

Network Neutrality, Product Differentiation, and Social Welfare

Response to Phoenix Center's Reply

A Policy White Paper Prepared by

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Executive Summary

Phoenix Center Policy Paper No. 24 argues that network neutrality harms consumers and creates social inefficiency. I responded to Policy Paper No. 24 and identified four fatal flaws in Phoenix's approach. Because of these flaws, Phoenix's conclusions regarding network neutrality are unsupported. The four flaws in Phoenix Policy Paper No. 24 are:

Phoenix's economic modeling does not address economies of scale in last-mile broadband networks.

Phoenix's economic modeling assumes policy makers, by pursuing a policy of network neutrality, can completely eliminate product differentiation among broadband providers.

Phoenix fails to acknowledge the impact of the abandonment of network neutrality on the consumption and production of Internet content, services, and applications.

Finally, Phoenix draws conclusions from their model that depend on the existence of low levels of sunk costs associated with constructing new last-mile networks. Within the context of their model, as well as in reality, this assumption is highly unrealistic.

Phoenix has published a reply to my response. Their reply does nothing to undermine my original criticism. In this paper I evaluate and respond to Phoenix's reply. I take a more detailed look at Phoenix's economic model, and compare Phoenix's current interpretation of entry and competition in last-mile telecommunications networks with Phoenix's previous analysis of these issues. I conclude that Phoenix continues to get it wrong with regard to network neutrality policy.

This paper also notes that Phoenix has published "Policy Bulletin No. 16," which renews their claims that network neutrality will cause social inefficiency. However, this new Phoenix research relies heavily on the economic arguments contained in Phoenix Policy Paper No. 24, thus Phoenix's additional claims that network neutrality harms society rest on very shaky ground.

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Introduction

Economic models are useful because they can simplify complex situations and cut away unnecessary details. However, economic models, if they are to be useful to policymakers, must reasonably reflect the reality which they are purporting to simplify. In my paper, “Network Neutrality, Product Differentiation, and Social Welfare,”¹ I provide a critique of Phoenix Center Policy Paper Number 24.² In that paper, I take issue with the Phoenix Center’s application of an economic model to matters surrounding the network neutrality debate. I argue that the model applied by Phoenix Center to evaluate network neutrality does not do a very good job of reflecting the market reality which provides the backdrop to the debate. The Phoenix Center has now responded to my criticism,³ which now inspires this response. While I appreciate Phoenix Center’s efforts to clarify their position, nothing in their Reply undermines my original criticism of their work.

Scale Economies

In my critique of Phoenix Policy Paper No. 24, I pointed out that Phoenix’s analysis did not reflect scale economies. Phoenix has previously provided a reasonable assessment of the nature of the scale economies associated with last-mile telecommunications facilities, including those utilized to provide broadband:

The construction of a local communications network – whether used for voice, video, data or some combination thereof – requires enormous capital expenditures.

¹ Available at: http://www.roycroftconsulting.org/response_to_Ford.pdf

² Phoenix Policy Paper No. 24. George S. Ford, Thomas M. Koutsky and Lawrence J. Spiwak, “Network Neutrality and Industry Structure,” April 2006. Available at: <http://www.phoenix-center.org/ppapers.html>

³ Phoenix Center for Advanced Legal & Public Policy Studies. *Network Neutrality and Scale Economies: A Response to Dr. Roycroft*, May 2006. (Hereinafter, “Phoenix Reply to Dr. Roycroft.”) Available at: <http://www.phoenix-center.org/RoycroftResponseFinal.pdf>

These expenditures are fixed costs and, consequently, firms in these markets have considerable economies of scale (i.e., average costs fall as output increases). The presence of these significant scale economies results in highly-concentrated market structures, since larger firms operate at a sizeable cost advantage over smaller firms.⁴

To summarize the key points which Phoenix previously recognized: Last-mile broadband networks require huge capital expenses; these capital expenses are largely fixed costs (which are primarily sunk);⁵ these fixed costs result in “significant” scale economies; significant scale economies result in cost advantages for large (incumbent) firms, and a highly concentrated market.

In Phoenix’s Reply, they point to various discussions in Policy Paper No. 24 to demonstrate that economies of scale “play a key role in the analysis” that they conduct.⁶ Let us consider whether the economic model Phoenix selects to analyze entry in last-mile telecommunications markets comports with the facts that Phoenix has elsewhere recognized. Specifically, does Phoenix’s approach in Policy Paper No. 24 reflect the “significant” scale economies which are present in last-mile markets?

Phoenix’s Modeling Choice: the Cournot Model

To model last-mile network entry, Phoenix has selected the Cournot model. The Cournot model assumes that firms compete by deciding what level of output to produce, and, as applied by Phoenix, is a static, one-shot entry game.⁷ When a Cournot game is played, the Cournot assumption is that each firm takes the level of output of its rival as given, and then decides how

⁴ Phoenix Policy White Paper No. 21, July 2005, p. 8.

⁵ *Id.*, p. 3.

⁶ Phoenix Reply to Dr. Roycroft, p. 3.

⁷ The Cournot model, while predating modern game theory, is widely recognized as a precursor to game theoretic analysis. Thus, I discuss Cournot in terms of game play. See, for example, Friedman, J. *Game Theory with Applications to Economics*, Oxford University Press, New York, 1986, p. 22.

much to produce.⁸ When the entrant and incumbent are roughly equal-sized firms, with no firm having superior market advantage, or when no firm exercises a leadership position, Cournot may be a reasonable approach to predict how firms will behave. Cournot modeling may make the most sense if marginal costs are sharply rising.⁹ These assumptions are completely out of sync with empirical evidence regarding market conditions in last-mile telecommunications networks, where incumbents have tremendous market advantages, where entrants are likely to face higher costs than incumbents, and where marginal costs are falling.

With Phoenix's application of the Cournot model:

- The incumbent and entrant face the same *constant* marginal costs of production, in other words, no firm has a cost advantage.¹⁰

Thus, Phoenix's use of Cournot does not comport with what we observe in a marketplace characterized by scale economies, i.e., cost advantages for incumbents and declining marginal costs.¹¹

When Phoenix's Cournot game is played, the following outcome is observed if entrants can differentiate their product, and sunk costs are not "too large":

- In equilibrium, the incumbent and entrant split the market and earn equal profits.¹²

This outcome reflects the fact that the incumbent has no cost or other market advantages in Phoenix's model, therefore, entrants face incumbents who accommodate entry and share the

⁸ Pindyck, R., and Rubinfeld, D. *Microeconomics*, MacMillan, 1989, p. 428.

⁹ Tirole, J. *The Theory of Industrial Organization*, MIT Press, 1989, p. 224.

¹⁰ Phoenix Policy Paper No. 24, p. 12. This is not a requirement of Cournot, but Phoenix does not explore the case where marginal costs differ.

¹¹ Phoenix concedes that a model which introduced declining marginal costs might serve as an alternative interpretation of market outcomes where scale economies are present. Phoenix Reply to Dr. Roycroft, p. 4, footnote 9.

¹² Phoenix Policy Paper No. 24, p. 16.

market.

Thus, according to Phoenix's application of Cournot, absent product differentiation, a "natural monopoly" market outcome results.¹³ However, the "natural monopoly" with which Phoenix's model begins can be overcome if the entrant differentiates its product, even by a little bit. The market outcome in Phoenix's Cournot model, when product differentiation is allowed, is an incumbent that accommodates entry (rather than fighting entry).

Does the story told by Phoenix's Cournot model comport with the reality of an incumbent operating with "substantial" scale economies and cost advantages over its rivals, as is reasonable to expect in last-mile telecommunications markets? Phoenix's model's prediction is that a monopolist's response to entry by a firm which offers a slightly differentiated product is to accommodate and share the market. Clearly this is not a reasonable expectation when incumbents are dominant firms. Substantial scale economies award the incumbent cost and market advantages which are not acknowledged in Phoenix's modeling approach. Phoenix's analysis indicates that the incumbent cannot capitalize on the advantages which are driven by substantial scale economies (or take advantage of any other benefit which incumbents have at their disposal, such as first mover advantages, the ability to raise its rivals costs, or superior access to capital, rights of way, or multi-tenant buildings). Phoenix's model simply says: faced with entry prospects, incumbents accommodate and share the market. This outcome does not reflect a market characterized by significant scale economies.

Is Cournot the Only Way to Think About Last-Mile Markets?

Is there another way to think about, and model, the behavior of entrants and incumbents in last-mile telecommunications markets? If "significant scale economies" (as well as sunk

¹³ Phoenix Reply to Dr. Roycroft, p. 4.

costs) are present, and “larger firms operate at a sizeable cost advantage over smaller firms,” then a market is better explained with a *dominant firm* approach.¹⁴ In Phoenix Policy Paper No. 12, titled “Why ADCo? Why Now?,” Phoenix used a dominant firm model to explain why it is good policy to encourage the provision of last-mile networks on a “neutral” basis.¹⁵ In “Why ADCo?” Phoenix points out the inherent conflict of interest associated with an integrated last-mile network provider that offers retail services, and which also provides access to its network facilities for competing retail firms to reach their customers.¹⁶ Specifically, Phoenix finds that in these circumstances an incumbent will have the incentive to “sabotage and discriminate against rivals.”¹⁷

In “Why ADCo?” Phoenix concludes that the entry of an unintegrated last-mile network provider (the “alternative distribution company” or ADCo) that allows unaffiliated third-party retail providers equal access to the last-mile will have the following favorable result:

[W]hile the number of local access networks the market can sustain may be few, the wholesale nature of the ADCo nonetheless permits the number of providers of advanced telecoms products and services to be many.¹⁸

Thus, Phoenix observed that in spite of market conditions dictating that competing last-mile

¹⁴ See, for example, Carlton, D. And Perloff, J. *Modern Industrial Organization*, 4th Ed. Pearson Addison Wesley, 2005, pp. 111-112.

¹⁵ Phoenix Center Policy Paper Number 12: “Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the ‘Last Mile’ in Local Telecommunications Markets,” November 2001. The authors of Phoenix Policy Paper No. 24, George Ford and Lawrence Spiwak, are coauthors of the “Why ADCo?” paper.

Their dominant firm model appears on pp. 23-25. The benefits of a neutral last-mile network are discussed on p. 40 and *passim*.

¹⁶ “Why ADCo?”, pp. 34-35.

¹⁷ *Id.*, p. 35.

¹⁸ *Id.*, p. 40.

networks are few, competition for advanced retail services can be achieved if a neutral last-mile platform is available, in other words—nondiscrimination (network neutrality) encourages retail competition over last-mile networks where facilities-based competition is unlikely.

Given the difference in Phoenix’s approach to interpreting last-mile markets in “Why ADCo?” and Policy Paper No. 24, it’s fair to consider whether Phoenix is addressing different underlying market structures. Phoenix’s position on the nature of last-mile telecommunications networks in Policy Paper No. 24 is described by Phoenix as follows:

We set out to analyze how Network Neutrality rules would affect industry structure in a market that is characterized by economies of scale, and fixed and sunk costs.¹⁹

Phoenix also indicates that it currently expects the fixed and sunk costs to be “large.”²⁰ How did Phoenix perceive the underlying market structure in “Why ADCo?” Was it different than the market structure that Phoenix addresses in Policy Paper No. 24? Clearly not, here is Phoenix’s take on market structure from “Why ADCo?”:

[T]his Policy Paper. . . explains that entry into the local exchange market requires large fixed and sunk costs, making entry risky and necessitating scale economies.²¹

Thus, in “Why ADCo?” the market structure they describe is the same as the last-mile world they model in Phoenix Policy Paper No. 24, i.e., fixed and sunk costs and scale economies prevail. However, the logical description of market conditions which Phoenix acknowledged in “Why ADCo?” is not reflected in Phoenix’s modeling approach in Policy Paper No. 24, where they do not employ a dominant firm approach.

¹⁹ Phoenix Reply to Dr. Roycroft, p. 3.

²⁰ *Id.*

²¹ Phoenix Center Policy Paper Number 12: “Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the “Last Mile” in Local Telecommunications Markets,” November 2001, p. 1.

Furthermore, it is clear from Phoenix's discussion in "Why ADCo?" that the economics of telecommunications market entry that they modeled with a dominant firm approach applied to broadband markets. In "Why ADCo?" Phoenix discussed the last-mile broadband provider RCN to make the point that the business case for last-mile entry was tenuous:

The inability of local telecoms markets to support large numbers competition can be illustrated by example. Telecommunications firm RCN targets residential customers in densely populated markets with its own network facilities over which it provides telephone, data and video services. According to its financial documents, RCN has \$2.75 billion in plant and passes about 1.5 million homes, or 1.1 million marketable homes. Network costs run about \$1,750 per home passed, \$2,500 per marketable home, or about \$6,500 per customer. A rough estimate of RCN's monthly plant costs (assuming a 15% hurdle rate and 15 year payoff) is about \$25 per home passed. Average revenue per subscriber per month is about \$130 and direct costs are about 46% of revenues, implying a gross monthly margin of about \$68 per subscriber. In order to cover plant costs with its net revenues, RCN needs a penetration rate of about 35%-40% (and that is in the more densely populated markets targeted by RCN over a network capable of generating services worth \$130 per subscriber). Notably, if a 35%-40% penetration is required for profitability, then only two firms can profitably service the same market, and RCN and the incumbent makes two. To construct an RCN-style network for every household in the U.S., the plant investment and total entry costs would be about \$300 billion and \$600 billion, respectively. Clearly, network-based entry is incredibly costly and not something that is replicable by numerous firms in the same market.²²

Phoenix's previous view of the difficulties facing a last-mile broadband provider, as illustrated by RCN's experience, was reasonable. In fact, RCN filed for Chapter 11 bankruptcy protection in 2004, and has yet to return to profitable operations.²³

Phoenix's Cournot approach to modeling entry in last-mile markets in Policy Paper No. 24 does not reflect the reality they previously recognized. Last-mile telecommunications competition faces an uphill battle, and incumbents hold a decided market advantage. It is entirely unreasonable to expect, as Phoenix does, that incumbents will not leverage their market

²² Phoenix Center Policy Paper Number 12: "Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets," November 2001, pp. 11-12.

²³ RCN Corporation, 10-K, December 31, 2005, p. 6.

advantages, including the advantages associated with scale economies, and fight entry.

When Dominant Firms are Present, a Neutral Last-Mile Network Serves the Public Interest

In “Why ADCo?” Phoenix’s policy vision called for the entry of a “wholesale-only carriers-carrier”²⁴ (the ADCo) which provides a neutral platform over which market entrants can sell retail services. Phoenix concluded that such an arrangement would serve the public interest.²⁵ Apparently, Phoenix does not see the parallel between a neutral wholesale network allowing retail service providers to reach their customers, and neutral last-mile broadband Internet access facilities which allow third-party providers of Internet content, applications, and services to reach their customers. Nor does Phoenix currently see the incentives which integrated incumbent last-mile providers have to disadvantage non-integrated rivals, even though it previously recognized these incentives. In “Why ADCo?” Phoenix was well aware of the power that a dominant firm has to disadvantage its rivals, and Phoenix indicated that “*to the extent that the incumbent dominant firm is able to impose costs on rivals, its incentives are to do so.*”²⁶ It is entirely reasonable to expect that a dominant last-mile broadband provider will disadvantage its rivals in a similar fashion, another lesson Phoenix has now forgotten. Dominant firms in last-mile markets make network neutrality the best policy.

In summary, Phoenix has now taken an economic position on the nature of entry in last-mile broadband networks that does not address the significant scale economies and sunk costs which hinder market entry. In “Why ADCo?” Phoenix noted:

²⁴ Phoenix Center Policy Paper Number 12: “Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the “Last Mile” in Local Telecommunications Markets,” November 2001, p. 2.

²⁵ *Id.*, p. 36.

²⁶ *Id.*, p. 29, emphasis in the original.

The economics of the telecommunications industry, particularly the supply-side economics, have not changed that much over time. Fewness in supply is the rule, not the exception. Instead, fiber optics, and other technological innovations, notwithstanding the inherent economies of scale and sunk costs of telecommunications networks, remain key drivers of industry structure. As Professors Carl Shapiro and Hal Varian succinctly state in their book *INFORMATION RULES: "Technology Changes. Economic laws do not."*²⁷

Phoenix can't have it both ways. Significant scale economies in last-mile markets result in a dominant incumbent that is willing to disadvantage its rivals and fight entry. We can't reasonably expect, as Phoenix does in Policy Paper No. 24, that an incumbent which commands the advantages of significant scale economies will accommodate entry and share the market.

Product Differentiation

Phoenix's basic premise in Policy Paper No. 24 with regard to product differentiation is that policymakers, by enforcing a policy of network neutrality, can eliminate all product differentiation between last-mile networks. Phoenix Center's Reply indicates that I have misunderstood their assumptions regarding product differentiation, and that their model "allows one to establish different degrees of permissible differentiation."²⁸ Phoenix's argument is not on point.

Within the context of their model, the parameter in question is represented by the Greek letter Theta (θ). In their Reply, Phoenix argues that θ can take on any value, "from identical goods ($\theta = 1$) to completely differentiated goods ($\theta = 0$), and everything in between."²⁹ Phoenix's Reply is a red herring. In Policy Paper No. 24, their conclusion regarding the undesirable nature of network neutrality is based on their analysis of the value which θ takes in

²⁷ *Id.*, p. 39, emphasis in the original.

²⁸ Phoenix Reply to Dr. Roycroft, p. 5.

²⁹ *Id.*

equilibrium. Specifically, they state: “*Without Network Neutrality requiring $\theta = 1$, a firm may enter with $\theta < 1$,*” as long as sunk costs “are not too large.”³⁰ Thus, it is not the case, as suggested by Phoenix’s Reply, that θ can “take on any value” for purposes of policy measures designed to enforce network neutrality, as defined in their model. Rather, the key assumption in Policy Paper No. 24, on which their conclusion fully rests, is that policymakers can force $\theta = 1$. If policymakers can’t force $\theta = 1$, then entry will occur (if sunk costs are not too high).

In my original response to Phoenix, I pointed out that policymakers would have a difficult time preventing all product differentiation, as network neutrality principles are consistent with both marketing differences (e.g., how much bandwidth is sold), and with inherent technological differences across broadband platforms (e.g., low-bandwidth mobility vs. high-bandwidth fixed). Phoenix, in its Reply, now suggests that these marketing and technology differences are not really differentiation.³¹ They accuse me of assuming “technological determinism.”³² Given Phoenix’s previous writings on product differentiation, this is a puzzling accusation. Phoenix Center has previously recognized that technological differences across platforms can introduce differentiation:

A recent study by the General Accounting Office (“GAO”) on competition between cable television and DBS firms illustrates the importance of product differentiation. While both terrestrial and satellite multichannel video providers offer similar products, there are some meaningful forms of differentiation between the two. The differences in the delivery technology itself (i.e., inter-modality) are not lost on consumers.³³

³⁰ Phoenix Center Policy Paper No. 24, p. 18, emphasis added.

³¹ Phoenix Reply to Dr. Roycroft, p. 6.

³² *Id.*

³³ George S. Ford, Thomas M. Koutsy and Lawrence J. Spiwak, “Competition After Unbundling: Entry, Industry Structure and Convergence,” Phoenix Center Policy Paper Number 21, July 2005, p. 24. Available at:

(continued...)

It's not clear why consumers of video services will be able to identify "meaningful forms of differentiation" resulting from "differences in delivery technology," while broadband customers will not. Thus, within the context of their model, differentiation sufficient to result in $\theta < 1$ is likely, regardless of policy decisions regarding network neutrality. Phoenix falsely concludes that network neutrality policy could eliminate all differentiation and prevent entry.

Finally, on the issue of product differentiation, Phoenix states that my analysis indicates that recent drafts of network neutrality legislation are "unenforceable."³⁴ Phoenix's illogic on this point is based on the premise that prohibitions on discrimination, such as those which have been included in draft legislation, would somehow trump technology differences which create the differentiation which Phoenix's model predicts will encourage entry. Network neutrality principles do not rule out technical or marketing differentiation, they simply rule out discrimination. In "Why ADCo?" Phoenix recognized the major problems that discrimination creates, and the overwhelming incentives that incumbents have to discriminate:

[T]he ADCo provides a viable economic solution for new entrants to the problems raised by the inherent incentive of an incumbent to unduly discriminate to protect its profits. This issue of incentives is key to understanding the current ills of the market, as it is now clear that policymakers significantly under-estimated the significant incentives of the incumbents to unduly discriminate against their rivals (not to mention . . . underestimating the entry costs of the local market).³⁵

Network neutrality principles are a much more modest solution to the discriminatory incentives faced by incumbents than structural separation, which was previously identified by Phoenix as

³³(...continued)

<http://www.phoenix-center.org/ppapers.html>

³⁴ Phoenix Reply to Dr. Roycroft, p. 6.

³⁵ Phoenix Policy Paper No. 12, "Why ADCo?", pp. 7-8.

the best way to address the incumbent's incentives to discriminate.³⁶

Upstream Competition

Abandonment of Network Neutrality principles will have definite consequences on the delivery of content, services, and applications over last-mile broadband facilities. Competition and innovation at the network edge could be damaged by gatekeepers in the last mile. In my original paper, I was critical of Phoenix's analysis as its model did not address the loss of social welfare that is likely to arise if competition and innovation at the network edge are harmed.

Phoenix states in its Reply that it was concerned about these issues, and points to two passages from Policy Paper No. 24 as proof.³⁷ While it is appreciated that these passages do pay lip service to the proposition that abandonment of network neutrality could lead to some other harms, Phoenix did not include these negative consequences in its modeling exercise, and otherwise ignores the larger issue of the harm to upstream competition. Most important, their social welfare analysis, as well as the mathematical proof which provides the entire economic basis for their conclusions, fails to incorporate the potential harm to upstream competition. This results in an incomplete analysis of the proposed policy change. When Phoenix states in its mathematical proof that if sunk costs of entry are "not too large, then Network Neutrality is socially inefficient,"³⁸ the "social inefficiency" is completely devoid of any consideration of the impact on upstream markets. This oversight makes Phoenix's analysis incomplete and incapable of lending any guidance to policymakers on the issue of network neutrality.

³⁶ *Id.* p. 8.

³⁷ Phoenix Reply to Dr. Roycroft, pp. 6-7.

³⁸ Phoenix Policy Paper No. 24, p. 18.

The Level of Sunk Costs

In my response to Phoenix Policy Paper No. 24, I pointed out that their analysis hinged on a low level of sunk costs. Phoenix says that their analysis depends on sunk costs which are “not too large.” In its reply, Phoenix provides a rather entertaining exercise in illogic to support the proposition that “low level” and “not too large” are entirely different concepts.³⁹

Of course, sunk costs of entry in the telecommunications industry in general, and the last-mile broadband market in particular, are very large. This fact has been previously acknowledged by the Phoenix Center:

As consistently demonstrated by academic and Phoenix Center research, and again in this POLICY PAPER, given the *huge fixed and sunk costs* inherent to the construction and commercial operation of communications networks, the equilibrium level of concentration of terrestrial firms in local communications markets (voice, video, and data) will be relatively high. . . . *fewness arises because scale economies and sunk costs limit the number of firms that can profitably serve a market – and local communications networks are notoriously riddled with scale economies and sunk costs.* Any policymaker interested in local communications markets should, therefore, start from the assumption that there will, at best be only a “few” facilities-based firms.⁴⁰

Furthermore, sunk costs of market entry are not just limited to the tremendous up-front costs of building a network. As Phoenix has previously observed:

On average, however, net plant amounts to about 37% (approximately two-thirds) of total entry costs. . . . In other words, for every dollar of investment in plant and equipment, an additional \$2 of entry costs are incurred on average. There is no reason to suspect that these additional entry costs are less sunk than plant and equipment, but good reason to believe such costs are more sunk.⁴¹

³⁹ Phoenix Reply to Dr. Roycroft, pp. 7-8.

⁴⁰ George S. Ford, Thomas M. Koutsky and Lawrence J. Spiwak, “Competition After Unbundling: Entry, Industry Structure and Convergence,” Phoenix Center Policy Paper Number 21, July 2005, emphasis added. Available at: <http://www.phoenix-center.org/ppapers.html>

⁴¹ Phoenix Center Policy Paper Number 12: “Why ADCo? Why Now? An
(continued...)

Given these facts, it is clear that Phoenix's attempt to paint "low" and "not too large" as diametrically opposites is another red herring.

As is noted by Phoenix, their mathematical proof associated with the level of sunk entry costs which will deter entry "provides a method to determine how small or large entry costs need to be for Network Neutrality rules to be inefficient."⁴² However, now with two opportunities, Phoenix has not utilized this "method to determine how small or large entry costs need to be" to provide any absolute numerical value, or relative evaluation, of what level of sunk costs deter entry within the context of their model. They say they can do it, but they don't. Let's consider why that might be.

Phoenix's modeling approach is a one-shot game. Interpreting the impact of sunk costs within the context of a one shot game is likely to drive the entry-detering threshold level of sunk costs to an extremely low level, as the entrant has only one period of play to earn profits sufficient to justify the sunk investments. In other words, within the context of Phoenix's model, the entrant must be able to justify the recovery of all sunk costs in a short period of time, thus making it imperative that the sunk costs are negligible for entry to be feasible. So, within the context of their modeling exercise, Phoenix's one-shot game makes it likely that a very low level of sunk costs will be sufficient to deter entry.

Phoenix might argue that the period of game play could be long enough to allow for the recovery of sunk costs, but such an assumption would create further inconsistencies. Sunk assets may be long-lived and interpreting a "one-shot" interaction which lasts over a period long

⁴¹(...continued)

Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets," November 2001, p. 14.

⁴² Phoenix Reply to Dr. Roycroft, p. 8.

enough to allow for the recovery of long-lived sunk costs is necessarily contradictory. Recall that an assumption of the Cournot model is that players of the game do not expect that other players will change their output during the play of the game. Holding this expectation over a long period of time is entirely unreasonable. Of course, to give the game a longer period of play, Phoenix could have selected a modeling approach which assumed that the Cournot game was repeated. However, when Cournot games are repeated, it is easy to show that incumbents are very likely to fight entry and attempt to drive rivals out.⁴³ This reality is one that Phoenix now prefers to ignore.

Conclusion

Policymakers need sound economic advice when considering issues associated with network neutrality. Economic analysis may be able to assist with this process. However, theoretical economic analysis must be reasonably consistent with empirical evidence regarding the nature of the market and the behavior of incumbent firms. The economic analysis contained in Phoenix Policy Paper No. 24 is entirely unsatisfactory as a result. Phoenix does not provide any economic evidence that network neutrality might be economically inefficient or harmful to consumers or society. Nor does their Reply to my critique undermine my conclusion that their approach is fatally flawed.

While Phoenix indicates in Policy Paper No. 24 that they do not take any position on the need for network neutrality rules, they have made their position more clear in their new paper on this matter. In this new research, Phoenix alleges that it has identified “efficiency risks”

⁴³ See, for example, Friedman, J. *Game Theory with Applications to Economics*, Oxford University Press, New York, 1986, pp. 136-139.

associated with network neutrality policy, based on a benefit/cost analysis.⁴⁴ To support their claims, they point to analyses produced by AT&T and BellSouth regarding alleged costs of building network capacity. They also attack views that dissent from the RBOC conclusions. As time permits, I will provide a detailed critique of the numerous problems associated with Phoenix's new research. However, first and foremost among these problems is the fact that Phoenix's new research points repeatedly to Phoenix Policy Paper No. 24 to support Phoenix's new conclusions.⁴⁵ Given this indefensible foundation, Phoenix's new claims regarding efficiency risks and network neutrality are dubious.

⁴⁴ "The Efficiency Risks of Network Neutrality Rules," Phoenix Policy Bulletin No. 16, May, 2006.

⁴⁵ *Id.*, pp. 2, 5, 6, & 7.