TABLE 1: USE OF DEDICATED CONNECTION BY HIGH-CAP CUSTOMERS

Use a PBX	78.0%
Use to Access a *Public* Switched Network	71.1%
Average Number of Those Lines	3.6
Percent of Those Lines Used for Data	27.4%
Use to Access a *Private* Network	21.1%
Average Number of Those Lines	3.3
Percent of Those Lines Used for Data	68.2%

Source: TNS Telecom Third Quarter 2000 Survey of Business Customers.
Note: The categories "Use to access a public switched network" and "Use to access a private network" do not sum to 100 percent because those choices are not mutually exclusive.

Of the 737 high-cap customers in the survey who provided follow-up information, 575 (78.0 percent) used a PBX, 58 (7.8 percent) used a Centrex system, and 12 customers used both a PBX and a Centrex system (1.6 percent). In addition, 27.4 percent of DS-1 lines used by respondents to access the public switched network were used for data services, whereas 68.2 percent of DS-1 lines used in private networks were used for data services.[19] Based on the those findings, I conclude that high-cap connections are used for a combination of voice and data services, but that data services are the primary motivation behind the customer's choice of a high-cap connection in a private network.

B. Special Access Services Are Distinct from Local Exchange Services from an Impairment Perspective

16. In its *Public Notice*, the Commission asks whether the exchange access and local exchange markets are "so interrelated from an economic and technological perspective" that an impairment test could not be applied to the two services independently.[20] In particular, the Commission seeks comment "on the nature of the special access market in terms of the types of end user customers carriers typically service in this market."[21] In its comments, AT&T

19. For each DS-1 customer with a line behind a PBX, the respondent was asked the extent to which it used those DS-1 lines for data traffic. The data traffic includes facsimile communications and dial-up Internet connections.

20. *Comments Sought on the Use of Unbundled Network Elements to Provide Exchange Access Service*, CC Dkt. No. 96-98 (released Jan. 24, 2001) [hereinafter SPECIAL ACCESS NOTICE].

21. *Id.*

incorrectly argues that the exchange access and local exchange markets are indistinguishable for purposes of the impairment test. As I demonstrate below, because the demand characteristics of special access customers are so favorable to competitive entry compared with the demand characteristics of local exchange service—namely, special access customers are very large businesses that tend to be clustered in certain areas—special access services and local exchange services are distinct for purposes of an impairment analysis.

17. Special access customers are distinct from local exchange customers in two important ways. *First*, as I demonstrate below, special access customers are very large businesses that spend a lot of money on telecommunications service. To examine the extent to which special access customers are larger than local exchange customers, I analyze the characteristics of customers for high-capacity services in the TNS Telecoms survey. For all survey respondents—not just those who said that they were high-cap customers—the following customer-specific information was also obtained: (1) sales volume; (2) 4-digit SIC code; (3) whether the company had multiple locations; (4) whether the current location was the company's headquarters; (5) the number of worldwide locations; (6) the number of U.S. locations; (7) the number of worldwide employees; (8) the number of U.S. employees; (9) the number of employees at the given location; (10) whether the company is the sole occupant of a building; and (11) whether the building is an apartment complex, a town home, or some other residential location. The survey data also contained weights for each customer that signify how representative that customer is relative to the U.S. business population. Table 2 summarizes the descriptive statistics of high-cap and non-high-cap users.

TABLE 2: DIFFERENCES IN END USER CHARACTERISTICS OF HIGH-CAP AND NON-HIGH-CAP CUSTOMERS (UNWEIGHTED RESULTS)

Characteristic	Average of High-Cap Customers	Average of Non-High-Cap Customers	Difference
Onsite employees	501.1	63.3	437.8*
U.S. employees	7,166.8	2,582.0	4,584.8*
Sales volume	$123.6 M	$15.5 M	$108.1 M*

Source: TNS Telecoms Third Quarter 2000 Survey of Business Customers.
Note: * Significant at 99 percent level.

As Table 2 shows, the differences between high-cap and non-high-cap customers in several dimensions are significant. For example, the mean number of onsite employees of high-cap subscribers was 501.1—whereas the mean number of onsite employees of non-high-cap subscribers was 63.3. The mean number of U.S. employees of high-cap subscribers was 7,166.8—whereas the mean number of U.S. employees of non-high-cap subscribers was 2,582.0. The mean sales volume of high-cap subscribers was $123.6 million per year—whereas the mean sales volume of non-high-cap subscribers was $15.5 million per year.[22]

18. When one adjusts those results to account for the weights in the sample—that is, to reflect how representative each business in the sample is for the entire population of U.S. businesses—the differences in the size of high-cap and non-high-cap customers become even more dramatic. The weight-adjusted mean number of onsite employees for high-cap subscribers was 102.3, whereas the weight-adjusted mean number of onsite employees for non-high-cap subscribers was 8.4—that is, looking beyond the sample of 3,500 businesses, our best estimate of the average number of onsite employees for the entire population of U.S. businesses with high-cap service is 102.3 onsite employees. The weight-adjusted average annual revenues of "high-cap" subscribers was $35,164,774, whereas the weight-adjusted average annual revenues of non-high cap subscribers was $5,241,721. The weight-adjusted average annual telecommunications expenditure (which includes local non-switched revenues, local switched hi-cap revenues,

regional toll revenues, domestic long distance revenues, and international long distance revenues) of "high-cap" subscribers was $45,088, whereas the weight-adjusted average annual telecommunications expenditures of non-high cap subscribers was $1,673. Cleary any business with over 100 onsite employees, $35 million in annual sales, and $45,000 in annual telecom expenditures would be considered very large under any standard.

19. *Second*, special access customers tend to be clustered in certain areas—for example, downtown, industrial parks, or college campuses. According to the *Special Access Fact Report*, more than 80 percent of SBC's special access revenues are generated in less than 25 percent of the wire centers in which it is providing special access.[23] In Verizon's region, more than 80 percent of special access revenues are generated from about 20 percent of Verizon's total wire centers.[24] In Qwest's region, more than 60 percent of special access revenues are generated from 11 percent of Qwest's total wire centers.[25] In BellSouth's region, 91 percent of special access revenues are generated from 20 percent of BellSouth's total wire centers.[26] The high degree of concentration generates the opportunities for large economies of density—that is, investment along one major artery in a CLEC fiber network can yield a substantial return—and hence provides CLECs an added incentive to serve those customers with their own facilities. Moreover, the mapping exercises performed by iMapData, upon which I rely later in my Declaration, confirm that special access customers are clustered geographically.

20. Because special access customers are very large businesses that are clustered in certain areas, CLECs have a strong economic incentive to use their own facilities to serve the

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22. The differences for the weight-adjusted means are significant at the 99 percent confidence level as well.
23. *Id.* at 4.
24. *Id.*
25. *Id.*
26. *Id.*

special access market. Unlike the case with local exchange mass-market service, a CLEC does not need to be capable of connecting one customer to all other customers; nor must a CLEC establish a mass-market customer care organization. Rather, by efficiently deploying fiber in specific geographic areas, and targeting its marketing to the buildings or office parks where special access demand is concentrated, a CLEC can efficiently and effectively compete to serve a very high percent of the entire universe of relevant customers. As I demonstrate below, application of the impairment test with respect to special access service reveals that CLECs would not be impaired without access to BOC facilities.

II. SPECIAL ACCESS CUSTOMERS AND ILEC CENTRAL OFFICES ARE CURRENTLY SERVED BY FACILITIES-BASED CLECS

21. Several CLECs argue that the Commission should find impairment because of the limited level of alternative transport providers.[27] These competitors rely on conclusory arguments or anecdotal claims of current reliance on ILEC facilities. Given the level of competitive entry, however, it is clear that carriers are not impaired. Indeed, this conclusion can be supported by either the level of fiber-based collocation, or the level of competitive fiber already deployed. In the following sections, I examine evidence of both.

22. In its *Pricing Flexibility Order*, the Commission adopted triggers that would determine when a local exchange carrier could obtain pricing flexibility for special access services.[28] After examining data on collocation, the Commission determined that the special

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27. *See* Comments of Broadriver at 2; Comments of Sprint at 5-6; Comments of AT&T at 17; Comments of WorldCom at 15.

28. To achieve the "Phase I trigger" for dedicated transport and special access services (other than channel terminations to end users), competitors must collocate and use competitive transport in 15 percent of a price cap LEC's wire centers in a metropolitan area, or in wire centers accounting for 30 percent of the price cap LEC's revenues from those services in that area. To meet the "Phase II trigger" for these same services, competitors must collocate and use competitive transport in 50 percent of a price cap LEC's wire centers in a metropolitan area, or in

access market was sufficiently competitive to remove price regulation completely for dedicated transport and special access services (other than channel terminations to end users) in markets generating almost two-thirds of the ILECs' revenues for these services. Moreover, the Commission determined that markets generating three quarters of ILECs' revenues for special access services were eligible for relaxed price regulation as a result of actual competition for customers, and it granted additional pricing freedoms for the ILECs' special access services in all markets nationwide.[29] It necessarily follows that entry is possible and is occurring without UNEs. In granting pricing flexibility, the Commission looked at whether customers had an actual choice of suppliers, thereby constraining the incumbents' power over prices.

23. It is important to explain from an economic perspective the relationship between the criteria used to determine pricing flexibility and the criteria used to determine impairment. With respect to pricing, economists are typically concerned about a supplier having the ability and incentive to exercise market power in the end user market. In particular, if it is determined that a supplier cannot raise prices to end users without losing so many marginal customers that the price increase would be rendered unprofitable, then one can conclude that the supplier in question does not have market power. Because it focuses on the ability to raise prices on end users, the pricing-flexibility test is a *consumer*-based test. By contrast, the impairment test asks whether competitors would be impaired without access to a network element of a rival—hence, the impairment test is a *competitor*-based test. Clearly, if there is sufficient competition to protect

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wire centers accounting for 65 percent of the price cap LEC's revenues from those services in that area. PRICING FLEXIBILITY ORDER, *supra* note 17, at ¶¶ 77-141. The Commission adopted somewhat higher triggers for channel terminations to end users.

29. Id. at ¶¶ 77-141 (The Commission explained that "[a]s the market becomes more competitive, such [pricing] constraints become counter-productive. We recognize that the variety of access services available on a competitive basis has increased significantly since the adoption of our price cap rules. Therefore, in response to changing market conditions, we grant price cap LECs immediate flexibility to deaverage services in the trunking basket and to introduce new services on a streamlined basis.")

consumers from anticompetitive pricing, then it necessarily follows that competitors could not be impaired in their *ability* to offer a competing service. If the consumer-based test is met, then the impairment test could not be because the consumer-based test must be more rigorous.

24. The Commission has already determined that it no longer needs to protect access customers from exclusionary pricing behavior by ILECs once competitors have made irreversible investments in facilities because efforts to exclude competitors are unlikely to succeed.[30] As demonstrated herein and in the ILECs' pricing flexibility petitions, facilities-based competition in the special access market is widespread throughout the nation. The same reasoning that led the Commission to remove regulations that protect CLECs from exclusionary pricing for ILEC special access services based on the presence of their irreversible investment in facilities compels the conclusion that CLECs are not impaired in the provision of special access services if they are not allowed to convert the ILECs' special access services into combinations of unbundled elements.

25. Moreover, while the pricing test was restricted to limited geographic areas, there is no reason for such a limitation here. Because facilities-based collocation has been demonstrated to be so significant in virtually all areas of the country, there is clear evidence that carriers are relying on such collocation in a wide variety of circumstances. This justifies a finding that there is no impairment for the service generally—that is, that this conclusion holds without geographic limit.

26. Finally, while the collocation evidence is sufficient to support a finding of no impairment, there is evidence based on fiber deployment that provides an independent basis to reach the same conclusion. Indeed, the Commission's *Third Report & Order* recognized that

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30. PRICING FLEXIBILITY ORDER, *supra* note 17, at ¶ 77.

focusing on collocation alone misses those carriers that deploy fiber and bypass the ILEC network entirely.[31] As I have already noted, competitive fiber networks have already been built in virtually every market where there is a significant demand for special access services, and the capacity, geographic reach, and number of these networks is continuing to grow. The pattern of development in these markets indicates that supply is elastic, and that it can expand wherever there is demand to support it. Given the availability of alternative supply, carriers cannot be impaired if high capacity loops and transport are not unbundled.

27. In this section, I will take a conservative view of the availability of alternatives by analyzing the extent to which this fiber deployment has *already* placed facilities in position to offer service to potential special access customers. In particular, I demonstrate that a significant percentage of potential special access customers are currently within reach of the existing facilities of several facilities-based CLEC carriers. Because so many CLECs are contesting the market for special access services through their own facilities, one cannot conclude that CLECs would be impaired in the delivery of special access services if they lacked access to unbundled network elements.

A. A Significant Percentage of Potential Special Access Customers Is Served by Existing CLEC Fiber Lines

28. My analysis of alternative special access facilities involves four steps. *First*, using a survey of 3,549 business customers from the third quarter of 2000, I estimate the likelihood that a given customer subscribes to high-cap services (DS-1 or DS-3 services) based on that customer's characteristics. *Second*, I assign to each business in each of the six representative cities identified above the probability of subscribing to special access service. *Third*, using data

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31. *See Implementation of the Local Competition Provisions of the Telecommunications Act of 1996*, Third Report and Order and Fourth Further Notice of Proposed Rulemaking, 15 FCC Rcd 3696, (1999).

on the specific location of actual CLEC fiber lines from iMapData, I estimate the percentage of potential special access customers that are currently "addressable" by CLECs in a given MSA. A potential special access customer is defined as addressable when it is located within the range that CLECs historically have extended their networks to serve special access customers. I conclude that a significant percentage of potential special access customers either are currently served or could be served by existing CLEC fiber lines. *Fourth*, for each potential special access customer, I determine whether, based on its expected revenue generation and the costs of extending the network, that customer is close enough to an existing CLEC fiber line that a CLEC would be willing to extend its network to serve that customer.

1. Identifying the Characteristics That Influence the Choice of Special Access Services

29. In stage one of my analysis, I develop a model that enables me to calculate the likelihood that a given customer would subscribe to high-cap special access services based on that customer's economic characteristics. Using the TNS Telecom survey data described above, I perform a probit estimation that controlled for survey weights.[32] For respondents to the TNS Telecom survey, the model correctly predicted subscribership of high-cap service 80.4 percent of the time. Variables with high explanatory power include onsite employees; whether or not the company has one location; (the log of) sales volume; whether the company is involved in engineering and management services, electrical and electronic equipment, communications, educational services, printing and publishing, or business services; and whether the company is the only firm in the building. The coefficients and *t*-statistics are included in the Appendix.

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32. The weights are derived by balancing the sample to the Dun & Bradstreet universe along the following dimensions: (1) state; (2) LATA; (3) 1 digit SIC code; (4) location size; and (5) firm size. The inclusion of the geographic and location size dimensions is necessitated by the sampling plan, which over-samples based on size and

2. Locating Potential Special Access Customers in the Six Subject Geographic Markets

30. In stage two of my analysis, I select six representative U.S. cities to apply the predictions of my high-cap user model. Table 3 provides the demographic characteristics of the cities that I chose.

TABLE 3: POPULATION AND RANK OF SURVEY CITIES

Census Place	*Population*	*Rank by Population*	*Group*
Greenville, SC	58,282	433	Small
Dayton, OH	182,044	89	Small
St. Paul, MN	272,235	57	Medium
Tucson, AZ	405,390	33	Medium
Cleveland, OH	505,616	23	Large
Seattle, WA	516,259	21	Large

Note: A census place generally (1) includes the population mass included in the city, (2) is contained within the metropolitan statistical area, and (3) is contained within the county border. The Census Bureau uses "places" to identify a collection of persons in a geographic area. For the reporting of decennial census data, places include census-designated places (CDPs), consolidated cities, and incorporated places. CDPs are delineated for each decennial census as the statistical counterparts of incorporated places, and "provide data for settled concentrations of population that are identifiable by name but are not legally incorporated under the laws of the state in which they are located." Information downloaded from the Census Bureau's web site at http://www.census.gov/geo/www/tiger/glossary.html#Place.

As Table 3 shows, the cities are chosen to represent a broad range of population. More importantly, the range of population covered in those cities cover the vast majority of the special access market. According to a breakdown of total BOC special access revenues by MSA, 86 percent of those revenues are generated from MSAs with population greater than 100,000; 81 percent of those revenues are generated from MSAs with population greater than 250,000; and 74 percent of those revenues are generated from MSAs with population greater than 500,000.[33] Because special access customers are concentrated *within* MSAs—a small share of the BOCs' wire centers generate the majority of the BOCs' special access revenues[34]—it is

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geography. For an explanation of the weighted-probit estimation, see 4 STATA REFERENCE MANUAL, RELEASE 6, 51-75 (1999).

33. Note that the "large" cities in my sample are not among the twenty largest cities in the United States—if special access customers in Cleveland and Seattle are adequately served by CLECs, then special access customers in New York, Dallas, Los Angeles, and Chicago are likely to be served by CLECs as well.

34. SPECIAL ACCESS FACT REPORT, *supra* note 14, at 3.

reasonable to assume that a similarly large percent of total BOC special access revenues are generated from cities with population greater than 50,000 (the smallest population in my survey). Moreover, the cities in my survey are representative because they vary widely in other dimensions as well.[35] For example, the density of the sample cities ranges from a low of 2,322 persons per square mile (Greenville) to a high of 6,564 persons per square mile (Cleveland). The income per capita of the sample cities ranges from a low of $9,258 (Cleveland) to a high of $18,308 (Seattle).[36] Hence, one can reasonably infer the level of competition in the special access market at the nationwide level based on the level of competition in the six survey cities.

31. For each city above, I identify the set of potential high-cap subscribers by assigning to each business entity in the city the probability that it would subscribe to high-cap service based on the estimated probit model and its characteristics.[37] Because the explanatory variables in my prediction model are the *same* variables that my data sources maintained for all business customers in the six cities—Dun & Bradstreet (provided by TNS Telecom) and InfoUSA (provided by IMapData) maintain the same business economic characteristics—I am able to use my econometric model to predict the likelihood of subscribing to high-cap services for every business in each of the representative cities. A "potential" high-cap customer is defined to be any business in the census place that is assigned a "high" probability of subscribing to high-cap services.[38] Note that such demand modeling can be performed without any knowledge

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35. Note that the choice of cities also reflects the availability of up-to-date fiber data from iMapData.

36. Population and per capita incomes for each census place are based on 1990 figures.

37. *See* Appendix. The term "potential special access customer" is used herein to refer to potential or actual special access customers. Thus, in referring to certain customers as potential special access customers, I do not mean to imply that these customers do not now subscribe to special access services. I mean only to identify those customers that have the attributes of a special access customer.

38. Based on the weighted survey sample, I estimate that 5.8 percent of all businesses have a high-cap connection. I arrive at this figure by multiplying the high capacity variable with the sample weights, and then calculating the weighted mean. After obtaining weighted-probit coefficient estimates, I apply those estimates to the sample, and retrieve the estimated probabilities. Using those probabilities I find that a probability cutoff of 0.1886 is

of the supply of special access services—that is, I only use the characteristics of the firm and a prediction model based on those same characteristics.

32. Of the 25,626 businesses within the Cleveland census place, 625 businesses (2.44 percent) are determined to be potential high-cap customers. Figure 1 identifies the potential high-cap customers in Cleveland by assigning a triangle to their geographic coordinates.

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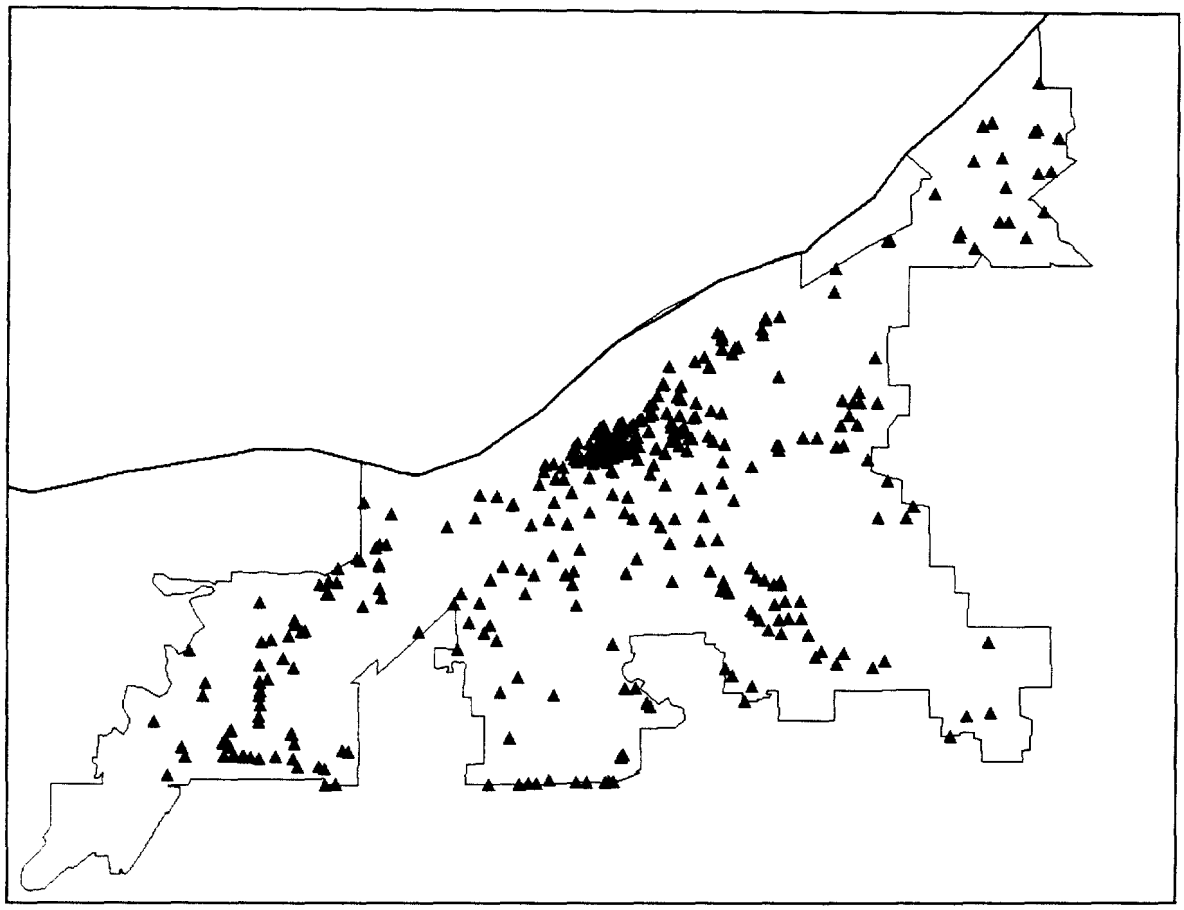
necessary to infer that 5.8 percent of the weighted sample will in fact use a high-cap connection. The threshold number is obtained by summing the weights of the highest probability businesses until 208—the sum needed to select 5.8 percent of the weighted sample—is achieved.

FIGURE 1: POTENTIAL HIGH-CAP CUSTOMERS IN CLEVELAND, OHIO



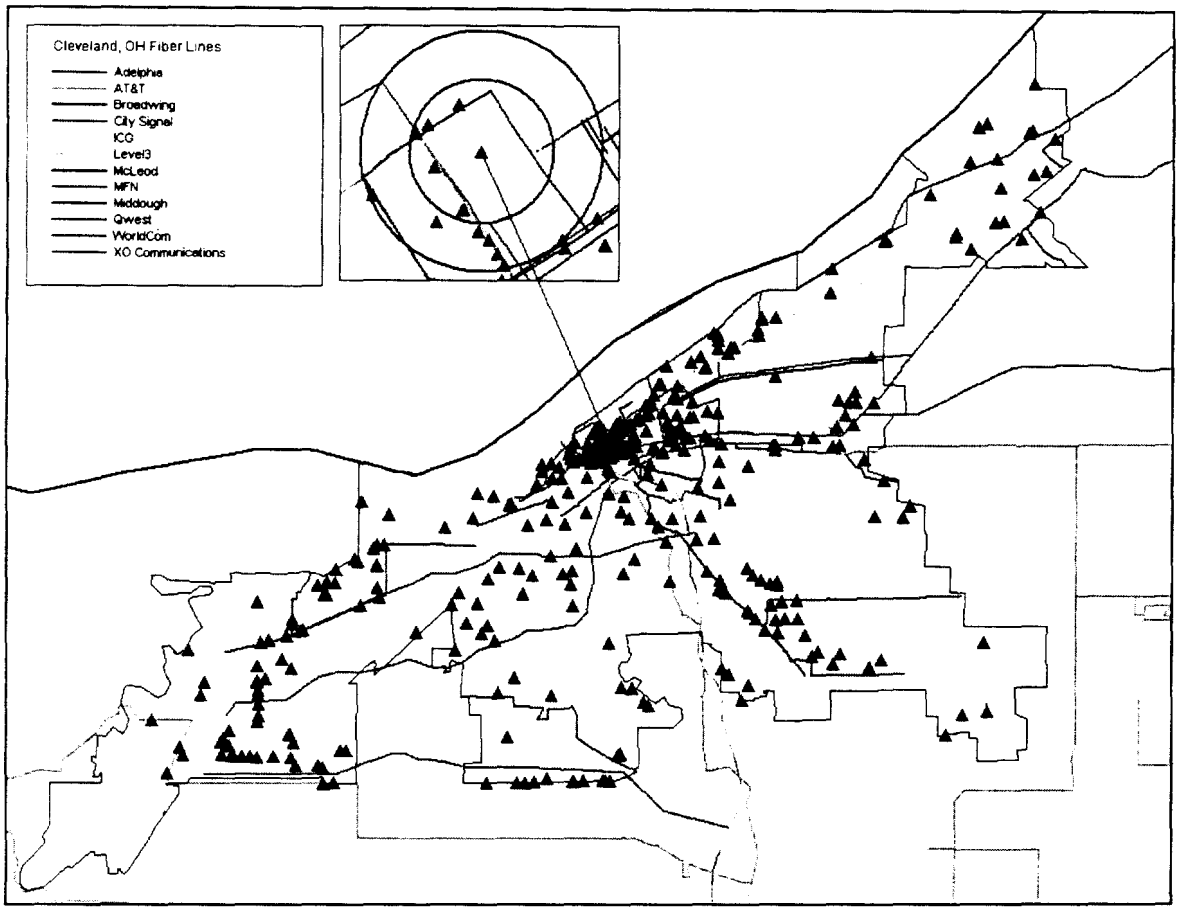
As Figure 1 shows, a large portion of the potential high-cap customers in Cleveland are located along the lakefront. This "clustering" of potential high-cap customers is observed in each of our subject cities, and suggests that a large percentage of all high-cap customers could be addressed by CLECs in a cost-effective way. (Note that this clustering bolsters my earlier contention that CLECs should enjoy large economies of density when using their own fiber networks to serve special access customers.)

3. Calculating the Percent of Potential Customers That Is Currently Addressable by CLEC Fiber Lines

33. The third stage in my analysis is to calculate the share of potential customers in each of the six cities that is "addressable" by existing CLEC fiber lines. A potential special

access customer is defined as addressable when it is located within the range that CLECs historically have extended their networks to serve special access customers. IMapData maintains a database of the geographic coordinates of CLEC fiber lines for several cities in the United States. Figure 2 shows the potential high-cap customers in Cleveland (from Figure 1) overlaid with the existing CLEC fiber lines in Cleveland.

FIGURE 2: POTENTIAL HIGH-CAP CUSTOMERS IN CLEVELAND OVERLAID WITH EXISTING CLEC FIBER LINES IN CLEVELAND



As Figure 2 shows, existing CLEC fiber lines cover a large portion of Cleveland. For each potential high-cap customer in Cleveland, it is possible to calculate the number of unique CLEC fiber lines within a given distance from that customer. Figure 2 also shows an enlargement of the area around one potential high-cap customer. When the radius is set at 500 feet, which is the *smallest* radius in my analysis, the customer is addressable by *three* existing CLEC fiber lines (AT&T, MFN, and ICG). When the radius is set at 1000 feet, the customer is addressable by *five* CLECs (AT&T, MFN, ICG, Broadwing, and Qwest). With such a large number of potential suppliers at such close range, it is fair to characterize competition for that customer to be extremely intense.

34. To examine addressability of potential customers in a market, I have juxtaposed the fiber deployed by CLECs with the location of potential special access customers. Using the results from my model of the characteristics of a special access customer, I then calculate the percentage of customers that are addressed by fiber extending various distances from existing networks.[39] Through this analysis I am able to demonstrate that a significant majority of customers are already addressable by existing competitive fiber networks—that is, they are within the range CLECs historically have extended their networks to serve special access customers. Clearly, this is well above the critical mass necessary to prove that carriers are not dependent on loop-transport combinations to provide this same service. Table 4 summarizes the addressability of potential customers by at least one CLEC fiber line in Cleveland.

TABLE 4: DISTRIBUTION OF ADDRESSABILITY FOR POTENTIAL CUSTOMERS, CLEVELAND, OHIO—AT LEAST ONE CLEC FIBER LINE

Feet	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000
Percent	67%	76%	84%	91%	94%	96%	98%	98%

As Table 4 shows, when the radius is set equal to 500 feet, 67 percent of all potential high-cap customers (equal to a total of 419 businesses) are addressable by at least one CLEC fiber line. When the radius was set equal to 2,000 feet, 91 percent of all potential high-cap customers were addressable by at least one CLEC fiber line. The percent addressable grows as the radius is increased—the larger the area around the potential customer, the larger the likelihood that a CLEC fiber line passes through that area.

35. Table 5 summarizes the addressability of potential customers by *at least two* CLECs in Cleveland.

39. These data are based on fiber networks that we have located and mapped. This is likely to understate existing fiber that is growing and is not comprehensively catalogued. As a result, my results significantly understate the actual reach of competitive fiber. Nevertheless, the data are adequate to illustrate that competitors have deployed in sufficient numbers and scope to prove that unbundled elements are unnecessary.

TABLE 5: DISTRIBUTION OF ADDRESSABILITY FOR POTENTIAL CUSTOMERS, BY DISTANCE CLEVELAND, OHIO—AT LEAST TWO CLEC FIBER LINES

Feet	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000
Percent	50%	59%	65%	72%	76%	82%	86%	88%

As Table 5 shows, when the radius is set equal to 500 feet, 50 percent of all potential high-cap customers are addressable by *at least two* CLEC fiber lines. When the radius is set equal to 2,000 feet, 72 percent of all potential high-cap customers are addressable by at least two CLEC fiber lines. When the radius is set equal to 4,000 feet, 88 percent of all potential high-cap customers are addressable by at least two CLEC fiber lines.

36. Note that the choice of distances (500 feet, 1000 feet, 1500 feet, 2000 feet, 2500 feet, 3000 feet, 3500 feet, and 4000 feet) around potential customers is conservative. For example, Fiberworks, a regional CLEC that has deployed fiber networks in 15 major metropolitan markets in the Southeast, states that its fiber network "will consist of 388 route miles that will pass within 6,000 feet of 1,938 buildings making broadband service available to 19,380 businesses and 585,000 employees."[40] Moreover, an analysis of the *evolution* of the CLEC fiber network reveals that CLECs have been willing to extend their networks by as much as 22,000 feet to serve new special access customers. Table 6 summarizes the distances of the extensions made to the CLEC fiber network in Cleveland from 1999 to 2001.

TABLE 6: DISTRIBUTION OF DISTANCE FOR ACTUAL EXTENSIONS MADE TO THE CLEC FIBER NETWORK CLEVELAND, OHIO FROM 1999 TO 2001

Feet	500	1000	1500	2000	2500	3000	3500	4000+
Percent	20%	10%	10%	20%	10%	10%	0%	20%

Source: iMapData.
Note: The maximum extension in the distribution for Cleveland is 22,200 feet.

As Table 6 shows, only 20 percent of all extensions to the CLEC network in Cleveland were less than or equal to 500 feet, and only 30 percent were less than or equal to 1,000 feet. The median

of the distribution of extensions is 1,800 feet. Most importantly, 80 percent of the historical extensions in Cleveland are between 500 and 4,000 feet.

37. The above data show that it is reasonable to consider a range of distance between 500 and 4,000 feet to make inferences about whether those addressable customers are likely to be served by a CLEC. I present the distribution of addressability for the other five cities in the Appendix. Based on the high degree of addressability revealed through my survey over the relevant range of distances, it would be difficult for a CLEC to claim impairment in the provision of special access service if it were denied access to unbundled network loop-transport combinations.

4. Estimating the Percentage of Potential Customers That Is Likely to Be Served by an Existing CLEC

38. To complete the proof that most of the addressable customers in Cleveland are likely to be served (if they are not served already) by an existing CLEC, I rely on an engineering-based cost study conducted by Cambridge Strategic Management Group (CSMG)[41] that provides the breakeven level of revenues (generated by a building) necessary for a CLEC to extend its network by 500 feet, 1000 feet, 1500 feet, 2000 feet, 2500 feet, 3000 feet, 3500 feet, and 4000 feet. The CSMG cost study used as inputs, among other things, the cost per foot of expanding a

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40. *Fiberworks to Light up Atlanta and Alleviate Atlanta's Bandwidth Bottleneck*, Company Press Release, Sep. 22, 2000 (downloaded from company web site at http://www.fiberworks.com/PressRoom/TheBuzz/PressReleases/Lighting.htm).

41. CSMG is a professional services firm specializing in the global communications, Internet, and high-technology industries. The scope of its consulting practice includes demand and opportunity analysis, new product and services definition, market and competitive positioning, business case development, and economic valuation. CSMG has extensive experience in developing detailed business cases for providers, manufacturers as well as for venture capital and private equity firms. In these contexts, CSMG leverages its deep experience and industry knowledge to develop detailed analyses and provide insight on the business implications of new technology deployment, and in particular the revenues and costs associated with various strategic options. For more information about CSMG's capabilities, visit its web site at http://www.csmgusa.com.

network in the particular city and the CLEC's cost of capital. Table 7 shows the results of this "breakeven analysis" for a CLEC in Cleveland, Ohio.

TABLE 7: BREAKEVEN LEVELS OF ANNUAL REVENUES REQUIRED FOR A CLEC TO EXPAND THE NETWORK, BY DISTANCE CLEVELAND, OHIO

Feet	500	1000	1500	2000	2500	3000	3500	4000
Revenue	$46,988	$51,155	$55,321	$59,488	$63,655	$67,821	$71,988	$76,155

As Table 7 shows, a CLEC in Cleveland would break even by extending its network by 500 feet to serve a special access customer if that customer (or some collection of customers in the same building) generates at least $46,988 in expected annual revenues. Stated differently, $46,988 represents sufficient annual revenue for the CLEC's net present value from expanding 500 feet to be at least $0. Note that the *incremental* revenue requirements of extending the network from 500 feet to points beyond 500 feet are small. According to CSMG, the incremental annual telecommunications revenues from the building needed to justify an expansion of an additional 500 feet (for a total of 1000 feet) is only $4,127 (=$51,115 – $46,988). The flatness of the breakeven frontier suggests that the CLEC decision to expand its network depends more on the attractiveness of the potential customer than on the distance between that customer and the CLEC's fiber line. The assumptions and methodology of the CSMG cost model are presented in the Appendix.

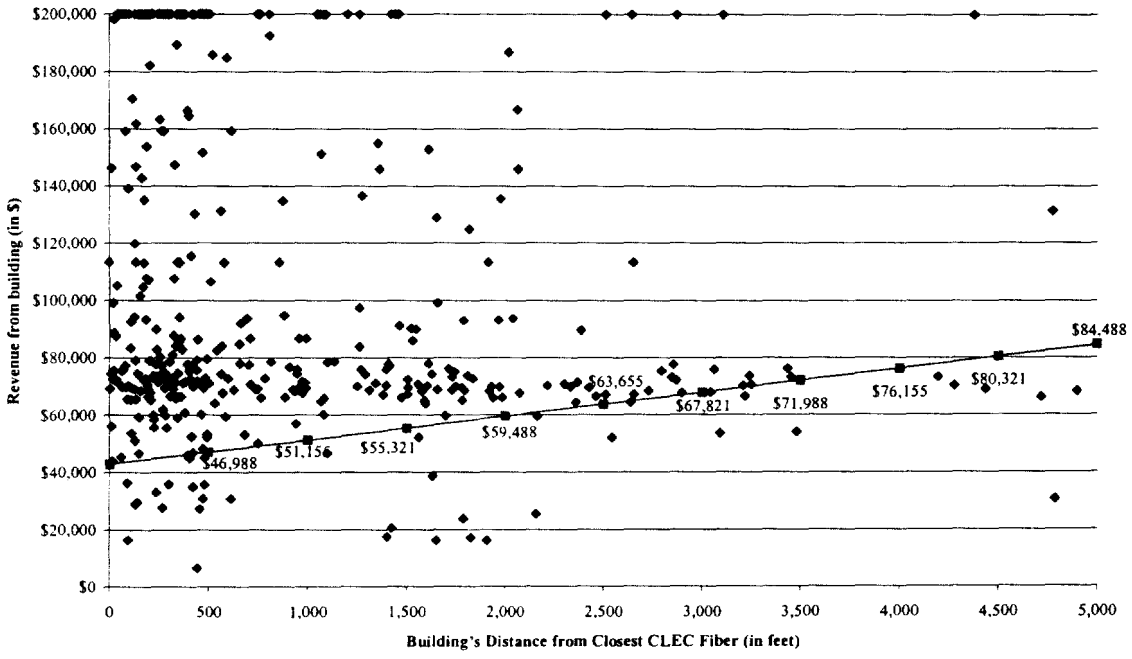
39. For each potential special access customer in Cleveland, I assigned two values: (1) the expected telecommunications revenue available for the CLEC for the building that contains a potential special access customer,[42] and (2) the distance between that building and the nearest CLEC fiber line. I estimated the expected telecommunications revenues for those buildings by applying the parameters from a regression model on TNS survey customers

42. Consider the potential customer to be the "anchor tenant" of that building.

("revenue forecast model"). The estimates of the revenue forecast model are presented in the Appendix.

40. Based on my predicted revenue for the buildings and the breakeven combinations of revenue and distance provided by CSMG, I determined whether each potential customer was sufficiently attractive to be served by the nearest CLEC. Figure 3 shows the relationship between each building (that contains a potential special access customer) and the breakeven combinations of revenues and distances in Cleveland when the revenues are equal to the maximum revenues expected to be captured by the CLEC.[43]

FIGURE 3: DISTRIBUTION OF EXPECTED REVENUES FROM BUILDINGS AROUND BREAKEVEN FRONTIER FOR CLEC TO EXTEND ITS NETWORK, CLEVELAND, OHIO



Note: 86 of the 406 Cleveland buildings with an anchor tenant had expected telecommunications revenue greater than $200,000. Those buildings are represented by the points at the top ($200,000) of the graph. 90.4 percent of all buildings with an anchor tenant lie above the breakeven frontier.

43. The revenue figure contains five components: (1) local non-switched; (2) local switched hi-cap; (3) regional toll; (4) long-distance; and (5) international long-distance.

As Figure 3 shows, 90.4 percent of potential special access customers in Cleveland, when considered in conjunction with the other tenants in the same building, are sufficiently attractive to be served by the nearest CLEC. When those buildings are weighted by their expected revenue, 98.0 percent of total CLEC expected revenues are above the breakeven frontier. Similar results were obtained for the other five cities in my sample.[44] The breakeven frontiers for the other five cities are presented in the Appendix.

41. This analysis is conservative, for at least two reasons. *First*, as I have noted, the analysis is based on a snapshot of fiber deployment. Because this deployment can be expected to continue, a similar assessment made next year would show even greater availability of alternative supply. *Second*, I have performed my analysis for each building separately. It is reasonable to expect that, when considering a network extension, a CLEC would look at clusters of buildings that could be served. For example, an extension down a side street might pass five additional buildings. The CLEC would compare the sum of the expected revenues from those buildings to the estimated cost. My breakeven analysis would effectively require the CLEC to justify five separate extensions. It is likely that some of the buildings which appear to be below the breakeven frontier in Figure 3 would actually be attractive to a CLEC that considered them in combination with other buildings.[45]

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44. I performed a sensitivity analysis to determine how the results would change if the CLEC discounted the expected total building revenues by a certain percentage. When the total revenues are discounted by 25 percent for each building, I find that 70.2 percent of all buildings with an anchor tenant in Cleveland are above the breakeven frontier. When those building are weighted by revenues (discounted at 25 percent), I determine that 91.0 percent of all special access revenues are above the breakeven frontier. Finally, when the total revenues are discounted by 50 percent for each building, I find that 36.2 percent of all buildings with an anchor tenant in Cleveland are above the breakeven frontier. When those building are weighted by revenues (discounted at 50 percent), I determine that 77.3 percent of all special access revenues are above the breakeven frontier. Based on my sensitivity analysis, I conclude that profit opportunities of serving special access customers would not be eliminated as the CLEC discount rate varies between 0 and 50 percent.

45. Moreover, the CSMG cost model makes the conservative assumption that there is no existing conduit available for lease in the market for the installation of the lateral fiber connection. Therefore, the model assumes that the CLEC would have to incur the expense of trenching, boring, and plowing for the installation of the lateral fiber

B. A Significant Percentage of Central Offices Is Interconnected to Existing CLEC Fiber Networks

42. A similar exercise can be done using incumbent local exchange carrier (ILEC) central offices rather than potential customers as the focus of attention. I followed three steps. *First*, I locate each central office within the census place. *Second*, I draw rings around each central office of 500 feet, 1000 feet, 1500 feet, 2000 feet, 2500 feet, 3000 feet, 3500 feet, and 4000 feet. *Third*, I calculate the number of CLEC fiber lines that passed through the rings around the central offices. In contrast to the addressability analysis of potential special access customers above, I do *not* assign an expected revenue to a collocation in the ILEC central office.

43. My analysis reveals that a majority of ILEC central offices within Cleveland are addressable by existing competitors. Table 8 summarizes the results.

TABLE 8: DISTRIBUTION OF ADDRESSABILITY OF CENTRAL OFFICES, BY DISTANCE CLEVELAND, OHIO—AT LEAST ONE CLEC FIBER LINE

City	500 feet	1,000 feet	1,500 feet	2,000 feet	2,500 feet	3,000 feet	3,500 feet	4,000 feet
Cleveland	54%	77%	85%	92%	100%	100%	100%	100%

As Table 8 shows, 92 percent of all central offices in Cleveland are addressable within 2,000 feet of an existing CLEC fiber line; 100 percent of all central offices in Cleveland are addressable within 2,500 feet of an existing CLEC fiber line.

44. Table 9 shows the percentage of ILEC central offices in Cleveland that are addressable by at least two CLEC fiber lines.

TABLE 9: DISTRIBUTION OF ADDRESSABILITY OF CENTRAL OFFICES, BY DISTANCE CLEVELAND, OHIO—AT LEAST TWO CLEC FIBER LINES

City	500 feet	1,000 feet	1,500 feet	2,000 feet	2,500 feet	3,000 feet	3,500 feet	4,000 feet
Cleveland	38%	46%	54%	69%	100%	100%	100%	100%

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connection. However, many markets do in fact have much conduit available for lease. If a CLEC were to lease such conduit instead of installing the fiber by trenching, boring, and plowing, the costs in the model would be less. At lateral distances of 500 feet, the costs in the model run on average 5 percent lower with some variance by market under an assumption of leased conduit. At distances of 5,000 feet, costs in the model run on average 34 percent lower with some variance by market under an assumption of leased conduit. These reduced costs in the model would in turn lower the revenue breakeven frontiers by a corresponding percentage

As Table 9 shows, 69 percent of all central offices in Cleveland are within 2,000 feet of at least two CLEC fiber lines; 100 percent of all central offices in Cleveland are within 2,500 feet of at least two existing CLEC fiber lines. The addressability of central offices in the other cities is presented in the Appendix.

III. POLICY IMPLICATIONS

45. According to my survey of the six subject cities, 94 percent of potential special access customers in large cities (population greater than 500,000) are located within 2000 feet of *at least one* CLEC fiber line; 78 percent are located within 2,000 feet of *at least two* CLEC fiber lines. Similarly, 72 percent of potential special access customers in medium-sized cities (population between 250,000 and 500,000) are located with 2,000 feet of at least one CLEC fiber line; 45 percent are located within 2,000 feet of *at least two* CLEC fiber lines. Finally, 65 percent of potential special access customers in small cities (population less than 250,000) are located within 2,000 feet of at least one CLEC fiber line; 38 percent are located within 2,000 feet of *at least two* CLEC fiber lines.

46. The degree of addressability rises when the radius is expanded from 2,000 feet to 4,000 feet. For example, 99 percent of potential special access customers in large cities (population greater than 500,000) are located within 4,000 feet of *at least one* CLEC fiber line; 88 percent are located within 4,000 feet of *at least two* CLEC fiber lines. Similarly, 84 percent of potential special access customers in medium-sized cities (population between 250,000 and 500,000) are located with 4,000 feet of at least one CLEC fiber line; 64 percent are located within 4,000 feet of *at least two* CLEC fiber lines. Finally, 76 percent of potential special access customers in small cities (population less than 250,000) are located within 4,000 feet of at least one CLEC fiber line; 49 percent are located within 4,000 feet of *at least two* CLEC fiber lines.

47. More importantly, the results of my breakeven analysis demonstrate that approximately 89 percent of all buildings that contain potential special access customers are sufficiently attractive and sufficiently close to a neighboring CLEC fiber line such that it would be profitable for a CLEC to extend its facility and provide special access services to such customers' premises. When those buildings are weighted by their expected revenues, 97 percent of all special access revenues are sufficiently close to a neighboring CLEC fiber line such that it would be cost-effective for a CLEC to extend its facility and provide special access services to such customers' premises.

48. Similar results were obtained for central offices. According to my survey of the six subject cities, 93 percent of ILEC central offices in large cities (population greater than 500,000) are located within 2000 feet of *at least one* CLEC fiber line; 69 percent are located within 2000 feet of *at least two* CLEC fiber lines. And 73 percent of ILEC central offices in medium-sized cities (population between 250,000 and 500,000) are located with 2,000 feet of at least one CLEC fiber line; 46 percent are located within 2,000 feet of *at least two* CLEC fiber lines. Finally, 63 percent of ILEC central offices in small cities (population less than 250,000) are located within 2,000 feet of at least one CLEC fiber line; 50 percent are located within 2,000 feet of *at least two* CLEC fiber lines.

49. The degree of addressability of central offices rises when the radius is expanded from 2,000 feet to 4,000 feet. For example, 96 percent of ILEC central offices in large cities (population greater than 500,000) are located within 4,000 feet of *at least one* CLEC fiber line. Similarly, 88 percent of ILEC central offices in medium-sized cities (population between 250,000 and 500,000) are located with 4,000 feet of at least one CLEC fiber line. Finally, 88

percent of ILEC central offices in small cities (population less than 250,000) are located within 4,000 feet of at least one CLEC fiber line.

50. Because the large majority of potential special access customers and central offices are addressable by existing CLEC facilities, and because CLECs continue to deploy new facilities at a rapid pace, it is impossible for the Commission to conclude that the lack of access to unbundled loop-transport combinations would materially diminish the ability of CLECs to provide high capacity special access services. But this proceeding is about more than the impairment test. Encouraged by Commission regulatory policies, like expanded interconnection, and lured by the attractive economics of the special access market, dozens of CLECs and third party wholesalers have invested in their own special access facilities. If the Commission allows UNEs to displace special access services, further deployment of competitive facilities will be severely inhibited. Moreover, those CLECs that have taken their risk of investing their own facilities will be punished.

51. Why would the Commission take such a step in the one market in which competition is indisputably most advanced? Stated differently, why would the Commission effectively preempt market-based pricing of special access services with a TELRIC prescription when it has just concluded that competition has advanced to the point that incumbent LECs warrant considerable pricing flexibility in geographic areas accounting for most special access revenue? If the Commission wants to encourage continued investment and innovation in telecommunications markets, it must allow markets to dictate prices and allocate resources. Mandatory unbundling for special access service would be a step in the opposite direction.

APPENDIX

A. Estimation of Weighted-Probit Model to Identify Likely High-Cap Customers

52. I used a "probit" method to estimate the regression equation rather than the standard ordinary least squares (OLS) method.[46] The probit method is designed to estimate equations where the dependent variable is discrete—that is, it takes on values of one or zero—whereas the OLS method is used to estimate relationships when the dependent variable is continuous. The probit method estimates how changes in variables on the right-hand side of the equation affect the likelihood that the dependent variable takes on a value of zero or one, assuming that the dependent variable fits nicely on the standard bell curve. Stated differently, probit estimation relates the switching of the dependent variable from zero to one to an actual measure of probability that is commonly used in statistical analysis.

53. In particular, I estimated the effects that a firm's characteristics have on the probability of purchasing a high-cap line. To outline the standard probit model, first define B_i as the benefit to firm i of purchasing a high-cap connection. Next define C_i as the economic cost of the connection to firm i, and let 1 indicate "success" and 0 indicate "failure" of purchasing that connection. After recognizing that firm i will purchase such a connection if $B_i > C_i$, and will not purchase the connection if $B_i < C_i$,[47] I write

$$Prob(purchase\ high\text{-}cap) = Prob(1) = Prob(B_i - C_i > 0) \qquad \text{(Eq 1)}$$

$$Prob(do\ not\ purchase\ high\text{-}cap) = Prob(0) = Prob(B_i - C_i < 0) \qquad \text{(Eq 2)}$$

54. I next define $Z_i = B_i - C_i$ and posit the following regression relationship $Z_i = X_i\beta + \varepsilon_i$, where X_i is a 1 x K row vector of firm characteristics, β is a K x 1 column vector of

46. For a detailed explanation of probit models, see G. S. MADALA, LIMITED DEPENDENT AND QUALITATIVE VARIABLES IN ECONOMETRICS 15-16 (Cambridge University Press 1983).

parameters, and ε_i is a stochastic shock from a random sample. Note that one cannot observe the exact values of Z_i. Instead one observes the outcome Y_i that is 1 when a high-cap connection is purchased. Based on equations 1 and 2 above, one can write

$$Prob(Y_i = 1) = Prob(\varepsilon_i > -X_i.\beta) = 1 - F(-X_i.\beta),$$

where $F(.)$ is the distribution function of ε. If one assumes that that $F(.)$ is the normal distribution, then we have the model:

$$Prob(Y_i = 1) = 1 - \Phi(-X_i.\beta) \qquad \text{(Eq 3)}$$

where $\Phi(.)$ is the standard normal distribution function, completing the basic model.[48]

55. Next I turn to the weighting of the data. Note that the weighting occurs not because of an element in the above model, but because of the nature of the survey data that I used to estimate the model. A survey only reflects a small portion of the total population and is conducted randomly, which means that different observations may have different probabilities of selection. Hence, surveys include weights that are equal to the inverse of the likelihood that a given firm is selected. A firm with a higher probability of selection is more representative of the population, and this must be accounted for in my estimation.[49] I discount observations by their associated weights before estimating the model in equation 3.

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47. Because we use a continuous probability model, I need not consider the case of $Bi = Ci$—that is, the probability of benefit equal cost is zero.

48. MADALA, *supra* note 49.

49. STATA CORP., STATA USER'S GUIDE 51-75 (Stata Press 6th. Ed. 1999).

TABLE A1: PROBIT RESULTS

Variable	Est Coef	T Stat	P-Value
OnSiteEmployee	0.001562	13.16	0
SIC_1	0.658198	2.05	0.041
SIC_20	0.4698022	1.14	0.254
SIC_22	1.25721	2.26	0.024
SIC_23	0.5981426	1.66	0.096
SIC_24	0.9305574	2.16	0.031
SIC_25	1.217561	2.46	0.014
SIC_26	0.6585838	1.46	0.143
SIC_27	1.394902	4.02	0
SIC_28	0.8063944	2.42	0.016
SIC_29	2.570435	2.71	0.007
SIC_30	1.135523	2.35	0.019
SIC_33	0.3771978	0.93	0.355
SIC_34	0.8544147	2.71	0.007
SIC_35	0.7663414	2.68	0.007
SIC_36	1.476011	4.31	0
SIC_37	1.400575	2.68	0.007
SIC_38	0.6976178	2.01	0.044
SIC_39	1.034401	1.97	0.049
SIC_40	0.5006631	0.7	0.483
SIC_41	0.4638304	1.28	0.2
SIC_42	1.036975	3.22	0.001
SIC_43	-0.385488	-1.11	0.268
SIC_44	0.8347609	1.51	0.131
SIC_45	-0.4902944	-1.13	0.258
SIC_47	-0.4849077	-1.36	0.174
SIC_48	1.690208	4.63	0
SIC_49	1.017408	2.89	0.004
SIC_50	0.9960306	3.62	0
SIC_51	0.3550529	1.12	0.263
SIC_52	1.085068	1.97	0.049
SIC_53	0.8508257	1.57	0.117
SIC_54	0.6651488	1.88	0.061
SIC_55	0.7530957	2.71	0.007
SIC_56	-0.5019785	-1.6	0.109
SIC_57	0.864957	2.13	0.033
SIC_58	0.3449317	0.9	0.366
SIC_59	0.301314	0.97	0.331
SIC_60	0.9321801	2.4	0.016
SIC_61	1.295484	2.65	0.008
SIC_62	1.274597	2.78	0.005
SIC_63	0.3769243	1.01	0.311
SIC_64	1.038011	3.1	0.002
SIC_65	0.227795	0.76	0.449
SIC_67	1.791157	4.01	0
SIC_70	1.060723	3.44	0.001
SIC_72	0.56196	1.38	0.166
SIC_73	1.053365	3.91	0
SIC_75	0.2235073	0.68	0.498
SIC_76	0.0287962	0.08	0.933
SIC_78	0.5670483	1.11	0.266
SIC_79	0.9461156	2.81	0.005
SIC_80	0.8016397	2.89	0.004
SIC_81	1.155617	2.47	0.013
SIC_82	1.166602	4.45	0
SIC_83	0.5345895	1.78	0.075
SIC_84	1.111485	1.69	0.092
SIC_86	0.654781	2	0.046
SIC_87	1.362935	5.24	0
SIC_89	-0.6735174	-1.41	0.159
SIC_91	0.8381818	2.69	0.007
SIC_92	1.618066	3.19	0.001
SIC_93	1.082868	1.85	0.064
SIC_94	0.5104386	1.18	0.239
SIC_95	1.283132	3.33	0.001
SIC_96	1.145249	1.8	0.071
SIC_97	0.1566099	0.38	0.704
single	-0.6575988	-8.19	0
log Sales	0.1826997	7.58	0
Constant	-4.512608	-11.17	0

Note: SIC Codes: 01-09 Agricultural; 10-19 Construction; 20 Food & Kindred; 22 Textile; 23 Apparel; 24 Lumber; 25 Furniture; 26 Paper &Allied; 27 Print & Publish; 28 Chemical & Allied; 29 Petrol & Coal; 30 Rubber; 31 Leather; 32 Stone & Clay & Glass; 33 Primary Metal; 34 Fab. Metal; 35 Industrial Machinery; 36 Electrical & Electronic; 37 Transport; 38 Instruments; 39 Miscellaneous; 40 Railroads; 41 Local Transit; 42 Freight Transportation; 43 USPS; 44 Water Trans; 45 Air Trans; 46 Pipeline; 47 Trans Services; 48 Communications; 49 Elec. Gas Sanitary; 50 Wholesale Durables; 51 Wholesale Non-Durables; 52 Building Mats. Hardware; 53 Merchandise; 54 Food Stores; 55 Auto/Gas Service; 56 Apparel; 57 Home Furnishing; 58 Restaurants Bars; 59 Misc. Retail; 60 Deposit Inst.; 61 Non-deposit Credit; 62 Broker Sec. & Com; 63 Insurance Carrier; 64 Insurance Broker; 65 Real Estate; 67 Holding & Investment; 70 Hotels; 72 Personal Services; 73 Bus. Services; 75 Auto Repair; 76 Misc. Repair; 78 Motion Picture; 79 Amusement Rec.; 80 Health Services; 81 Legal; 82 Education; 83 Social Services; 84 Art Gallery; 86 Membership Org.; 87 Engineering; 89 Misc. Service; 91 Government; 92 Justice Public Order; 93 Finance Tax Monetary; 94 Human Resource Administration; 95 Environment Housing; 96 Economic Admin; 97 Security Int. Affairs.

B. Estimation of Regression Model to Forecast Expected Building Revenues

56. I used an OLS regression model to estimate the expected building revenues for each building that contains a potential high-cap customer or anchor tenant. TNS Telecoms provided revenue information for each of the survey respondents in five categories: local non-switched; local switched hi-cap; regional toll; long-distance; and international long-distance. I regressed the sum of those revenues on the characteristics of the customers, which included (1) the log of sales, (2) the number of onsite employees, (3) the firm's SIC code, and (4) a series of interactive terms between the decision to subscribe to a high-cap service (the "high-cap dummy variable") and the above three independent variables. Table A2 summarizes the results.