefore, we explore the effect of price cuts using various assumptions of providers’ BDS-input-cost/BDS-revenue ratio, other variable cost/BDS revenue ratio (i.e. variable cost for inputs other than BDS), and incremental capital expenditures.
- To determine which markets are “non-competitive,” the FCC will apply a test based on geographic markets. Along with geography, the FCC’s test is likely to be based on technology—e.g. TDM and Ethernet—as well as speed of transmission.
- If the FCC deems census blocks with fewer than four BDS providers to be non-competitive, about 98% of the markets in which BDS is sold will be considered non-competitive. A test based on three or fewer providers is likely to result in over 90% of the markets in which competitive providers participate being deemed non-competitive. In other words, any competitive provider is almost certain to be captured in almost every market in which that provider participates.

- Because competitive providers focus on high-speed packet-switched technologies, they are likely to be disproportionately affected if Ethernet is deemed non-competitive. The higher the Ethernet speed that is subject to price cuts, the greater the effect on the competitors.
- We assume that these competitive providers will respond to price cuts by incumbents. Whether the FCC explicitly applies cuts to competitors as well as incumbents is irrelevant, for all practical purposes. As numerous competitive fiber providers have noted in the docket recently, the overwhelming majority of BDS purchases (measured by revenue) are made by large enterprises and carriers who are sophisticated and will insist on price cuts from competitors that match those forced on the incumbents.
- 5G backhaul will require far greater bandwidth than backhaul for current technologies. Thus, price cuts on TDM and low-capacity Ethernet would not help the migration to 5G. However, cuts to the prices of the technologies that are likely to be relevant, i.e. high capacity Ethernet and dark fiber, would greatly increase the negative effect on the free cash flow of BDS providers, especially competitive fiber providers.
- The damage from FCC-mandated price cuts to providers' financial viability is likely to be magnified because their valuations reflect their cash flow, the expected growth of that cash flow, and the multiple investors are willing to pay on that cash flow. As cash flow declines, so do multiples. FCC-mandated price cuts on BDS are likely to result in lower valuations on both publicly and privately held BDS-infrastructure providers.

Introduction

On April 28th, the Federal Communications Commission (FCC) voted a Further Notice of Proposed Rulemaking (FNPRM) seeking comment on ways to reform its regulation of business data services (BDS). The document defines BDS as: “the dedicated point-to-point transmission of data at certain guaranteed speeds and service levels using high-capacity connections.”¹ The FCC claims several goals for the BDS proceeding. It seeks to enhance competition in the BDS market, to advance the deployment of wireless 5G technology, to facilitate the migration from TDM (time-division multiplexing) to IP (Internet protocol), and to help consumers.

The primary mechanism the FCC proposes is to cut prices on BDS in markets that it deems insufficiently competitive. Those markets appear to be defined by a combination of technology,² transmission speed, and physical location. The FNPRM’s call for comment brought forth numerous responses. Proposed definitions of “markets” to be regulated swirl around various permutations of circuit-switched v. packet-switched (also known as TDM v. Ethernet), speed tiers at various thresholds such as 50 Mbps (megabits per second), 100 Mbps, or 1 Gbps (gigabit per second) or higher, census tract v. census block v. building or cell tower. One possible permutation, for example, might decree all TDM³ below 50 Mbps uncompetitive regardless of location, thus leaving both higher-speed TDM and Ethernet unregulated. Another permutation might decree that any census block in which there are fewer than four competitors offering BDS at any speed below 1 Gbps is uncompetitive. The latter definition would capture almost every census block in which there is any demand for BDS⁴ as well as many BDS services and thus lower the price umbrella over virtually all competitors offering BDS in the U.S.

As has been the case under Chairman Wheeler’s leadership, the FNPRM places a heavy emphasis on competition. The FNPRM notes that “First, competition is best.”⁵ Chairman Wheeler, in an earlier interview with *ars technica* went further, explaining that he has “a facilities-based proclivity. I think if you’re going to get competition, competition is a facilities-based issue....Tell me, how can you ever win if you have to buy your capacity from your competitor?”⁶ Unfortunately, however, the path the FCC is pursuing in this proceeding is likely to do serious damage to the financials of competitive providers as well as incumbents who provide BDS infrastructure, and the heaviest damage is likely to be to those

¹ Federal Communications Commission, *Tariff Investigation Order and Further Notice of Proposed Rulemaking*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, adopted April 28, 2016, released May 2, 2016, ¶12. [Hereafter referred to as FNPRM.] BDS has traditionally been called “special access.” As the title of the document indicates, the FCC released an order at the same time that modified various terms and conditions in some incumbent carriers’ contracts. In this paper, however, we deal only with the FNPRM.

² The FNPRM argues for a technology-neutral approach, which has resulted in targeting Ethernet as well as TDM for rate cuts, albeit in somewhat different ways.

³ TDM stands for time division multiplexing. Ethernet is a protocol that is increasingly run over fiber.

⁴ Unless we state otherwise, any reference in this paper to a census block is to a census block in which there is demand for BDS.

⁵ FNPRM ¶15.

⁶ Jon Brodtkin, “Why Tom Wheeler rejected broadband price caps and last-mile unbundling,” *ars technica*, March 16, 2016.

who are chiefly facilities-based.⁷ Reduced cash flows and valuations will reduce access to capital, which will reduce the facilities-based providers' ability to invest in their infrastructure.

This path is also likely to be detrimental, rather than helpful, to the advancement of 5G, which will require high-capacity backhaul, in the form of high-speed Ethernet, wave, and dark fiber.⁸ Cutting the price of low-speed TDM, which is grossly inadequate for 5G, can do nothing to help 5G's deployment, but may harm it by slowing the transition away from TDM. Cutting the price of Ethernet several years before 5G is even deployed is likely to have at least two detrimental effects. By distorting the relative pricing of Ethernet and dark fiber, it may slow the transition to dark fiber. By depriving facilities-based providers of capital, the artificial reduction of any of these rates is likely to reduce investment in fiber infrastructure in general and competitive providers in particular.

Responses to the FNPRM

Many parties have responded to the FNPRM's request for comment, with recommendations for and against rate regulation, design of a competitive market test, and other issues. In this paper, we focus on the impact rate regulation would have on facilities-based infrastructure providers, particularly competitive providers. The sample of responses we describe here provides a sense of the range of rate-related proposals and reactions in the docket. Rate-cut proposals have ranged wildly, but recently appear to be spanning a range of 0% to 25%.

One set of responses to the FNPRM advocates for BDS rate cuts, generally encompassing an up-front cut combined with additional annual cuts. A recent proposal by Level3 would set rates for packet-BDS services deemed non-competitive by deriving the weighted average of the rates charged the incumbent's five largest wholesale customers and its five largest retail customers and then cutting that already deeply-discounted rate by 19.7%.⁹ Sprint recently submitted a declaration by Frentrup and Sappington that proposes a cut of 17.1% plus annual cuts for TDM, would index Ethernet prices to TDM, and would apply the cuts to deeply-discounted contracts.¹⁰ An INCOMPAS-Verizon joint letter proposes an up-front cut of 15% (in two tranches) plus annual cuts of 4.4% minus inflation, for a total of roughly 20%-23% over the first two years.¹¹ Windstream's original demand of a one-time rate cut of 25%-44% plus annual cuts on TDM (with IP rates anchored to TDM) appears to have been replaced by support for the INCOMPAS-Verizon proposal, but with an additional demand for wholesale discounts beyond those offered to retail customers.¹² Ad Hoc Telecommunications Users Committee, which represents end-

⁷ While incumbents in markets containing non-incumbent entrants are certainly competitors in these markets, when we use the term "competitors" or "competitive providers," we generally intend to refer to non-incumbent competitors or providers.

⁸ Wave is shorthand for wave division multiplexing, which allows several communications streams to run over the same fiber. Dark fiber is fiber without the optronics attached, as opposed to lit fiber which is ready for use.

⁹ Level 3, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, September 9, 2016, p. 12.

¹⁰ *Declaration of Chris Frentrup and David Sappington*, submitted by Sprint in dockets WC 05-25, RM-10593, WC 15-247, WC 16-143, August 31, 2016, p. 3.

¹¹ INCOMPAS and Verizon, *letter*, submitted in dockets WC 16-143, WC 05-25, RM-10593 on August 9, 2016, p. 1. Verizon and INCOMPAS have submitted a series of joint letters in which their proposals have evolved.

¹² Windstream, *Comments of Windstream Services LLC on the Further Notice of Proposed Rulemaking*, dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, June 28, 2015, p. 54. Windstream, *reply*, August 9, 2016, p. 3.

user enterprises who are purely purchasers of BDS,¹³ argues on the other hand that only retail cuts can be justified. Ad Hoc states that the economics of serving large enterprises is not different from the economics of serving wholesalers and wholesalers already receive the same sort of volume and term discounts that enterprises receive.¹⁴ Ad Hoc Telecommunications Users Committee proposes that the FCC first reduce rates in areas where incumbents have been allowed to raise rates in the past and then “re-initialize” BDS rates with a cut of 25.2% with additional annual cuts of 4.4% minus inflation.¹⁵

On the other hand, a paper by Dr. Mark Schankerman and Dr. Pierre Régibeau argues that low-speed TDM rates should be raised by 0% to 17.5% up front and 0.5% annually to reflect the increasing cost of providing TDM.¹⁶ AT&T and CenturyLink argue that there is no justification for any up-front cut: “the Commission must reject proposals to reduce price caps” given the lack of evidence the incumbents are exercising market power.¹⁷ Cox argues that a rate cut of as little as 5% would cause it to abandon some infrastructure projects, because the risk inherent in the investment would no longer be supportable.¹⁸ A declaration by Dr. Michael Katz and Bryan Keating, submitted by NCTA, argues that ex ante rate regulation of BDS would be inimical to competition, investment, and consumer welfare.¹⁹ A declaration by Dr. John Mayo, submitted by Comcast, provides evidence that the BDS market is competitive and argues that price-cap regulation, which was designed for monopoly, is likely to reduce investment as well as quality of service in this market.²⁰

Recently, numerous relatively small fiber-based infrastructure providers have expressed concerns about the potential for rate cuts, both those that might be imposed directly on competitors and those imposed on incumbents, because competitors would have to mirror those. Lightower’s August 1st presentation to the FCC noted that Lightower faces competition from the incumbent (ILEC) wherever it operates and from others in most places. It highlighted that it cannot sell at a price higher than the ILEC’s, unless it provides compensating value, and stated that: “If the FCC regulates ILEC prices at those locations where it deems competition to be inadequate, Lightower and other competitive fiber providers will never be in a position to exploit imperfect market conditions.”²¹ A letter submitted on August 29th by a hundred competitive fiber providers urges the FCC to reject regulation of rates, terms, and conditions offered by those companies because it would undermine the deployment of the fiber networks on which businesses, anchor institutions, and wireless carriers rely.²² Wilcon points out that “Wilcon faces

¹³ The Ad Hoc Telecommunications Users Committee does not list its members, but the website of its law firm--LB3-- indicates that it represents 48 Fortune 100 companies with a concentration in banking, financial services and insurance. [Hereafter referred to as Ad Hoc.]

¹⁴ *Reply Comments of the Ad Hoc Telecommunications Users Committee*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 9, 2016, pp. i-iv.

¹⁵ In areas that were previously deemed competitive, providers were allowed the flexibility to both raise and lower rates. Ad Hoc reply comments pp. iv and 12.

¹⁶ Dr. Mark Schankerman and Dr. Pierre Régibeau, *Response to the FCC Further Notice: Regulation of DS1 and DS3 Services*, Charles River Associates, p. 6, submitted by Wilkinson, Barker, Knauer, LLP, August 9, 2016. [Hereafter referred to as Schankerman and Régibeau.]

¹⁷ AT&T and CenturyLink, *letter*, in dockets WC 16-143, WC 05-25, RM-10593, September 8, 2016, p. 2.

¹⁸ Cox, *comments*, in dockets WC 05-25, RM-10593, June 28, 2016, pp. 21-22.

¹⁹ *Reply Declaration of Michael L. Katz and Cr. Bryan G. M. Keating (on behalf of NCTA)*, August 9, 2016, Exhibit A to NCTA, *reply comments*, in dockets WC 16-143, WC 05-25, August 9, 2016, pp. 9-21.

²⁰ *Declaration of Dr. John W. Mayo*, exhibit B to Comcast, *comments*, in dockets WC 16-143, WC 15-247, WC 05-25, June 28, 2016, ¶¶ 80-97, 103-113.

²¹ Lightower, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, August 1, 2016, attachment slide 4.

²² Letter by one hundred fiber providers, in dockets WC 16-143, WC 05-25, RM-10593, August 29, 2016.

competition from the incumbent LEC in virtually every location it serves and from other competitive providers in most of its locations. To induce customers to purchase, Wilcon must meet or beat prices of other providers of BDS.”²³ Wilcon notes that “Wilcon often incurs substantial capital costs for new construction, and any rate regulation, as well as the uncertainty of rate regulation of CFPs [competitive fiber providers] based on an ILEC’s rates, would increase Wilcon’s cost of capital, causing Wilcon to forego some otherwise viable projects.”²⁴ Lumos Networks’ August 29th *ex parte* argues that “the ILEC is ubiquitous and the cable company competes with Lumos for virtually all of Lumos’ customers.”²⁵ Lumos echoes Lightower’s and Wilcon’s concern that regulation, particularly regulation that impacts the fiber providers, will impede access to capital and investment in their networks. Zayo’s comments express a concern that “it would be counter-productive to impose regulations on markets that are competitive and to dissuade new carriers from entering markets because of regulations.”²⁶ Thus, competitive providers make it clear that rate regulation of BDS which lowers the incumbent’s prices and thus lowers the price umbrella under which competitors operate will harm competitive providers’ financials and their ability to invest in their networks.

In general, this paper leaves it to others to discuss the validity (or lack thereof) of the rationale behind various commenters’ rate proposals. Our focus is on the impact such BDS price cuts would have on the BDS providers’ financials, particularly on those who are facilities-based.²⁷ An examination of the likely impact of rate cuts on the free cash flows of BDS providers makes it clear that the competitive fiber providers are justified in fearing that rate regulation of the BDS market poses an existential threat to them, even if that regulation is targeted at the incumbents.

Methodology

Cash flow is a function of both revenue and cost

To understand how price cuts would affect providers, and how providers may react in terms of ongoing investments in digital infrastructure, it is necessary to understand cash flow. At its most basic level, cash flow is cash in minus cash out. A company’s revenue is the cash coming in. Subtracted from it are various categories of variable and fixed cash cost. Revenue minus cash operating expenses (opex) equals earnings before interest, taxes, and depreciation (EBITDA).²⁸ Cash operating expenses include the amount paid for BDS as an input, other variable operating costs (network, SG&A), and fixed

²³ Wilshire Connection LLC, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 25, 2016, p. 1.

²⁴ Wilshire Connection LLC, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 25, 2016, p.2.

²⁵ Lumos Networks Corp., *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, RM-11358, GN 13-5, GN 12-353, August 29, 2016, p. 2.

²⁶ Zayo, *comments*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, June 28, 2016, p. 5.

²⁷ The bottom line for both incumbents and competitors is that a provider’s operating cash flow changes by the net of revenue change minus cost change. That relationship of cost to revenue varies for providers depending on their reliance on their own network v. those of others, on their efficiency, on their mix of in-region v. out-of-region operations, on their mix of wireline v. wireless operations, and many other variables.

²⁸ EBITDA is also known as operating cash flow (OCF). There are numerous variations, with adjustments for non-recurring costs for example, but this is the basic structure.

operating costs. EBITDA minus capital expenditures (capex) equals unlevered²⁹ free cash flow (UFCF), which can then be used to pay interest, taxes, and other cash expenses to arrive at net free cash flow, which can be used for debt repayment, dividends, acquisitions, or other purposes.

For those who sell BDS, it is a source of revenue. However, BDS is also a component of opex for those who buy it to use as an input. We highlight that in our table below by breaking out BDS-input-cost [i.e., the amount paid for BDS used as an input] separately from the other variable operating expenses. BDS-revenue minus BDS-input-cost equals gross margin (GM). GM minus other cash operating costs, both fixed and variable, equals EBITDA.³⁰ If revenue decreases by more than opex decreases, then EBITDA decreases. For the purposes of this analysis we assume that BDS-input-cost is entirely variable.

BDS revenue
minus BDS-input-cost
equals gross margin (GM)
minus fixed cash operating cost
minus variable cash operating cost other than BDS-input
equals earnings before interest, taxes, depreciation and amortization (EBITDA)
minus capital expenditures (capex)
equals unlevered free cash flow (UFCF)

As we noted, BDS can be both revenue and cost. It is revenue to the seller of the service, cost to the buyer of the service, and in the cases of those incumbents and competitors who both sell and buy the service it can be both. When a company both sells and buys BDS, a price cut will affect both its revenues and its costs. Whether its UFCF increases or decreases as a result of a BDS price cut depends on whether the company is a net seller or net buyer of BDS, i.e. whether it sells or buys more BDS.³¹ It also depends on the demand elasticity of BDS, i.e. the extent to which a change in price results in increases or decreases in quantities sold. And it depends on the provider's cost structure, i.e. the incremental operating and capital costs that accompany the change in quantities that result from the price change.

²⁹ It is presumably called "unlevered" because it does not reflect the cost of leverage, i.e. debt, in that it is calculated before both interest and debt repayment.

³⁰ Other variable cost might include the variable cost of operating the provider's own network facilities. It might also include the variable portions of sales, marketing and administration. How variable either BDS-input or other operating costs are at any point in time depends in part on the terms of the contracts under which they are purchased. Because we are exploring price cuts that would, assuming price elasticity of -0.5 to -1.5, increase quantities purchased (or leave quantities unchanged at elasticity of 0) rather than decreasing them, it is fair to assume that the incremental BDS-input is a variable cost.

³¹ As we explain below, the effect on a specific company depends on numerous variables including the levels of price cuts on different components of BDS (e.g. TDM vs. Ethernet v. dark fiber), on the mix of services the provider buys v. sells, and on the price elasticity of BDS.

At one extreme, those who only sell BDS³² would feel the full impact of a price cut on their revenues, without any offsetting benefit from decreased BDS-input cost. At the other extreme, those who only buy BDS would enjoy the full benefit of decreased BDS-cost without any offsetting revenue loss. Those providers of fixed³³ infrastructure who rely most heavily on their own facilities are most likely to be net sellers of BDS and are likely to see the most-heavily decreased EBITDA and UFCF as a result of a BDS price cut. Pure buyers such as enterprises and some wireless carriers are most likely to see some increase in cash flow because they would enjoy cost savings without suffering any revenue loss, i.e. they get no revenue from BDS in the first place so have no revenue decrease.³⁴ Most incumbent and competitive BDS-providers are likely to fall between the extremes, buying some BDS from each other at wholesale to help provision the BDS they sell at retail. However, there is quite a range among BDS-providers between those who are almost pure facilities-based providers v. those who are almost pure resellers.

Rate-cut is assumed to affect all providers equally

We assume that both incumbents and competitors will experience the same price cuts. Even if the FCC decides to mandate price cuts only for incumbents, in practice competitors are likely to have to match them to avoid losing market share. Because the purchasers of the vast majority of BDS are either carriers or large enterprises, i.e. sophisticated buyers, it is prudent to assume that any price cut that is imposed on incumbents will also be extracted from their competitors by those sophisticated buyers.

As Zayo's chief financial officer (CFO) explained at a recent conference, "we're selling to the biggest users."³⁵ Lightower, for example, argues that it cannot sell at a price higher than the incumbent's unless it offers compensating value. Lightower points out that it faces competition from incumbents in almost every location as well as competition from other fiber providers, so that customers have three or more broadband choices at over 99% of Lightower's locations and four or more at over 80%.³⁶ Similarly, "Level 3 must frequently charge prices significantly below its list prices because, for example, it must compete with incumbent LECs that reduce their own prices."³⁷ Uniti Fiber argues that CFPs like Uniti "face competition—at a minimum from the ILEC—at essentially every location served, and therefore already sell at competitive prices." Uniti states that it principally sells backhaul and argues that backhaul contracts "are always awarded pursuant to a highly competitive bidding process" which results in pricing as well as terms and conditions that are "necessarily competitive."³⁸ Unite Private Networks writes that "UPN faces competition from ILECs and other competitive providers in essentially every location it

³² This extreme is probably theoretical, since most providers including incumbents buy some BDS from others, but there is an enormous range in the amount of BDS bought from almost-pure facilities-based providers to almost-pure resellers.

³³ We discuss fixed infrastructure (as opposed to wireless or satellite infrastructure) because it is not clear that BDS price cuts won't spread to other forms of fixed infrastructure like dark fiber which may be perceived as substitutes by buyers.

³⁴ Verizon, AT&T, and Sprint are to varying degrees pure buyers on the wireless side and a mix of buyers and sellers on the wireline side. T-Mobile has no wireline side and is a pure buyer.

³⁵ Zayo Group Holdings Inc. at Drexel Hamilton Telecom, Media & Technology Conference, September 7, 2016, Thomson Reuters transcript, p. 7.

³⁶ Lightower Presentation in BDS Docket, August 1, 2016, attached to Lightower, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, August 1, 2016. Slide 4 states that Lightower faces incumbent competition everywhere it operates and cannot charge higher prices under most circumstances.

³⁷ Level 3, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, July 14, 2016, p. 2.

³⁸ Uniti Fiber, *letter*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, September 16, 2016, p. 2.

serves, and as a result, UPN must meet or beat prices of other providers for Business Data Services (“BDS”) to attract customers...UPN agrees that CFPs often incur capital costs for new construction, and any regulation of CFP pricing would increase the cost of capital and would contort a CFP’s business plans and services if it were ‘required to price element by element and location by location to the ILEC’s prices.’”³⁹

In other words, assuming as this proceeding does and these competitive fiber providers (CFPs) confirm, that incumbents are ubiquitous, any census block in which a BDS competitor operates will include an incumbent.⁴⁰ If that incumbent’s prices are cut by FCC mandate, then we expect buyers to force that competitor to meet the incumbent’s newly lowered prices or lose the business.

We highlight this assumption because we believe its financial implications have not received adequate focus from the FCC and commenters. The analysis of competition in the docket has generally focused on the question of “how many competitors does it take to lower the incumbent’s prices in a market?” and has, until the CFPs began to intervene very recently, ignored the question of “what happens to the competitors after a mandated price cut?”⁴¹

Price elasticity of demand affects both revenue and cost

As we mentioned above, one of the factors that affect a provider’s UFCF after a price cut is the price elasticity of demand for the service whose price is cut. One of the basic tenets of economics is that demand for a good or service generally varies with its price, and that the relationship is usually inverse. Put simply, when the price of a good or service falls the quantity that is demanded rises and when the price rises the quantity that is demanded falls.⁴² There are, however, two extreme possibilities: demand elasticity that is infinite, i.e. an infinitesimally small price change results in infinite changes in quantity, and demand elasticity of zero, when quantity demanded does not change regardless of the size of the price change.

Price elasticity is expressed as the percentage change in quantity demanded divided by the percentage change in price. Thus, for example, a price decrease of 5% accompanied by a quantity increase of 5% would have an elasticity of $0.05/-0.05 = -1$. At that elasticity of -1, there would be no change to total revenue because the quantity sold would increase to offset the price decrease.

The price elasticity of demand matters because a change in the price of a service affects both the revenues from that service and the cost to produce those revenues. Gross margin, EBITDA, and UFCF all

³⁹ Unite Private Networks, *ex parte*, in dockets 16-143, 15-247, 05-25, and RM-10593, September 12, 2016, p. 1, writing to support filings by Lightower, Lumos, Cox and Crown Castle.

⁴⁰ Dr. Mark Rysman, *Empirics of Business Data Services*, April 2016, Rev. June 2016, p. 16-17, table 9. Originally FNPRM, attachment B. [Hereafter referred to as Rysman, revised]

⁴¹ Incumbents as well as competitors would be affected by price cuts, of course. The effect on UFCF depends on the level of price cut, reliance on BDS as an input, and demand elasticity, not on status as incumbent or competitor. However, we focus on the competitive providers since enhanced competition is one of the goals of the proceeding.

⁴² Conversely, when price rises quantity supplied increases and when price falls quantity supplied decreases. A change in price results in both changes in demand and supply, the former characterized as price elasticity of demand and the latter as price elasticity of supply. Whenever we refer to demand elasticity, we are referring to the price elasticity of demand. Note that when these relationships appear to fail to hold, it is usually because there are other non-price factors influencing supply and demand that are not being held constant.

change, as both the revenue line and the cost lines are affected. Even in the case of a service whose demand-elasticity is -1, in which total revenue does not change with a price change, GM, EBITDA, and UFCF are likely to change because a greater quantity now has to be produced to obtain the same revenue.

In other words, a price change triggers both incremental revenues and incremental costs, which are likely to include both operating costs and capital expenditures.⁴³ On the operating side, not only are there some incremental network costs, but there are also sales costs, since the new revenues are not likely to spring unbidden as a result of a price cut. On the capital side, at least some new construction is likely to be required.

Uniti Fiber points out that "Like other CFPs, most new services that Uniti Fiber provisions require some new construction. Like other CFPs, Uniti Fiber spends a substantial portion of its revenue on capital expenditures....Before bidding on projects that require new fiber deployment, Uniti Fiber analyzes the potential for return on its investment, including the payback period."⁴⁴ It explains that projects have to have returns that exceed Uniti's cost of capital, and that reduced revenues or increased cost, including a higher cost of capital resulting from regulatory uncertainty, may force Uniti to abandon or not even bid on projects that today would meet its targets.

Zayo's CFO made the same point in a venue that targets investors rather than regulators. At a recent conference, he explained that a metro network that ultimately serves multiple customers leverages some fiber for all of them but is likely to also require some fiber specific to individual customers.⁴⁵ Thus, incremental capex is likely to be required to obtain incremental revenues. Also, the salesforce has to be compensated for bringing in additional sales, and that compensation has to be designed to incent the salesforce to target projects that will result in internal rates of return that exceed Zayo's threshold.

The demand elasticity of BDS has not been accurately measured in the FCC proceeding on BDS

While demand elasticity is an important factor in determining the effect of a price cut on service providers, it is not one that has been accurately measured for the BDS market. Unfortunately, the record in the BDS proceeding does not include any valid current analysis of BDS demand elasticity, and comments in the docket make it clear that no valid current analysis exists outside the record, either.⁴⁶

INCOMPAS submitted a paper by J. Scott Marcus of WIK that bases its arguments about the hypothetical social welfare effect of a price cut on the assumption that the demand elasticity of both Ethernet and TDM in the U.S. must be in the range of -1 to -2. Marcus justifies that range based on British Telecom's claim that, in response to an Ofcom mandate, it cut Ethernet prices by 25% from 2012 to 2015 and saw its Ethernet revenues rise by 11%. However, Marcus himself points out that may or may not mean that

⁴³ An operation that consists of purely fixed operating and capital expenses is theoretically possible, but unlikely in reality.

⁴⁴ Uniti Fiber, *letter*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, September 16, 2016, p. 4.

⁴⁵ Zayo Group Holdings Inc. at Drexel Hamilton Telecom, Media & Technology Conference, September 7, 2016, Thomson Reuters transcript, pp. 4-6. He discusses the salesforce cost as well as the capital expenditures.

⁴⁶ A paper by James Prieger, *Investment in Business Broadband in Rural Areas*, attached to a letter by Invest in Broadband for America, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 8, 2016, uses -0.1 for DS-1 and DS-3, based on studies conducted in 1988 and 1994. Prieger critiques the 2003 study referenced by WIK, and explains in footnote 39 that he can find no valid current studies.

BT had a price elasticity of -1.9 and has little relevance to the market as a whole: “First, this is a measure of BT’s firm specific elasticity, which may be greater than the overall market elasticity. Second, the quantity consumed might have increased even in the absence of price reductions. Without detailed econometric analysis, it is not possible to exclude that other factors may have contributed to the observed result.”⁴⁷

Marcus also assumes that TDM’s demand elasticity is in the same range as Ethernet’s, because “the services are near-perfect functional substitutes for one another.”⁴⁸ Marcus then uses TDM demand elasticity findings from a 2003 study of DS-1 and DS-3 demand elasticity to justify using the -1 to -2 range for both TDM and Ethernet. There are at least two difficulties with that particular claim.

First, while low-speed Ethernet has proven to be a good substitute for DS-1 and DS-3,⁴⁹ the reverse is not generally the case, as the one-directional migration from TDM to Ethernet makes clear. As Gartner Research notes: “By migrating WAN access from legacy time division multiplexing (TDM) to Ethernet, enterprises will experience greater agility, resiliency and scalability in their network design. In addition, they will enjoy cost savings.”⁵⁰

Second, TDM’s demand elasticity has been quite uncertain in recent years. Gartner Research shows TDM access prices declining roughly 3% total during 2012-2015 in North America, while the volume of legacy lines, i.e. TDM, declined roughly 40% and is expected to continue to decline at double-digit rates.⁵¹ Zayo, which provides enormously detailed financials including pricing trends, also shows that TDM volumes declined sharply in 2012-2015 regardless of whether the prices of specific services decreased or remained flat.⁵² Both of these observations suggest a migration away from TDM that is being driven by many factors other than price. But in any event, neither of these sources supports Marcus’ use of TDM demand elasticities of -1 to -2 based on a 2003 study.

James Prieger’s analysis of the potential impact of TDM price cuts on investment in business broadband in rural areas, on the other hand, assumes that the demand elasticity for DS-1 and DS-3 is -0.1. Prieger also highlights the dearth of econometric demand studies of special access markets. His own estimate is based on studies conducted in 1994 and 1988.⁵³ However dated his sources may be, his estimate appears to be more consistent than Marcus’ with the Gartner and Zayo data that show that TDM demand is currently not very price-elastic.

⁴⁷J. Scott Marcus, *Welfare effects of reductions in the price of leased line equivalents in the U.S.*, WIK consult, July 26, 2016, p.2, footnote 2.

⁴⁸ Marcus, p. 13.

⁴⁹ These are TDM circuits at 1.5 Mbps and 45 Mbps, respectively.

⁵⁰ Danielle Young, *U.S. Ethernet WAN Access Enables Digital Business Strategies*, Gartner Research, October 6, 2015.

⁵¹ Gartner Research, *Leverage Declining U.S. Telecom Prices to Control Enterprise IT Spending*. Gartner predicts that legacy leased lines would decrease roughly 19% per year between 2014-2019. In fact, the Gartner data would indicate that TDM has a demand price elasticity that is greater than 0. Rather than assume the TDM is defying the accepted laws of economics, it is reasonable to assume that factors other than own-price elasticity of demand are causing the migration away from TDM.

⁵² Zayo provides both prices and units each quarter, but as far as we can tell, unit growth is not adjusted for acquisitions in these charts (i.e., the most recent charts do not provide pro forma information for prior quarters), so we are not attempting to use them to derive specific price elasticities.

⁵³ James E. Prieger, *Investment in Business Broadband in Rural Areas*, August 9, 2016, submitted by Invest in Broadband for America into dockets WC 15-247, WC 05-25, WC 16-143, and RM-10593, p. 8 and footnotes 39-40.

Marcus' assumptions about the demand elasticity of Ethernet are also problematic, as the author admits. Not only is the relevance of a UK firm's demand elasticity to the U.S. market questionable,⁵⁴ it is not clear how much of the increase in demand was due to the decrease in the price of Ethernet itself.

As Marcus himself points out, in the UK as well as in the U.S., there has been a transition from TDM-based BDS to Ethernet-based BDS. As we mentioned above, users are migrating because Ethernet has both better technical properties and a lower price per megabit than TDM. In addition, there has been an enormous increase in demand for IP capacity in both Western Europe and the U.S. that is primarily driven by demand for streaming video. Cisco VNI⁵⁵ shows that in Western Europe, business IP traffic increased by 52% from 2012-2015 and CDN⁵⁶ traffic increased by 80%. In the same period in the U.S., business IP traffic increased 78% and business video traffic increased 158%. That supports the Marcus comment that the quantity of Ethernet consumed might have increased even in the absence of price reductions.

Thus, the upper range of Marcus' demand-elasticity assumption appears to be too high, because it is based on a far-too-high elasticity for TDM and ignores non-price factors that increase demand for Ethernet. The demand for TDM in recent years also appears to be driven to a considerable extent by non-price issues. There is no other way to explain the Gartner data,⁵⁷ which indicates that in response to a small decrease in price, there has been a large decrease in the quantity of TDM that is sold—i.e., that TDM has a demand elasticity above zero. It is more likely that TDM has a price elasticity of demand that is very slightly negative and its demand is falling because of the relative price and technical qualities of Ethernet, wave, and dark fiber.

In our analysis in Figures 1 through 4 below, we use a range of market demand elasticities of -0.5 to -1.5 for BDS. Because we examine markets where competitive providers must follow all price-cuts by the incumbent, these market elasticities are also the demand elasticities facing each individual provider.⁵⁸ We use a somewhat higher low-end elasticity for TDM than Prieger's estimate to try to filter out the non-price issues in the TDM to Ethernet migration. For the same reason, as well as to reflect the enormous underlying demand created by IP video, we use a somewhat lower elasticity for Ethernet than Marcus' upper bound. Like both Prieger and Marcus, we recognize the limitations of the available data and econometric research regarding BDS demand elasticity. In general, because BDS is purchased by companies to use in producing their own products, and typically only amounts to a small percentage of

⁵⁴ Another WIK problem is the questionable relevance of UK prices and demand for the U.S., including the assumption that U.S. market forces would not reduce prices simply because the UK market (arguably) would not. That is patently false. According to Gartner Research, during 2012-2015, Ethernet pricing in North America decreased 8% per year for WAN and 12% per year for access, i.e., at least as much as in the UK, without price cuts mandated by the FCC. Gartner Research, *Leverage Declining U.S. Telecom Prices to Control Enterprise IT Spending*.

⁵⁵ Cisco VNI, *Forecast and Methodology 2012-2017 and 2015-2020*, and *U.S. Forecast Highlights, 2012 and 2015*.

⁵⁶ CDN stands for content delivery network, which generally carries video.

⁵⁷ More accurately, one would have to posit that the standard economic assumption that quantity demanded varies inversely with price is wrong.

⁵⁸ We assume that lock-step changes in the price charged by all market participants do not disrupt pre-existing market shares.

these products' cost of production, it is likely that its market demand elasticity shades toward the lower end of the -0.5, -1.0, -1.5 range that we illustrate.⁵⁹

Analysis of free cash flow at different up-front price cuts

So far, we have not discussed one of the most significant problems with the Marcus analysis, i.e. that it focuses only on the impact of demand elasticity on revenues and ignores the effect on costs.⁶⁰ In fact, if a service is demand elastic, i.e. if demand varies with price, then costs as well as revenues are likely to change. Certainly for investors, the relevant consideration is the bottom line impact on free cash flow, not just the effect on revenues.

In Figures 1 through 4, we model BDS providers as if BDS were their only business. For example, the model does not consider a provider's local operations, wireless operations, or data center services (if any). Furthermore, BDS is defined however the FCC defines it. For example, if the FCC includes only TDM, so does our model. However, if it includes TDM and Ethernet, but excludes dark fiber, so does our model.

In our model, the price of BDS as an input is decreased by the same percentage as its price as a source of revenue. For example, if the price of BDS is cut by 5%, then both BDS-revenue and BDS-input-cost are reduced by 5%. We do not separately examine the effect of a 0% price cut, i.e. a possible FCC decision that does not change the status quo, because it would leave revenues, costs, and free cash flow unchanged from their current levels.⁶¹ However, that status quo is the baseline against which our model compares the various price cuts.

Price cuts are likely to result in changes in the quantity produced, which will induce incremental opex and capex. Furthermore, the level of these incremental expenses will vary significantly, depending on whether the additional capacity is sold to existing customers at the existing site or a new site, new customers at an existing site, or new customers at a new site. Figures 1 through 4 below show a range of UFCF changes as functions of changes in variable non-BDS-input cost.

We have also built into the model incremental capex. For a pure facilities-based provider, i.e. with 0% BDS-input-cost/BDS-revenue, the model sets an incremental 15% capex/revenue ratio.⁶² At the opposite extreme, for a provider with 100% BDS-input-cost/BDS-revenue, the model sets a 0% capex/revenue ratio. The model decreases capex proportionately between those two extremes.

⁵⁹ Per the Hicks-Marshall laws of derived demand. For example, financial service providers are extremely communications-intensive. Yet for American Express the cost of communications amounts to roughly 1% of its revenue and 1.5% of its total non-interest expenses, per its 10K for 2015. Bank of America's cost of communications is 1.4% of non-interest expenses, per its 2015 10K.

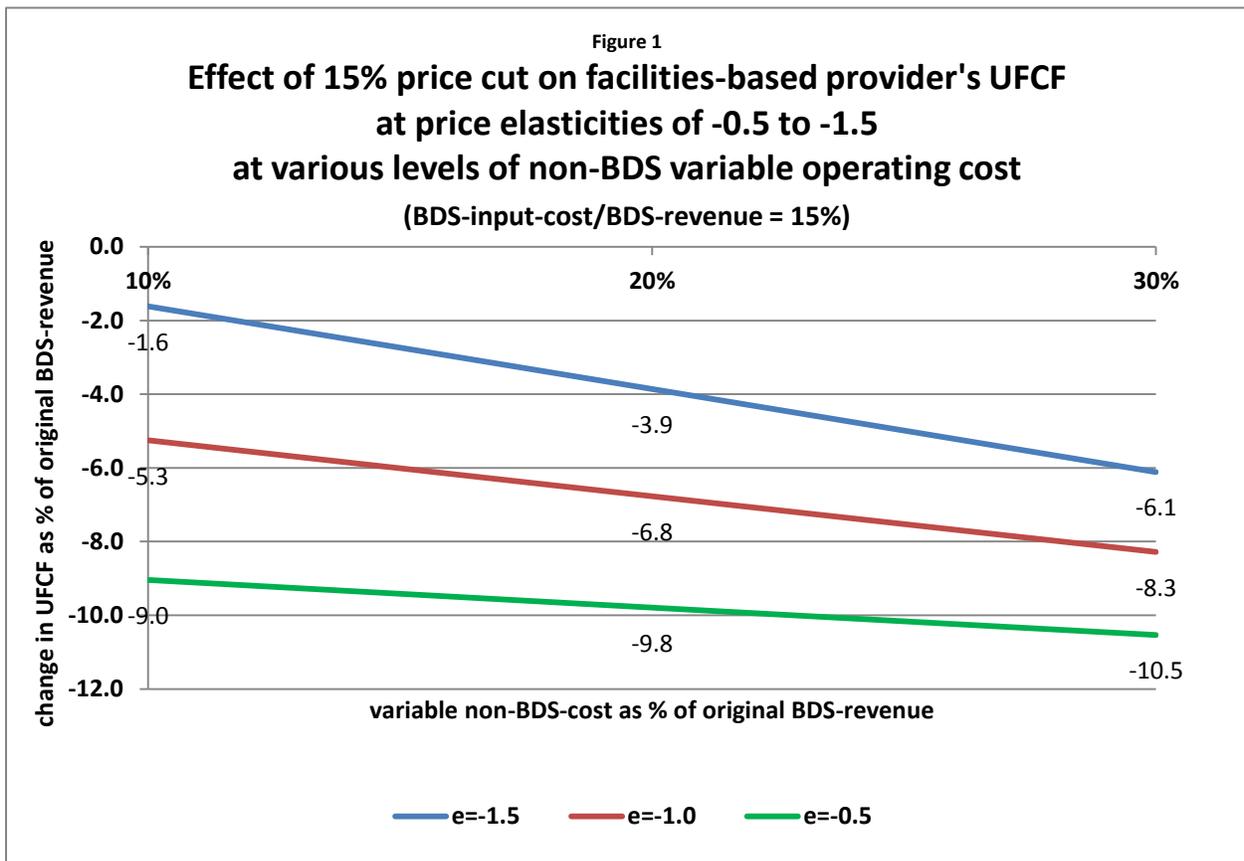
⁶⁰ See George Ford, *Learning from Bad Technique: The WIK-Consult Report on Business Data Services*, Phoenix Center for Advanced Legal & Economic Public Policy Studies, August 4, 2016, for additional issues. Also, *declaration* by Michael Katz and Bryan Keating, footnote 11.

⁶¹ Because all the figures implicitly include the status quo, we do not have a separate figure for 0% price change—which would result in 0% UFCF change—although some commenters argue that the FCC should not have any up-front price cut.

⁶² We may be understating incremental capex/revenue, in which case we are understating the decrease in free cash flow. For example, Zayo's network connectivity segment in calendar 2015 increased revenues by 5.5% and capex by 13.7%. As noted above in relation to pricing and volumes, Zayo's acquisitions make it difficult to do precise comparisons.

Our paper is focused on the effect of BDS price cuts on providers who rely primarily on their own facilities. Figures 1 through 3 show the effects of three levels of price cuts at three levels of demand elasticity on providers who are primarily facilities based. Figure 4 shows the effect on a provider who is a reseller. In Figures 1 through 4, we are describing the incremental costs that are associated with the incremental revenues that result from a price cut. We ignore fixed costs, because those do not vary with a change in either price or quantity, so they are not affected by demand elasticity. They may, however, be substantial.

Figure 1 shows the effect of a 15% price cut on the unlevered free cash flows of a facilities-based provider, at -0.5, -1.0 and at -1.5 demand elasticity. The model underlying this figure assumes that the facilities-based provider makes minimal use of BDS as an input, specifically that BDS-input-cost equals 15% of this provider's revenue.⁶⁴



⁶⁴ This assumption approximates Zayo's mix of owned and leased facilities. Zayo's "netex" during FY 2014 was 14.9% of revenue and during FY 2015 was 13.2% of revenue. Zayo defines "netex" as "third-party network service costs resulting from our leasing of certain network facilities, primarily leases of circuits and dark fiber, from carriers to augment our owned infrastructure, for which we are generally billed a fixed monthly fee." Zayo 10K for FY 2016, p. 43. The highest proportion of BDS-input-cost to BDS-revenues we have seen in publicly available information is that of Windstream, at roughly 50%-55% of revenue. Windstream supplemental data for q4 2015 show combined revenues for carrier and enterprise (excluding voice and long-distance) of \$2.030 billion for 2015. Windstream's CEO Tony Thomas indicated in the q2 2016 earnings call (Thomson Reuters transcript, August 4, 2016, p. 5) that it spends about \$1 billion on BDS for enterprise. Opex for carrier was \$185 million in 2015 and some of that was for costs other than BDS. Combining the two, Windstream's spending on BDS-cost is about \$1.1 billion, i.e. in the 50%-55% of BDS-revenues range.

For those who are not financial analysts, it may be useful to walk through the derivation of a point on this figure. That point is at 15% variable non-BDS-input cost, at $e=-0.5$, i.e. on the green line interpolated between UFCF decrease of -9.0 and -9.8.

At this point, the model assumes that the provider initially sells 100 units at \$1 each and has BDS-revenue of \$100. The provider uses \$0.15 of BDS-input per unit, for a BDS-input-cost of \$15. Its gross margin is \$85. The model assumes that the provider also has \$0.15 variable non-BDS-cost per unit (for its own network and SG&A cost), for a total of \$15.

At this point, the model assumes that the provider has to match a mandated price cut of 15%. The model assumes that the provider has a firm demand elasticity that equals the market demand elasticity of -0.5, meaning that a 15% price cut would trigger a 7.5% increase in quantity. The provider's revenues would fall by \$8.62 from \$100 to \$91.38 (107.5 units at \$0.85 each). Its BDS-input-cost would decrease by \$1.29 from \$15 to \$13.71 (107.5 units at \$0.1275 each). That results in a gross margin reduction of \$7.33. Its variable non-BDS-cost would remain at \$0.15 per unit.⁶⁵ For the extra 7.5 units, that would add a cost of \$1.13. The combined decrease of GM by \$7.33 and additional variable cost of \$1.13 results in an EBITDA decrease of \$8.46. Assuming incremental capex at \$0.15 per unit,⁶⁶ capex would increase by \$0.96, and UFCF would decrease by \$9.41, i.e. by 9.41% of its original BDS-revenue of \$100.

How would that \$9.41 reduction in UFCF translate to a percentage of the original UFCF? That depends on the fixed cash operating costs and the original capex. For example, if the fixed cash operating cost is \$15, then the provider's original EBITDA is \$55. Assuming its original capex is 25% of revenue,⁶⁷ then this facilities-based provider's original UFCF is \$30, i.e. 30% of revenue.

After the price cut, fixed non-BDS operating costs don't change (by definition), i.e. they don't affect the EBITDA decrease of \$8.46. We have accounted above for all other lines in the cash flow statement that determines UFCF. Thus, the \$9.41 reduction in UFCF translates to a 31% decrease in UFCF, from \$30 to \$20.59.

Having explained how the model works, we won't go through each calculation in detail here. The bottom line is that depending on the demand elasticity, the ratio of BDS-input-cost to BDS-revenue, the ratio of variable non-BDS-cost to revenue, and the ratio of incremental capex to revenue, a 15% BDS price cut can result in a decrease of 5% to 35% of the original UFCF.

As figure 2 shows, the result for a 25% price cut is even more dire, with a reduction in UFCF of 20% to 62%. Conversely, as Figure 3 shows, the effect of a 5% price cut is a UFCF reduction of up to 11% of the original UFCF.

⁶⁵ Only the price of BDS has been cut, so the other variable inputs remain at the old price.

⁶⁶ Incremental capex could, in fact, vary enormously, depending on the extent to which the new sales leverage the existing network. For example, in CY 2015, Zayo's incremental capex for its network connectivity segment was 13.5% of revenue, while for its dark fiber segment it was 57.2% of revenue.

⁶⁷ This model loosely approximates Zayo's network connectivity segment, whose EBITDA was about 53% in CY 2014 and CY 2015. Zayo's capex in CY 2014 was 27% of revenue and in CY 2015 was 29% of revenue for its network connectivity segment. However, we show a range of possible variable costs, because providers do vary.

Figure 2
Effect of 25% price cut on facilities-based provider's UFCF
at price elasticities of -0.5 to -1.5
at various levels of non-BDS variable operating cost
(BDS-input-cost/BDS-revenue = 15%)

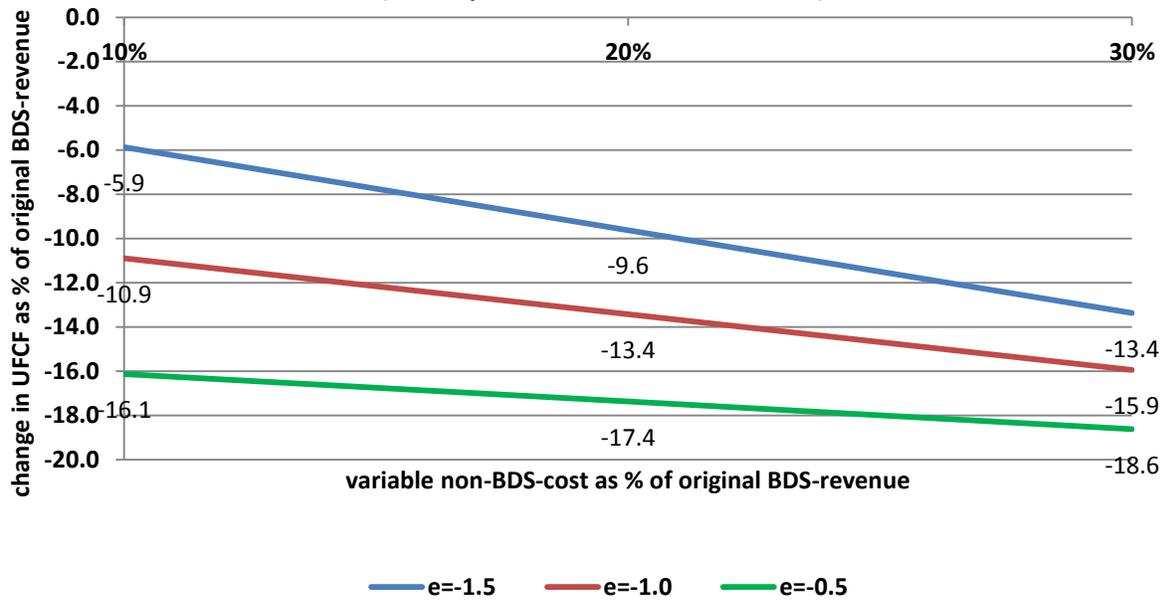
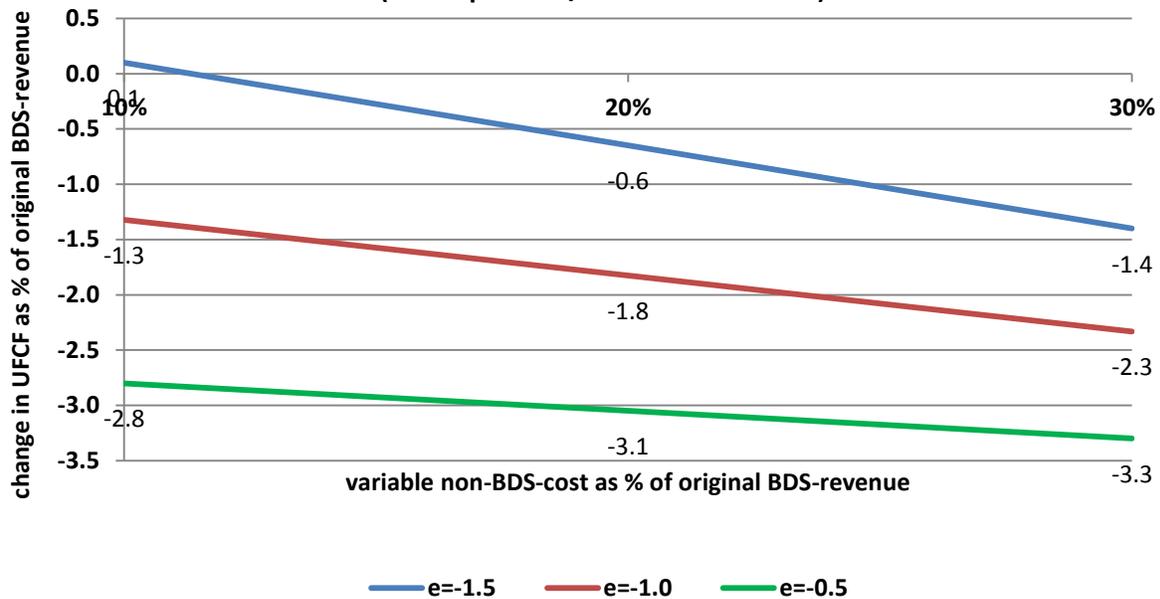
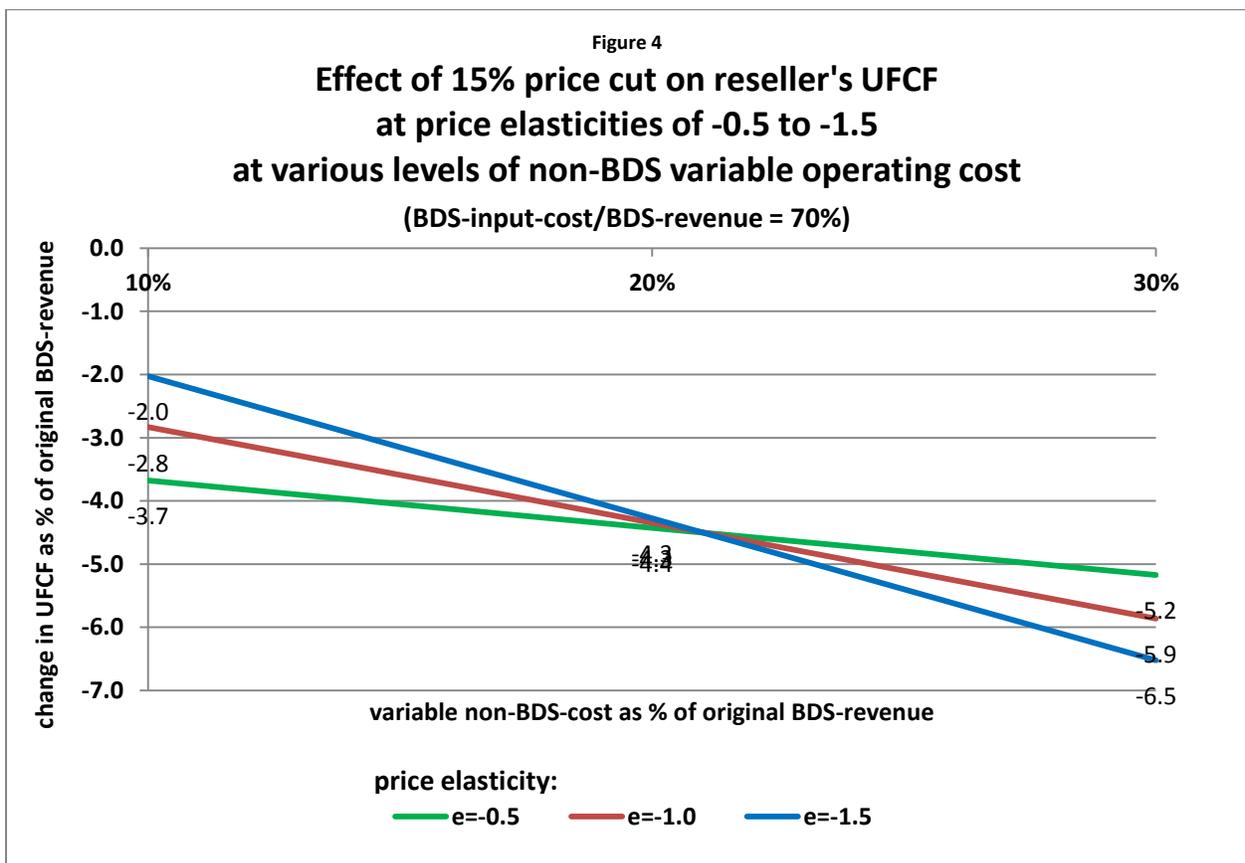


Figure 3
Effect of 5% price cut on facilities-based provider's UFCF
at price elasticities of -0.5 to -1.5
at various levels of non-BDS variable operating cost
(BDS-input-cost/BDS-revenue = 15%)



While our focus in this paper is on facilities-based providers, we include Figure 4 to show that resellers are not exempt from the negative effects of price cuts. For a reseller for whom BDS-input-cost constitutes 70% of BDS-revenue,⁶⁸ a price cut results in a substantial reduction in UFCF even though the reseller enjoys the benefit of lower BDS-input-cost. Having said that, a comparison with Figure 1 also shows that the lower the percentage of BDS-input cost, the greater the damage from a price cut. Also, because such a reseller has no capital invested in the facilities it is reselling (as opposed to any facilities of its own to which it may attach the resold facilities), its return on those resold facilities is infinite even at the lowered UFCF. Bottom line, the greater the reliance on owned facilities, the greater the negative impact of a price cut on the infrastructure provider. The pure facilities-based provider suffers the worst loss, because its UFCF falls most sharply and all of its facilities are based on its own invested capital.



The effect will be different for each company, depending on its own mix of BDS-cost and non-BDS-cost as well as on its capex. Thus, there is no handy formula that the FCC can use to try to impose a price cut on BDS that will not harm competitors as well as incumbents.

⁶⁸ As we notes above, the highest BDS-input-cost/BDS-revenue ratio we have found in publicly available financials is Windstream's in the 50%-55% range. However, Windstream is likely to use its own facilities in-region and to some extent out-of-region, so we are assuming a higher ratio for a pure reseller that primarily arbitrages high-volume discounts on its purchases against higher retail prices on its sales.

Nor will a guaranteed wholesale discount provide much solace to facilities-based BDS providers. Facilities-based BDS competitors sell wholesale to both incumbents and competitors, but they buy very little or no BDS themselves. For them, the additional wholesale discount will simply act like a deeper price cut. Even if the FCC mandates that only incumbents have to provide such a wholesale discount, the facilities-based competitors are likely to have to follow suit in order to retain their market share in the sophisticated carrier market.

How will BDS price cuts affect real-world providers?

We have so far focused on a theoretical model of a provider that sells only BDS. But real companies in the real world are far more complex than that. To understand how an FCC-mandated price-cut might affect an individual company, it is important to understand what portion of the provider's revenues the cut will hit. The impact will, obviously, be very different if the affected revenues constitute 1% of the company's total revenues than if they constitute 100%. Given the way the FCC is approaching its "market test," the relevant factors appear to be location, technology, and speed.

Location is perhaps the simplest to explore. Many parties are advocating that the FCC deem any census block in which there are not at least four competitors to be non-competitive and thus subject to price-regulation. A declaration by Zarakas submitted by Sprint⁶⁹ as well as the revised Rysman study⁷⁰ indicate that less than 2% of census blocks in which there is demand for BDS have four or more competitors and only 4% to 10% have three or more.⁷¹ The Zarakas declaration indicates that only 0.8% of such census blocks have four or more competitors offering 50 Mbps or lower speeds and 2.63% have four or more offering speeds above 50 Mbps. The same calculation by building/cell tower offers very similar results.⁷² Looked at from the perspective of an individual competitor, that means that any census block in which that competitor is doing business, at either low or high bandwidth, has a 90% to 99% probability of being deemed non-competitive and subject to price regulation.⁷³

In other words, any competitor offering BDS at either low or high speed and in almost any location should assume that its prices will be cut, either directly via FCC mandate or indirectly. As numerous CFPs have stated in the record, even if the FCC excludes competitors from its mandate, the sophisticated customers BDS-providers serve will demand that competitors match incumbents' price cuts.

As a result, it is reasonable to assume that BDS price cuts targeted at incumbents will also affect competitors at all the locations they serve. The key question for assessing the effect of an FCC-mandated cut on a provider's financials then becomes: how will the FCC define BDS?

To take one example, Zayo is a facilities-based provider of fiber. It sells a mix of TDM, Ethernet, wave, and dark fiber. According to its December 2015 pricing-trends and earnings supplement, 48% of its

⁶⁹ William P. Zarakas, *Further Supplemental Declaration of William P. Zarakas*, Attachment A to *Reply Comments of Sprint Corporation*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 9, 2016, table 1.

⁷⁰ Rysman revised, pp 16-17, table 9.

⁷¹ Rysman and Zarakas, respectively. We leave it to others to critique these papers and take their results as given for the purpose of calculating our examples.

⁷² Zarakas, August 9, 2016, tables 5 and 6

⁷³ Some of the Zarakas tables are highly redacted and it is somewhat difficult to tell whether above 50 Mbps refers to all speeds above 50 Mbps or to speeds between 50 and 800 Mbps, given that circuit counts are provided in a different table up to 800 Mbps.

revenues were from network connectivity.⁷⁴ Roughly 34%⁷⁵ of that was TDM and Ethernet below 1 Gbps and another 20% of that was Ethernet at or above 1 Gbps. Depending on the speed threshold the FCC adopts in its market test, anywhere from 16% to 26% of Zayo's revenues might be exposed to the FCC's price cut. Depending on the depth of the price cut, there may also be an effect on services that are close substitutes. For example, if the price of Ethernet at 1Gbps is cut, that might affect the sales of Ethernet at 2.5 Gbps. Price cuts on Ethernet might also have some effect on the pricing of wave or dark fiber, to the extent that they might be substitutable for some customers.

Based on its cost data, it appears that Zayo buys very little BDS from others. In its FY 2015 10K, it broke out a category called "netex"⁷⁶ which includes third-party network-service costs. The category amounted to about 13% of Zayo's FY 2015 revenues and included leased circuits, dark fiber, and the cost of colocation facilities purchased by Zayo. It is, therefore, safe to assume that Zayo's BDS-input-cost/BDS-revenue is at the low end of the range. It appears to be one of the companies that would suffer nearly the full hit of the price decrease as applied to the relevant revenues with little off-setting cost savings.

Unlike Zayo, which has relatively little exposure to TDM and to speeds below 100 mbps, roughly 74% of the BDS incumbents sell is TDM and the vast majority is below 50 Mbps.⁷⁷ Thus, even if the FCC limits its price cut to TDM or to low speeds, incumbents are heavily exposed. Those like Frontier, who operate only in-region and don't have wireless operations, are particularly likely to be affected, because the incumbents usually operate over their own facilities in-region. Thus, they are likely to have little BDS-cost saving to offset the BDS-revenue cut that is imposed on them. By contrast, those like Windstream that operate heavily out-of-region are likely to have greater BDS-input-cost as a percent of BDS-revenue so that savings on that BDS-input-cost will help offset some of the revenue cut. But, as we showed above, even for a reseller that relies very heavily on purchased BDS as an input, a price cut is likely to result in a free-cash-flow decrease.

Generally, providers of BDS purchase it as an input into either BDS or managed services which are bought by enterprises. While the FCC has not suggested price cuts on managed services, it is reasonable to expect that sophisticated buyers will demand that the BDS price cuts be passed along to them. Indeed, when the FCC claims that consumers will benefit from BDS price cuts, it is essentially assuming such a pass-through. Thus, we can expect analysts to model BDS price cuts as affecting a larger portion of incumbent and competitive carriers' enterprise and wholesale revenues than their specific BDS revenues.

Some incumbent BDS providers run wireless as well as wireline operations. Their wireline operations will suffer revenue cuts as well as reap BDS-cost cuts, as we explained above. Their wireless operations, on the other hand, do not sell any BDS and so will not suffer any revenue cuts, while they do reap the benefit of BDS-cost-cuts. How those net out depends on the size of the wireless operation v. the wireline's BDS and managed services operations, as well as the proportions of those operations that are in-region (BDS self-supplied) v. out-of-region.

⁷⁴ 37% were from dark fiber and 15% from cloud connectivity.

⁷⁵ Applying the proportions derived from the monthly recurring revenues to the segment revenues.

⁷⁶ Zayo, FY 2015 10K, pp. 32-33.

⁷⁷ Rysman, revised, p. 7, table 1.

Thus, the FCC's goal of promoting the expansion of competitive BDS providers and facilities via the BDS proceeding is likely to backfire if the tool it uses is price cuts. It will injure the free cash flow of competitive BDS-providers as well as that of the incumbent BDS-providers.

How will BDS price cuts affect the transition to 5G?

Another goal set forth in the FNPRM is promoting the transition from 4G to 5G, the next generation wireless technology that is expected to begin widespread deployment around 2020. The throughput of 5G networks is expected to be far higher than that of 4G networks. As Chairman Wheeler has explained, it is expected that carriers deploying 5G will use far more cell sites than they do today and that means that they will need more backhaul from the cell sites to their core networks.⁷⁸ He has also stated that "The next generation of wireless must be like mobile fiber—and that means speeds 10 to 100 times faster than today."⁷⁹ Addressing TIA in June, Commissioner Rosenworcel noted that "5G services are poised to provide speeds more than 10 times faster than today's 4G networks."⁸⁰ The expectations of Amy Yong of Macquarie Research are even higher: "5G is teasing consumers with speeds 100x faster than 4G to 1 Gbps downlink, low latency and enough capacity to meet demand."⁸¹ Michael Rollins of Citi Research, summarizing his takeaways from CTIA's 2016 industry show, states that 5G will require "multi-gigabit speeds."⁸²

Not only will there be more backhaul to more sites, but the backhaul for 5G will have to have far higher capacity than today's backhaul. As CCA pointed out in an ex parte dated August 3d, while competitive carriers today rely on some DS-1 and DS-3 for backhaul, "these services will have limited to no use in a 5G world...Backhaul at 50-100 Mbps or below likely will not support 5G."⁸³ Even today, carriers are moving away from TDM to high-speed Ethernet and, increasingly, to dark fiber. Windstream's sales of TDM to wireless carriers decreased by about 40% in 2015 and were down about 30% in the first half of 2016.⁸⁴ Verizon's EVP David Small said at the recent Oppenheimer conference that Verizon moved from DS-1 and D3-3 to Ethernet at 50-100 Mbps for 4G and is now pre-positioning itself to move to dark fiber for 5G.⁸⁵

Reflecting these trends, Zayo's Fiber to the Tower product mix in roughly two years has moved from 6% TDM, 89% Ethernet, 5% dark fiber to 1% TDM, 72% Ethernet, 27% dark fiber.⁸⁶ Zayo's CEO, Dan Caruso, explained at a recent conference that wireless carriers are beginning to make decisions about 5G now: "The decision they have to make is how is it going to transition their mobile, their backhaul network, their fiber network such that they are readying it for densification. Well, the way that you do that is you convert from leasing bandwidth, which is what they would have done five years ago. When those

⁷⁸ Chairman Thomas Wheeler, *The Future of Wireless: A Vision for U.S. Leadership in a 5G World*, June 20, 2016.

⁷⁹ Wheeler, June 20, 2016.

⁸⁰ Commissioner Jessica Rosenworcel, *Remarks*, at Telecommunications Industry Association Network of the Future, Dallas, Texas, June 8, 2016, p. 1.

⁸¹ Amy Yong, *Telecom and Pay TV The Rules Have Changed*, Macquarie Research, September 12, 2016, p. 1.

⁸² Michael Rollins, *CTIA 2016 Takeaways*, Citi Research, September 9, 2016, p. 1.

⁸³ CCA, *ex parte*, in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, August 3, 2016, p. 1.

⁸⁴ Windstream Holdings Inc., quarterly supplemental information (non-GAAP), for q4'15 and q2'16, p. 3 in each case.

⁸⁵ Verizon Communications Inc., at Oppenheimer Technology, Internet & Communications Conference, August 9, 2016, Thomson Reuters transcript, p. 9.

⁸⁶ Zayo, FY 2016 q4 earnings call slides, August 25, 2016, p. 20 and FY 2016 q2 slides, p. 32.

contracts come due, you want to replace that with dark fiber-to-the-tower and then dark fiber small cell implementations, and you want to make those decisions now because those get built over two, three years.”⁸⁷

That backhaul is not only shifting to increasingly higher throughput levels, but it is being purchased from numerous competitors. Peter Ewens, Chief Corporate Strategy Officer of T-Mobile, stated at the recent MoffettNathanson conference that “more and more will be required of wireline backhaul...However, we do think there are a number of providers there. Cable is certainly a provider but we have managed to deploy fiber to virtually every one of our cell sites using a broad mix of providers; regional fiber providers, utilities, municipalities, cable providers, the fiber players.”⁸⁸

5G’s demanding requirements have numerous implications for the FCC’s BDS reform proceeding. First and foremost, it means that lowering the price of TDM—especially DS-1 and DS-3 at 1.5Mbps and 45Mbps respectively-- will accomplish nothing positive for 5G deployment, because wireless carriers will not use TDM for 5G. Nor, given how badly low-speed TDM would constrain cell sites attempting to provide 5G, should carriers be encouraged to do so via artificially lowered prices. The vast majority of the BDS revenue the FCC contemplates cutting is TDM. According to the Rysman attachment to the FNPRM, in 2013 TDM constituted \$16.1 billion of the \$21.7 billion in ILEC BDS revenue and \$9.7 billion of \$23 billion in competitive provider BDS revenue. In other words, roughly 58% of the \$44.7 billion in BDS revenue to which the FCC is contemplating applying rate cuts comes from services that are too low-capacity for 5G.⁸⁹ Price cuts applied to TDM may, however, deprive BDS providers of the capital they need to upgrade their networks to be able to provide the high-speed backhaul 5G requires. Thus, rate cuts applied to TDM cannot be helpful but may be profoundly detrimental to 5G deployment.

At the same time, attempting to cut rates on the services that 5G will actually use would devastate the infrastructure providers, especially the CFPs. A recent *ex parte* by CCA shows that Dr. Raul Katz discussed with the FCC price cuts on backhaul in the range of 10% to 30%.⁹⁰ He argued that this would provide savings to the wireless carriers that would cause them to increase their own capex by 0.91%-6.81%. What he ignores, unfortunately, is the effect such a cut would have on the providers of backhaul, particularly competitive fiber providers such as Zayo.

There are numerous problems with Raul Katz’s analysis, even setting aside the lack of any attempt to explain how the FCC would legally justify such cuts. Looking only at the numbers he does provide, in slide 7 it is clear that when he talks about the savings to wireless carriers from BDS price cuts, he includes the cost of tower rentals in the savings. Thus, he overstates the cost of BDS substantially. Wireless carriers who responded to the FCC’s survey and represented about 78% of cell sites spent \$5.6 billion on backhaul in 2013.⁹¹ Wireless industry revenues in 2013 were \$189.2 billion. In other words, in

⁸⁷ Zayo Group Holdings Inc. at Goldman Sachs Communicopia Conference, September 21, 2016, Thomson Reuters transcript, p. 4.

⁸⁸ T-Mobile US Inc. at MoffettNathanson Media and Communications Summit, May 19, 2016, Thomson Reuters transcript, p. 11.

⁸⁹ Rysman, revised, p. 7, table 1.

⁹⁰ Presentation by Dr. Raul Katz attached to Competitive Carriers Association, *ex parte* in dockets WC 16-143, WC 15-247, WC 05-25, RM-10593, slides 7-9. This is extracted and modified from the Raul Katz declaration, pp. 6-7, which advocates price cuts of 20% to 60%.

⁹¹ FNPRM, ¶76. The \$5.6 billion was spent by the 15 responding carriers who collectively had 237,000 cell sites. Per CTIA, in 2013, the total number of cell sites was 304,360, so that roughly 78% of cell sites were represented

2013 the industry spent about 3.8% of its revenues on backhaul,⁹² not the 6% average that Raul Katz claims. Perhaps even more important to fiber providers such as Zayo, he includes all backhaul, which as we indicated above means that he is including increasingly high-capacity Ethernet, wave, and dark fiber in the BDS categories whose rates he wants the FCC to cut.

As we explained earlier, when trying to estimate the effect on real-world providers, the FCC's definition of non-competitive BDS determines a key variable, namely the portion of the providers' total revenues and costs that will be affected by the BDS price cut. For example, if the non-competitive BDS definition covers TDM and Ethernet below 1 Gbps, then roughly 16% of Zayo's revenues would be affected by the cut.⁹³ If it includes all the categories that are actually in use for backhaul today and will increasingly be used for 5G, as Katz is implying in his calculations, then the FCC's cuts would affect revenues from Ethernet and wave at speeds above 1 Gbps as well as dark fiber, with the result that 84% of Zayo's revenues would be exposed.⁹⁴ The FCC could, of course, attempt to treat backhaul as a different category from BDS provided to other customers,⁹⁵ but it would be difficult to cost-justify such treatment⁹⁶ and carrier- and enterprise-customers as well as BDS providers would be likely to challenge the attempt.

If the FCC followed Raul Katz's advice, then, the result for Zayo would be a revenue reduction of 10% to 30% on 84% of its revenues. As Figures 1 through 3 above show, that would result in a devastating decrease in Zayo's UFCF, and in that of similar competitive fiber providers.

Keeping in mind that UFCF=EBITDA-capex, i.e. that UFCF has to cover interest and taxes as well as debt repayment, such extreme cuts would be likely to make at least some BDS providers insolvent. In other words, Raul Katz is suggesting decimating the cash flows of the backhaul providers, in some cases literally bankrupting them, in order to possibly stimulate a trivial increase in self-provisioning by the wireless carriers. Of course, if backhaul prices fall, wireless carriers facing build v. buy decisions are more likely to buy more rather than build more, so their capex is actually more likely to fall than increase. There is nothing about Raul Katz's scenario that is positive for 5G, and a great deal that is negative for the survival of competitive fiber providers.

The "multiple" effect

Investors value companies at a multiple of their cash flow, which is based on its expected growth rate. If that growth rate is expected to slow, the valuation will decrease, reflecting both a lower cash flow and a lower multiple. For example, assume that a BDS provider whose EV/UFCF multiple is 30⁹⁷ and whose

(assuming the FCC and CTIA use the same criteria). It is not clear in the FNPRM that the backhaul consisted only of BDS as defined in the document, rather than including dark fiber, for example.

⁹² \$5.6 billion divided by 78% results in a total of \$7.2 billion in industry-wide backhaul spending in 2013. Divided by \$189 billion in revenues, results in 3.8% of revenues spent on backhaul. Katz' example claims that the average is 7.6% of opex, which per slide 8 he claims in turn is 80% of revenue, resulting in his example in backhaul at 6% of revenue.

⁹³ We are using calendar year 2015 results as the basis for these calculations.

⁹⁴ The rest of Zayo's revenue comes from colocation.

⁹⁵ E.g., to cut price on dark fiber for backhaul but not for connectivity between data centers.

⁹⁶ As Ad Hoc pointed out in its reply comments, pp. ii.

⁹⁷ As of the opening prices of the stocks of Zayo and Level3 on 9/25/16, Zayo had an enterprise value (EV) of \$11,179 million and Level3 had an EV of \$26,620 million. We estimate that Zayo's calendar 2015 UFCF was \$227

UFCF is expected to decrease by 25% sees its multiple cut by 25%.⁹⁸ If its original UFCF was \$10, its enterprise value was \$300.00, i.e. \$10 times 30. Once its FCF is reduced to 7.5 and its multiple is reduced to 22.5, its EV is reduced to \$168.80 from \$300.00, a reduction of 44%.

Assuming that the company is publicly held, and assuming that the enterprise value consists of a combination of stock and long-term debt, the stock-price will fall by a far greater percentage than the EV, because the debt does not change. In the example above, the stock price will reflect the full decrease in EV of \$131.20. If the EV consisted originally of half debt and half stock market-cap, i.e. \$150.00 of each, when the EV falls to \$168.80, the debt will still be \$150.00 but the stock market-cap will be \$18.80, i.e., the value of the stock would fall 87%.

If a company is privately held, as many fiber-providers are, its valuation will undergo the same process, with the value of the equity declining as it would if it were public, but without the visibility of a stock price.

Recall Figures 1 and 2 above, which showed the effect of a 15% and 25% price cut on the UFCF of a facilities-based provider. Based on a 15% price cut, the UFCF was reduced by 5% to 35%, depending on the demand-price elasticity and use of variable non-BDS inputs. At a 25% price cut, the decrease in UFCF ranged from 20% to 62%, depending on the price elasticity and level of variable non-BDS-input cost. Such decreases in expectation for UFCF growth would be accompanied by multiple-compression. Thus, what may appear as relatively tolerable absolute decreases in FCF at a 15% price cut could result in catastrophic decreases in the company's enterprise value and stock price, once multiple-compression is taken into account.

Summary

At many of the BDS providers' earnings calls during the last two quarters, analysts have asked about the potential impact of the BDS proceeding on the providers' financials. Given all the uncertainties about what the FCC will do, companies have not been able to give guidance.

No matter how the FCC defines the geographic market, most competitors are likely to be captured by the price cuts because any market that includes a competitor also includes an incumbent. If the FCC cuts the incumbents' BDS prices, competitors will have to match incumbents' reduced prices or lose their share of sophisticated enterprise, carrier, and wireless customers.

From a financial perspective, the key questions for BDS providers are (1) which of their services will be covered by the FCC's definition of BDS, i.e. what technologies and speeds are covered, and (2) the size of the mandated cut. It is these variables that both the providers and investors are anticipating with great anxiety. They will determine the effect on unlevered free cash flow, which in turn will affect the valuations of the providers, both those that are publicly held and those that are privately held.

The broader the definition of BDS—i.e. the more revenue it captures—and the deeper the price cut, the greater the damage is likely to be not only to incumbents but to many competitive providers, with the greatest harm to those that are primarily facilities-based. By depriving facilities-based providers of

million and Level3's was \$1,441 million. Thus, we estimate their EV/UFCF multiples at 49 for Zayo and 18 for Level3.

⁹⁸ The actual multiple decrease will depend on several factors, including the trading patterns of the stock.

capital, the artificial reduction of any of these rates is likely to reduce investment in fiber infrastructure in general and competitive providers in particular.