Attachment D

Pricing Network Elements at TELRIC: A Necessary Prerequisite for Local Competition

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I. INTRODUCTION AND SUMMARY

Local telecommunications competition has not developed as was expected when the Telecommunications Act of 1996 was passed.[2] Only a limited number of large business locations and a handful of small office and residential consumers are enjoying the benefits of competition today. This is due at least in part to the incumbents' success in resisting the Act through extensive litigation and regulatory efforts in the courts and before state commissions. However, the Supreme Court has now definitively rejected virtually all of the ILECs' attacks on the FCC's pricing regulations implementing the Act, and state commissions have become increasingly sophisticated in responding to incumbents' arguments that are in fact inconsistent with the Act's market-opening philosophy. It is now up to the FCC and state commissions to maintain their vigilance

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[2] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, codified at 47 U.S.C. §§ 151 *et seq.* (1996) ("1996 Act" or "Act").

with regard to forward-looking pricing of unbundled elements and not to succumb to ILEC pressure to reduce unbundling obligations prematurely. While the recent D.C. Circuit decision may have required consideration of more granular unbundling requirements, it did maintain a standard for unbundling that still supports the public policy conclusion that extensive unbundling is required to obtain the benefits of competition in the local exchange.

Successful enforcement of the Act likely will lead to great consumer benefits. Absent regulation, the incumbent local exchange companies have the power and incentive to leverage their control over the loop plant to achieve unwarranted competitive advantages in downstream markets that are dependent upon local exchange transmission facilities. These markets include long-distance services, DSL transmission services, ISP services, and other enhanced services. Successful unbundling allows downstream competition to develop relatively free from monopoly interference and regulatory oversight. It also can help bring competition to upstream monopoly markets such as the provision of local exchange services and local access. In the absence of mandated access to ILEC facilities, there is little hope that vibrant and lasting competition in the provision of local exchange and local access services will develop in a timely fashion.

For access to be meaningful, the regulator must identify the particular network elements that should be unbundled and set the rates and terms under which access must be provided. Much of the debate since passage of the Act has centered on the rates and terms under which the ILECs should lease the unbundled network elements ("UNEs") to competitive entrants. The Supreme Court has now resolved the legal issues by approving

the total element long run incremental cost ("TELRIC") methodology and dismissing arguments against it made by the ILECs.[3] In this paper, I describe why this conclusion is economically sound. I continue to believe that providing access at rates set on the basis of forward-looking long-run economic costs estimated using TELRIC models offers the proper basis for regulatory policy in this arena.[4]

Forward-looking pricing allows competitors to benefit from the incumbents' economies of scale and scope in the shared facilities, offers proper signals for investments in the network, and allows the entrant to build a customer base that ultimately could lead to more competitive markets. At the same time, TELRIC-based pricing ensures that the incumbent retains the incentives to invest in the network and earn a reasonable rate of return on its assets.

This paper makes the following points concerning the proper role of regulation and the appropriate methodology for determining the pricing and availability of unbundled elements.

- Unbundling of network elements controlled by the current local exchange monopolist provides a sound basis for public policy both over an immediate horizon as well as over the long run while there is a continuation of monopoly power and no prospect for pervasive competitive entry. (Section II)
- TELRIC provides the proper basis for the pricing of those unbundled network elements for which competition is not strong enough to constrain the dangers of monopoly pricing and exclusionary behavior. TELRIC-based prices also provide correct economic incentives for investment in the network by all parties and

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[3] *Verizon Communications Inc. v. FCC*, 122 S.Ct. 1646 (2002).

[4] *See* Affidavit of William J. Baumol, Janusz A. Ordover and Robert D. Willig, May 14, 1996, filed as Appendix C with Comments of AT&T Corp. in CC Docket 96-98, May 16, 1996.

provide proper signals for efficient competitive entry into the local telecommunications market. (Section III)

- Existing TELRIC Models appropriately reflect these economic considerations. (Section IV)
- ILEC criticisms of TELRIC are flawed and biased. (Section V):
    - TELRIC does not systematically understate the costs of providing network elements to competitors.
    - TELRIC does not disregard real-world principles of network construction and operation.
    - TELRIC does not fail to account for the so-called "real options" effect.
    - TELRIC permits states to set appropriate depreciation and cost of capital.
    - TELRIC appropriately accounts for network growth.
    - TELRIC produces reasonable results, and it is not surprising that there is a substantial difference between forward-looking and embedded costs.
- TELRIC is far superior to any of the available alternatives for establishing the ILECs' economic cost of providing network elements to competitors. (Section VI)

II. ANALYTICAL FRAMEWORK FOR UNBUNDLING

As the Supreme Court has concluded, in enacting the Telecommunications Act of 1996 "Congress passed a ratesetting statute with the aim not just to balance interests between sellers and buyers, but to reorganize markets by rendering regulated utilities' monopolies vulnerable to interlopers."[5] Congress mandated the FCC to promote "novel ratesetting designed to give aspiring competitors every possible incentive to enter local retail telephone markets, short of confiscating the incumbents' property."[6] Congress did

[5] *Verizon*, 122 S.Ct. at 1661.
[6] *Id.*

so because it understood the basic economic concept that "a company that owns a local exchange would have an almost insurmountable competitive advantage. . . . In an unregulated world, another telecommunications carrier would be forced to comply with the incumbents' conditions, or it could never reach the customers of the local exchange."[7] Accordingly, Congress required ILECs to provide unbundled network elements to competitors when the competitors would be "impaired" without access to those elements, a standard that is obviously intended to be more generous than the antitrust standard under which access to "essential facilities" may be required.[8] Stated simply, the Act mandates access whenever there is an upstream monopolist with significant and lasting market power over the facilities needed by potential rivals who otherwise could not compete for the end users on economically viable terms.

The local exchange has been, and for the most part continues to remain, a bottleneck monopoly, meaning that, at least for the foreseeable future, without access to the extensive infrastructure owned and controlled by the ILECs, no competitor can even hope to compete for the provision of local exchange service to a meaningful number of telecommunications subscribers, even if it is willing and able to deploy some of its own facilities. ILECs control the vast array of loops and switches that provide service to virtually every home and office throughout the country, and there is no comparable network in place at this time. To duplicate this network would require investment of billions of dollars, would take years, and could expose an entrant to substantial risks.

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[7] *Id.* at 1662.

[8] It is my understanding that a heightened "necessary" standard applies only when the

These risks stem in part from the fact the entrant would have to make huge sunk investments in the loop plant when there is already an incumbent with a ubiquitous market presence: this is a risk that the incumbent does not and did not face.[9] These asymmetrical risks give the incumbent an almost insurmountable competitive advantage.

Facilities-based competition is limited at this point in time: only certain telecommunications customers in limited geographic areas benefit from facilities-based competition.[10] That limited competition is not effective at constraining the ILECs' market power over the vast majority of end users, nor would the limited presence of competitive local telecommunications facilities offer a ubiquitous and potent constraint on the rates for access to the network elements that the incumbent would voluntarily charge. Further, the promise of widespread intermodal competition is just that – a promise that is far from being realized. Therefore, in order to unlock the local exchange bottleneck monopoly and stimulate long-run competition in the provision of local exchange services and access, policymakers have imposed unbundling requirements coupled with regulation of the terms on which access should be provided. It is now clear

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network element is proprietary in nature.

[9] ILECs, of course, also made sunk investments. However, when these investments in the local loop and other sunk portions of the network were made, the ILECs faced no competitive threats from other advantaged incumbents and were operating under rate of return regulation which virtually guaranteed them a return on *ex ante* prudent investments.

[10] Even in those dense urban areas potentially suitable for competition, there are many barriers to full effective competition such as limited access to buildings and rights-of-way.

that absent strict enforcement of those regulations, and sometimes even in the face of such enforcement, the incentives to deny access (or offer it on discriminatory terms) are so potent that the bottleneck owner may engage in various practices that succeed in delaying, disadvantaging or preventing competitive entry.

III. PRICING OF UNBUNDLED ELEMENTS

As noted above, provision of network elements on efficient terms is a precondition for competitive opening of local markets. If competitors must incur costs for the needed facilities that substantially exceed costs incurred by the incumbents to provide these facilities to themselves, then competitors' ability to offer competitive services that depend upon access to those facilities will be severely impaired. The costs that must be incurred by the new entrants are either the costs of providing their own facilities or the rates charged by the incumbent for access to the needed facilities. If the price for access to the network elements is out of line with the underlying economic costs, the result may be inefficient duplication of facilities and socially-harmful delays in competitive entry. More likely, competition could be altogether stymied. The regulatory framework should thus create incentives for efficient evolution of competition in the provision of local exchange services and local access while preventing the bottleneck firm from frustrating others from developing and deploying new competitive networks and services. As the Supreme Court has correctly emphasized, "competition as to 'unshared' elements may, in many cases, only be possible if incumbents simultaneously share with entrants some costly-to-duplicate elements jointly necessary to provide a

desired service. . . . Low prices for the elements to be leased become crucial in inducing the competitor to enter and build."[11]

At the same time, it must be recognized that it is not a public policy virtue to set prices for network elements "low." Indeed, if UNE prices are set below the ILECs' properly calculated costs, then that too would have harmful effects on the telecommunications sector. Prices that are too low could lead competitors to lease network elements when they might otherwise build efficient competitive facilities, or could unfairly deprive incumbents of the ability to recover their efficiently incurred network costs, and so cause them to cut back on investments in new facilities. Regulation should not inadvertently frustrate the incentives for firms – both incumbents and new entrants – to develop and implement the next generation of telecommunications services. Therefore, rules regulating the unbundling obligations must ensure adequate rewards for investment in the network, maintain incentives for innovation by incumbents and rivals, and make those bottleneck facilities available to competitors.

In sum, for unbundling to accomplish its stated public policy objectives, it is essential that prices be set at the incumbents' cost of providing the requested elements; inefficiencies arise if they are above or below that level. Several different pricing methodologies have been proposed to identify those costs. In what follows I explain why the forward-looking TELRIC pricing model is currently the best methodology available for determining prices for unbundled network element. Setting prices on the basis of TELRIC offers the best way to balance the goals of competitive entry and the legitimate

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[11] *Verizon*, 122 S.Ct. at 1672 n.27.

needs of the incumbents to earn economic returns on their efficient investments. At the same time, TELRIC pricing preserves the incentives for innovation in the network and in the development of new services.

TELRIC models calculate the entire (*i.e.*, total) forward-looking cost of providing a network element. The term "long-run" means that all network inputs are variable. That is, long-run forward-looking costs do not depend on past monopoly practices or investments, but instead are calculated on the assumption that *all* costs are "variable" at the time the cost model for the network is run. Under TELRIC, long-run forward-looking costing models reflect current technology and input prices. Generally, the most efficient network investments and practices should be assumed, but under the FCC implementation of TELRIC, existing network nodes are used to "build out" the network rather than using the most efficient network infrastructure throughout. In contrast to short-run cost methodology, which tends to provide rather low estimates of incremental cost because it does not include fixed costs, TELRIC methodology incorporates all relevant costs. In addition, as we shall see later, TELRIC methodology assumes that the network is optimally scaled to serve the current demand with some excess capacity and charges all users for the assets (network) in place. TELRIC is not the same methodology as TSLRIC, which focuses on the costs of providing a particular service, the provision of which calls for the use of several underlying network elements.

As discussed above, the goal of regulation ought to be to set prices that most closely reflect the incumbents' cost of providing the leased facilities. TELRIC is a "bottom-up" method of costing network elements designed to accomplish this goal.

TELRIC methodology is based on a basic economic principle that the "economic cost" of a facility is the cost of replicating the facility's functions using the most efficient technology presently available. No one seriously disputes that the competitive marketplace values assets based on their forward-looking replacement value.

In a fully competitive market, a firm cannot expect to recover more than the full economic cost of its operations. Retail rate regulation is designed to mimic such a competitive market rate, *i.e.*, the rate that just assures the firm its competitive rate of return. The application of this principle to wholesale pricing for unbundled network elements suggests that these rates also ought to be set at the level that would emerge in a competitive market for network (wholesale) services. When wholesale prices are set at efficient levels using this basic principle, efficient retail competition (*i.e.*, competition for telecommunications subscribers) should follow as a result. When TELRIC rules are properly applied, they will promote efficient entry and investment decisions by ILECs and CLECs, while enabling the ILEC to recover its investment in its network facilities.[12]

The TELRIC pricing and costing methodology divides the network into "elements" like loops and switches, rather than "services" like access and local exchange service. This has the effect of reducing the common cost allocation problem that frequently vexes regulatory practice. This is because the magnitude of joint and common costs between any two elements is likely to be much smaller than the magnitude of joint

[12] The measures of costs must include applicable transaction costs incurred in dealing with CLECs.

and common costs between different services that require same network elements.[13] Indeed, my understanding is that the experience in state arbitration proceedings over the last six years shows that the ability of TELRIC to deal with the problem of joint and common costs has been one of its real benefits. There has been precious little controversy over the need to "allocate" these costs to the specific UNEs, precisely because the level of joint and common costs in the models is relatively low.

TELRIC thus presents a comprehensive cost estimate that includes all of the incremental costs of constructing and operating an efficient telephone network at a wholesale level. It includes the cost of capital, depreciation, and can be adjusted to deal with different fill factors (how much the capacity will be used over time). Therefore, TELRIC-based rates are, by definition, designed fully to compensate ILECs in a manner consistent with the competitive standard for use of their network elements.

TELRIC-based pricing of unbundled network elements does not retard efficient facilities-based entry where such entry is efficient and sustainable because it provides socially efficient buy/build signals.[14] When competitors can provide services as efficiently as the ILECs without using ILEC facilities, they have powerful incentives to do so, and will not rely on their principal competitor's inputs. However, if, because of economies of scale and scope, the benefits of leasing at efficient rate exceed the costs of

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[13] *See Local Competition Order*, para. 678. The forward-looking overhead percentage established in the HAI Model is 10.4%. The FCC's Synthesis Model used a different approach, setting overhead at $7.32 per line per month. *See Federal-State Joint Board on Universal Service,* Tenth Report & Order, 14 FCC Rcd 20156, n.855 (1999).

[14] The D.C. Circuit raised this point in *USTA v. FCC*, 290 F.3d 415 (D.C. Cir. 2002). The discussion here and in Section V.E below should be useful to the Commission in

self-provision, leasing best serves the public interest. If the requesting carrier cannot satisfy its need for the element as cheaply as can the incumbent, then its facilities-based entry would waste resources and is not necessarily in the social interest as it only increases the costs of providing telecommunications services to the public. On the other hand, an entrant has incentives to rely on its own facilities (whenever feasible) so as to reduce dependence on the rival whose interests are not likely aligned with those of the requesting carrier.[15] In fact, CLECs have made investments in their own facilities even when similar ILEC facilities have been available. They have made these investments where it was in their interest to control their own facilities and they could do so cost effectively.

Ultimately, as firms move toward facilities-based competition where appropriate, the TELRIC-based pricing regime should lead to less downstream regulation over the long-term, as well as less burdensome regulation of the network elements themselves. Unbundling requirements coupled with TELRIC-based prices provide proper long-run investment signals to entrants, thus promoting entry of efficient facilities-based competitors. Staged entry will enable the rivals of the ILECs to develop a customer base that will enable them ultimately to realize economies of scope and scale and further stimulate construction of network facilities. In sum, efficient entry that uses the most suitable technologies and entry modes will ultimately break down the local bottleneck

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addressing the questions remanded to it by the D.C. Circuit in that decision.

[15] In the discussion below, I address the erroneous claims that TELRIC in fact sets rates

monopoly to the benefit of telecommunications consumers and the U.S. economy as a whole.

Having outlined the uncontroverted benefits of unbundling and TELRIC-based prices, I now turn to a more complete discussion of the TELRIC methodology.

IV. OVERVIEW OF TELRIC MODELS CURRENTLY IN USE

At the present time, there are at least two engineering-economic models used in state and federal proceedings to estimate TELRIC costs – the FCC's Synthesis Model[16] and the HAI Model.[17] The Synthesis Model was originally developed for use in estimating the subsidy required to meet the FCC's obligations under the Act to implement a transparent, competitively neutral mechanism for funding affordable telecommunications service in high cost areas. It has since been adapted for use in estimating the cost of unbundled network elements. The HAI Model, which formed the basis for much of the FCC's model, was developed specifically for the purpose of estimating universal service costs *and* the TELRIC cost of unbundled network elements. In addition, several of the ILECs have themselves constructed models that purport to estimate the TELRIC cost of UNEs. These models exhibit varying degrees of fidelity to the theoretical principles that underlie the overarching TELRIC methodology. While

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below the ILECs' costs.

[16] *See* http://www.fcc.gov/wcb/tapd/hcpm/welcome.html.

[17] HAI local exchange proxy cost model, "HAI Model, Release 5.0a," filed with the FCC on February 16, 1998 ("HAI Model").

there are some differences in how these models implement the TELRIC methodology, my focus here is on the common elements. In the following discussion I focus on the FCC and HAI Models since these have been most fully developed and most frequently used.

To estimate the forward-looking economic cost of a telecommunications network, one must first determine the quantities of service demanded and the locations at which demand must be served. The FCC and HAI models determine customer demand by using public FCC data on loops and minutes of use. ILECs provide these data to the FCC.

The FCC's Synthesis Model locates customers by distributing populations within census block groups on the road network. The HAI Model uses a combination of the FCC's technique and also locates customers by actual street addresses. A model used by BellSouth in some of the states where it provides service uses the actual locations in its customer records to determine where demand needs to be served. In general, any of the models currently in use is capable of using data at whatever degree of specificity is available to determine the locations where demand must be served.

Once the locations to be served are determined, the models use algorithms that mimic the process followed by telephone company engineers in designing and engineering the telephone network. Using a set of rules that describe engineering parameters such as the maximum length of copper cables and the number of lines that may be served using digital loop carrier systems, the models first group customer locations into clusters that may efficiently be served within a single distribution area, then design feeder and distribution cable routes that reach the individual customers efficiently.

In the process, the model determines the length and size of copper and fiber optic cables and the amount and type of structures supporting the cables (*i.e.*, telephone poles, trenches, and underground conduits) based on a set of user-adjustable inputs and cost-minimization rules. The models follow a similar process to determine the number and size of switches (in existing central office locations) needed to serve demand, and to design an interoffice fiber network to connect the switches to each other and to the tandem switches.

After the types of cable and other equipment needed have been determined, public information on the prices of these items, and on the cost of labor to install them, is used to estimate the investment needed to serve each cluster of customer locations. The amount of investment in each category of equipment is then used to calculate the annual capital cost for each category, including depreciation, interest on borrowed funds, return on stockholder's equity, corporate income taxes, and property taxes. The TELRIC models are flexible in how capital cost is calculated, permitting the user of the model to adjust depreciation lives and net salvage values for each category of equipment, to use several different methods of depreciating network assets, and to adjust cost of capital (interest rates and equity returns) for the operation as a whole.

The following table presents a simplified[18] illustration of the recovery of a $1,000 investment in the HAI Model:

Year	1	2	3	4	5
Beginning Investment	$ 1,000.00	$ 800.00	$ 600.00	$ 400.00	$ 200.00
Ending Investment	$ 800.00	$ 600.00	$ 400.00	$ 200.00	$ -
Average Investment	$ 900.00	$ 700.00	$ 500.00	$ 300.00	$ 100.00
Depreciation	$ 200.00	$ 200.00	$ 200.00	$ 200.00	$ 200.00
Interest	$ 31.19	$ 27.72	$ 20.79	$ 13.86	$ 6.93
Return	$ 79.84	$ 62.10	$ 44.35	$ 26.61	$ 8.87
Income Tax on Return	$ 31.34	$ 24.37	$ 17.41	$ 10.45	$ 3.48
Total Capital Cost	$ 342.36	$ 314.19	$ 282.55	$ 250.92	$ 219.28
Levelized Capital Cost	$ 247.72	$ 247.72	$ 247.72	$ 247.72	$ 247.72

Finally, the operations and maintenance expense associated with each category of investment is calculated based on information reported by the ILECs on the relationship between expenses and investment. The expenses included are not only those directly associated with maintenance and repairs of the physical plant, but also include the cost of supporting facilities such as motor vehicles, office equipment, and land and office buildings.

Unit costs for each network element are determined by simply dividing the total annual cost by twelve and dividing the result by monthly demand volumes. For example, the unit cost for loops (which are made up of several pieces) is determined as follows:

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[18] The actual calculations in the HAI and Synthesis Models are far more complex, as they consider differences in IRS and regulatory depreciation methods and depreciation lives. The HAI and Synthesis Models can accommodate either straight line or equal life group methods of depreciation, and include calculations (not shown here, but included in the results) to gross up return dollars so as to provide a post-tax return equal to that specified

1	Annual cost – Network Interface	$123,709,571
2	Annual cost – Distribution	$1,093,417,745
3	Annual cost – Concentration	$737,694,879
4	Annual cost – Feeder	$292,441,508
5 = SUM(1-4)	Annual cost – Loops	$2,247,263,703
6 = 5 ÷ 12	Divide by 12	$181,271,975
7	Number of Loops	29,594,673
8 = 6 ÷ 7	Monthly Unit Cost	$6.33

In sum, the current TELRIC models produce estimates of the cost of each component of an efficient network, designed to serve total current demand at current customer locations, using engineering and economic techniques similar to those employed by telephone company engineers in designing "real world" networks. The TELRIC models are also designed to be flexible with respect to growth in the network and can accept different input vectors as well.

The TELRIC models are conservative – in the sense that they overestimate the full-forward looking cost of the network – in a number of respects. First, as required by the FCC, existing ILEC wire center locations are used in the models. This prevents savings that might be available through consolidating traffic aggregation points in a more efficient network. Second, as I discuss in detail below, the models build networks with excess capacity. Third, the models do not fully account for the economies of scale and scope that the ILECs in fact enjoy when they construct and operate their actual networks.

From the public policy standpoint it also matters that TELRIC models are transparent. That is, all of the data inputs and calculations are exposed to public scrutiny.

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as an input.

Any interested party can obtain a copy of the model and use its own assumptions to change the inputs. This is in stark contrast to models historically used by telephone companies in regulatory proceedings that were often proprietary and cumbersome to operate.[19]

V. ILEC CRITICISMS OF TELRIC LACK MERIT

The incumbent local exchange carriers and their economists have repeatedly criticized both the theory of TELRIC and the way in which the TELRIC models have been implemented. Their most fundamental criticism is that by constantly incorporating the newest and most efficient technology, TELRIC models assume an unobtainable level of efficiency and thus render any actual network financially infeasible. Second, they argue that TELRIC is too theoretical and not sufficiently linked to real world network operations, leading to speculative and unrealistic choices. Third, the incumbents claim that TELRIC models do not take account of the full costs associated with committing resources to a market – the so-called real options effect. Fourth, they claim that these models do not contain realistic depreciation and rate of return assumptions. Fifth, they claim that the models do not account for network growth. Finally, they claim that the models do not produce reasonable results – as judged by the difference between

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[19] ILECs have criticized the HAI model as being "unstable" because it has been revised numerous times. In fact, the model has improved over time to reflect the availability of better data and to incorporate new learning. Had the model not been revised, it would have been subject to the criticism that it did not reflect this new information. Some of the revisions to the model were necessary to correct errors in the original model. These errors were the result of the fact that in devising the original model regulators were operating under severe time deadlines imposed by the 1996 Act. Consequently, test

estimated forward-looking and embedded costs. Obviously, many of these criticisms are interrelated. Most of them now have been definitively rejected by the Supreme Court as simply wrong, or as inconsistent with the goals and purposes of the 1996 Act. I address each of the criticisms below.

A. TELRIC Models Are Based on Obtainable Efficiencies

ILECs claim that TELRIC systematically understates the true economic costs borne by the ILEC in providing access to UNEs. This alleged flaw in TELRIC-based prices stems from the TELRIC assumption that the pertinent costs – and hence prices – are determined by the most efficient carrier using only the most up-to-date equipment and technology. Thus, according to these critics, TELRIC assumes that the ILEC must "compete" at every instant with this hypothetical most efficient carrier. This of course is the specific feature of TELRIC that was at issue in the Supreme Court litigation, and that the Supreme Court ultimately declared to be the "[m]ost important of all" for setting an appropriate competitive price.[20]

The critics point to the fact that in the "real" world no firm continuously faces a rival that has just deployed the most efficient currently available technology. Instead, real carriers deploy a mix of new and old equipment, and are constrained in the choice of new equipment they purchase by equipment they have already purchased. Because real carriers never operate from a "blank slate," according to this line of criticism, it is wrong

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(beta) versions of the model had to be relied upon to meet these deadlines.

[20] *Verizon*, 122 S.Ct. at 1664.

to set rates based on the assumption that competition would drive rates to costs that would be incurred by a carrier that (hypothetically) installs the latest technology.

This criticism of TELRIC ignores a fundamental feature of market-driven pricing. In effectively competitive markets, all firms are forced to price at the level of an efficient new entrant, regardless of when they built their facilities and regardless of what technology they are using.[21] In competitive markets, firms subjected to competition from newer technologies (or from superior products) cannot ask their customers to support higher prices required for the recovery of the embedded costs of an old or inefficient technology. As the Supreme Court correctly observed, a merchant is likely to charge its customers current market prices for its inventory, regardless of the prices at which that inventory was acquired. For example, the eBay price of a two-year old laptop is not determined by the purchase price of that laptop but by the price of a new and comparable laptop. TELRIC's efficiency assumption, therefore, is not counterfactual, but reflects an accepted manner of valuing assets in competitive markets. To assume, as TELRIC does, that the economic cost (value) of equipment is determined by the cost of newer equipment that provides identical functions is not at all the same thing as an assumption that the ILECs replace their existing equipment or reconfigure their network every time more efficient equipment comes on the market or customer demands change. Of course it would be uneconomic for a firm to rip out its network only to replace it with the latest technology every day.

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[21] For an informative discussion of the forces of technological competition in free markets, *see* W. J. Baumol, *The Free-Market Innovation Machine*, Princeton U. Press

This does not mean, however, that for the purposes of calculating rates for unbundled network elements, these rates should be based on the outdated technology. In competitive markets, firms do not change their equipment every time technology or input prices change. They *do* change the prices they charge in recognition of the fact that competitors using new technology would take away their customers if they did not charge competitive prices. Therefore, output prices change to reflect such declines in value of the inputs used to produce them, and these changes in the economic value of the inputs are reflected in proper economic depreciation schedules that reflect technological change as well as normal wear and tear. The benefits of technological progress (as reflected in falling equipment prices, for example) are captured in the depreciation factor built into the calculation of the TELRIC.[22]

In sum, even though the network constructed in a TELRIC model is a "hypothetical" network, it nevertheless is a proper benchmark for costing and pricing that part of an ILECs' real world network that is used to provide the relevant regulated wholesale services.[23]

(2002). Of course, Joseph Schumpeter expressed some of these ideas decades ago.

[22] Price cap regulation of retail services also assumes that the regulated firm will adopt cost saving technologies at market determined rates. As shown by various economists, the price cap approach to regulating end user services can be adapted to UNEs as well, once the initial rates are set at the TELRIC-based levels.

[23] These may not be equivalent with the costs of the actual ILEC networks, but for reasons having nothing to do with the fact that one is "real" while the other is "perfect." I discuss the differences between the ILECs book costs and TELRIC costs below in Section VI.

Critically, the ILECs make similar assumption regarding the depreciation in their "embedded cost" studies by adjusting the value of the assets to reflect economic depreciation. The rates that the ILECs charge are designed to allow them to recover their prudently incurred costs fully taking into account the economic depreciation of their assets. In this regard, the principal difference between an embedded cost model and a TELRIC model is that the former attempts to account for any decline in value indirectly through economic depreciation, while TELRIC accounts for it directly by postulating a hypothetical carrier using only efficient market-priced technology. The claim that either kind of model assumes "perfection" in the way the network is constructed and operated is incorrect.

Not only does TELRIC not assume perfection in any theoretical sense, it does not assume perfection as a practical matter either. As the Supreme Court explained, "TELRIC does not assume a perfectly efficient wholesale market or one that is likely to resemble perfection in any foreseeable time."[24] Instead, by assuming the placement of existing ILEC wire centers, by modeling only currently available equipment, and by leaving prices static for 3 or 4 years, TELRIC contains certain built-in rigidities that assure that TELRIC rates are above those that would exist in a frictionless, perfectly competitive market. A similar point can be made about the criticism that TELRIC unrealistically assumes that networks are continually reconfigured to account for changes in network demand. The models build in some excess capacity as discussed below.

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[24] *Verizon*, 122 S.Ct. at 1669.

B. Use of a Hypothetical Network Is Appropriate

The ILECs also criticize TELRIC models because they calculate costs for hypothetical networks rather than the ILECs' actual ("real-world") networks. As a result, TELRIC is said to be unlinked to actual expenditures made by the ILECs to provide actual services, and so is allegedly subject to objectionable manipulation by "experts."

It is true that modeled networks are "hypothetical." It is also true that any model of necessity makes simplifying assumptions. If there were no simplifying assumptions, the resulting construct would not be a model, and would be so complicated that it would be of little use to regulators. At its core, this criticism is an attack on the use of economic models of any kind to inform public policy.

But TELRIC models are linked to real network operations. As I described above, demand and customer location used in the model are based on real world data, much of it provided by the ILECs. The technologies assumed are those actually being deployed in ILEC networks. Input prices are derived from public sources. TELRIC models are firmly grounded in the real world through real-world inputs and real-world engineering assumptions.

Moreover, the embedded cost models that the ILECs favor are every bit as complex as TELRIC models, rely every bit as much on simplifying modeling assumptions, and would engender precisely the same kinds of "battles of the experts" that are a feature of any contested cost case. Indeed, embedded cost studies are *more* complex and subject to manipulation than TELRIC studies. As I describe in what follows, the ILECs' books of accounts are not neatly maintained on an element-by-

element basis. As a result, to make use of embedded cost data in a study used to derive network element prices, the regulators would be forced to make use of complex modeling, sampling techniques, and ultimately arbitrary assumptions. Thus, it is false to claim that embedded cost studies neatly reflect actual ILEC expenditures to provide unbundled network elements. It is an argument that masks the ILECs' real complaints about TELRIC – TELRIC's assumptions are visible and verifiable, and it relies on publicly available data equally available to all parties to a pricing dispute. The Supreme Court put this erroneous line of argument to rest when it concluded:

> Finally, as to the incumbents' accusation that TELRIC is too complicated to be practical, a criticism at least as telling can be leveled at traditional ratemaking methodologies and the alternatives proffered. "One important potential advantage of the TELRIC approach, however, is its relative ease of calculation. Rather than estimate costs reflecting the present [incumbent] network – a difficult task even if [incumbents] provided reliable data – it is possible to generate TELRIC estimates based on a 'green field' approach, which assumes construction of a network from scratch." To the extent that the traditional public-utility model generally relied on embedded costs, similar sorts of complexity in reckoning were exacerbated by an asymmetry of information, much to the utilities' benefit. And what we see from the record suggests that TELRIC rate proceedings are surprisingly smooth-running affairs, with incumbents and competitors typically presenting two conflicting economic models supported by expert testimony, and state commissioners customarily assigning rates based on some predictions from one model and others from its counterpart. At bottom, battles of experts are bound to be part of any ratesetting scheme, and the FCC was reasonable to prefer TELRIC over alternative fixed-cost schemes that preserve home-field advantages for the incumbents.[25]

C. TELRIC Properly Accounts for "Real Options" Value.

The ILECs also have argued that TELRIC-based prices are vastly understated because they neglect the real option value that should be included in the price of the

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[25] *Id.* at 1678 (citations omitted).

UNEs leased by the CLECs. As I will show below, the option the ILECs allegedly provide to CLECs may or may not be substantial, and in any event, can be incorporated into a TELRIC cost model.

According to the real options theory, when a sunk and irreversible investment is made, this extinguishes the option of waiting and later making a decision to invest, after more has been learned about a technology or the evolution of demand for the existing or new products. Under certain circumstances, an investor rationally requires a premium to undertake the sunk investment (and extinguish the option not to invest) relative to what it would require if it could rationally time its investment. The ILECs argue that CLECs should be required to pay the ILEC a premium in excess of TELRIC to compensate the ILEC for the value of this real option. Indeed, one ILEC-sponsored affidavit claimed that, based on several implausible assumptions, this premium would be at the level of 100% of TELRIC.[26] The ILECs claim that because TELRIC fails to account for this premium, they will be greatly under-compensated for the risks they incur, thereby reducing their incentive to invest in the network.

I will analyze this argument in two steps. First, I consider whether regulation of the ILECs' *retail* rates will deter investment, assuming there is no wholesale market. This is an important step to take in this analysis, because if the real options argument were taken to its logical conclusion, it could apply equally to retail regulation and dictate the abandonment of existing forms of price regulation. After showing that price

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[26] This issue was raised initially by Jerry Hausman, "Reply Affidavit of Jerry Hausman," CC Docket 96-98 (May 29, 1996).

regulation, based on the cost of capital, does not deter investment by a monopolist, I will consider whether the addition of a requirement to wholesale UNEs at cost-based rates adds to the standard risks and will create a disincentive to invest unless an upward adjustment in TELRIC rates is made to reflect a higher opportunity cost of capital.

Rate regulation has always been based on some estimate of cost, including the cost of capital needed to support the flow of the services provided by the regulated firm, with the cost of capital applied to the (prudently) incurred physical assets. Irrespective of the form regulation takes, these rates include a return on capital investment, which is calculated by multiplying the rate base (or forward looking investment cost) by an estimate of the cost of capital of the regulated firm.[27] Thus the issue of accounting for various types of risk is nothing new in the regulatory arena. To the contrary, it is an essential part of the determination of the cost of capital the regulated firm should be allowed to earn. Regarding whether the presence of real options requires a premium to be added to the cost of capital, Baseman, Warren-Boulton, and Woodward note:

> With respect to this issue, the realization that virtually all businesses give their customers options is especially helpful. In particular, it suggests that if businesses have successfully compensated investors in the past, we need not now think that the cost of capital is higher than we previously believed. Indeed, work on the CAPM has long noted that firms in industries that involve large sunk cost and irreversible investments tend to have higher betas, and therefore higher cost of capital.[28]

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[27] Price cap regulation, which supposedly breaks the link between the regulated firm's cost and the regulated prices, always initiates the price caps based on the prudent costs or existing rates of the regulated firm.

[28] K. Baseman, F. Warren-Boulton, S. Woodward, "Depreciation and Capital Recovery Issues: A response to Professor Hausman," CC Docket 96-98 (July 24, 1996).

These authors also show that Professor Hausman's claim that traditional measures of cost of capital fail to capture real options and risk is erroneous and based on a false interpretation of an analysis of corporate hurdle rates conducted by Lawrence Summers in 1987.[29] Therefore, it would be wrong to conclude that price regulation, as such, based on an economic cost model using an appropriate cost of capital factor, would not provide adequate compensation for the ILECs and would deter them from investing in their monopoly bottleneck infrastructure.

Still, there is a question about how much difference it makes if the ILEC sells (or rents) its facilities to competitors rather than selling the services made possible by these facilities directly to end users. If anything, it would appear that providing wholesale services would *decrease* the ILECs' risk. For a similar flow of service, the ILEC makes exactly the same investment, or even less investment for a customer that is served by a CLEC that does not use all of the ILEC facilities. The presence of CLECs that have an incentive to stimulate demand also increases the intensity of demand for the underlying network elements and thus potentially stabilizes the demand for the elements, thus reducing the option risk.

The novel type of risk to the ILEC from supplying its elements at wholesale is that the CLEC may at some future point migrate the customers to a different network – either its own or a that of another vendor – if the demand is strong and there are other

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[29] Summers, L. "Investment Incentives and the Discounting of Depreciation Allowances," in M. Feldstein, ed. *The Effects of Taxation on Capital Accumulation*, University of Chicago Press, 1987.

available facilities. In the alternative, if demand is weak, the CLEC will not build but either will continue to use the UNEs or cut back on supply altogether.

The answer to this concern is that the CLECs are no different from certain retail customers whose demand is subject to certain types of stochastic events. For example, a new real estate development may require the LEC to make large investments in telecommunications plant, yet a failure or long delay in the development's ability to attract new tenants would expose the ILEC to the risk of not recovering its investments. Centrex customers are provided large quantities of loop plant, available on demand, without committing to using the plant over its useful life. Yet, rates for Centrex are mostly set below the rates for business customers' local exchange loops, for which demand is much more predictable. When the ILECs pursue business opportunities that do not threaten their long term monopoly, they do not appear to be concerned about the real options given to their customers. This powerfully suggests that the risk option value effect is much less substantial than the ILECs claim.

At a more fundamental level, the ILECs face risks of stranded or underutilized facilities irrespective of whether CLECs are given the right to lease UNEs at TELRIC. The ILECs are not protected from the risk that new technology will develop and provide a competitive alternative to their network. Nor are they guaranteed that demand will not materialize for new services enabled by new investments. Leasing UNEs will facilitate competition, but it will not be the only (or even the principal) factor in determining whether the ILECs' investments are utilized in the long run.

For these reasons, absent any compelling information to the contrary, there is no reason to apply different ratesetting principles to UNEs than to retail services. Retail and wholesale customers will be leasing long-lived ILEC assets, which they do not commit to using for the entire life of the asset. Moreover, many of the assets deployed by the ILECs to serve their (potential) retail customers must be deployed well in advance of the knowledge of the state of demand. If the ILECs were truly concerned about matching the price charged for risk to the nature of the demands for their services, they would seek to do this through tariffing provisions that affect retail and wholesale customers uniformly. For example, the ILECs could include discounts for term commitments that did not discriminate based on the identity of the user. So long as non-discrimination conditions were tightly enforced, these provisions could increase efficient investments and use of the network, without increasing the likelihood of anticompetitive behavior. But to impose the cost of any alleged risk uniquely upon wholesale services discriminates against the wholesale customers, making it difficult or impossible for them to compete in the retail market. Imposing these costs solely on wholesale customers also gives the ILECs a powerful incentive to overstate costs, which is evident from the magnitude of the claimed option value in their submissions.

Leasing UNEs or providing retail services are not sure bets. There are many complex and interrelated factors that will affect the profitability of the ILECs' present and future investments. It is especially difficult to assess whether leasing UNEs increases or decreases the ILECs' risks. Certainly the ILECs' self-serving statements that UNE prices must include a risk "surcharge" do not reflect a careful assessment of the nature of

how the CLECs will use the network, but rather of the threat they pose to the ILECs' monopoly position.

D. TELRIC Models Do Not Preclude the Use of Reasonable Depreciation Rates

TELRIC does not mandate any specific depreciation rate; instead the regulations call for state commissions to set rates. To my knowledge, states follow practices that are similar to the FCC's. For the past twenty years, the FCC has set depreciation rates that reflect economic factors in addition to physical deterioration. That is, depreciation rates assume that the value of equipment declines both because of wear and tear, and also because newer, more efficient, equipment is introduced into the marketplace that has the effect of reducing the value of older equipment.

The ILECs have offered two different criticisms of TELRIC depreciation rates. The first is that because the telephone network is characterized by rapid and unexpected technological change, TELRIC depreciation rates do not adequately reflect the true pace of technological obsolescence.

Of course, by definition no depreciation schedule can anticipate change that is unanticipated. This problem is no different in a TELRIC study than it would be in an embedded cost study, which, as I previously explained, also makes use of economic deprecation schedules. And, of course, it is possible that technological change will occur at an unanticipated pace. Depending on the actual realization of the endemic uncertainty, in competitive markets, firms will either realize capital gains or losses. But the fact that a regulator cannot anticipate the unanticipated does not invalidate the use of the TELRIC model for setting UNE rates. Rather it shows that under certain extreme conditions

economic modeling becomes a challenging exercise, regardless of the model involved. For the ILEC criticism to be valid, it would have to be true that all "unanticipated" changes in technological advance would be more rapid than expected, and that it would be impossible to increase depreciation to account for this. The implausibility of this situation is obvious. In any case, if it were the case that the depreciation charges were to fall behind, the BOCs could, as they have done in the past, ask for a "true-up" adjustment that would shore up their (so far very sound) balance sheets and possibly increase UNE prices.

For present purposes, the critical point is that no empirical evidence supports the view that the telephone network has so far demonstrated a rapid and unpredictable decline in value as a result of technological progress such that making any sensible predictive judgments about economic cost would be impossible. To the contrary, by far the largest component of network investment is outside plant, which has not precipitously dropped in value. Of the $307 billion in total telecommunications plant investment on the books of the BOCs at the end of 2001, $149 billion, or 48.4%, was in cable and wire facilities, or in stable assets such as land, buildings, and furniture. Much of the booked value of the outside plant is represented by capitalized labor and material costs (used to install the loops) that have gone up, not down, including the value of the ubiquitous telephone poles.

It must also be noted that not all technological change (expected or unexpected) in telecommunications shortens asset lives. DSL technology has actually prolonged the life of copper technology because it allows new broadband applications to be delivered over

the old transmission technology. On the other hand, adoption of fiber technology in the loop has been a gradual process and the TELRIC models account for its use where economical, in providing unbundled network elements. Interoffice transmission technology is all fiber and has been for many years.

The ILECs' second criticism of TELRIC depreciation rates is their claim that TELRIC assumes a brand new network every three or four years, and therefore consistently must also adopt radically shortened depreciation lives for equipment on the theory that it will be replaced every three years. But as I pointed out earlier, this argument rests on a mischaracterization of TELRIC. It does not assume that networks will be torn out of the ground and built afresh every three years. In fact TELRIC makes no assumptions at all about when carriers will replace equipment – it does not purport to model that decision. Rather, TELRIC's "blank slate" feature is simply a way to *value* the network at a single point in time, and as a result, the ILECs' wholesale networks are indeed subject to revaluation periodically.[30] (Re)valuation does not have any effect at all on the economic life of an asset: in and of itself it neither shortens nor lengthens depreciation lives. Presumably, the more frequently depreciation schedules are adjusted, the more likely they will conform to the most current understanding of the economic life of the network elements.

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[30] Indeed, familiar price cap models assume that the underlying costs of the network will decline at a predicted rate and the price cap is adjusted at intervals to correct for the potential discrepancies (up or down).

E. TELRIC Appropriately Addresses the ILECs' Cost of Capital

TELRIC's critics also claim that it does not properly account for the ILECs' cost of capital. At first glance, this is an odd criticism, since the FCC's rules say very little about cost of capital, and what they do say is plainly unobjectionable. The Act requires that the element prices include a "reasonable profit" for the ILECs, which the FCC's rules understood to mean a "risk adjusted rate of return" on their investment. The claim that the FCC rules do not properly account for the riskiness of ILEC investment therefore lacks merit.

On closer inspection, the ILECs appear to be making two different objections, each of which is more properly directed at the state commissions that actually set rates of return. More importantly, and each of these objections is groundless.

First, they argue that because TELRIC assumes a perfectly competitive market with no barriers to entry and no sunk costs, the cost of capital that is consistent with this hypothetical state of affairs would have to be much higher than the real cost of capital of the ILECs, or for that matter of any other participant in the telecommunications market. This criticism is yet another instance of the ILECs' misconstruction of TELRIC. As I have demonstrated, TELRIC does not assume that the actual telephone market is in fact perfectly competitive. It merely assumes a hypothetical competitive market as a means of designing the benchmark network and valuing the concomitant assets. To the extent that TELRIC can be said to make any assumptions at all about the competitive status of the actual market, like any model designed to establish a regulated price, TELRIC makes the realistic assumption that ILECs have market power and their rates need to be

regulated. In particular, TELRIC assumes the ILECs are a monopoly wholesaler of telephone facilities to competitors who will compete with the ILEC for retail customers. The claim that this assumption means that it is highly risky for the ILECs to provide wholesale facilities is entirely without merit.[31]

The ILECs' second claim about cost of capital is that unless they are given a sufficiently high premium above the cost of capital they already face, they will not invest in new facilities. In its recent decision remanding the FCC's *UNE Remand Order*,[32] the D.C. Circuit echoed this argument, and asked to FCC on remand to consider whether "[i]f parties who have not shared the risk are able to come in as equal partners on the successes, and avoid payment for the losers, the incentive to invest plainly declines." I have three responses to this claim.

First, to the extent this claim has any legitimacy at all, it would apply only to a very narrow set of investments. The ILECs have at times used this argument as if it applied to all investments in the network, or, more narrowly, to all investments in broadband facilities. But claims about "risky" investment cannot be applied so broadly.

Much incremental ILEC investment is not at all unusually risky or sunk. The FCC appears concerned with the pace of deployment of broadband facilities, but it bears repeating that many of these facilities are not new at all. DSL-based services all make use of existing wire loop facilities. These facilities, along with the rights of way, building

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[31] The ILECs' claim that increased retail competition creates risk for their monopoly wholesale products more accurately states a real cost of capital issue. But as I demonstrated in the "real options" discussion, above, this claim fails on the merits.
[32] *USTA v. FCC*, 290 F.3d 415 (D.C. Cir. 2002).

access and related ILEC assets, constitute the most valuable part of the ILEC networks. The promise of further monopoly rents in downstream markets is not needed to encourage deployment of these assets, for they are already deployed.

Nor are monopoly rates of return necessary to provide incentives for the ILECs to upgrade these loop facilities to be DSL-compliant. Incremental changes that add value to a company's most valuable assets are not unusually risky, and the ILECs already have ample incentive to make full use of their existing loop plant. Moreover, the electronic equipment necessary to upgrade loops to be capable of carrying DSL-based signals is not especially risky investment. Unlike investment in loops themselves, which is sunk, electronic equipment may be re-deployed as demand dictates. It also may be deployed initially on a targeted basis to test demand assumptions.

Of course it is possible to imagine the ILECs investing in more risky endeavors than the expansion of DSL service. In some cases, these endeavors will leverage their unique bottleneck position, while in other cases the connection to the bottleneck will be less direct. Extending fiber closer to the home is an example of a risky investment that the ILECs are uniquely positioned to make because of their control of the infrastructure (poles, conduits, *etc.*) over which the fiber will ride. By contrast, investments with only tenuous connections to the network could be inherently more risky, because other firms will face lower barriers to entry and will be able to compete more effectively with the ILECs. Inasmuch as such competition adds to the risk, a higher expected return is warranted to induce ILECs to make such investments.

The question arises what regulatory treatment is appropriate for the riskier category of investments, and for that matter whether there is any need to require unbundling of these "new" facilities at all. I will consider an investment, such as an extension of fiber closer to the home, which may be riskier than traditional investments made by the ILEC, yet it is one which the ILEC is uniquely positioned to provide and in which it may have the potential to earn above-normal returns.

Since TELRIC requires only that state commissions adopt a "risk adjusted rate of return," it is certainly capable of pricing such risky investment and giving appropriate investment incentives. While state commissions to date have felt no need to assign separate cost of capital to separate network investments, nothing in TELRIC prohibits such a practice, and faced with truly novel and risky network expenditure, much recommends it. The practice of setting one uniform rate of return for all network elements simply indicates that the ILECs have not presented a compelling case that any of their investments require special treatment.

I agree in principle that some socially desirable investments are so risky that unless the investor is given the full benefit of the investment if it proves to be successful, it is not likely to make the investment in the first place. This is unlikely to create a problem of monopoly power for an investment that is separate and totally disconnected from the ILECs' local bottleneck. If an investment is both highly risky and connected to the network, there is a danger that the ILECs would cement a monopoly position for a very long period of time and receive profits far in excess of what is needed to give them an incentive to make the investment. Furthermore, a commitment by the regulator to

never require unbundling or sharing of the new investment could allow the ILEC to leverage a monopoly position into vertically related markets. Various solutions to this (at least for now) hypothetical problem, can be proposed, but they do not require that the TELRIC methodology be jettisoned in favor of some inchoate adjustments to the cost of capital or, worse, no regulatory oversight at all.

I stress that I have seen nothing to suggest that current ILEC investments are particularly risky and so deserving of this special treatment. Certainly the ILECs' DSL-based deployment does not fall within this category. But if the Commission were concerned that the ILECs were failing to deploy truly risky facilities because of the risk that (in the event that the investments are successful) they would be forced to lease them to competitors at rates that did not cover the extra reward necessary for the risk they have taken, the Commission could address that problem by proposing or mandating that states follow special rules when considering these special facilities.

I would add that although I do not believe rules governing the exceptional case would be harmful if properly limited to the exceptional case, neither am I at all persuaded that such rules would currently bring much benefit. While the ILECs suggest that but for the Commission's TELRIC rules they would be investing in all manner of risky but potentially beneficial services, I think a fair degree of skepticism is in order. In particular, the claim that there is a potent pent-up demand for new services that would be facilitated by new broadband deployment remains unproven.[33] Moreover, claims that

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[33] According to newspaper accounts, demand for broadband is hampered by the policies of content providers that restrict its availability.

there is a fierce verifiable demand for new services are inconsistent with the claim that it is highly risky to deploy facilities serve this demand.

F. TELRIC Accounts for Growth in the Network

The ILECs' claim that TELRIC models do not account for growth also lacks merit. The claim is based on the fact that the TELRIC model is "static," in that it is a snapshot of a network that will serve a specified amount of demand, whereas the real network is "dynamic," in that it is always growing from the embedded network to meet new demand. At one level, this is simply a reiteration of the groundless assertion that a "realistic" model should start with the embedded network and model additions to serve the desired level of demand. As I have explained, this criticism falsely assumes that TELRIC is intended to be a model of a "real" network rather than of a hypothetical network designed to measure the value of the real one under hypothesized competitive conditions.

The ILECs also assert that it is necessary to anticipate future demand and "overbuild" the local exchange network, and that TELRIC models fail to take this consideration into account. Their claim that a "static" hypothetical network is incapable of accounting for the fact that the network grows over time and that efficiency dictates that the ILECs build excess capacity to meet expanding future demand is wrong for two reasons.

First, it is important to recognize that it is impossible to capture every aspect of network engineering in a model. A model that attempted to capture all dynamic factors would require too many simplifying assumptions about growth in demand to be tractable,

and would be subject to endless disputes about whether these assumptions were reasonable. For this reason, the parties to costing cases, including the ILECs, have never attempted to build a dynamic cost model, and the regulatory agencies have never required them. Therefore, the fundamental issue to address is whether the simplification of a static demand creates a bias in the outputs of the cost model.

As it turns out, by making the simplifying assumption of constructing at one time, from scratch, a network to serve current demand, TELRIC likely overstates the cost of the network elements. The telephone network is characterized by economies of scale. By building a network that (according to the ILECs) is slightly smaller than the one they actually would build in order to meet increasing demand over time, TELRIC overstates the per-unit cost of the elements it prices. That is, if one were to model a network as it would actually be constructed in the real world, and then devise a formula to assess current users that portion of the cost that reflects construction necessary to serve them, and future users that portion of the cost that is necessary to serve them, because of economies of scale, the per unit costs would be lower, not higher, than the costs derived from a model that was build to serve current demand alone.

Indeed, it is the ILEC cost models that improperly account for growth in the network by failing to distribute the cost of adding capacity for growth to the future ratepayers, who are actually causing these costs. They typically size a plant in anticipation of future growth in demand, yet consider only current demand levels in determining the unit costs of and price for that capacity. Thus current users end up paying for facilities needed only to serve future users. If a UNE is sized to accommodate

future demand, then the per unit cost of the UNE must be calculated based on the overall demand level during the useful lifetime of the investment, and not only on a lower current demand level. A firm that charged current users for facilities built to serve future users would lose current customers to an efficient competitor that gave proper weight to the discounted revenue-generating capacity of future customers. Stated otherwise, a distribution network properly sized for long-run growth should reduce, not increase, the costs properly borne by today's users after accounting for the anticipated contribution from future users. As the FCC noted in its *Local Competition Order*, the "per-unit costs associated with a particular element must be derived by dividing the total cost associated with the element by a *reasonable projection* of the actual total usage of the element."[34]

The second reason the ILECs' criticisms lack merit is that their claims do not acknowledge the fact that the models add a conservative cushion to the cost results by building some excess capacity.[35] TELRIC model runs used by Federal and State agencies do not assume that the networks are sized perfectly at any point in time. Rather, they assume that all facilities are constructed with sufficient excess capacity to meet administrative needs, to permit for lack of perfect foresight in predicting demand, as well as to handle short-term growth. For example, the default input cable sizing factors (a factor applied to actual demand to increase installed cable sizes) used in the HAI Model for distribution cable range from 50% to 75% and for feeder cable range from 65% to

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[34] See Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, First Report and Order, 11 FCC Rcd 15499, ¶ 682 (1996) ("Local Competition Order") (emphasis added).

[35] The network is designed to serve current capacity, but, of necessity, as discussed

80%.[36] Due to the phenomenon of "breakage" (cables are available in discrete size increments, such that one must always select a cable with larger capacity than is needed to meet demand), the actual percentage of the lines that are in use ("achieved fill levels") in the model are in fact much lower than this, and, generally are comparable to those achieved in the "real world." Thus, the models build in extra capacity. Finally, to the extent the ILECs claim that the fill factors should be lower still, this is a debate over input levels, not over the validity of the TELRIC model, which can very well accommodate different assumptions about the fill rates and the optimal excess capacity, given expected growth rates.

G. Model Results Are Reasonable

The ILECs also try to bolster their claim that TELRIC undervalues their network with empirical evidence showing that TELRIC rates are well below embedded costs. In fact, there are several reasons why we should expect a significant difference between TELRIC and embedded costs.

To begin with, there is reason to doubt the accuracy of the numbers on the ILECs' accounting books covering regulated services. As I explained above, accounting separations between regulated and unregulated expenses and investment are inherently arbitrary, and the ILECs have an incentive to shift costs to the "regulated" portion of their activities. Due to the widespread adoption of price cap regimes, less and less attention is

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above, builds in excess capacity.

[36] In other words, there is 20 to 50% excess capacity in the cable plant.

being paid to the costs that ILECs put on their regulatory accounting books.[37] Indeed, among the harshest critics of reliance upon regulatory accounting books are the ILECs themselves.

Additionally, the TELRIC models assume that the network is configured efficiently for the provision of network elements. In contrast, the actual ILEC networks are configured to produce a whole range of services such as Centrex and long distance that are not properly part of the wholesale network. Nor, as discussed earlier, is it straightforward to develop from ILEC accounting books, which reflect costs for "services," the costs of network elements, as mandated by the unbundling provisions of the Act.

The ILEC network also includes the expenses and investments associated with providing retail services, such as customer care and billing expenses. These additional services require additional investment and expenses, and the costs are included in the ILECs' historical books. Existing accounting mechanisms are not capable of clearly disentangling these expenses from those incurred to provide the network elements.

The expenses associated with investments needed to provide additional services can be substantial. Centrex service requires a dedicated wire pair for each line served.

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[37] Indeed, FCC audits have found that much equipment still listed on ILEC books of account could not be located. *See [BOC] Continuing Property Records Audit,* Notice of Inquiry, 14 FCC Rcd 7019 (1999). The FCC terminated its investigation into these audits on the grounds that substantial rate cuts had occurred since the audits were performed. In doing so, however, the FCC explicitly did not preclude the state commissions from investigating further. *[BOC] Continuing Property Records Audit,* Second Report and Order in CC Docket No. 99-137 and Order in CC Docket No 99-117 and AAD File No. 98-26, 16 FCC Rcd 4083, ¶ 12 (2000).

When installing capacity to serve a commercial building, ILECs typically install a sufficient number of loops to provide Centrex service. Moreover, advanced Centrex, which supports enhanced services and automatic call distribution, requires more sophisticated (and more expensive) digital switches. By contrast, competing PBX-based services can serve multiple lines in a building with many fewer loop facilities. Specifically, Centrex requires from 8 to 15 times the number of loops as a PBX installation.

The ILECs nevertheless have invested in additional loop facilities to give their customers the option of purchasing Centrex, even though providing this option is expensive. Moreover, Centrex customers have the option at any time to switch to PBX service.[38] The ILECs have willingly incurred the cost of providing this option to their customers, but by seeking to price UNEs based on the cost of their embedded plant, they improperly seek to spread these costs to their UNE customers through inflated loop rates.

Rather than taking the ILECs' past construction and marketing decisions as a given, TELRIC requires that each construction decision be justified based on current best practices and technology. If (as is the case), the tremendous investment necessary to provide Centrex services to every business customer cannot be justified in a TELRIC cost proceeding, the resulting TELRIC network will be substantially smaller and less expensive than the ILECs' actual network. That fact does not "prove" that TELRIC is

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[38] *See* the earlier discussion about the ILECs' provision of an option to their retail customers without the requirement of a premium.

defective; it merely shows that a forward-looking wholesale network will not necessarily look in every respect like the actual network constructed by the ILECs.

Another reason the wholesale network may be different (and smaller) than the ILEC's actual network is that the ILEC's network may have been constructed to provide services other than the telecommunications services that are subject to the Act's unbundling rules. For example, for many years the ILECs have been extending fiber further into the network. Thus, NYNEX adopted a strategy of deploying digital loop carrier ("DLC") throughout its network. This may be a reasonable business strategy for a firm that anticipates entering new markets – broadband video, for example.[39] However, in a competitive market, the cost of providing unbundled narrowband loops would be based on the most efficient transmission technology for such loops, which is copper when distances between the customer and the central office are relatively short.

ILECs, particularly the BOCs, also have been investing heavily in fiber to connect offices within their regions, perhaps in anticipation of being granted the authority to provide interLATA services. The investment in these "official networks" is substantial. For example, one study found that the capacity of BellSouth's interLATA network in Florida exceeded the capacity of AT&T and MCI combined. This investment was made

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[39] BOC video services entry is discussed in Application of New Jersey Bell Telephone Company for Authority Pursuant to Section 214 of the Communications Act of 1934, as Amended, to Construct, Operate, Own & Maintain Advanced Fiber Optic Facilities & Equipment to Provide Video Dialtone Service Within a Geographically Defined Area in Dover Township, Ocean County, New Jersey, Order and Authorization, 9 FCC Rcd 3677 (1994); see also Application of the Chesapeake and Potomac Telephone Company of Virginia, Order and Authorization, 10 FCC Rcd 2975 (1995).

even though BellSouth (which has not won interLATA authority in Florida) has no interLATA customers in the state.[40]

Additionally, accounting costs as carried on the books of an ILEC will reflect any existing inefficiencies in the network. Actual networks may involve construction and design practices that evolved in a world where competitive and regulatory pressures to be efficient were inadequate.

Moreover, ILEC profits potentially exceed competitive levels (and thus are excessive). While this does not result in a difference between embedded and TELRIC costs, it does affect the difference between ILEC revenues and the revenues they would receive from their wholesale operations based on TELRIC rates (which only includes a reasonable economic profit). The starting point for TELRIC cost of capital calculations is the rate used for universal service proceedings. The FCC's Universal Service Cost Model assumes a rate of return of 11.25 percent. FCC data show that in 2000, price cap ILECs were earning a return of 19.53 percent on interstate services. This large gap between the current realized rate of return and an efficient return no doubt is one reason the ILECs prefer their retail business with the generous profits it provides to the wholesale business mandated by the 1996 Act. But the ILECs' desire to earn monopoly profits is not a legitimate reason to abandon TELRIC in favor of some method that provides the ILECs a greater return on their investment.

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[40] Testimony of Joseph Gillan, In re: Comprehensive Revieew of the Revenue Requirements and Rate Stabilization Plan of Southern Bell Telephone and Telegraph Company, Florida Public Service Commission, Docket No. 920260-TL, November 8, 1993, pp. 20-26.

Finally, it should be observed that the fact that the TELRIC network is smaller than the ILECs' actual network actually artificially *raises* TELRIC rates above cost, to the benefit of the ILECs. This is so because the limited TELRIC network model does not reflect the substantial economies of scale or scope that the ILECs enjoy as a result of their large network built to provide a whole range of services that are not properly part of the wholesale network priced in a TELRIC study.

VI. TELRIC IS A BETTER METHODOLOGY FOR PRICING UNBUNDLED NETWORK ELEMENTS THAN ANY OF THE PROPOSED ALTERNATIVES.

At least in theory, the economic cost of a network element could be determined by any of several different cost models. For example, where costs are declining, economic depreciation of historical or embedded costs ought to reflect indirectly what a replacement cost model reflects directly: the true economic value of the deployed assets. Thus, prudently incurred and properly depreciated embedded capital costs of providing a given increment of service ought in theory to be equal to the forward-looking cost of providing the same increment of service. Although much ink has been spilled over arguing about which cost model best reflects economic cost, the fact is that many methodologies attempt to measure proper economic cost, and each methodology has unique strengths and weaknesses that make it more or less appropriate to costing the goods or services it is attempting to cost.

I believe the FCC correctly adopted TELRIC as the methodology best suited to the task at hand, and in particular that the FCC properly concluded that TELRIC was superior to embedded cost methodologies. The incumbents argued for an embedded cost

methodology for determining network element prices, but its well-understood weaknesses made it a poor choice. I have discussed above the problems that plague embedded cost methodologies: reliance on ILEC books that are maintained for different purposes, subject to manipulation and reflective of costs of a different network. The ILECs agree with these problems when advocating price caps and pricing flexibility for new services. The Supreme Court agreed with the deficiencies of embedded cost methodologies in its recent decision.[41] For all of these reasons, the FCC correctly found TELRIC to be by far a more preferable method of pricing unbundled network elements than embedded cost methodologies.

Some of the BOC economists have advocated the use of the efficient component pricing rule (ECPR) or a modified version of that rule (M-ECPR).[42] While the efficient component pricing rule has many desirable features, it is not a preferred methodology for UNE pricing,[43] as I have previously testified. ECPR sets wholesale rates based on retail rates. For the ECPR to lead to efficient outcomes, therefore, the retail rates must themselves be reasonable and cost-based. Unfortunately, retail pricing in the telecommunications network bears little relation to cost and therefore strict application of

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[41] As the Supreme Court said, TELRIC "avoids this problem [of having to rely on ILEC depreciation schedules] by basing its valuation on the market price for most efficient elements; when rates are figured by reference to a hypothetical element instead of an incumbent's actual element, the incumbent gets no unfair advantage from favorable depreciation rates." 122 S.Ct. at 1675.

[42] Sidak, G. and Spulber, D. *The Tragedy of the Telecommons: Government Pricing of Unbundled Network Elements Under the Telecommunications Act of 1996*, 97 COLUMBIA LAW REVIEW 1081 (1997).

[43] Resale pricing under Section 252(d)(3) of the Act is based on ECPR.

the ECPR, or M-ECPR would lead to an entrenchment of the exiting inefficiencies rather than paving the way for efficient competitive entry and use of the existing network. Indeed, one of the beneficial effects of cost-based wholesale rates is that it would inevitably create pressures to re-balance retail rates to bring them closer in line with costs. Any ECPR-based wholesale pricing, however, would merely lock in a retail rate structure that is not the result of competitive pressures, but regulatory choices that were not always designed to have rates closely mirror costs. In my submission to the FCC with Professors William Baumol and Robert Willig in 1996 in the *Local Competition* proceeding, we explained in more detail why the ECPR is inappropriate in the current telecommunications environment.[44] Both the FCC and now the Supreme Court have now agreed with this analysis.[45]

The other proffered alternative, so-called "Ramsey pricing," was properly rejected by the FCC because it would tend to impose higher costs on the loop-related elements because demand for those facilities is relatively inelastic. But, as the Supreme Court has correctly observed, "this very feature appears to be a drawback when used as a method of setting rates for the wholesale market in unbundled network elements," as it would discourage leasing most where leasing was most needed – on the networks' bottleneck facilities.[46]

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[44] *See* Affidavit of William J. Baumol, Janusz A. Ordover and Robert D. Willig, May 14, 1996, filed as Appendix C with Comments of AT&T Corp. in CC Docket 96-98, May 16, 1996.

[45] *Verizon*, 122 S.Ct. at 1673.

[46] *Id.* at 1675.

In sum, many cost methodologies in theory are designed to identify a carrier's "costs," and none of them is perfect. TELRIC, however, is far superior to the embedded cost models suggested by the ILECs, and is, in my opinion, the best choice for setting network element prices.

VII. CONCLUSIONS

TELRIC now has the imprimatur of the Supreme Court as the methodology for pricing of unbundled network elements. The purpose of this paper has been to show that the TELRIC methodology leads to efficient prices for network elements, creating the right incentives for investment for both ILECs and CLECs. TELRIC-based pricing of UNEs also spurs short-term competition in the provision of local services as well as offers a stepping-stone towards efficient facilities-based long-run competition.

TELRIC provides a sound public policy tool for balancing the need to open up a monopoly network while ensuring adequate compensation for risky investments for the ILEC. The criticisms leveled against the TELRIC methodology are misplaced, and serve to only to achieve the ILECs goal of maintaining their market monopoly by increasing the entry barriers to local competition. The best way to get local competition is to maintain, where needed, the availability of the full panoply of unbundled elements until there is true ubiquitous choice in the availability of the elements.