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The Pricing of Pole Attachments: Implications and Recommendations

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Abstract

The FCC is currently considering whether it should adopt a uniform rate for pole attachment services for broadband services. Based on Ramsey pricing principles, we find that while historical differences in rates were sensible, technological convergence dictates that broadband providers should now pay a unified rate and that rate should be significantly lower than the rates currently applied.

KEYWORDS: broadband, telecommunications, Internet, pricing, pole attachments, Ramsey pricing

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1. Introduction

The humble utility pole has achieved an iconic status in the telecommunications industry. Tens of millions of utility poles dot the nation, linking households and businesses to both modern communications networks and the electricity grid. While remarkable in their scope and nearly ubiquitous in their presence, they are often regarded merely as regulatory antiques or artifacts of a bygone era. This perception is unfortunate because utility poles remain an essential input of production for modern communications services, and the rates, terms, and conditions for their use (“pole attachments”) may have an important impact upon the availability and costs for next-generation broadband Internet access networks.

Today, chaotic regulation applies to pole attachments. Dozens of regulatory bodies are involved, ranging from state and local governments to the federal government. Poles are often privately owned (either by an electric utility or telephone company) and the rates, terms, and conditions over which communications companies can “attach” to privately-owned poles is directly regulated by federal and state law. In particular, Section 224 of the Communications Act requires that the rates and terms be “just and reasonable” and prescribes specific rate methodologies for some categories of service providers (47 U.S.C. § 224). Rates are not symmetric across attachments. For instance, “cable television providers” enjoy a lower rate for pole attachments than “telecommunications providers.” Moreover, “incumbent local exchange carriers” are not provided the benefit of a regulated rate at all when they seek to attach their equipment to a pole that is typically a monopoly facility. This patchwork of regulation results in a widely disparate set of rates for what essentially amounts to the same input for critical communications services—a foot or two of space on a utility pole.

Concerned about the differences in pole attachment rates paid by communications carriers, the Federal Communications Commission (“FCC”) is currently considering whether it should adopt a new, uniform rate for pole attachment services for broadband Internet access services. This formal regulatory review, which we refer to as the *Pole Attachments Notice*, provides an opportunity to take a look at pole attachment rates as a matter of first principles (FCC, 2007a). Moreover, the FCC has singled out pole attachment rates as an important component of its *National Broadband Plan* released in March 2010, calling for lower rates for broadband providers, so the question of pole attachment regulation remains a significant public policy issue (FCC, 2010a).

Establishing feasible rates for a mixed-use facility like utility poles ordinarily requires that the fixed costs of constructing the facility be recovered from users of that facility. However, this cost recovery requires that rates deviate from the first-best marginal cost rate. It is arguably the task of the regulator to

divide those fixed costs among users of the facility in a way that recovers them, yet ideally maximizes welfare. Ramsey pricing, a form of elasticity-based price setting, achieves this goal by assigning the shares of fixed costs to users of the facility to reflect their elasticities of demand for the facility's services.¹ The Ramsey, inverse-elasticity rule is, in fact, the optimal uniform price mechanism for doing this (Brown and Sibley, 1986, Ch. 3; Mitchell and Vogelsang, 1991, Ch. 4). The goal of this approach, though, is efficiency, not uniformity—indeed, a Ramsey pricing approach often requires different users of a pole attachment to pay a substantially different share of the fixed costs of that facility while consuming essentially identical services. Still, from the public interest perspective, Ramsey prices are highly desirable.

The practical implementation of Ramsey pricing regulation for pole attachments would require an examination of the elasticities of demand for pole services by electricity, cable television, and telecommunications providers. In the ordinary course of things, one would expect that these elasticities might differ substantially. However, in today's environment, with cable, telecommunications providers, and incumbent local exchange carriers all requiring poles to build advanced broadband networks that offer integrated voice, video, and broadband data service platforms, a Ramsey pricing approach might suggest that the optimal pole attachment rates paid by some of these firms should actually be converging, since the product market offerings are exhibiting increasing standardization. This development would represent a substantial change from the historical experience, when rate differentials may have been justified by profound differentiation in the firms' offered services. Both FCC proposals, which call for the creation of a more uniform rate structure, are actually consistent with this emerging economic reality, in which all types of firms offer competing packages. In fact, it is arguably an important goal of regulation to avoid "tilting the board" in favor of one mode of service delivery over another. Price differences, under a Ramsey system, would reflect differences in demand elasticities and differences in costs of providing the input. If some elasticities, as we will argue below, are now more similar, and costs differences, in this case, are relatively unproblematic, then the implementation of a more uniform rate system would appear highly desirable from the social point-of-view.

In addition, we will show that the available evidence suggests that a harmonized communications industry pole attachment rate would be relatively low. The overall market elasticity of demand for pole attachments may now be more elastic, in both an absolute and relative sense, than was the demand for communications services when Section 224 was enacted and implemented. As a

¹ Some papers, including Bolt and Tieman (2006) and Krueger (2009), have extended the analysis of Ramsey pricing to two-sided markets.

result, on welfare grounds alone, the FCC could probably justify allocating a low portion of fixed costs to communications providers, while allocating more of the fixed and common costs of utility poles to services with more inelastic demand—namely, electric utilities. Such a result would promote economic efficiency and increase welfare (at least in a static sense).²

This paper is structured as follows: Section II provides some basic historical background information on the regulation of pole attachments. Section II then outlines the principles of Ramsey pricing, and how such a mechanism could be an optimal approach for establishing pole attachment rates. Section III provides an empirical analysis of this approach and demonstrates that pole attachment rates paid by communications network firms should similarly converge. In addition, based on available evidence, Ramsey pricing indicates that it may be justifiable to increase the share of costs allocated to electric ratepayers.

2. Regulation of Pole Attachment Rates under Section 224

Section 224 of the Communications Act of 1934, 47 U.S.C. §224, regulates the rates of pole attachments. As used in the Act, “pole attachments” or “pole” refers to a myriad of physical assets, namely, “any attachment . . . to a pole, duct, conduits, or rights-of-way controlled by a utility (47 U.S.C. § 224(a)(4)).” In particular, Section 224(b)(1) requires the FCC to ensure that the “rates, terms, and conditions” of pole attachments used for any purpose be “just and reasonable.” Significantly, the Supreme Court has ruled that the FCC has broad authority to prescribe rates for communications services under this provision, noting that this area is “technical, complex, and dynamic.”³ Given this broad authority, it is important that the FCC exercise this authority properly, as pole attachments are a critical input to broadband services.

While the FCC has broad authority, the regulation of pole attachment rates, terms, and conditions is complicated by several factors. First, while utility poles are ubiquitous and have been critical to telephone and electric services for over a century, federal regulation of these inputs has been in place only since 1978, when Section 224 was first enacted. Prior to that time, a handful of states regulated the rates for pole attachments, and Section 224 specifically provides that federal regulation only serve as a backstop and apply only where states do not regulate pole attachments. This unique regulatory structure remains to this day. Currently, nineteen states and the District of Columbia regulate pole attachments

² Gayle and Weisman (2007) discuss the trade-offs between static and dynamic efficiency when designing telecommunications policy, and Mandy and Sharkey (2003) do so with specific reference to pricing of network infrastructure using cost models.

³ *NCTA v. Gulf Power*, 534 U.S. 327, 328 (2002).

independent of the FCC's authority (FCC, 2008). Some states use a methodology similar to the FCC's, but others charge a uniform rate to cable systems and telecommunications carriers.

In addition to this geographic variation, pole attachment rates also vary by service provider, as a result of specific Congressional mandate. When Section 224 was enacted in 1978, it provided a specific rate for pole attachments used to provide "cable television service (47 U.S.C. § 224(d))." Ever since, the electric utility industry has argued that the cable rate structure is unreasonably low and, "subsidiz[es] communications giants (Richards, 2008, p. 1)."⁴ In 1996, as it attempted to promote competition in telecommunications services, Congress permitted competitive telecommunications providers to obtain access to utility poles at a regulated rate higher than the cable rate (47 U.S.C. §224(e), §224a(5)). However, while the FCC has since extended the application of the "telecommunications services" rate to certain other providers, such as wireless providers (FCC, 1998, paragraphs 34-42), incumbent local exchange companies ("ILECs") are still often charged a higher rate for pole attachments than other telecommunications providers or cable companies. In practice, since ILECs own poles, ILEC rates are obtained through negotiated joint-use agreements with other utilities that own poles.

Evidence of the variation in rates is presented in Table 1 below. Table 1 summarizes various computations of these three different average nationwide rates recently filed before the FCC. In the Table, the average rate paid is expressed as the annual payment per foot of pole space. Table 1 assumes, based on historical data provided by the electric utility industry, the cable operator and CLEC attachments require one foot of space each, while the hypothetical ILEC requires two feet of pole space (Edison Electric Institute, 2008a, p. 42). In instances where the ILEC uses more or less than two feet of space, the rate differential will, of course, vary from that reported here.

Given these assumptions, the differences in rates paid per foot is sometimes dramatic. Based on electric utility data, the average rate paid by cable operators is \$6.63 per foot, per year. Telecommunications carriers (CLECs primarily) pay about twice that, with payments falling in the \$10 to \$15 range. Assuming an average of two feet per attachment, the ILECs pay about \$20 per foot, per year, which is about three times the rate paid by cable operators and twice that of CLECs. Even if we assume an average of three feet per ILEC attachment, the ILEC average rate remains substantially higher than the cable rate. Table 1 illustrates significant differences across communications providers.

⁴ See, e.g., *FCC v. Florida Power Corp.*, 480 U.S. 245 (1987).

Table 1. Evidence on Pole Attachment Rates, \$/ foot/year			
Summary Statistics provided by:	Cable Rate	CLEC Rate	ILEC Rate
Cable TV Industry	\$5.25	\$11.97, \$17.10	...
CLEC Industry	\$5.70	\$15.00	...
ILEC Industry	\$3.65	\$7.05	\$14.41
Utilities	\$6.63	\$10.02, \$15.12	\$20.40
Sources: National Cable Television Association (2008: Pelcovits Declaration 9-10); USTelecom (2008: 8); Time Warner Telecommunications (2007: 10); Edison Electric Institute (2008b: 15). Calculations assume 1 foot for cable and CLECs and 2 feet for ILECs (Edison Electric Institute 2008a: 42).			

While Table 1 is expressed per-foot used, we do not suggest that this is the only reasonable method of calculating rates. Moreover, a few states have implemented approaches to calculating rates that differ from the FCC method (e.g., Maine Public Utilities Commission, 1993). But, for the remaining states, the FCC methodology prevails and the per-foot rate differentials described in Table 1 are broadly present. (We note, however, that ILEC rates are not determined by regulation but by negotiated joint-use agreements with other utilities.)

The differences between the cable system and telecommunications carrier rates are the result of different allocations of the fixed and common costs of the non-usable space on a utility pole. These differences bring to light the central issue—how the common costs of building and maintaining the pole, as a whole, are to be allocated between electric, telecommunications, and cable providers. Each pole attachment rate contains at least two components—the marginal cost of the attachment itself, as well as a charge reflecting some portion of the fixed and common costs of the pole. We next examine this issue in greater detail.

2.1 The Treatment of the Cost of Pole Space in the Current Rate Structure

As with many utility and communications facilities, the cost of a utility pole is largely fixed, with very little cost incremental to any specific use. Although setting the pole rental rate at marginal cost is first-best optimal, this price is insufficient to fully recover the economic costs of production. The fixed and common costs of pole attachments are significant, and allocating these costs between firms is the central problem in establishing desirable pole attachment rates. Default values for utility pole rate setting assume a pole that is 37.5 feet high, 13.5 feet of which is usable for attachments (36%), meaning that nearly two thirds of common operating and capital costs of a pole need to be allocated between electric, cable, telecommunications providers, and other attachers (Kyle and Klein, 2007).

Today, the FCC allocates different shares of these fixed costs between cable and telecommunications companies. For cable operators, Section 224 essentially caps the allocation of these costs at the share of total usable space the cable attachment requires.⁵ Electric utilities have repeatedly claimed that the cable rate is improper because it does not make any contribution to the operating and capital costs of the non-useable space, but this allegation is not strictly true. Under the statute, cable providers do contribute to the “operating expenses and actual capital costs of the utility attributable to the entire pole (47 U.S.C. § 224(d)(1))”—but what the current rate structure does in practice is allocate to them a significantly *smaller* share of those expenses and costs than is allocated to telecommunications providers.

This point can be illustrated with simple algebra. Let K be the capital carrying costs and operating costs attributable to the entire pole, t be the feet required by the cable system, T be the total feet of the pole, and λ be the share of usable space on the pole. By statute, the (maximum) rate for cable systems (R_C) is,

$$\begin{aligned} R_C &= (t/\lambda T)K \\ &= (t/\lambda T)k_U + (t/\lambda T)k_N \end{aligned} \tag{1}$$

where k_U is the cost assigned to the usable portion of the pole, and k_N is the non-usable portion (so that $K = k_U + k_N$). Therefore, the cable rate contributes to the costs of both the usable and non-usable portion of pole at an equal rate of $t/\lambda T$ (the share of usable space). If all usable space were occupied by cable systems, then we would have $t/\lambda T = 1$, and the full costs of the pole K would be recovered. This implies that the cable companies do, in fact, contribute to the entire fixed and common costs of the poles, since they would pay the entire cost if they occupied all the usable space. However, alternative allocations of costs to cable companies are legally possible under the statute, as Section 224(d)(1) only established a cap on the fixed cost allocation for cable companies (though the FCC uses the maximum rate).

As described in Section 224 of the Act, pole costs are allocated to telecommunications carriers by separating the recovery of costs across the usable

⁵ That is, if a cable attachment takes up 10% of the total usable space on a pole, then Section 224(d)(1) requires that the cable pole attachment rate not be allocated more than 10% of the “sum of the operating expenses and actual capital costs of the utility attributable to the entire pole.” 47 U.S.C. §224(d)(1). “Usable space” means the space on the pole above the minimum grade level, which can be used for the attachment of wires, cables, and associated equipment. 47 U.S.C. §224(d)(2).

and unusable space on the pole. Expressed algebraically, the rate for pole attachments by telecommunications carriers (R_T) according to the statute is

$$R_T = (t/\lambda T)k_U + (2/3n)k_N \quad (2)$$

where n is the number of attaching entities. Here, the cost of the usable space is recovered in the same manner as for the cable system. However, the allocation of the costs of the unusable portion of the pole varies based upon the number of firms attaching to the pole, and this cost is limited to two thirds of the total costs of such space (the second part of the right-hand side of Equation 2). Under Section 224(e)(2), if, for example, only one (non-ILEC) telecommunications firm attaches (in addition to the electric company), then it must pay an equal one-half share of two-thirds of the costs related to unusable space. If there are multiple telecommunications attachers, then that allocation is divided proportionately based upon the number of attachers.⁶ So, in the plausible case that an electric company, a cable company, and a (non-ILEC) telecommunications carrier all attach to the same pole, the telecommunications carrier will be allocated 22.2% of the unusable space on the pole (two-thirds divided by three, or $2/9^{\text{th}}$) regardless of how much space the carrier actually uses (47 U.S.C. §224(e)(2)). The cable company, however, will be allocated only that part of the costs of unused space in proportion to its usage share of the usable space. These two different rate setting methodologies essentially ensure that telecommunications carriers bear a larger share of the costs of the unusable space on the pole (when compared to a cable company), and consequently pay a higher rate. Under plausible assumptions on the space used, only in the case of nine attachers would the telecommunications rate be equal to the cable rate. On average, however, there are only three attachments, typically including an ILEC (American Electric Power Service Corporation, 2008).

Although a number of interested parties have claimed that regulatory practice fails to provide for fixed and common pole cost recovery from cable operators, the current cable rate does in fact contribute to these costs, but that contribution is lower than the contribution made by telecommunications carriers. The FCC certainly appears to be legally able to re-examine these allocations, particularly with regard to attachments made to construct multiservice, broadband Internet access networks. According to the Supreme Court, these specific rate formulas “work no limitation on §§224(a)(4) and (b)” of the Act, the two sections that represent the “theoretical coverage” of the FCC’s authority and establish a

⁶ Cable operators are counted as attachers, though their rate is not affected by the number of attaching entities.

general requirement for just and reasonable rates.⁷ Section 224 of the Act also governs the rates for access to ducts and conduit. Unlike the case of pole attachments, no particular formulas are suggested by statute for ducts and conduit. FCC rules establish an identical rate for cable systems and telecommunications providers in these cases.⁸ The equal treatment of cable systems and telecommunications carriers with regard to rates for ducts and conduit also lends support to the validity and potential legality of uniform pole attachment rates.

2.2 An Optimal Approach for Pole Attachment Rates

Fortunately, pricing facilities with high fixed and low marginal costs such as utility poles is familiar ground in public utility regulation. When fixed costs must be recovered, as in the case of a utility pole, prices must be set above marginal costs, and the challenge for the regulator is to ensure that those mark-ups reduce welfare to the least degree possible. It is well known that the best (most socially efficient) linear prices, which recover costs, are the inverse-elasticity-based prices known as Ramsey prices.⁹ Put simply, since raising prices above marginal costs will inefficiently reduce quantities purchased to suboptimal levels, if mark-ups over marginal costs are required to recover high fixed costs, then Ramsey's approach prescribes raising prices where it does the least damage to the public interest (Brown and Sibley 1986; Mitchell and Vogelsang 1991).¹⁰ Ramsey pricing is efficient because it minimizes the suppressive effect on consumption that arises from raising prices above marginal costs. Sometimes called "second-best" pricing, Ramsey pricing in fact maximizes the sum of consumer and producer surplus, while ensuring that the producer surplus just covers fixed costs.¹¹ To accomplish this result, Ramsey prices are established so that all deviations of prices from marginal costs are inversely proportional to the corresponding demand elasticities (e.g., Brown and Sibley, 1986 at 40). By following this rule under a zero profit constraint, decreases in the welfare losses from reductions in quantities purchased are minimized and (static) consumer

⁷ *NCTA v. Gulf Power*, supra n. 1, 534 U.S. at 337.

⁸ 47 C.F.R. § 1.1401-1.1408; <http://www.fcc.gov/eb/mdrd/PoleAtt.html>.

⁹ We ignore non-linear pricing for pole attachments in this paper for two reasons. First, pole attachments are an input of production and the efficiency gains of two-part tariffs do not necessarily apply to inputs (Ordover and Panzar, 1982). Second, the quantity of pole attachments is largely fixed for any user. In such cases, the two-part tariff is effectively a linear price.

¹⁰ "Least damage" in the sense of static pricing efficiency. Regulators may have alternative motivations, such as dynamic efficiency, fairness, litigation risk, and other concerns.

¹¹ These prices are second best in that prices are not set equal to marginal cost. The first best prices create problems of their own, however, since they do not allow the recovery of full economic costs.

welfare is maximized. Prices that deviate from Ramsey prices necessarily reduce aggregate welfare defined in this sense. In the case at hand, the “consumer” is the firm buying an attachment, but in the competitive (and even some imperfectly competitive settings), the inefficiencies arising from non-optimal pricing of inputs are, in the end, borne solely by the end-user consumer (Brown and Sibley 1986: Ch. 6).

Ramsey pricing is a staple of regulatory economics, and detailed treatments are found in such seminal regulatory texts as Brown and Sibley (1986, Ch. 3) and Mitchell and Vogelsang (1991, Ch. 4). A published study by Huettnner (1982) considers Ramsey pricing specifically for pole attachment regulation.

Summarizing the theory, Ramsey pricing stipulates that the markup of price (p) over marginal cost (c) in market i is:

$$\frac{p_i - c_i}{p_j} = \frac{\theta}{\varepsilon_i} \quad (3)$$

where ε_i is the (absolute value of the) own-price elasticity of demand for market i and θ is a proportionality constant that adjusts uniformly across all markets so that seller profits are zero (Brown and Sibley 1986, p. 40). Consider some examples. If $\theta = 0.5$ and $\varepsilon = 2$, then the price-cost margin is $0.25 (= 0.5/2)$. Or, if $\varepsilon = 3$, then the price-cost margin is $0.17 (= 0.5/3)$. The Ramsey prescription is that the more elastic the demand curve, the lower the markup over marginal cost.

Given two markets i and j , the relative Ramsey markups across the two markets are:

$$\frac{(p_i - c_i)/p_i}{(p_j - c_j)/p_j} = \frac{\varepsilon_j}{\varepsilon_i} \quad (4)$$

where, $i \neq j$ and the mark-ups $(p - c)/p$ are positive and sized to recover all costs.¹² Continuing with our example, the ratio of elasticities is $3/2 = 1.5$, and the ratio of margins from above is $0.25/0.17 \approx 1.5$. These formulae show that if prices are to be higher than marginal costs, then price increases should be placed where they matter least (i.e., where demand is relatively inelastic) to minimize static demand distortions.

¹² Notably, these expressions are derived under simplifying assumptions. In more complex settings—such as non-constant marginal costs, interrelated demands, and so forth—Ramsey pricing is not as simple as just described. Nevertheless, the underlying logic of Ramsey pricing is “of the same flavor” (Brown and Sibley, 1986, p. 41).

For present purposes, it is Equation (4) that provides the most relevant guidance. The equation reveals that when two firms have similar demand elasticities for pole attachments the price-cost margins on such attachments should likewise be similar. Alternately, if one firm has a relatively more elastic demand for the attachment, then its price-cost margin should be lower. If one assumes equal marginal costs for all attachments, then the relationship between relative prices is the same as that for the margins. Attaching entities with relatively more elastic demand curves for attachments should pay a commensurately lower price for attachments. Although the presentations of the Ramsey logic familiar from economics texts usually fail to emphasize, or even mention, the role of time in these calculations, this aspect is critical for the practical application of these ideas. In particular, in the absence of significant intertemporal dependencies (such as those arising, say, from inventory behavior), the elasticities used need to correspond to the time frame over which price setting and price adjustments are possible. It is commonplace that elasticities of demand are always larger in the long-run than in the short (at least for non-durable goods). The relevant interval for the calculation of Ramsey prices in the simplest case, though, necessarily refers to the time period over which a regulated price will apply. There is no guarantee, however, that this administrative period will correspond very well to the time periods for which empirically obtained elasticities are available. On the other hand, if the goal is solely to describe the relative shares of common costs properly assigned to different types of users rather than the absolute rates they should pay, then it is not so clear that the use of shorter- or longer-run elasticities makes a great deal of difference, so long as the *ratios* of these elasticities are roughly constant over time.

With approximations for the relevant elasticities (ϵ) and marginal costs (c), Ramsey pricing can provide some useful guidance for the efficient pricing of pole attachments. For present purposes, the policy implications of Ramsey pricing are straightforward. If marginal costs and elasticities are equal across firms, then prices should be equal. If marginal costs are equal and elasticities are not, then prices should be different. This simple prescription is very useful for formulating pole attachment rates in the current economic environment. We discuss this prescription in more detail in the next section.

3. Ramsey Pricing for Pole Attachments

As just noted, there are two straightforward and policy-relevant principles from Ramsey pricing for pole attachment regulation. First, assuming equal marginal costs, which are directly proportional to the number of feet required for the attachment, attaching carriers with identical demand elasticities should pay the same rate. Second, users of utility poles with more inelastic demands should bear

a higher proportion of the fixed and common costs of the poles. In this Section, we examine the elasticities of demand of the various users of utility poles to determine how they compare.

3.1 Demand Elasticities for Attachments by Cable and Telecommunications Providers

Table 2 provides typical values for the demand elasticities for the various services provided over networks attached to utility poles. These values represent approximate averages of estimated elasticities from a variety of studies. The major categories are multichannel video (GAO, 2003, -2.7; GAO, 2002, -2.1; GAO, 2000, -3.2; Beard et al., 2005, -2.7; Chipty, 2001, -5.9; Ford and Jackson, 1997, -2.74; Rubinovitz, 1993, -1.5; Goolsbee and Petrin, 2004, -1.5), telecommunications (Rodini et al., 2003, -0.43; Eisner and Waldon, 2001, -0.35 for second lines; Duffy-Deno, 2001, -0.15 for primary, -0.59 for second lines; Solvason, 1997, -0.006 to -0.017 for primary lines; Crandall and Waverman, 2000, -0.10; Ford and Jackson, 2004, -0.28 average for international calls; Ford, 2004, -0.69 for domestic long distance; Burnstein, 2005, -0.835 and -0.654 for domestic long distance), broadband (Dutz et al., 2009, -1.5; Rappaport et al., 2003, -1.5; Crandall et al., 2002, -1.2;), and electricity services (Bernstein and Griffin, 2006, -0.2; Espey and Espey, 2004, -0.35; Kamershen and Porter, 2004, -0.15). Estimated elasticities vary across studies and time, so those listed in the table are *approximations* of the average estimated values. Since we cannot know the frequency with which attachments rates might be subject to administrative reviews, we will simply use short-run demand elasticities when available. As noted above, this approach will not yield qualitatively different conclusions from those obtained using instead the long-run elasticities whenever the ratios of these elasticities are constant.

In an effort to make our findings more useful, we also provide an approximation of the own-price demand elasticity for a bundle comprised of a so-called “triple-play” of popular services, and this elasticity is intended to represent that faced by the modern broadband service provider capable of offering voice, video and broadband Internet services. We use the revenue-weighted average of the services making up the “triple play” (voice, data, and video) based on expense share and elasticities of local phone (\$37), long distance (\$14), international long distance (\$1), multichannel video (\$43), and broadband (\$53) for this calculation (FCC, 2007b; National Cable Television Association Data from www.ncta.com, and OECD, 2007).¹³ The value implied is -1.50, which is in the elastic region of

¹³ Electric utilities have experimented with Broadband-over-Powerline (BPL) services, but the service serves only a few thousand customers (NTIA, 2008, p. 26). The D.C. Circuit Court’s (Footnote Continued. . . .)

demand. We emphasize that all of these values, and particularly the last one, should be taken to be no more than reasonable guesses, which serve to illustrate the argument. To this end, we also consider some alternate assumptions in our examples below, and the calculations easily permit other assumptions not considered here. In the case of the triple-play service, analyses by Rappaport et al. (2003) and Hauge and Prieger (2009) suggest that the own price elasticity might be somewhat lower than -1.5, and it is almost surely declining over time, whatever its value. Complicating matters further, the time periods to which these various elasticities correspond are not identical, and all such values will have relatively short shelf-lives. However, if attachment rates are reset by the FCC by reference to Ramsey pricing principles, then we expect extensive evidence on demand elasticities will be presented and debated as part of any formal regulatory proceeding. The elasticities reported in Table 2 are based on studies that are more recent and perhaps reflect the general nature of the problem, but still they should be viewed as illustrative.

Table 2. Final Service Demand Elasticities	
Product	Final Product Demand Elasticity (η)
Multichannel Video	-3.00
Local Telephone	-0.10
Domestic Long Distance	-0.75
Int'l Long Distance	-0.30
Broadband	-1.50
Electricity	-0.20
Modern Broadband Provider (Triple Play)*	-1.50
* Author calculation. These are "short-run" elasticity values.	

In the case at hand, the relevant elasticities, given by the terms ε_i in the equations, are the elasticities of the demands for the pole attachment inputs and so

decision in *American Radio Relay League v. FCC*, 524 F.3d 227, (D.C. Cir 2008), will indefinitely impede BPL growth by remanding the FCC's efforts to encourage its development. BPL is claimed to interfere with Amateur Radio signals, and the Court found that the FCC's decision to the contrary was procedurally defective, leaving intact the interference hurdle for BPL deployment. In April 2010, BPL service in Manassas, Virginia — which some referred to as the most successful BPL deployment in the nation — was terminated. *Agenda, Special Meeting of the City Council, City of Manassas, Virginia* (April 5, 2010) (available at: <http://www.manassascity.org/archives/42/Agenda%20Packet%20-%20April%205,%202010.pdf>). Also see K. Teal, *BPL Death Knell Sounds with Latest Network Shutdown*, *Von* (April 13, 2010). The recent *National Broadband Plan* (FCC, 2010a) does not even mention BPL as a viable broadband platform.

are referred to as elasticities of *derived demands*. The elasticities in Table 2 (labeled η), on the other hand, are for the final services, and are not the relevant derived demand elasticities. In general, very little is publicly known about the elasticities of derived demands for pole attachments or similar inputs. When only retail level elasticities are available, as is the case here, one must make some assumption about how those elasticities should plausibly be related to the derived elasticities necessary for the Ramsey formula for pole attachments. Under a constant elasticity demand curve and no substitution of the pole input for other inputs, the elasticity of derived demand for an input is simply the final product or service demand elasticity multiplied by the input's share of total cost (Layard and Walters, 1978, p. 262).¹⁴ Thus, the derived demand elasticities are simply $\varepsilon = w\eta$, where w is the share of total expenses of the pole attachments used to produce a final service with consumer price elasticity of demand, η . Given this, we can use the elasticities in Table 2 to *approximate* the derived demand elasticities. (It should be noted, however, that large changes in pole attachment rates may well alter the cost shares, so caution is called for in this calculation.)

Our estimates indicate that pole attachment costs represent only about 1% to 2% of total expenses for communications firms (ILECs) and electric utilities.¹⁵ Given this small fraction of costs, the derived demand for pole attachments is almost surely inelastic for all attaching firms. As shown in Equation (3), however, it is the *relative* values of the elasticities across attachments, and not the absolute values, that determine the shares of pole costs paid in any practical application. Consequently, given the similarity of the pole attachment cost shares across firm types (and our ignorance of the actual values), the relative elasticities of the final products can serve as proxies for the derived demand elasticities when computing *relative* prices and margins (but not *absolute* prices or margins).

¹⁴ Over the relatively narrow price range contemplated in the regulations, and given the low share of total costs of pole attachments, the assumption of no substitution is reasonable.

¹⁵ We assume that electric and ILECs attach to the 126 million poles in the U.S. (which excludes railroad-owned poles). The cable industry is assumed to attach to 67% of all poles (84 million). For the cable industry, we compute total expenses for the industry by multiplying the average expense per home passed for Comcast by total industry homes passed (\$394 per home passed by 123.4 million homes passed). The cost share for cable is about 1%. For ILECs, we assume they pay \$40 per attachment. We then sum the expenses of AT&T and Verizon and assign pole costs to these carriers based on their share of access lines. The cost share is about 2%, though it would be lower if the cable rate was paid. Financial data for cable and telecommunications firms are from their 2007 Form 10-Ks. Access line data is from FCC (2007). Pole data is from Pelcovits (2008) at 6-9. For electric utilities, we assume an average attachment rate of \$40 per year and divide that by total industry expenditures provided by the Energy Information Administration (www.eie.doe.gov). The cost share is about 2%. Of course, the share is dependent on the assumptions regarding attachment rates.

These absolute elasticities do, however, suggest the total welfare consequences of more efficient prices. While positive, these may not be large relative to the size of the industry. This is unsurprising given the small cost share of poles in service production. Still, efficient prices are preferred even when the gains are relatively modest, though other concerns with more substantial implications may take precedence in practical policymaking. Moreover, in sparsely populated areas, the cost of pole attachments may be sizeable relative to revenues. In the *National Broadband Plan* (FCC, 2010a, p. 110), the FCC notes that in a rural area with 15 households per linear mile, the cost of pole attachments can range from \$4.54 per household passed at the cable rate to \$12.96 per household passed at the ILEC rate. These high costs may discourage network deployment in such areas.

3.2 The Consequences of Rate Uniformity and Convergence

Recent years have seen substantial “convergence” between the disparate types of communications networks, which use pole attachments. As noted by many business analysts and academics, the product offerings available to consumers from modern cable and telecommunications are often highly competitive, similar in content and appeal, and packaged and delivered in manners indistinguishable to the final user. As these service offerings converge, it is reasonable to expect that the elasticities of final demand for the services offered over the network also “converge,” i.e., become more nearly equal. In the Ramsey context outlined here, this implies that the optimal prices for attachments are likewise converging. Further, although the triple play service is the only such service we evaluate here, that is solely due to the prevalence of this bundle in the marketplace. It is possible that, in the future, electric utilities and perhaps others will offer similar bundled products. If so, this process will further the convergence described above and the argument will extend to other users and uses of utility poles.

It is interesting to note that the rate differentials created by the existing statute and regulatory scheme can be informally rationalized by the Ramsey pricing logic. When the pole attachment regulatory regime was originally put in place in the late 1970s, the cable and telecommunications industries were largely distinct. As shown in Table 2, under Ramsey pricing, a “cable only” network would face a substantially different price for attachments than a “voice only” network. The elasticity of demand for cable services is typically estimated to be in the elastic range, whereas the demand elasticity for traditional voice services is much more inelastic. Assuming approximately equal cost shares, the resulting elasticities of derived demand that imply lower rates for “cable only” networks

may have been justifiable historically. However, as we discuss below, this basis for rate differentiation is now much weaker.¹⁶

Today, as integrated, multi-service fiber-optic networks proliferate, the differences between the services offered by cable and telecommunications providers have substantially disappeared in some important cases. For example, in 1978 there was no broadband and no commercial Internet. Even when the 1996 Act was being drafted and codified, broadband Internet service was in its infancy. In 1999, the first year for which FCC data on high-speed Internet lines is available, there were only 1.4 million cable broadband lines, about 1.0 million DSL lines, and only around 2.7 million broadband lines altogether. In contrast, as of December 2008, there were 41.4 million cable broadband lines, about 31 million DSL broadband lines, and 102 million broadband lines in the United States (FCC, 2010b, Table 1). Plainly, the communications industry has undergone a substantial transformation in a short period of time.

Furthermore, the service mix offered across communications providers has become much more uniform. Consider the cable industry. At the end of 2002, six years after the 1996 Act was passed, Comcast's Annual Report indicated that the firm had 21.3 million video subscribers, 3.6 million high-speed internet subscribers, and 1.4 million phone service subscribers. At the end of 2009, just seven years later, Comcast had 23.6 million video subscribers, 15.9 million high-speed Internet subscribers, and 7.6 million phone customers. For Comcast, average annual growth rates in the numbers of video subscribers (1.5%), Internet subscribers (49%), and phone customers (63%) illustrate the phenomenon starkly. The ratio of commingling [(Internet + Phone Subscribers)/Video Subscribers] has risen from 0.23 in 2002 to 1.0 in 2009 (i.e., the cable company has as many broadband and phone subscribers as video subscribers), and this ratio is expected to grow. The growth in broadband connections for the telephone companies is similar to that enjoyed by cable, and now the largest telecommunications firms (AT&T and Verizon) are successfully offering multichannel video services.

The implications of these trends are important for pole attachment pricing. Due to the growing similarity between service offerings over communications networks, the retail market demand elasticities for services have grown more alike. Assuming roughly equal cost shares for pole attachments, the derived demand elasticities for attachments likewise have converged. This reasoning

¹⁶ Furthermore, in 1978, the cable penetration rate in the United States was very low, about 15%. One motivation for a preferential rate may have been to spur cable deployment. Subscription data from www.ncta.com and housing data from the Census Bureau (www.census.gov) shows 13.4 million cable subscribers among 88.4 million households at that time.

leads to a relatively clear recommendation for the reform of the pole attachment pricing system: rates charged to different attachers should be more uniform.¹⁷

Currently, the ILECs do not pay the regulated telecommunications rate for pole attachments, but are instead required to negotiate fees with other utilities. Section 224(a)(5) specifically excludes an ILEC from being classified as a “telecommunications carrier.” An important policy question is whether the FCC has the legal authority to bring the ILECs under a regulated, uniform, “broadband provider” pricing scheme. Absent such activity, the impact of attachment rate changes will be (largely) limited to cable companies and, consequently, may fail to resolve the efficiency problem of non-uniform prices for broadband firms. The Supreme Court decision in *NCTA v. Gulf Power* suggests that the “theoretical coverage” of the FCC’s authority is sufficient, and the FCC has requested comment on the eligibility of ILECs to pay regulated attachment rates (FCC, 2007a, p. 10).¹⁸ If the FCC resets pole attachment rates, then this “theoretical coverage” of its authority certainly will be litigated.

An important ancillary consequence of the application of Ramsey principles to pole rates in the case considered here is the promotion of “competitive parity,” where that term is taken to mean that regulation should not arbitrarily advantage one mode of competitive entry or expansion over another. In general, regulators are not very efficient in predicting the future course of industrial development. This constraint argues strongly for a somewhat “agnostic” approach to regulation, at least where regulatory decisions might be expected to determine which of several competing technologies emerges as the market standard. In practice, this consideration has usually been cited as support for a cost-based system of regulatory pricing which eschews demand-derived inputs. Such a goal is outside of the Ramsey logic, however. In the present case, though, application of the Ramsey mechanism coincidentally serves to promote competitive parity since Ramsey pricing will lead to more nearly equal rates for pole attachments by broadband providers. While this result is purely fortuitous, it strengthens the case for use of the Ramsey mechanism.

3.3 The Allocation of Fixed Costs between Electric and Communications Firms

Ramsey pricing may be useful in implementing efficient rate design not only between communications firms, but also between different utilities that share utility poles. As Table 2 suggests, the demand for broadband Internet access services is price elastic (-1.5) in the “short run,” probably far more so than the

¹⁷ *NCTA v. Gulf Power*, 534 U.S. at 336, 338-39 (2002).

¹⁸ *NCTA v. Gulf Power*, 534 U.S. at 337 (2002).

demand for electric service (-0.20). While these elasticities are only crude approximations, it is the conclusion of numerous independent researchers that broadband connection demand is more elastic than electric demand.

The evidence on the relative derived demand elasticities for electric and communications services implies that optimal pricing would assess a lower per-foot rate to communications providers than to electric utilities (assuming equal marginal costs), since the optimal relative price-cost margins are proportional to the relative elasticities for the attachments (see Equation 4). Important questions, then, become: how do the current rates compare to the prescriptions of Ramsey pricing, and how much would current rates need to change to better comport with optimal pricing of the attachments? We can provide some insight into these questions using available estimates of elasticities, costs, and prices.

To begin, assume equal cost shares for all firms (at 1.5% of costs) and a uniform marginal cost for attachments. Assume an end-user demand elasticity for a triple-play or broadband service of approximately -1.5, and an electricity elasticity of -0.20. Given the estimated cost shares, the derived demand elasticities for these services are -0.0225 for communications and -0.003 for electric. This is a substantial difference—the derived demand elasticity for pole attachments of communications firms is approximately 7.5 times greater than that of electric utilities. It follows, then, from Equation (4), that the price-cost margins between electric utilities and communications firms likewise should differ by a factor of about 7.5 ($\epsilon_j/\epsilon_i = -0.0225/-0.003 = 7.5$).¹⁹ With equal marginal costs, this implies optimal prices (per-foot) should be significantly higher for electric utilities than for communications firms.

Using this simple calculus, we can also analyze whether applying the cable system rate to all communications firms (including ILECs) is consistent with optimal pricing. The cable system rate is the lowest rate currently applied to broadband providers. Assume that there is one electric utility, one cable provider, and one ILEC attached to a pole. Consistent with historical data, suppose the cable system needs one foot of space while the ILEC needs 2 feet (see Kyle and Klein, 2007). Assume the electric utility owns the pole so that it pays all costs not paid by the communications firms. If K is \$90, then the cable operator would pay

¹⁹ Further, before the services provided over communications networks converged, the elasticity of demand for local telephone services was highly inelastic, roughly equivalent to electricity (see Table 2). Historically, simple joint use and cost-sharing for utility poles between incumbent LECs and electric utilities was possible and efficient, in large part because efficient pricing would divide fixed costs between the two equally. But now that the elasticity of demand for communications services has increased, those co-equal cost-sharing arrangements will be inefficient. Further, the large and growing imbalance in pole ownership between ILECs and electric utilities may also create asymmetries in the bargaining process underlying such agreements.

\$6.67, the ILEC \$13.34 (\$6.67 per foot), and the electric utility the residual of about \$70 (or \$6.67 per foot).²⁰

But are these prices consistent with optimal pricing? To make this determination, recall that, given the assumed demand elasticities, the price-cost margin for electric utilities should be about 7.5 times larger than that for the communications firm. So, we need to first compute the price-cost margins and then make a comparison. The marginal cost of a pole attachment is difficult to determine precisely, but one estimate places it at less than \$4 per year (Kyle and Klein, 2007, p. 39). We know from the cable rate calculation, however, that the marginal cost must be less than \$6.67, since that price level theoretically recovers the full costs of the pole attachment (so it must include some fixed costs). If we assign marginal costs based on the simple rule-of-thumb of usable-to-total space, then 36% of the carrying costs of the pole are marginal. The marginal cost per foot of usable space is \$2.4 per year ($= 0.36 \cdot 90 / 13.5$). For communications firms, the price cost margin is 0.64 [$= (6.67 - 2.4) / 6.67$], which is the same as that for the electric utilities. At the cable system attachment rate, there is no difference in the price-cost margins between the communications firms and electric utility (0.64 versus 0.64). Optimal pricing indicates that the electric utility price-cost margin should be about 7.5 times larger than the comparable figure for the communications firms, so applying the cable rate to all communications providers is not compatible with optimal pricing. Under the cable system methodology, broadband firms pay too much.

The inputs to this calculation are all approximations, and the relative prices are certainly sensitive to the chosen inputs. For example, assume that pole attachment fees represent a 1% cost share for communications firms, and a 2% cost share for electric utilities. Now, the ratio of elasticities (and of Ramsey prices) is 3.75, or half the 7.5 value calculated above. Even so, the cable rate remains well above the optimal level. Elasticity estimates also vary among studies, and they materially affect the calculation. In a meta-analysis, Espey and Espey (2004) report a mean short-run demand elasticity for electricity of -0.35 and a median of -0.28, but the range of elasticities is -0.004 to -2.01. Other demand elasticities also exhibit wide ranges. Variation in elasticity estimates arises for many reasons, including differences in the time period studied, geographic coverage of the data, estimation techniques, and in some cases the quality of the analysis itself. Elasticities also may vary over time, particularly for

²⁰ The assumption of $K = \$90$ is backed out from the averages in Table 1 as provided by the Electric Utilities (listing the cable rate at \$6.63). Also see Kyle and Klein (2007, pp. 8-9). For the computation of actual rates paid, historical or book costs are used. The computed rates here are based on Equations (1) and (2). The electric utility is assumed to use the remaining 10.5 feet of usable pole space.

broadband services, which are incompletely diffused throughout the economy. Even the assumption of constant marginal cost is a significant determinant of optimal rates. If the FCC uses Ramsey Pricing in setting pole attachment rates, then arguments about elasticities, cost shares, and marginal costs all must be resolved in the proceeding. Our calculations are primarily illustrative rather than final, though we try to use the latest data available.

3.4 A Harmonized Rate

What, then, should a harmonized rate for broadband network providers look like? The Ramsey prices computed under various assumptions are summarized in Table 3. Given a marginal cost of \$2.40 per foot, Ramsey pricing implies a final per-foot rate for broadband networks (which includes both this marginal cost and a proper allocation for fixed costs) would be about \$2.64 per foot. Commensurately, the implied rate for electric utilities would be about \$7.82 per foot of pole space (at 10.5 feet used). With these rates, the price-cost margins for pole space will be proportionate to the ratio of the derived elasticities of demand for communications and electric services ($0.69/0.09 = 7.5$).

To defend the current cable system rate under Ramsey pricing principles, one would need to make quite unrealistic assumptions about marginal costs. Using our example above, even when one assumes that 50% of pole costs are marginal (resulting in a \$3.33 marginal cost per foot), the optimal communications firm rate is still only about \$3.60 per foot, substantially below the \$6.67 per foot rate communications firms would be charged under application of the current cable rate methodology. The communications rate would match the cable system price (of about \$6.67 per foot), only when approximately 95% of total pole costs were marginal.²¹ This high percentage of marginal costs is unrealistic, especially given the fixed cost nature of utility pole deployment.

Table 3. Ramsey Prices				
	Elasticity Ratio 7.5		Elasticity Ratio 3.75	
Marginal Cost/ft	2.40	3.33	2.4	3.33
Comm. Price	2.64	3.60	2.94	3.91
Electric Price	7.82	7.54	7.73	7.45
Cost Paid by Communications	7.93	10.80	8.82	11.72
Cost Paid by Electric Utility	82.07	79.20	81.18	78.27
Assumptions: $K = 90$. Feet required for electric utility = 10.5 ft.				

²¹ At 10.5 feet, it is impossible for the cable rate to be consistent with Ramsey pricing with an elasticity ratio of 7.5.

As discussed above, certain assumptions about cost shares would cause the optimal ratio of price-cost margins to be 3.75 (rather than 7.5). We consider this case again. Assuming marginal cost is 36% of carrying costs, the optimal price for communications firms would be \$2.94 per foot, well below the \$6.67 per foot rate implied by the cable formula. If marginal costs are 50% of carrying costs, then the optimal communications attachment rate would be \$3.92; again, well below the cable formula rate of \$6.67. The analysis indicates that the cable formula, if applied broadly to communications firms, would result in rates well above efficient levels.

Applying the current telecommunications carrier rate method to all communications firms would result in prices even more inconsistent with Ramsey pricing than those outlined above, since the telecommunications carrier rate is higher than the cable rate. In our example, this (non-ILEC) telecommunications carrier rate is calculated as \$15.20 per-foot for all communications firms. Electric utilities would implicitly pay *less* on a per-foot basis, only \$5.04/foot at 10.5 feet.²² This result turns the Ramsey principle on its head by providing the inelastic buyer with a very low price. Unless the marginal costs of electric utility attachments are substantially lower than those of other users, the telecommunications rate is entirely incompatible with Ramsey pricing.

4. Conclusion

Ramsey pricing is generally viewed as an optimal method of setting simple, uniform rates in a way that recovers the fixed costs of facilities that have multiple users. The challenge to the regulator lies in establishing rates that do not unduly suppress the quantity demanded of the input, while providing for full recovery of the economic costs of that input. Ramsey pricing explicitly allocates costs based on the elasticities of derived demands for the input from each user. As a result, firms or classes of firms with inelastic demands for the input pay a higher share of fixed costs than firms with more elastic demands.

Our review and application of Ramsey pricing to pole attachment rates provides two potentially useful conclusions:

First, a uniform rate for all modern communications network buyers may now be justified on economic efficiency grounds. Historically, the differences in rates across cable and telecommunications firms were roughly efficient because the demand for cable services was evidently much more elastic than the demand for telephone services. However, the products now being offered by cable and

²² Communications firms rent 3 feet at a total cost of \$45.78 and the residual is \$44.22 spread over 7 feet.

telephone companies are quickly converging into a common “triple play” of voice, video, and broadband services. With this convergence, the elasticities of demand for pole attachments by these providers have also (presumptively) converged. As a result, Ramsey pricing principles for pole attachment rates would recommend that the same rate be paid by firms that offer the same services over such broadband networks.

Second, Ramsey pricing principles and available evidence suggest that a harmonized rate for integrated voice, video, and broadband data networks should be set at a level below the current telecommunications or cable rates. Current rates are too high. Further, the evidence presented above suggests that the allocation of the costs of unusable space between electric utilities and the communications industry needs to be re-examined. The demand for electricity remains highly inelastic today, while the demand for broadband and triple-play communications services is relatively elastic. An efficient Ramsey pricing approach to pole attachment rates supports lowering the allocation of the cost of unusable space collectively paid by the broadband network operators, and commensurately increasing the allocation of these costs to electric utility companies. Prior to setting a specific rate, however, further analysis is warranted, particularly if policymakers wish to change significantly attachment rates across industries.

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