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26.6 percent),¹²⁹ while the fraction of households purchasing only a landline fell steeply (from 23.8 percent to 12.9 percent).¹³⁰

69. It should be clear that what matters from the point of view of ILEC profitability (or lack thereof) is not the “proportion of households subscribing to both services,”¹³¹ but rather the fact that the demand for landlines has declined. Indeed, the Commission’s observation—that a substantial fraction of the ILEC’s dwindling customer base also chose to purchase wireless service—appears to be an indication that these customers are *more likely* to engage in cord-cutting, given that they can do so without purchasing new wireless service. This is consistent with the fact that the wireless-only share has increased steadily in the years since the *Phoenix Order*, while the proportion of households purchasing both wireless and wireline has simultaneously declined (as noted above).

2. The *Phoenix Order* Gives Undue Weight To An Inapplicable and Non-Standard Theory That Pricing Power Would Be Enhanced by the Presence of Competitive Alternatives

70. Elementary economic theory shows how the existence of competitive alternatives for a given product tends to make demand for that product more elastic.¹³² This is true both of homogenous products and of the more general case of differentiated product markets.¹³³ All else equal, a dealership can charge more for a Honda sedan when there are no competing Toyota dealerships in the vicinity. In contrast, the *Phoenix Order* gives undue weight to the non-standard theory that “the demand for wireline services may have become less elastic

129. *Id.*

130. *Id.*

131. *Phoenix Order*, ¶55.

132. *Katz & Rosen* at 79.

133. *Id.* at 463-64. *See also Merger Guidelines*, §6.1 (“In differentiated product industries, some products can be very close substitutes and compete strongly with each other, while other products are more distant substitutes and compete less strongly. For example, one high-end product may compete much more directly with another high-end product than with any low-end product.”)

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over time if the remaining wireline customers view the actual or perceived benefits of retaining the wireline service to have increased over time.”¹³⁴ According to this theory, ILECs would have *less* pricing power if they did not face *any* competition from intermodal alternatives such as wireless voice service. This non-standard theory is based on special circumstances observed in pharmaceutical markets, and has been invoked to explain why the price of branded pharmaceuticals may increase after generic entry occurs, despite the fact that average prices for the drug tend to fall as a large fraction of customers switch to cheaper generics when they become available. The existence of a sub-group of price-insensitive customers that remain disproportionately loyal to the branded product, even when a generic equivalent is available at a significantly reduced price, causes demand for the branded drug to become less elastic even as it contracts.¹³⁵

71. It bears emphasis that, even under this non-standard theory, generics place significant downward pricing pressure on the average price of pharmaceuticals.¹³⁶ Thus, even if this theory were applicable here, it would still predict (1) that wireless competes with wireline; and (2) that cord-cutting places substantial downward pressure on average prices in the voice services market.

72. In any case, the presumption that the market for wireline voice services should somehow deviate from the standard antitrust framework, and instead resemble the decidedly non-standard case of branded pharmaceuticals, is not justified. In the first place, it is obvious that wireless voice service is not the generic equivalent of wireline voice. If it were, then

134. *Phoenix Order*, ¶58, n. 174.

135. Richard Frank & David Salkever, *Generic Entry and the Pricing of Pharmaceuticals* 6(1) *Journal of Economics & Management Strategy*, 75-90 (1997), at 76-77.

136. *Id.* at 76, 89.

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wireless service would perform precisely the same function as wireline service, only at a substantially reduced price. Cord-cutting could then, in theory, leave the ILEC with only a subgroup of customers with disproportionately inelastic demand for “branded” wireline service, as opposed to the “generic” version. Of course, this is not an accurate description of the market for voice services. Far from being a generic equivalent, wireless service is a differentiated product with a qualitatively distinct set of product attributes.

73. More generally, the presumption that the market for voice services somehow differs fundamentally from standard differentiated product markets is unfounded. The *Phoenix Order* refers to a declaration submitted in a prior proceeding suggesting that “certain customers have a powerful demand for wireline service, either because of habit, higher-quality, ease-of-use in a large household, dependability to reach first-responders, or other reasons.”¹³⁷ But this is simply a restatement of standard conditions that would be expected to apply in any differentiated products market: Customers tend to be heterogeneous in their tastes for product attributes, and therefore tend to cluster around the products offering the bundle of characteristics they find most appealing.¹³⁸ This clustering does not upset the standard assumption in antitrust analysis that pricing power in differentiated product markets is diminished, rather than enhanced, by the presence of competitive alternatives: While there may be “Honda loyalists” and “Toyota loyalists,” this does not prevent Honda from exerting downward pricing pressure on Toyota (and vice-versa), because prices are constrained by the behavior of marginal customers willing to choose Honda over Toyota (or vice-versa) when relative prices are altered.

137. *Phoenix Order*, ¶58, n. 174.

138. *Katz & Rosen* at 463-464; see also *Merger Guidelines* §6.1.

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74. Finally, the non-standard theory offers a clear prediction about consumer behavior that has been contradicted by recent events. According to the non-standard theory, because the ILEC's residual customer base has a "powerful demand"¹³⁹ for wireline service, these remaining customers should have been unwilling to engage in cord-cutting. Indeed, proponents of the non-standard theory predicted in 2009 that it was "very likely that the households that remain attached to the cord are less likely in the future to cut the cord..."¹⁴⁰ If this were true, then cord-cutting should have tapered off in subsequent years. Instead, the proportion of households engaging in cord-cutting has nearly doubled (from approximately 23 percent in 2009 to approximately 41 percent in late 2013).¹⁴¹ Similarly, as noted above, Professor Mayo and his co-authors found that the marginal propensity to cut the cord increased substantially over their sample period; yet the non-standard theory would have predicted precisely the opposite.¹⁴²

B. The *Phoenix Order* Assumes Without Justification That Current, Regulated Wireline Prices Are At Or Above Competitive Levels

75. In applying the SSNIP test, the *Phoenix Order* asks "whether a hypothetical profit-maximizing firm that was the only present and future seller of wireline local access services could profitably impose a small but significant and nontransitory increase in price."¹⁴³ In finding that mobile wireless offerings do not constrain the price of wireline service, the *Phoenix Order* points to evidence that "stand-alone landline access prices have remained

139. *In the Matter of Petition of Qwest Corporation for Forbearance Pursuant to 47 U.S.C. § 160(c) in the Phoenix, Arizona Metropolitan Statistical Area*, Cavalier Telephone LLC Opposition to Qwest Petition for Forbearance, WC Docket No. 09-135 (September 21, 2009) Declaration of Michael D. Pelcovits [hereafter *Pelcovits Declaration*] at 15.

140. *Id.* at 14

141. See Figure III, *supra*.

142. Mayo *et. al.* (2014) at 22.

143. *Phoenix Order* ¶56.

relatively stable and do not appear to have declined substantially below the levels at which they are capped by regulation.”¹⁴⁴

1. Economists Recognize That Regulation Cannot Be Expected To Replicate Competitive Pricing Outcomes

76. The *Phoenix Order* therefore presumes that regulators have accurately calibrated wireline prices at or above competitive levels, such that even a small increase above current, regulated price levels would be anticompetitive. However, economists have long recognized that it, as a practical matter, it is difficult for the regulatory process to duplicate the type of outcomes that market forces would produce under competitive conditions.¹⁴⁵ Accordingly, the assumption underlying the *Phoenix Order*'s implementation of the SSNIP test is not justified.

2. Failure To Distinguish Regulated Prices From Competitive Prices Can Lead To Improperly Narrow Market Definitions And Erroneous Inferences Of Market Power

77. Because regulated prices do not generally mimic their competitive counterparts, the *Phoenix Order*'s approach to the SSNIP test can be misled by a “reverse cellophane fallacy,”¹⁴⁶ resulting in “improperly narrow market definitions and erroneous inferences of market power.”¹⁴⁷ According to the standard cellophane fallacy, applying the SSNIP test to an unconstrained monopolist would lead one to infer incorrectly that the monopolist lacks market

144. *Id.* ¶58, n. 175 (citing *Competitive Landscape Report* at 66).

145. *See, e.g., Carlton & Perloff* at 682 (“Government regulation of firms may increase welfare in markets that are not perfectly competitive. Unfortunately, actual regulation often deviates considerably from optimal regulation and exacerbates market inefficiencies.”)

146. *See* Debra Aron & David Burnstein, *Regulatory Policy and the Reverse Cellophane Fallacy*, 6(4) *JOURNAL OF COMPETITION LAW & ECONOMICS* 973-994 (2010) [hereafter *Aron & Burnstein (2010)*]; *see also* Luke Froeb & Gregory Werden, *The Reverse Cellophane Fallacy In Market Delineation*, 7 *REVIEW OF INDUSTRIAL ORGANIZATION* 241-247 (1992).

147. *Aron & Burnstein (2010)* at 973; *see also* Gregory Werden, *Demand Elasticities In Antitrust Analysis*, 66 *ANTITRUST LAW JOURNAL* 363-414 (1998) [hereafter *Werden (1998)*], at 388 (“The common critique of the Supreme Court's analysis in *Cellophane* is that the Court delineated an overly broad market because it measured the elasticity of demand when market power was already being exercised. While there is merit to this critique, the delineation of overly narrow markets also can result from measuring the elasticity of demand when market power is not already fully exercised.”)

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power, because an the monopolist will already have increased its price to the point where consumers begin to perceive goods as competitive alternatives, even though they do not belong in the relevant product market.¹⁴⁸

78. Conversely, by artificially restricting prices below competitive levels, regulation can make competing services appear to be less attractive alternatives, creating the illusion that the regulated firm possesses market power.¹⁴⁹ To illustrate, suppose hypothetically that price of wireline voice service were subject to an unrealistically low price cap of \$0.25 per month. Removal of the price cap through deregulation would almost certainly result in a substantial and non-transitory increase in price, the magnitude of which would be well in excess of the standard five percent threshold typically used to delineate relevant antitrust markets in merger reviews by the DOJ and FTC.¹⁵⁰ If the tendency for market forces to push prices above sub-competitive levels is erroneously taken as evidence of ILEC market power, then price regulation can become self-perpetuating.¹⁵¹

79. There is empirical evidence that regulation has generated just such an outcome in the telecommunications industry. In an article published in the *Journal of Competition Law & Economics*, the economists Debra Aron and David Burnstein observe that, in competitive markets with economically efficient pricing structures, prices and costs tend to be positively correlated: Competition should push prices higher in areas where costs are higher, and lower where costs are lower. Using a probit regression analysis of telecommunications pricing the

148. See, e.g., *Werden (1998)* at 377 (“The Court’s error, commonly termed the “Cellophane fallacy,” was mistaking competition created by the exercise of market power for competition that can prevent the exercise of market power. As a firm with market power raises price above competitive levels, there is a strong tendency for demand to become more elastic as other products become better substitutes at the margin. A firm fully exercising its substantial market power is necessarily constrained by competition from further raising price.”)

149. *Aron & Burnstein (2010)* at 973.

150. *Merger Guidelines*, §4.1.2.

151. *Aron & Burnstein (2010)* at 973.

authors found the opposite: After controlling for other factors, regulated ILEC retail prices were found to be higher in the lower-cost areas, and lower in the higher-cost areas. The authors also found that retail price regulation had discouraged entry by CLEC competitors in the high-cost areas (where the available price-cost margins were least attractive). They concluded that regulation had produced artificially low prices, which had prevented competition from materializing.¹⁵²

C. The *Phoenix Order* Ignores the Fact That the Price of Wireline Service Is Constrained by All Competitive Alternatives Simultaneously

80. In analyzing the relevant product market, the *Phoenix Order* examines the extent to which competition from wireless services constrain the pricing of wireline service by asking “whether there are a sufficient number of wireline service customers who, in response to a price increase in wireline local access service, would stop subscribing to their wireline service and instead rely exclusively on mobile wireless service, so as to render the price increase unprofitable.”¹⁵³ As explained below, this approach to product market definition is flawed, and contradicts elementary economic principles.

1. Antitrust Product Markets Are Delineated Based On The Extent Of Aggregate Customer Switching to All Products Outside of the Candidate Market

81. As the *Merger Guidelines* make clear, a relevant product market consists of a *group* of competing products; the hypothetical monopolist test involves identifying a set of products that, from customers’ point of view, are reasonably interchangeable with the product in question (in this case, wireline voice service). In order to constitute a relevant product, the candidate market must “contain enough substitute products so that it could be subject to post-

152. *Id.* at 992.

153. *Phoenix Order*, ¶56.

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merger exercise of market power significantly exceeding that existing absent the merger.”¹⁵⁴ Stated differently, a candidate market must include enough competitive alternatives to allow the hypothetical monopolist to engage in a post-merger exercise of market power. Otherwise, the product market will be defined too narrowly.

82. Thus, what matters is not whether some individual competitive alternative (such as wireless voice service) is capable of single-handedly defeating a hypothetical price increase; what matters is whether *aggregate* switching towards *all* competitive alternatives would be sufficient to defeat such a price increase. As I have noted in prior work, ILEC pricing power is determined not by switching towards wireless alone, but by switching between wireline service and all intermodal alternatives simultaneously:

Regulators attempting to determine whether price caps for Incumbent Local Exchange Carriers (ILECs) should be relaxed must assess the degree of market power that a deregulated local service provider would be able to exercise. This depends on the extent to which consumers view intermodal alternatives—such cable voice, voice over internet protocol (VoIP), and wireless telephony—as economic substitutes for traditional landline service. The greater the degree of substitutability that exists between landline service and the *aggregate suite of intermodal alternatives*, the less likely it is that a price increase above competitive levels would be profitable for the incumbent landline carrier.¹⁵⁵

2. The Own-Price Elasticity Is a Weighted Average of The Cross-Price Elasticities for All Competitive Alternatives

83. The same point can be illustrated with elementary economics, which shows formally how the own-price elasticity of a given product depends on the cross-price elasticities

154. *Merger Guidelines*, §4.1.1.

155. *Caves (2011)*, at 985 (emphasis added).

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between that product and all competitive alternatives. The relationship can be expressed mathematically as follows:¹⁵⁶

$$\varepsilon_{11} = 1 + \sum_j \left[\frac{\varepsilon_{j1} s_j}{s_1} \right] \quad (0.5)$$

84. Above, ε_{11} is the own-price elasticity for product 1, and ε_{j1} is the cross-elasticity of demand for product j in response to a one percent increase in the price of product 1. Finally, s_1 and s_j represent the customer's expenditure shares on products 1 and j , respectively. Thus, the own-price elasticity of demand for a product is, in essence, a weighted sum of the cross elasticities of demand for other products with respect to the first product's price. When cross-price effects of competitive alternatives are greater—that is, when the ε_{j1} are larger—the own-price elasticity ε_{11} increase in absolute value, because a greater mass of consumers will tend to switch to competitive alternatives in the face of a price increase.

85. For this reason, the strong cross-price effects observed between wireless and wireline cannot be considered in isolation, as in the *Phoenix Order*. Instead, the price-disciplining effect of wireless offerings should be considered in addition to those of intermodal alternatives (such as cable voice and over-the-top VoIP), as well as competitive offerings from CLECs.

156. See, e.g., *Werden 1998* at 413-414. The formula in (0.5) holds real income constant. If nominal income is held constant instead, the formula is modified to $\varepsilon_{11} = 1 + \sum_j \left[\frac{\varepsilon_{j1} s_j}{s_1} \right]$.

V. OUTDATED REGULATIONS ARE EXPECTED TO HARM COMPETITION, CONSUMERS, AND ECONOMIC EFFICIENCY IN COMPETITIVE TELECOMMUNICATIONS MARKETS

86. Economists recognize that outdated regulations in competitive industries are not just unnecessary, but also harmful to consumers, competition, and economic efficiency.¹⁵⁷ In this Section, I provide specific examples of regulations whose justification has been undermined by competitive forces in the industry.

A. The Commission's 64 kbps Unbundling Requirement

87. The Commission's 64 kbps requirement requires that ILECs offer unbundled narrowband service, either by maintaining an existing copper loop connected after deploying fiber to the home, or by "provid[ing] unbundled access to a 64 kbps transmission path over its FTTH loop."¹⁵⁸ Economists have recognized for some time that unbundling regulations such as these can harm both consumer welfare and economic efficiency. For example, both economic theory and empirical evidence indicate that unbundling regulations can lead to diminished investment incentives, lower broadband penetration, and slower deployment of fiber-to-the-premises (FTTP) networks.¹⁵⁹

88. The Commission itself has correctly recognized the principle that increased competition should eliminate any remaining justification for such regulation, noting more than a decade ago that it "expect[ed] intermodal platforms to become increasingly a substitute for

157. *Carlton & Perloff* at 682, 734.

158. *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, 18 FCC Rcd 16978, ¶ 277 (2003) (hereafter *Triennial Review Order*).

159. See, e.g., Robert Crandall, Jeffrey Eisenach, and Allan Ingraham, "The Long-Run Effects of Copper Unbundling and the Implications for Fiber," 37 *Telecommunications Policy*, 262-281 (2013); see also Robert Crandall, Allan Ingraham, and Hal Singer, "Do Unbundling Policies Discourage CLEC Facilities-Based Investment?" *The B.E. Journals in Economic Analysis & Policy* (April 2004).

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wireline voice telephony services,”¹⁶⁰ and that the emergence competitive alternatives for traditional wireline telephony “may enable us to find that requesting carriers are no longer impaired in their ability to compete without access to incumbent LEC loops.”¹⁶¹ The evidence reviewed above provides ample justification for such a finding.

89. There is also evidence that technological progress in the industry has substantially diminished the competitive significance of the 64 kbps requirement. For example, among the RBOCs, the number of consumers receiving narrowband voice services from CLECs using analog UNE loops, which are typically used for narrowband voice service, represented only about [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]] of the 135 million access lines in service¹⁶² as of 2013. From 2009-2013, the number of RBOC analog UNE loops declined by approximately [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]]. Over this four-year interval, the number of access lines in service declined by about 14 percent (from 157 million 135 million).¹⁶³ Thus, the erosion in analog UNE loops [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]] the overall decline in the landline business. Further, among the RBOCs for which data are available, the number of analog UNE loops in service declined by approximately [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]] from 2003 – 2013, while the number of *new* analog UNE loops brought into service annually (i.e., gross additions) declined by approximately [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]].

160. *Triennial Review Order* ¶¶245-46.

161. *Id.*

162. *2013 Local Competition Report*, Table 1.

163. *Id.*

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90. Given the diminishing significance of narrowband voice service, it is unsurprising that one CLEC has stated in the record that a 64 kbps voice-grade channel “is inadequate to meet the bandwidth demanded by both business and residential customers,”¹⁶⁴ and that “[f]ew business customers today want only simple, single-line, voice service, which is all a CLEC can offer using a 64 kbps channel.”¹⁶⁵ These trends in the data provide further evidence that eliminating the unbundling requirement would promote competition and economic efficiency, by encouraging investments in and deployments of the network technologies that consumers and businesses actually demand.

B. Regulation of Stand-Alone Long Distance Services

91. Competition from wireless carriers, VoIP operators, and other sources have rendered the distinction between local and long distance calling increasingly obsolete, and long distance rates have fallen precipitously over time.¹⁶⁶ As the Commission itself observed in 2008,

The increased availability and marketing of discount and promotional long distance plans, as well as the popularity of wireless “bucket-of-minutes” plans, has made basic schedule rates obsolete for many long distance customers, particularly business customers and high volume residential consumers. Today wireline, wireless, and cable companies are offering consumers bundled packages of local and long distance service, and buckets of minutes that can be used to call anyone, anywhere, and anytime.¹⁶⁷

92. Given the trends noted several years ago by the Commission, it is unsurprising that data from more recent time periods confirm that the vast majority of voice customers do not presubscribe to any stand-alone long distance carrier. Among the RBOCs, approximately

164. Comments of TelePacific Communications, *In re AT&T Petition to Launch a Proceeding Concerning the TDM-to-IP Transition*, GN Docket No. 12-353 (January 28, 2013), at 12.

165. *Id.*

166. *Caves (2011)*, at 989; see also Kevin Caves & Jeffrey Eisenach, “What Happens When Local Phone Service Is Deregulated?,” *Regulation* (Fall 2012).

167. Federal Communications Commission, *Reference Book of Rates, Price Indices, and Household Expenditures for Telephone Service* (2008), at iv (emphasis added).

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[[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]] of customers had a presubscribed long distance carrier as of 2013. Yet among those that did presubscribe, only about [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]] opted for a stand-alone long-distance carrier. Given that ILEC lines accounted for only about 18 percent of voice connections in 2013,¹⁶⁸ the overall share of voice connections that were ILEC lines presubscribed to stand-alone long distance carriers can be estimated at approximately [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]].¹⁶⁹

93. These developments are unsurprising in light of the fact that the range of competitive alternatives for long-distance communication has expanded still further in the years since the Commission first observed the increasing obsolescence of traditional long distance markets. Long-distance alternatives currently available to consumers include VoIP offerings such as Vonage, which offers unlimited, flat-rate domestic and international calling,¹⁷⁰ wireless voice offerings, which include (sometimes unlimited) flat-rate calling plans with no distinction between local and long distance,¹⁷¹ and an array of services that transmit various combinations of text, voice, pictures, and video across the globe (often at little to no incremental cost), including e-mail, text messaging, social networks, Skype, FaceTime, Hangouts, iMessage, Snapchat, Viber, WhatsApp, and others.¹⁷²

168. See Part I, *supra*.

169. The corresponding figures for 2012 are [[BEGIN CONFIDENTIAL]] ██████████ [[END CONFIDENTIAL]]. Note that the estimates for both 2012 and 2013 are conservative because, due to data limitations, some RBOC affiliate VoIP lines had to be excluded when calculating the proportion of lines presubscribed to RBOCs. Because RBOC VoIP lines are, by definition, presubscribed to RBOCs, the exclusion of such data will increase the estimated share of RBOC lines presubscribed to stand-alone long-distance providers.

170. See <http://www.vonage.com/>.

171. See, e.g. <http://www.t-mobile.com/simple-choice-international-plans.html>.

172. See, e.g., *Digital Trends, supra*.

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CONCLUSIONS

94. As economists have recognized for some time, traditional ILEC voice offerings face widespread competition from a range of competitive alternatives. In the years since the *Phoenix Order* was issued, evidence of robust and intensifying intermodal competition has continued to accumulate. Thanks to ongoing competition from both wireless and wireline rivals, traditional ILEC services are now selected by only about one in three households, and account for fewer than one in five voice connections. Even these statistics understate the relevant competitive pressures, because ILECs must also contend with an expanding set of communications technologies that transmit voice, text, pictures, and video over vast distances, often at little to no incremental cost. By any reasonable economic standard, traditional ILEC services are now just one of many communications offerings in a competitive industry with many players.

95. In competitive communications markets, the risk that outmoded regulations will result in harm to consumers, competition, and economic efficiency is particularly acute. Unfortunately, the *Phoenix Order* magnifies this risk by adopting an analytical framework inconsistent with fundamental principles of economics and antitrust. By ignoring the principle that prices are set at the margin, the *Phoenix Order* erroneously infers economic complementarity between wireless and wireline service, and compounds the error by relying on outdated econometric studies from now-irrelevant time periods. By improperly conflating current, regulated prices with their competitive counterparts, the *Phoenix Order* increases the likelihood that product markets will be defined too narrowly, and that market power will be inferred erroneously. Finally, the *Phoenix Order* fails to recognize the basic principle that ILEC pricing power is constrained not by one alternative in isolation, but by aggregate switching to all competitive alternatives in response to a hypothetical price increase.

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96. The Commission should therefore adopt a framework for assessing competition more consistent with standard principles of economics and antitrust, allowing it to properly incorporate the price-disciplining effects of wireless and other competitive alternatives. This would help to ensure that the Commission reaches conclusions and adopts policies consistent with the competitive realities of the industry, to the benefit of consumers, competition, and economic efficiency.

♦ ♦ ♦

A handwritten signature in black ink, appearing to be 'K. L.', written in a cursive style.

October 6, 2014

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EXHIBIT A: CURRICULUM VITAE

Kevin W. Caves

Office Address

Economists Incorporated
2121 K Street, NW
Suite 1100
Washington, DC 20037
Phone: (202) 833-5222
caves.k@ei.com

Education

Ph.D. Economics, University of California at Los Angeles, December 2005
Fields of Study: Industrial Organization, Applied Econometrics

M.A. Economics, University of California at Los Angeles, May 2002

B.A. *Magna cum laude*, Departmental Honors in Economics, Haverford College, May 1998

Current Position

Senior Economist, Economists Incorporated, January 2014 - Present

Employment History

Director, Navigant Economics, March 2011 to December 2013

Associate Director, Navigant Economics, February 2010 to March 2011

Vice President, Empiris LLC, September 2008 to February 2010

Senior Economist, Criterion Economics LLC, October 2006 to September 2008

Senior Consultant, Deloitte & Touche LLP, September 2005 to October 2006

Teaching Fellow, Department of Economics, UCLA, January 2002 to June 2004

Assistant Economist, Federal Reserve Bank of New York, August 1998 to June 2000

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Publications and Research Papers

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Speaking Engagements

Competition and Monopsony In Labor Markets: Theory, Evidence, and Antitrust Implications, New York State Bar Association, Antitrust Law Section, New York, NY (April 23, 2014).

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Econometric Tests of Common Impact, Covington & Burling LLP, Washington, DC., (May 23, 2013).

Regression Methods: Theory and Applications of Fixed-Effects Models, O'Melveny & Myers LLP, Washington, DC., (July 16, 2012).

Regression Methods: Theory and Applications, Antitrust Practice Group, Cohen Milstein Sellers & Toll PLLC, Washington, DC., (June 4, 2012).

Using Regression in Antitrust Cases, University of Pennsylvania Law School, Philadelphia, PA., (April 12, 2012).

Interview with *IT Business Edge* on Rural Utilities Service Broadband Subsidies (May 17, 2011).

Reviewer

Review of Network Economics

International Journal of the Economics of Business

Honors and Awards

Howard Fellowship for Excellence in Teaching, University of California at Los Angeles, Spring 2005.

Graduate Fellowship, University of California at Los Angeles, 2000 – 2004.

Departmental Honors in Economics, Haverford College, May 1998.

Phi Beta Kappa Society, elected May 1998

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Quantifying price-driven wireless substitution in telephony

Kevin W. Caves*

Director, Navigant Economics, LLC, 1801K Street, NW, Suite 500, Washington, D.C. 20006, United States

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ABSTRACT

For the better part of a decade, a non-trivial and steadily increasing share of households in the United States has come to rely exclusively on wireless technology for their voice communications needs. Aggregate data show clearly (1) that the share of wireless-only households has risen steadily in recent years; while (2) the price of wireless service has fallen substantially relative to traditional landline service. The aggregate data are therefore consistent with the hypothesis that wireless/wireline cross-price elasticities are positive and economically significant. However, econometric corroboration of this conjecture has proven elusive in the existing empirical literature, which has relied on datasets compiled at the turn of the millennium, when wireless substitution was very limited. Partly in response to this dearth of econometric evidence, regulators and competition authorities in the US have generally been reluctant to conclude that wireless voice service represents a meaningful economic substitute for traditional wireline telephony. In the absence of reliable econometric estimates, even the sign of the relevant cross-price elasticities is an open question: The majority of US households maintain both a landline and at least one wireless connection, so it is unclear, *ex ante*, whether the two services are substitutes or complements. Thus, it is critical to identify consumer behavior at the margin. Using state-level panel data from a relatively recent time period (2001–2007), this study develops and estimates a demand system that permits evaluation of the own-price, cross-price, and income elasticities of demand for wireless and wireline telephony in the United States. A one percent decrease in the price of wireless service is estimated to decrease the demand for fixed-line service by approximately 1.2–1.3%, and the parameter estimates imply that the Slutsky symmetry holds for the demand system. These results substantially exceed prior econometric estimates from the existing empirical literature, and provide evidence that wireless voice service has evolved into a strong economic substitute for traditional landline service. The parameter estimates from the demand system suggest that roughly two thirds of observed landline attrition in the United States over the sample period is attributable to the observed decline in the relative price of wireless service.

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1. Introduction

For the better part of a decade, a non-trivial and steadily increasing share of consumers in the United States has eschewed wireline telephony in the home, relying instead on wireless voice communications technology. The most recently available estimates indicate that approximately one in four US households was wireless-only as of early 2010.¹ Nevertheless, regulators and competition authorities in the United States have generally been reluctant to conclude that

* Tel.: +1 301 787 6781.

E-mail address: kevin.caves@naviganteconomics.com

¹ Blumberg and Luke (2010) identify a household as wireless-only if (1) there is no functioning landline inside the household; and (2) at least one family member living in the household possesses a functioning wireless telephone.

wireless voice service represents a meaningful economic substitute for traditional telephony. Instead, regulators have generally focused on facilities-based providers of cable voice services as the only demonstrably viable competitors faced by incumbent wireline voice carriers.

When performing competition analysis in telecommunications, key empirical issues include the sign and magnitude of cross-price elasticities between intermodal alternatives. Regulators attempting to determine whether price caps for Incumbent Local Exchange Carriers (ILECs) should be relaxed must assess the degree of market power that a deregulated local service provider would be able to exercise. This depends on the extent to which consumers view intermodal alternatives – such as cable voice, voice over internet protocol (VoIP), and wireless telephony – as economic substitutes for traditional landline service. The greater the degree of substitutability that exists between landline service and the aggregate suite of intermodal alternatives, the less likely it is that a price increase above competitive levels would be profitable for the incumbent landline carrier. In this context, the sign of the cross-price effect between wireless and wireline is a first-order concern, because a wireline incumbent attempting to increase prices above competitive levels will lose customers to wireless competitors if and only if the cross-price elasticity is positive. If the cross-price elasticity is zero or negative, wireless services are not properly included in the set of products that constrain the price of wireline. The magnitude of the cross-price effect is also highly relevant, because wireless substitution will contribute little to intermodal price discipline if the cross-price elasticity is positive yet economically insignificant (Brennan, 2008).

In the absence of reliable cross-price elasticity estimates, even the sign of these parameters is an open question: The majority of US households continue to maintain both a landline connection and at least one wireless telephone, and it is unclear, *ex ante*, whether the two services are substitutes or complements. Thus, it is critical to identify consumer behavior at the margin. Absent reliable econometric estimates, one can make rough conjectures about these parameters by observing trends in the aggregate data—which, as it happens, tend to support the hypothesis that wireless/wireline cross-price effects are both positive and economically significant. But despite these high-level trends, econometric evidence corroborating this hypothesis has proven elusive in empirical work, which has typically relied on rather dated datasets compiled at the turn of the millennium, when wireless substitution was still quite rare: A recent survey of the literature summarized the state of existing empirical work by stressing the paucity of “quantitative analyses of the latest and arguably most dramatic developments [in the industry]” (Vogelsang, 2010, p. 14).

Partly in response to this dearth of empirical evidence, US competition authorities such as the U.S. Department of Justice (DOJ) and the Federal Communications Commission (FCC) have generally been skeptical of the proposition that mobile telephony should be included in the suite of intermodal alternatives that potentially constrain the price of wireline telephony. The DOJ has summarized this view, stating that “[c]ompetition for residential consumers occurs primarily between the ILECs and cable companies”, and that “the available evidence does not establish that mobile services currently represent an effective competitive constraint on landline access pricing” (DOJ, 2008, p. 88). The FCC largely concurred with this assessment in a recent proceeding in Arizona, citing a lack of “evidence that would support a conclusion that mobile wireless service constrains the price of wireline service” (FCC, 2010a, p. 32). At the same time, in light of the rapidly growing share of wireless-only households, regulators and academics alike have acknowledged the possibility that the true magnitude of cross-price effects might not be reflected in the empirical literature to date.

In this study, a state-level panel dataset from a relatively recent timeframe (2001–2007) is employed to develop and estimate a demand system that permits evaluation of the own-price, cross-price, and income elasticities of demand for wireless and wireline telephony in the United States. The results provide evidence that wireline and wireless voice service are strong economic substitutes, and indicate that changes in relative prices drive economically significant intermodal substitution. Specifically, it is estimated that a one percent decrease in the price of wireless service leads to a decline in the demand for traditional wireline service of approximately 1.2–1.3%. These results substantially exceed prior econometric estimates from the existing empirical literature, and suggest that roughly two thirds of observed landline attrition in the United States over the sample period is attributable to observed declines in the relative price of wireless service.

2. Trends in aggregate US data

The share of US households relying exclusively on wireless telephony has risen steadily in recent years, and now represents a substantial fraction of the voice communications market. The Centers for Disease Control and Prevention (CDC), through the National Health Interview Survey, have collected detailed data on wireless substitution since the year 2003 (Blumberg & Luke, 2006), and the FCC has reported similar data in earlier time periods. (FCC, 2008a). The CDC survey results reflect biannual interviews of tens of thousands of households drawn from the civilian, non-institutionalized population.² As seen in Fig. 1, the share of US households that use wireless voice service in lieu of a landline connection has risen from 1.1% to 26.6% from 2001 to 2010, respectively.³

² Note that the CDC implemented changes to its questionnaire in 2007. In prior years, respondents were asked whether “the family’s phone number” was a cellular telephone number. If so, the respondent was then asked whether there was at least one functioning telephone in the home that was not a cell phone. Starting in 2007, instead of a being asked two-part question, respondents were simply asked whether there was “at least one phone inside your home that is currently working and is not a cell phone” (Blumberg & Luke, 2009a).

³ Although nationwide statistics on the share of wireless-only households provide useful high-level evidence of wireless substitution, note that these data are not well-suited to econometric analysis, and are not employed to estimate the econometric model developed here. See Section 4.1.

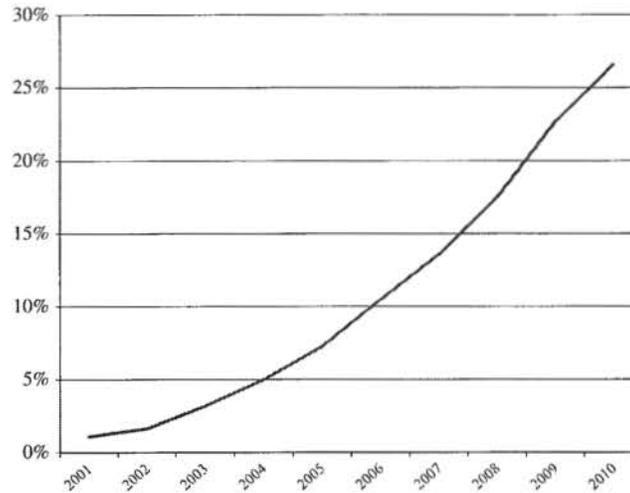


Fig. 1. Wireless-only share of US households, 2001–2010.

Source: Data for 2001–2002 from FCC (2008a). Data for 2003 forward from Blumberg and Luke (2006, 2007a, 2007b, 2008a, 2008b, 2009a, 2009b, 2010).

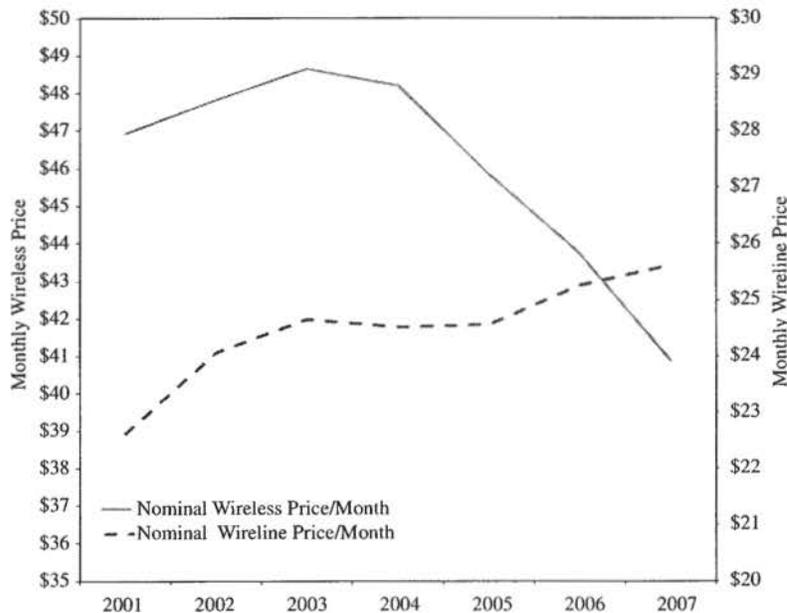


Fig. 2. US wireless and wireline prices, 2001–2007.

Sources: Wireless prices based on average monthly local wireless bills for voice service (excluding data revenues), derived from a survey of wireless carriers, reported in FCC (2010c). Wireline prices also based on average monthly local rates, derived from a separate survey of wireline carriers, reported in FCC (2008b).

In earlier years, wireless substitution was sometimes viewed as a niche phenomenon restricted to certain narrow demographic groups (Rodini, Ward, & Woroch, 2003). In light of the fact that approximately one in four US households is now wireless-only, this characterization has become increasingly obsolete. Indeed, the data show that cord-cutting has become widespread across a range of demographic categories (Blumberg & Luke, 2010). There is also evidence that wireless substitution varies substantially across geographic regions in the United States, although the available data on state-level variation are more limited.⁴

Given the rise in wireless telephony and other intermodal voice technologies, it is perhaps unsurprising that ILECs have been losing landlines at non-trivial rates for some time. According to the FCC, incumbent fixed lines decreased by more

⁴ Although most of the CDC's wireless substitution surveys report only national aggregates, the CDC has also released a cross-section of state-level wireless-only estimates. However, the CDC's state-level estimates should be interpreted with caution, as they rely on a methodology that exploits state-level demographics to predict rates of wireless substitution, and are characterized by relatively loose statistical precision. For example, the widest plausible interval for the Oklahoma point estimate ranges from 12.9% to 38.8% (Blumberg et al., 2009).