Abstract

Our paper explores the effects of network unbundling in telecommunications. It includes discussions of the basic economics of unbundling; the competitive effects of unbundling on voice services in the United States and broadband in the US and the European Union; and unbundling policy in a world of convergence. Mandatory unbundling can delay facilities-based entry and reduce network investment, particularly if unbundled input prices are set too low. Excessive prices for essential network elements could hamper competitive entry. Some argue that mandatory unbundling has stimulated competition; however, our results suggest that when relevant demand and supply determinants are included in the analysis, the association between mandatory unbundling and increased broadband penetration is not statistically significant. Assessing the costs and benefits of unbundling is more difficult because of convergence and intermodal competition among the video, wireless and telephone providers. Thus, the dynamic nature of the sector and the costs of implementing mandatory unbundling imply that policy makers should carefully examine the costs and benefits of regulatory intervention.
Overview

This paper explores whether network unbundling leads to increased competition in the communications industry by assessing US experience with wireline voice, EU and US experience with broadband, and experience with wireless resale in different countries. It includes a summary of the economic arguments for and against mandatory network unbundling; an evaluation of the effects of mandatory unbundling efforts; and our views of how the concepts and the experience with network unbundling apply in a world of convergence and portfolio competition.

Our primary findings are: mandatory unbundling carries with it significant risks—i.e., if prices for unbundled network elements (UNEs) are set too high, UNEs will not be used by entrants; if they are set too low, then investment incentives are distorted for both the facilities provider and the entrant. Wholesale unbundling in some instances may have contributed to increased competition. However, our analysis suggests that the apparent association between unbundling and increased broadband penetration is not statistically significant when relevant economic, demographic and supply determinants are included in the analysis. As communications networks converge and the demand for wireline services decreases globally, intermodal competition is more prevalent and the benefits of unbundling are more difficult to assess, and unbundling arguably becomes a regulatory tool of the past. Given the dynamic nature of the communications industry, the costs and the risks of implementing mandatory unbundling, and the international differences in geographic, demographic, and market conditions, policy makers should use a case-by-case approach that carefully examines the contours of the relevant market(s) at issue as well as the costs and benefits of any regulatory intervention.

Forms of Network Unbundling

Communications networks are subject to unbundling at different levels for different services. The most familiar forms of unbundling are for the local loops of incumbent local exchange carriers (ILECs) and wired broadband facilities. Local (typically copper) loop unbundling generally is imposed by regulators, although in principle it can be implemented under commercial terms and pricing without regulatory intervention. Unbundling is also an issue with respect to wired copper and fiber broadband facilities. As shown in the left half of Figure 1, competitive local exchange carriers (CLECs) may utilize unbundled right loops, and data local exchange carriers may use unbundled local broadband facilities. In each case, they purchase either individual network elements or an entire platform. In the latter case, the practice is more like resale than unbundling.
The right side of Figure 1 illustrates that voluntary and mandatory mobile virtual networks (MVNOs) wholesale access and Internet backbone network neutrality are conceptually similar to traditional unbundling. MVNOs purchase wholesale wireless services and resell them at the retail level. MVNOs are relevant because, as discussed below, policy makers in some countries have required mandatory access to and resale of wireless services in order to further competition for retail mobile services. The term “wireless unbundling” refers to mandatory resale. Net neutrality for backbone access shares some characteristics with unbundling. Definitions of net neutrality vary, but its advocates argue that “certain users or applications should not be favored over others,” and that providers should not charge for different service priorities (CBC News Canada, 2009). Thus, net neutrality, like mandatory unbundling, may require Internet network operators to allow use of their networks subject to regulatory control.

**Examples of Unbundling in the United States**

A key provision (§ 251 (c)(3)) of the US Telecommunications Act of 1996 requires mandatory unbundling of facilities needed by entrants to compete with ILECs. Congress evidently believed that requiring ILECs to share essential facilities would serve as the catalyst for competition by allowing entrants to begin competing as non-facilities based carriers and build their networks in the long-run. When the Federal Communications Commission (FCC) implemented the policy, it unbundled specific network components including local loops, and initially DSL and 10 other elements. The FCC also found that UNE prices should be set based on forward-looking total element long-run incremental cost or TELRIC-based rates, and the ILECs had to meet certain performance metrics to prevent discrimination against the CLECs. Importantly, the FCC included a platform offering, called UNE-P, which included all elements needed to provide local exchange service, including local switching as well as the local loop facility. This extreme form of mandatory unbundling essentially enabled CLECs to enter the market without any telecommunications facilities. The FCC eliminated this requirement after the ILECs challenged UNE-P in court. Similarly, to comply with court orders, the FCC in 2003 phased out the line sharing requirement under which ILECs had to allow ISPs to use the high frequency portion of the local loop to offer DSL service (FCC News, 2003); and, in 2005, it decided to stop requiring ILECs to offer unbundled DSL service (FCC 2005). The requirement that ILECs provide unbundled ordinary local loops remains in place.
**International Experience with Mandatory Unbundling**

Policy makers outside the US also implemented mandatory local loop unbundling. The European Union requires local loop and bitstream unbundling for broadband service. Furthermore, wireless providers are required to provide wholesale access to MVNOs, e.g., in Spain, Slovenia, Hong Kong, and Turkey. The MVNO business model originated at around the same time in the US and Japan. In May 1996, TracFone Wireless, a subsidiary of América Móvil, launched its pay-as-you-go wireless services in the US, while at the same time Japan Communications Inc. introduced the data MVNO business model to Japan. The first MVNO in Europe was Virgin Mobile UK, which launched its mobile services in November 1999. In mid-2009, over 50 MVNOs were operating in the EU, serving a diverse set of customers and offering a range of voice and data services (Telecompaper, 2009). Similarly, the mobile market in the US offers customers a choice of approximately 55 MVNOs. According to the FCC (2008), resellers including MVNOs served approximately 8 percent of all US mobile subscribers (20.4 million subscribers) at the end of June 2008.

Finally, globally policy makers are debating the need for Internet backbone access requirements. The debate focuses on the terms and conditions under which Internet network operators must allow access. Net neutrality advocates are seeking policies that constrain network operators’ ability to control the flow of data over their facilities and prevent them from charging more for faster or higher priority access to the Internet. Network providers seek to control access in ways that allow them to maximize profits. They argue that they invested substantial amounts to deploy facilities, and that they should be able to manage and price the use of their networks to maximize profits and promote efficient network use (Taylor, 2007).

**The Economics of network unbundling**

The traditional model of telecommunications regulation calls for regulatory intervention in the presence of market failure, in particular when: excessive market power (or a natural monopoly) would generate risks to consumers from excessive prices and/or poor quality and reduced innovation; or network externalities imply that subscribers benefit from extending the network to additional customers or service areas.

The issue of mandatory unbundling of an essential facility is, in most instances, tied closely to concerns about excessive market power. That is, competition in the retail market may be at risk when a provider has a monopoly over an essential facility in the wholesale market. In this case, mandatory unbundling is a commonly considered remedy for retail (and ultimately for wholesale) market power. Proponents argue that when network elements are essential facilities, potential retail competitors face high barriers to entry because incumbents have an incentive to forestall competition by denying access to or by demanding above-cost prices for the essential elements. Hence, they maintain that retail competition is constrained and potential entrants are unable to build the customer base needed to warrant building their own networks. Those supporting mandatory unbundling argue that it yields benefits, including: lower prices; higher service quality; increased innovation; higher penetration and take-up rates; economic stimulus; and the possibility of greater facilities-based competition at the wholesale level, once the entrants have expanded their customer base sufficiently to justify network investments.
Many challenges arise in implementing wholesale unbundling. First, the process of identifying genuinely essential facilities is very contentious—e.g., ILECs argue that loops are no longer essential because the relevant market includes cable telephone and wireless services that have no need for loops, but CLECs argue that they need loops to serve many areas. Thus, the essential facility doctrine and impairment tests are difficult to apply, particularly in markets in which technology and market forces are rapidly changing and thus the relevant market itself is changing.

Second, it is similarly difficult to determine appropriate cost-based prices. Many issues must be resolved, including: the type of cost to use, whether to model hypothetical or actual network costs, the appropriate profit, the amount of joint and common costs to recover in UNE rates, the appropriate cost of capital method, and how to capture forward-looking costs, given the dynamic constantly evolving nature of next generation networks (NGNs).

Third, there are significant potential harms from setting UNE prices incorrectly or requiring unbundling for nonessential facilities. For instance, setting uneconomically low UNE rates creates fundamental problems. Such prices distort investment incentives for both the incumbent and potential entrants. Incumbents that face the prospect of providing network elements to competitors at rates that do not cover their costs will not invest. Additionally, such pricing constrains facilities-based entry. As Kahn (2001) states: “If you can buy the [network elements], or lease them at that rate, why on earth would anybody construct his own [network elements]?"

Such complexity often results in lengthy cost proceedings and engenders high regulatory costs. For example, in the US, there was substantial litigation about what constitutes an essential facility. The most contentious issues surrounded the FCC’s mandate that the ILECs provide UNE-Ps, which include all elements needed to provide local exchange service. The ILECs challenged this requirement in court. Similarly, the regulatory costs associated with determining the proper rates have been extremely high in the US. ILECs and CLECs have built competing models of many types. Not surprisingly, the results vary widely, and regulators held numerous hearings on the economic principles and the proper input assumptions for the models. Although the results of the cost models have converged over time, during the course of the regulatory process, they remain contentious.
Does wholesale unbundling increase competition?

An assessment of whether unbundling is successful must balance the benefits of mandatory unbundling against the costs of regulation. In addition, this assessment must be made on a case-by-case basis as the balance of costs and benefits depends on whether the facility at issue is really an essential facility and on how the policy is implemented. Moreover, the analysis must be made in the market for the final good. If wholesale regulation has no effect downstream, then it has no benefit to consumers.

Assessing the costs of mandatory unbundling is particularly complex because some of the costs are indirect—e.g., reduced incentives to invest may stifle innovation and network development in ways that are not immediately apparent. Moreover, it is difficult to measure the impacts of mandatory unbundling on investment and innovation because many factors, including changes in other forms of regulation, mergers and acquisitions, and the state of the national economy affect those activities, and only net effects are observable in the retail market. In addition, policy makers must consider whether unbundling requirements could distort retail market competition because some platforms are regulated while others are not. This requires understanding what services are in the relevant market. For example, the issue of whether wired and wireless broadband services are in the same relevant market is problematic.

Effects of Mandatory Unbundling on Voice Services in the US

What were the effects of local loop unbundling and UNE-P requirements on voice services in the US? First, local exchange prices did not fall. Instead, US Bureau of Labor Statistics Consumer Price Index for local telephone services shows that local rates in the US increased by about 45 percent from mid 1996 through January 2009 (BLS, 2009). Unfortunately, it is difficult to separate the effect of unbundling policies from those of other factors such as rebalancing. Indeed, even if unbundling stimulated entry, local service price reductions would have been surprising because competition yields more cost-based rates and local telephone prices were historically been set below cost in the US; thus, prices increases were a more likely outcome as regulators granted greater pricing flexibility to incumbents in response to increased competition. In either case, because of the regulatory distortions of local prices in the US, one should consider other indicators of competition, such as the entry and growth of competitive options to identify the effects of unbundling.

Second, the number of CLEC lines did initially increase following the implementation of the provisions of the 1996 Act as shown in Figure 2. However, the initial increases were driven mainly by the CLEC use of UNE-Ps; the use of unbundled local loops played a far smaller role (FCC, 2007). Moreover, Figure 2 also shows that wireless substitution for wireline service likely accounted for an even larger share of ILEC (and total wireline) losses.
Figure 3 shows two key factors in the growth of wireless as a replacement for wireline service—the increase in wireless usage per subscriber and the decline in the average charge per minute. Other factors that explain the growth of wireless over wired service include gains in call quality, service coverage, and sophisticated cell phone features.
The development of cable Voice over Internet Protocol (VoIP) service spurred the growth in availability and subscription to cable telephone service. The number and percent of homes passed by cable telephone increased dramatically in the US from 2002 to 2007 with cable VoIP making a major contribution to that growth (Halpern, 2008). In combination with demand for bundles like cable’s “triple play” (video, voice, and data services), the spread of cable telephony accounts for much of the conventional LECs’ losses in the US.

Figure 4 shows cable-voice service growth in the US; and, the acceleration of that growth during the period in which UNE-based competition declined. Combined with the gains by wireless, this growth in cable voice lines likely explains the decline in US LEC voice services since 2002.

Thus, the most significant competition faced by the ILECs came from cable telephone and wireless providers, and neither of these types of competitors relied on UNEs to provide local telephone services.

As cable voice and wireless connections increased, the use of UNEs declined in the US. The merger of Verizon with MCI and the merger of AT&T with SBC and Bell South complicate the interpretation of trends in the FCC’s UNE data because the UNEs formerly used by MCI and AT&T (when these firms were independent CLECs) are now counted as ordinary ILEC lines. Nevertheless, even factoring in these mergers, ILEC lines are likely less than they would have been had it not been for intermodal competition. As shown in Figure 5, which compares the actual number of ILEC lines with the trended number of lines, the difference is pronounced. ILECs only had approximately half the lines as they would have had historical trends continued though 2007.
Thus, ILEC loops were not necessarily essential facilities needed for local competition; UNE based competition does not appear to have reduced local rates; and, retail market evidence suggests that mandatory unbundling for voice services in the US had little to no benefits, and thus was superfluous at best. In short, competition faced by the ILECs for voice service may have grown in the US despite the FCC’s UNE policy because it came primarily from wireless and from cable telephone—two sources that did not rely on local loop unbundling.

**Has Elimination of Broadband Unbundling Harmed US Broadband Performance?**
Supporters of mandatory unbundling cite OECD data (like those in Figure 6) showing that certain EU countries have higher broadband subscription rates (subscribers per hundred inhabitants) than does the US. For example, entrants who utilize other carriers’ network elements cite such data as evidence of the success of local broadband unbundling. According to Innocenzo Genna, Chairman, European Competitive Telecommunications Association (ECTA), broadband unbundling stimulates competition and benefits consumers by enabling entry without the need to build local access facilities. (ECTA, 2007).
EU policy makers recognize that facilities-based competition has stimulated broadband penetration; however, they also believe that unbundling stimulates broadband competition and penetration (European Commission Information Society and Media, 2005). Viewed in isolation, there appears to be a positive association between use of unbundled broadband loops and the penetration of broadband facilities. However, a more careful analysis that includes other determinants of broadband penetration shows that this association is misleading because the extent of local loop unbundling is highly correlated with household computer ownership and population density—two factors that tend to increase broadband penetration.

Thus, to explore how supply and demand determinants interact with unbundling policy to influence broadband penetration, we gathered data for OECD member countries and performed several statistical analyses. The analyses include the estimation of linear, cross-section regression models that account for supply factors such as population density, population concentration and use of unbundling, and demand determinants such as computer ownership, income distribution, GDP per capita and price for broadband. More specifically, the models estimate broadband penetration as a function of:
• Population density (inhabitants/kilometer²);

• The percentage of land mass used by 50 percent of the country’s population—a measure of population dispersion/concentration. Higher values of this variable imply that the population in a country is less concentrated;

• Household computer ownership (percent of households with at least one computer);

• Income (GDP per household measured in US Dollars, purchasing power parity);

• Income inequality (the GINI coefficient—a higher index indicates greater inequality);

• Price (the minimum broadband price in US Dollars adjusted for purchasing power parity); and

• The percentage of main distribution frames (MDFs) with competitors present.

As summarized in Table 1, our results show statistically significant positive relationships between broadband penetration and the percentage of households with a computer, and with population density. The positive relationship between computer ownership and broadband penetration is as expected; moreover, computer ownership may also be a proxy for education, which would likely stimulate broadband penetration as well. Higher population density is likely associated with greater availability of broadband, which enables more of the population to subscribe. This is because high population densities reduce the cost and the time needed to deploy broadband and thereby increase its availability.

The results show statistically significant negative relationships between broadband penetration and a country’s GINI coefficient, and between broadband penetration and the percentage of land mass used by 50 percent of the population. These results are intuitively plausible—e.g., larger areas for 50 percent of a country’s population (thus meaning lower population concentration) and greater income inequality are associated with lower broadband penetration. The price variable also shows the expected negative relationship with broadband penetration. Our price results suggest that the variable is meaningful, but they are not definitive because the t-statistics for that variable—1.54 in one of our regressions and 1.45 in the other—imply that the variable is not statistically significant at conventional levels using two-tailed tests.

Additionally, and crucial to the subject of this paper, there is not a statistically significant relationship between the unbundling variable and broadband penetration—i.e., the t-statistic for the variable is only 0.42. Thus, the statistical evidence does not support claims by proponents of unbundling that this regulatory tool results in higher broadband penetration rates. Note that this result is based on a sample of only 16 European countries for which data were available on the percentage of MDFs with UNE loops present.

Table 1 also shows the results of a regression estimated using data for all 30 OECD countries for which all data—other than percentage of MDFs with UNE loops—were available. The results with this larger sample are consistent with those for the smaller sample, except that in this case, GDP per capita proved to be significant and to have the expected sign, although the size of the impact is small.
Table 1. **Broadband Lines Per 100 Inhabitants: Summary of Regression Results**

<table>
<thead>
<tr>
<th></th>
<th>EU Countries with Data on UNE Loop Use Coefficients (t-statistics Shown in Italics)</th>
<th>OECD Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>31.99 2.38</td>
<td>30.78 2.76</td>
</tr>
<tr>
<td>Percentage of Households With A Computer</td>
<td>0.22 2.38</td>
<td>0.18 2.54</td>
</tr>
<tr>
<td>Population density (inhabitants/km²)</td>
<td>0.02 1.92</td>
<td>0.01 2.32</td>
</tr>
<tr>
<td>Percentage of Land Mass Used by 50 Percent of the Population</td>
<td>(0.27) (2.13)</td>
<td>(0.34) (3.79)</td>
</tr>
<tr>
<td>Minimum Price per Month (US Dollars, PPP)</td>
<td>(0.25) (1.54)</td>
<td>(0.16) (1.45)</td>
</tr>
<tr>
<td>GDP per Capita ($1,000 US PPP)</td>
<td>0.03 0.50</td>
<td>0.13 2.05</td>
</tr>
<tr>
<td>GINI Coefficient</td>
<td>(59.14) (2.33)</td>
<td>(49.58) (2.50)</td>
</tr>
<tr>
<td>Percentage of MDFs With Competitor Present</td>
<td>5.46 NA</td>
<td>0.42 NA</td>
</tr>
<tr>
<td>$R^2$</td>
<td>92.95% 86.78%</td>
<td>86.56% 83.06%</td>
</tr>
<tr>
<td>Observations</td>
<td>16 30</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Broadband Subscribers per 100 Inhabitants—OECD data for December 2008; Percentage of households with a computer (2008 or most recent year)—OECD, May 2009, and Pew Center data for US; GINI coefficient—OECD, last updated September 2008; Minimum Price, PPP—OECD, last updated October 2008; Population density—OECD, as of 2006; Percentage of Land Mass Used by 50 Percent of the Population—OECD, last updated December 2008; GDP Per Capita (US Dollars, Purchasing Power Parity)—OECD, as of 2007; Percentage of MDFs (Main Distribution Frames) with Broadband Competitors Present—ECTA Broadband scorecard, as of end of September 2008.
As demonstrated by our econometric models, as well as in Table 2, differing demographic and geographic characteristics—rather than differing unbundling policies—between the US and EU countries with higher broadband penetration appear to go a long way towards explaining the differences in penetration. Our analysis not only fails to find a statistically significant relationship between competitors use of incumbents’ unbundled facilities and broadband penetration, it also implies that the apparently lower penetration of broadband in the US is most likely due to several factors that have a statistically significant impact on broadband adoption. That is, as shown in Table 2 the following factors appear to constrain broadband penetration in the US:

- Computer ownership in the US is about 11 percent below the average for EU countries with higher broadband penetration (the “higher-ranked countries”). Lower computer ownership of course, constrains demand for broadband. Adjusting for differences in household computer ownership by taking the ratio broadband penetration to the percentage of households with computers reduces the percentage difference between the US and countries with higher broadband penetration from 18 percent to only 8 percent.

- Population density, which has a positive impact on broadband development, is on average more than five times greater for higher-ranked countries than it is for the US, and it is quite a bit higher than that of the US for most of the countries in the sample.

- The US population is also somewhat more concentrated in urban areas than the average for the higher-ranked countries. Other things equal this is associated with higher broadband penetration; however, US urban residents likely have lower incomes, lower computer ownership and other demographic characteristics that could reduce their broadband demand.

- US GDP per capita is relatively high; however, the GINI coefficient is much higher in the US—i.e., the US has much greater income inequality than the higher-ranked countries. In fact, the US income distribution is much less homogenous than that of most other OECD countries. The larger number of relatively low-income people in the US likely constrains broadband penetration.

It appears that price of broadband—the factor that UNE-based competition could most greatly affect in principle—is relatively low in the US when measured using OECD data on minimum monthly price for broadband service; and, this price not the average price drives demand according to economic principles.11
Our regression results are not definitive because of limited sample size and data availability regarding unbundling variables, but the regression analysis combined with the demographic data indicate that US regulatory policies do not appear to have constrained broadband penetration.

To the contrary, given the geographic and demographic challenges faced by the US—e.g., lower computer ownership, greater income inequality, and lower population density—the US appears to be doing well. As shown in Figure 7, US broadband penetration—measured here as the percentage of households, (as opposed to inhabitants) with broadband subscriptions—has climbed rapidly over the years and now approaches the penetration of computers in the home. Even excluding mobile wireless connections, about 58 percent of US households had broadband service in 2008; thus, about 80 percent of US households with computers had wireline broadband connections in 2008.

Table 2. US and Average Country Group Values for Broadband Penetration and Explanatory Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Countries with Higher Broadband Penetration than the US</th>
<th>United States</th>
<th>Countries with Lower Broadband Penetration than the US</th>
<th>All Countries in Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Households with Computers</td>
<td>81%</td>
<td>72%</td>
<td>58%</td>
<td>69%</td>
</tr>
<tr>
<td>Population Density (Inhabitants/km2)</td>
<td>169</td>
<td>32</td>
<td>108</td>
<td>134</td>
</tr>
<tr>
<td>Percentage of Land Used by 50 Percent of Population</td>
<td>17%</td>
<td>14%</td>
<td>22%</td>
<td>19%</td>
</tr>
<tr>
<td>GDP per Capita (US Dollars, PPP)</td>
<td>39,826</td>
<td>45,489</td>
<td>25,723</td>
<td>32,963</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>0.28</td>
<td>0.38</td>
<td>0.34</td>
<td>0.31</td>
</tr>
<tr>
<td>Percentage of MDFs With Broadband Competitor Present</td>
<td>26%</td>
<td>—</td>
<td>8%</td>
<td>16%</td>
</tr>
<tr>
<td>Broadband Subscribers/100 Inhabitants</td>
<td>31.4</td>
<td>25.8</td>
<td>16.9</td>
<td>24.0</td>
</tr>
<tr>
<td>Ratio of Broadband Penetration to Computer Ownership</td>
<td>39%</td>
<td>36%</td>
<td>29%</td>
<td>35%</td>
</tr>
</tbody>
</table>
In addition, May 2009 data show that: “...broadband penetration among active Internet users in US homes grew to 94.65%.... [And]...96.91% of US workers [using the Internet at work] connected to the Internet with broadband…. (WebsiteOptimization.com, 2009)” Finally, a survey from the Pew Internet and American Life Project shows that 63 percent of adults without broadband (16 percent of the US adult surveyed) cited reasons such as lack of interest in the Internet, usability, too old, no computer, no reason to switch from dial up as the reason that they do not subscribe to broadband. Only 36 of those with dial up or no Internet at home (9 percent of adults) cited price or lack of availability as the reason they used dial up or did not subscribe to broadband. (Horrigan, 2009)

Our findings are generally consistent with other empirical studies, which find that mandatory unbundling has not enhanced competition. For example, Hausman and Sidak (2004) examined data from five countries and found that “...none of the four rationales [for mandatory unbundling] is supported in practice.” Hazlett and Caliskan (2008) examined US experience with broadband regulation and found that “‘open access’ broadband regulation deters subscriber growth...”
Some Implications for Mobile Network Mandatory Wholesale Access and Network Neutrality

Wireless access networks generally consist of mobile switching centers antennas, base stations, and transceivers that use the radio frequency spectrum to provide network access. MVNOs can self-supply the other operational components needed to serve customers—e.g., marketing and sales related to product and service marketing activities, and customer care activities relating to after-sale customer service and billing. However, MVNOs do not have spectrum licenses; thus, to serve their customers they access the network of at least one mobile network operator (MNO).

To justify opening MNO facilities to MVNOs through mandatory wholesale access at regulated rates, policy makers must establish that MNOs exercise sufficient market power to prevent the normal operation of competitive markets. Specifically, they need to demonstrate that MNOs retain vertical control over wholesale wireless access services (thus rendering them essential facilities). In markets with competing wireless access networks, a given network is not an essential facility. In this context, given the theoretical potential for different competitive outcomes—from effective competition to cartel-like behavior—MVNO policies range from mandatory access with regulated, cost-based prices to less stringent policies that only require that MNOs negotiate with MVNOs in good faith under reasonable and nondiscriminatory terms. While many MVNOs prospered, by far most MVNOs entered based on unregulated, commercially negotiated agreements. Very few MVNOs have taken advantage of the mandatory regulatory form of unbundling. Thus, it is questionable whether the policy has a positive impact.

As noted above, the ongoing net neutrality debate focuses on the tension between content providers, who argue that certain users or applications should not be favored over others, and network providers, who maintain that they need to control data flows (using pricing or other allocation mechanisms) to improve efficiency, profit, and innovation. The analyses of mandatory unbundling of voice and broadband networks discussed above imply that regulators should only interfere with the market as a last resort. The outcomes also lend credence to the arguments of US network operators that oppose net neutrality regulations on the grounds that they need the freedom to manage their networks as they see fit and that new obligations could discourage investments, without stimulating effective competition (Broach, Cnet News, 2008; Lasar, 2009; Taylor, 2007).
Conclusion

A number of factors make it difficult to assess the need for unbundling in today’s telecommunications sector. In particular, network convergence has blurred the boundaries between previously distinct platforms and given rise to vigorous intermodal competition. Formerly distinct industry sectors are converging. Cable companies offer voice and broadband as well as video; and, the LECs have transformed their platforms to provide broadband and video as well as voice services and traditional private line data services. Wireless mobile providers compete for voice services (from fixed locations as well as for mobile calls), data and video services instead of just for mobile voice. These formerly separate and distinct sectors now compete for the same service bundles—voice, data, and video; LECs, in particular, face the prospect of rapid entry and exit from their traditional markets (contestability) because of the presence of the other platforms; and, market definitions have blurred. For example, in the US cable broadband services and bundles of broadband voice and video compete with LEC broadband and bundled services. In this context, determining whether the theoretical benefits of network unbundling—notably the promise of greater competition in retail markets—outweigh the costs—notably regulatory costs, distorted investment incentives, and reduced facilities-based competition—has become more difficult.

The economic evidence from mandatory wholesale unbundling is not strong enough to justify its imposition without a showing that market forces have failed. Our analyses show that facilities based competition from mobile wireless and cable voice providers, rather than UNE-based entry, is the predominant source of competition faced by US ILECs; and supply and demand factors other than broadband unbundling policies explain the relative broadband penetration rates of OECD countries.

Thus, (especially when intermodal competition is present) policy makers must conduct a careful cost-benefit analysis before they require mandatory unbundling. The analysis must be conducted on a case-by-case basis because different geographic areas may have different economic and competitive characteristics. International comparisons that carefully account for regional economic and demographic differences may allow regulators to understand what worked, where, and why. As a general matter, regulation should be used as a last resort only after: the relevant economic market is defined; competition and potential competition in the relevant market(s) are carefully examined; and it is clear that market forces are likely to fail to lead to viable outcomes. Moreover, in view of the costs and imperfections of regulation—e.g., the direct costs, pricing distortions—unregulated markets do not have to work perfectly to beat regulated alternatives, which may also be highly imperfect.
End Notes

1 “(c) ADDITIONAL OBLIGATIONS OF INCUMBENT LOCAL EXCHANGE CARRIERS- In addition to the duties contained in subsection (b), each incumbent local exchange carrier has the following duties: . . . (3) UNBUNDLED ACCESS- The duty to provide, to any requesting telecommunications carrier for the provision of a telecommunications service, nondiscriminatory access to network elements on an unbundled basis at any technically feasible point on rates, terms, and conditions that are just, reasonable, and nondiscriminatory in accordance with the terms and conditions of the agreement and the requirements of this section and section 252. An incumbent local exchange carrier shall provide such unbundled network elements in a manner that allows requesting carriers to combine such elements in order to provide such telecommunications service.”

2 Specifically the FCC found (at ¶ 5) that: “Facilities-based wireline broadband Internet access service providers are no longer required to separate out and offer the wireline broadband transmission component…of wireline broadband Internet access services as a stand-alone telecommunications service under Title II, subject to the transition explained below. In addition, the Bell Operating Companies (BOCs) are immediately relieved of all other Computer Inquiry requirements with respect to wireline broadband Internet access services.”

3 Simple wireless resale has been around for much longer than this and, using a broader definition of MVNOs, one could argue that the simple reseller of the early 1980s brought about the MVNO trends observed today.

4 Due to the constant entry and exit of MVNOs and the increased blurring between what constitutes an MVNO, a mobile virtual network enabler (MVNE), and a simple reseller, these numbers are approximations only.

5 Hausman and Sidak (2004) observed a similar pattern. See p. 22.

6 We obtained data on cable telephone customers at various times from the National Cable and Telecommunications Association website. The most recent figure on the site is for March 2008. See http://www.ncta.com/StatsGroup/OperatingMetric.aspx. The historical data do not appear to be on the NCTA website any longer. To estimate the fourth quarter number for 2008, we assumed that growth was the same in each quarter from the end of 2007 to first quarter of 2009. We estimated lines by multiplying the number of customers by 1.1. That is we assume that one in ten customers have two lines.

7 For example, citing 2005 data, the European Commission Information Society and Media DG stated: “Countries with the highest broadband take-up (above 15% - Denmark, Netherlands, Finland, Sweden, Belgium) all have high roll-out of cable but they often also have well developed access regimes such as for LLU or bitstream access…. In other Member States, competition based on competing infrastructure is less developed but there are some notable successes where a combination of competing infrastructure and effective regulation have resulted in relatively high broadband penetration.”

8 For example, the correlation coefficient between the percentage of exchange main distribution frames with local loop unbundling present and the broadband lines per 100 inhabitants is about 0.78.

9 The correlation between the percentage of MDFs with unbundled loops present and the percentage of households with computers is 0.72, and the correlation between MDFs with unbundled loops present and population density is 0.60.

10 Population concentration differs from population density in that density is simply total population divided by the total area of a region, while concentration accounts for the percentage of the population that resides in a given fraction of a region’s land area—e.g., the OECD uses the percentage of land mass used by 50 percent of the population.

11 The price coefficient in our model suggests a relatively low price elasticity of demand—a 10 percent change in the price produces only about a 2 percent change in the number of broadband lines per 100 inhabitants—although, the coefficient is not statistically significant at conventional levels.

12 In June 2008, the ratio of residential high-speed connections to total US households was approximately 68 percent. The percentage has been approaching the percentage of the US population in households with computers, which was about 74 percent in 2008.

13 58 percent/74 percent = 80 percent. The sources for Figure 6 include Pew Internet and American Life Project data on computer ownership; FCC data on residential broadband subscribers, and US Census data on number of households.
Reference List


*United States Telecommunications Act, 1996*, § 251 (c)(3).

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