Disconnecting: Universal Service on the Decline

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Abstract

Universal service in voice telephony is generally taken for granted in the United States. However, recent data from the FCC shows a significant decline in the number of U.S. households that have a telephone of any kind (including mobile), from a peak in telephone penetration of 95.5% in March 2003 down to 92.9% in November 2005. This decline is both statistically significant and meaningful, as approximately 2.6% of U.S. households no longer can easily reach 911 for emergencies. In this paper we use regression analysis of state-level data to determine what is driving this decline in universal service. We find that the recent decline in universal service in the U.S. is driven by an increase in black populations, inadequate consumer protection laws, and increases in wireless telephones per capita. Lifeline effectiveness does not appear to mitigate the decline in penetration, while Link-Up effectiveness may have a limited effect.

Key Words: Universal service, Intermodal competition, Lifeline, Link-Up, Wireless, Telephone penetration, Household penetration, Demand elasticity

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Introduction

Universal service in voice telephony is generally taken for granted in the United States. Once a policy for extending the monopoly network to include all population, modifications continue to be made to achieve the goal of full penetration in a competitive environment.[1]When telephone competition was first introduced in the U.S. many expressed concern that universal service would not be sustainable in a competitive market. Universal service policies had allegedly relied on cross-subsidies in the monopolist's prices, and the ability to maintain these subsidies would disappear as competition developed.[2] However, universality of voice telephone service recently seemed to have benefited from the combination of the end of a ubiquitous monopolist and the corresponding universal service policy debate. As shown in Figure 1, penetration increased from 91.4% in 1983 to 95.5% in March 2003. Since then, however, telephone penetration has dropped significantly. Recent data from the FCC shows a significant decline in the number of U.S. households that have a telephone of any kind, including mobile, with telephone penetration down to 92.9% in November 2005 (FCC 2006). This decline is both statistically significant and meaningful, as approximately 2.6% (approximately 3 million) of U.S. households that could easily reach 911 for emergencies in 2003 no longer can. Ironically, this significant drop in households with basic telephone service comes at a time when the level of

[1] See Mueller, 1997 for thorough history of use of term universal Service and related policies
[2] We ignore discussions of expanding the scope of services to be included in universal service policy as this paper is concerned simply with voice telephony.

high-cost universal service support grew rapidly.[3] From 2003 to 2005 the USF increased by $615 million from $3.206 billion to 3.821 billion.[4] If universal service spending is climbing and penetration is dropping, we must question how the funds are spent, and if policymakers really understand the cause of this drop in telephone subscribership.

Figure 1 appears here

The recent decline in universal service is not unique to the U.S., but is far from a worldwide trend. Table 1 shows that the European Union (EU) on average and Canada have maintained constant telephone penetration from 2003 to 2005, with levels much higher than the U.S. In fact, only five of the 15 pre-accession EU member countries experienced any decline in telephone penetration from 2003 to 2005. With the exception of Portugal, all of the EU 15 member countries and Canada have higher rates of telephone penetration than the U.S.

While most states in the U.S. show overall declines in telephone penetration, several states experienced either gains or statistically insignificant declines. In this paper we will explore the policies and conditions of the different states to determine what is driving this decline in

[3] The FCC has established four types of Universal Service Support funds: (i) low-income, (ii) high-cost, (iii) schools and libraries, and (iv) rural health care support. According to the Commission:

> The high-cost support mechanisms enable areas with very high costs to recover some of these costs from the federal universal service support mechanisms, leaving a smaller remainder of the costs to be recovered through end-user rates or state universal service support mechanisms. In this manner, the high-cost support mechanisms are intended to hold down rates and thereby further one of the most important goals of federal and state regulation -- the preservation and advancement of universal telephone service.

Universal Service Monitoring Report CC Docket No. 98-202 2004 (Data Received Through May 2004) pages 3-1 to 3-2.

[4] http://www.universalservice.org/about/governance/fcc-filings/2003/Q4/HC02%20-%20High%20Cost%20Support%20Projected%20by%20State%20-%204Q2003%20.xls; and http://www.universalservice.org/about/governance/fcc-filings/2005/Q4/HC02%20-%20High%20Cost%20Support%20Projected%20by%20State%20-%204Q2005.xls.

universal service in the United States. By better understanding the cause of this recent increase in disconnection, we can more effectively allocate the funds collected and target policy to promote universal service.

Universal Service Policy and Trends

Historically, universal service policy involved maintaining low rates for local residential telephone service (relative to cost) while increasing the price well above the incremental cost of serving business customers, long distance calls, and other services considered more discretionary. Local residential telephone service prices were kept low for all subscribers, even the very wealthy. The effectiveness of such policy has been challenged extensively in the literature, where monthly price for local residential telephone service has been found to have little if any impact on penetration. Several papers have estimated the elasticity of connection with respect to monthly price and have consistently found this elasticity to be insignificant (Crandall and Waverman 2000; Garbacz and Thompson 2005; Rosston and Wimmer 2000). Since price elasticity of residential telephone subscription is very low, there are, at best, very small gains in penetration when monthly prices are lowered (Kaserman, Mayo, Flynn 1990). Further, other services, like long distance, for which prices were increased to subsidize local residential telephone service, were found to have much higher elasticity with respect to price. Thus prior research suggests that maintaining low local residential prices not only was ineffective for increasing penetration, but also caused distortions in the consumption of other services. Even if artificially low prices did help penetration, they were being provided far beyond

the relevant population, to all households even though most would subscribe to telephone service without the inducement of this benefit.

In addition to being ineffective, the traditional support for local service was becoming less sustainable with increased competition in telephone since the AT&T breakup in 1983. Yet penetration increased significantly after 1983, as shown in Figure 1. Policy shifts to alternative means of funding and providing universal service benefits appear to have been effective during this period. The FCC recently attributed the high penetration rate in the U.S. to these programs (FCC 2004). In particular, Lifeline and Link-Up programs were introduced in 1984 to target assistance to low-income subscribers to keep them connected. Lifeline provides discounted monthly service fee for a single telephone line in a primary residence. Link-Up provides a discounted fee for initial installation of telephone service. Lifeline and Link-Up are federal programs. Some states, however, have chosen to establish their own Lifeline and Link-Up programs, providing additional support for low-income consumers. Otherwise, a state defaults to the federal criteria.

The purpose of these programs is to target assistance to low-income households, correcting the inefficiencies of past universal service programs that kept residential local rates artificially low to all households. Optimal policy provides assistance only to those who otherwise would not subscribe. Yet the true effectiveness of these programs is currently limited, as only one third of the households eligible for Lifeline or Link-Up programs are actually enrolled (Burton and Mayo 2005). Studies of Lifeline and Link-Up enrollment provide conflicting results. According to an FCC study, the quality of outreach is an important element to success of Lifeline

and Link-Up programs in a state (FCC 2004). However, Burton and Mayo (2005) find outreach efforts to be insignificant, while eligibility criteria, restriction of access to additional lines or vertical services while in Lifeline program, easy enrollment procedures, and total average household spending on telephone services are the biggest drivers of Lifeline participation.

Despite the apparent earlier success of these programs, penetration rates have dropped significantly since their peak at 95.5% in March 2003. The most recent measure of average U.S. penetration is 92.9% as of November 2005. As shown in Table 1, this downward trend in the United States is especially stark when compared to other developed countries. Among Canada and the original 15 EU member countries, most had no change or an increase in penetration. Very few countries have experienced a decline in penetration, and none as large as the U.S. Also, most notably, all of these counties except Portugal have penetration levels higher than the U.S. Thus, the cause of the penetration decline in the U.S. since 2003 is a domestic phenomenon. Within the U.S., there is considerable variation among the states in penetration change. Most, but not all, states have declines in penetration in these recent years, as seen in Figure 2. While average telephone penetration has experienced a statistically significant decline, many states have declines that are not statistically significant, and some have increases. One state, North Dakota, even has a statistically significant increase in penetration. Several of the states with statistically significant declines are those with very large populations, like Texas, New York, Illinois, and Florida. Interestingly, none of the states where Quest provides service experienced statistically significant declines in penetration. State variation is sufficient to enable analysis of changes in penetration and its drivers, which can increase our understanding of its cause. To

better understand what is causing the recent declines in telephone penetration we first discuss the potential drivers of telephone subscribership.

Table 1 appears here

Figure 2 appears here

Explaining Universal Service Decline

There seems no simple or obvious explanation for the recent penetration decline in the U.S. The FCC regularly tracks penetration across many categories generally considered predictors of penetration. Table 2 shows that the decline in penetration occurs across all categories for many possible explanatory variables. The decline in penetration is consistent across most household sizes, with households of six or more people experiencing less decline. The youngest households have the greatest decline in penetration, but declines persist in households of all ages. Similarly, households of the employed are experiencing almost as much penetration decline as unemployed households. The following considers several other factors that may be considered possible explanatory variables for the recent penetration decline in the U.S.

Table 2 appears here

Prices

There are several possible explanations for the recent decline in universal service shown above. First, it is possible that increased local residential rates from rate rebalancing in the face of competition has caused an increase in disconnects. Many anticipated declines in universal service as competition inevitably drove prices closer to costs for local residential service. Increased competition in long distance brought long distance prices down, reducing access fees that funded low local service prices. Local competition is similarly forcing a rebalancing of rates between business and residential service, causing residential prices to rise (Knittel 2004). This, many feared, could reduce penetration and jeopardize universal service objectives. However, the low elasticity of subscribership with respect to monthly fee found in multiple studies (Crandall and Waverman 2000; Garbacz and Thompson 2005; Rosston and Wimmer 2000) suggests that the recent drop is not due to increased monthly prices for local residential service.

The connection charge has been found to be more important to subscribership than monthly fees. Crandall and Waverman (2000) found that the installation charge is a significant predictor of penetration in the U.S. Thus it is possible that installation fee increases have caused the sudden and dramatic drop in penetration since 2003. These findings imply there will be greater benefit from assistance for installation fees than for monthly rate payments, that is, greater benefit from Link-Up than from Lifeline. However, as shown in Table 3, there has been little change in average installation fee, which has remained around $36 from 2002 through 2005.

Table 3 appears here

Income

Studies of telephone penetration consistently find income to be an important driver (Garbacz and Thompson 1997 and 2003; Crandall and Waverman 2000). Crandall and Waverman (2000) find in an econometric study of U.S. cities that telephone penetration is inversely and significantly related to poverty. In the FCC's most recent report on telephone subscribership, November 2005 penetration for households with incomes below $5000 was 79.4% while penetration for households with income between $100,000 and $149,999 was 97.7% (FCC 2006). If penetration is driven by income, and not price, then the best policies to promote universality would be those addressing low income households who might require assistance to remain connected. We would expect changes in income, or more specifically, lower income or increased incidences of poverty, to be a possible explanation for the recent penetration decline.

Between 2002 and 2004 there was a small increase in percent of households with income levels less than the poverty level, as seen in Table 4. This small increase is not sufficient to explain the large decline in the household penetration rate. Table 2, above, shows that while the largest declines in penetration occur in lower income households, the decline occurs at all income levels. Therefore, other factors in addition to income must be considered as potential determinants of the decline in penetration.

Table 4 appears here

Unexpected Charges

Unpredictability of bills and inability to control them are also problems with telephone service for low income households, and could be contributing to the decline in penetration. When charges for long distance and value added or discretionary services vary with use, especially when such use is not fully controllable by the head of household, bills may be unexpectedly high, leading to outstanding unpaid balances. Mueller and Schement (1996) found such unpredictability led to outstanding balances, and ultimately disconnection from the network. When unpaid balances remain outstanding, they are often obstacles to reconnection as phone companies may require they be paid first. Similarly, an FCC study finds outstanding debt for accumulated toll service fees is a significant negative predictor of subscribership (FCC 2004).

Disconnects due to unexpected charges increase with new advanced offerings, and users cannot reconnect with the resulting debt of old unpaid bills outstanding and poor credit history (Mueller and Schement 1996). It may be that increases in unexpected charges result from increased marketing and promotion efforts of the telephone service providers. As local telephone service providers have increasingly become providers of multiple telecommunications services, including long distance, mobile, and broadband, they may be increasingly cross selling services that are charged by use, increasing the unpredictability of subscribers' monthly bills. Bills for wireless telephone service can vary unpredictably, especially when subscribers go beyond the minute allocation of their calling plan. However, the recent practice of bundling different

services together may decrease this unpredictability. Bundling usually involves a fixed monthly fee and therefore greater predictability. If the effect of increased marketing and promotion efforts on low-income households is greater than the effect of selling fixed-price bundled services, this could lead to an increase in unexpected variation in monthly bills for low income households, forcing them to disconnect their telephone service.

Intermodal Competition

Some respond to the drop in telephone penetration as though it was expected, as new communication technologies compete with traditional wireline voice. However, Figure 1 shows the decline in the number of people with access to a telephone of any type, including mobile telephones. The Current Population Study (CPS) question used to measure penetration is: "Does this house, apartment, or mobile home have telephone service from which you can both make and receive calls? Please include cell phones, regular phones, and any other type of telephone," (FCC 2006). This question has been used since December 2004 (FCC 2006). Prior to that, mobile phones may have been excluded from reported penetration levels. Inclusion of mobile telephones based on this wording change should increase penetration, not decrease it, if there has been substitution from wireline to mobile telephony. Thus substitution of traditional landline telephone service with wireless or other new technologies for voice service cannot explain the recent decline in universal service.

Data showing that wireline connections are declining while wireless connections are increasing are often used as evidence of substitution.[5] However, this does not explain the decline in households with access to any form of telephone (wireline or wireless) shown above. Studies conducted by the Bureau of Labor Statistics and the Center for Disease Controls have tried to discern the relationship between increasing mobile telephone penetration and decreasing wireline penetration to determine how much substitution has occurred. As seen in Figure 3, some of the increase in wireless is for customers with both. More recent data obtained by a Center for Disease Control survey shows the percentage of adults in households with a landline telephone decreasing by 3.4% from January 2003 to December 2004, while the percentage of adults in households with only a wireless telephone increased by 2.7% and the percentage of adults in households with no telephone increased by 0.6% during this period (Blumberg, Luke, Cynamon 2005). Thus it is clear that not all of the subscribers disconnecting from wireline telephone remain connected through wireless or other forms of telephony.

Figure 3 Appears Here

The decline in penetration may have a more indirect connection to intermodal competition. We do see from the data discussed above that mobile penetration is increasing. This may in fact be causing the beginning of a decrease in landline subscription, as consumers substitute mobile for landline more fully. Low-income households in particular may be likely to make this substitution complete and discontinue their landline in favor of mobile if they think the total cost of service will be lower. However, the subscribers may experience unpredictably high bills (from paying for received calls as well as outgoing, confusing details of calling plans, and

[5] See, for example, Taylor 2005.

usage beyond the fixed-price package) and must disconnect mobile service, now unable to reconnect landline service due to outstanding balances or poor credit history. Low-income households are also more likely to substitute mobile for landline if they have outstanding balances for their landline service that they are unable to pay. Such consumers may have discontinued their landline in favor of mobile, found their mobile bills even less in their control and more volatile and are forced to disconnect this as well, perhaps adding additional unpaid balances for the mobile phone and service.

The Bureau of Labor Statistics survey shows that beginning in 2001, there has been some substitution of cellular for landline telephones, with the beginning of an increase in the number of households with cellular telephone service only (Tucker et. al. 2005). This is consistent with the above story that such substitution can lead to disconnection from all telephone service. Prior to the 1st quarter of 2001, less than 1% of households used only mobile telephone. This then increases to 4% in the 1st quarter of 2003. These households with only cellular telephone service are most likely to be students, renters, single-person households, urban, and households that are not in the highest income quartile (Tucker et al 2005). This is not inconsistent with the story that lower-income households may be making this substitution and then finding themselves disconnected completely. A later survey by the Center for Disease Control shows that by December 2004, 5.5% of households had cellular telephone only (Blumberg, Luke, Cynamon 2005). Using survey data through 2003, prior to the decline in U.S. penetration, Tucker et. al. note that as the number of households with mobile only increases, the number of households without any phone is decreasing. This suggests that from 2001 to 2003, unconnected households were making connections with mobile phones. However, the sharp decrease in telephone

penetration occurs after this survey. Are these incremental disconnected households coming from the mobile-only category?

Lifeline, Link-Up and Universal Service

The Lifeline and Link-Up programs may be helpful in understanding the cause of the recent decline in universality of voice telephony. There is a federal minimum level of support that must be provided to low-income households through these programs. Some states have established their own Lifeline and Link-Up programs, providing additional support for low-income consumers. Only one third of the eligible households currently subscribe to Lifeline and Link-Up (FCC 2004). The FCC responded by expanding eligibility, adopting outreach guidelines. (FCC 2004), and subsequently, "Lifeline Across America," a national outreach program (FCC 2005). Changes in the Lifeline and Link-Up programs, their implementation, or their ability to address the dynamics of low-income telephone use, could impact penetration. Thus, it is important to understand how these programs address the difficulties of low-income households in obtaining and maintaining their telephone service, and how these differ across states.

Some existing studies provide indications of how the Lifeline and Link-Up programs assist low-income households. Based on FCC Report and Order and Further Proposed Rulemaking (Docket 03-109, 4/29/2004), eligibility criteria are important. Originally, the federal requirements for eligibility were linked to participation in other government assistance programs that are based on income eligibility. However, this may exclude some low-income

consumers in need of Lifeline and Link-Up. This is particularly affected by recent public assistance legislative changes that place time limits on participation, even for households who otherwise remain eligible for such assistance based on sufficiently low income. States with an income eligibility requirement as well as program participation eligibility requirements may achieve greater penetration through greater use of Lifeline and Link-Up. For those states with income eligibility, the higher the multiple of Federal Poverty Guidelines used as income criteria, the higher the Lifeline subscription rates.

The FCC finds that outreach regarding Lifeline and Link-Up programs impacts uptake of benefits by those eligible: "According to an August 2000 report by Telecommunications Industries Analysis Project, the Lifeline/Link-Up take rate almost tripled from 13.1% to 39.6% when states implemented outreach initiatives designed to increase telephone penetration and participation," (Report and Order and FPR, paragraph 42). Outreach programs make a difference, but there is no data on outreach expenditures by state. Burton and Mayo (2005) use a binary variable to reflect a state's outreach efforts based on FCC identification of states engaged in special outreach efforts.[6] They find outreach is not a significant predictor of Lifeline enrollment. Rather, enrollment is enhanced by higher benefits and easy enrollment procedures. Enrollment is dampened by restrictions on vertical services and additional lines and the remaining average household expenditure for telephone services after Lifeline benefits. Federal default states, which use federal rules and criteria, may be more or less successful in achieving penetration through use of Lifeline and Link-Up than states with their own programs and rules and criteria, depending on relative effectiveness of rules and criteria.

[6] They obtained this from FCC Docket 96-45, Adopted 3/27/03.

While the differences in Lifeline and Link-Up programs may help explain the difference in penetration between states, its impact on the recent decline in penetration is less clear. Only changes in these programs, and their effectiveness in helping low income households that would otherwise disconnect stay connected, would cause the recent decline in penetration.

The distribution of Universal Service Fund (USF) support is also a possible determinant of penetration change. USF support is meant to subsidize high network costs to keep telephone connection more affordable. Figure 4 shows, as indicated by the flat linear relationship between change in support and household penetration, that there is no clear relationship between change in USF allocation and the change in penetration from 2003 to 2005.

Figure 4 illustrates how a few states have experienced large declines in their household penetration rate despite receiving increased federal support. For example, Massachusetts, Nevada, Maryland, Connecticut, and Hawaii have experienced statistically significant decreases in the household penetration rate during the same years in which the level of federal support per household has increased. Georgia, Delaware, and New Jersey, on the other hand, experienced statistically significant declines in the household penetration rate during a time in which federal support to these states was declining. The figure also shows that the one state with a statistically significant increase in the household penetration rate between 2003 and 2005, North Dakota, did so despite practically no change in the level of high-cost federal support.

Figure 4 Appears Here

Telephone Provider

It is possible that the practices of the telephone providers are linked to changes in telephone penetration. A recent Public Utility Research Center (PURC) study found that Lifeline participation rates were lower for Verizon, Alltel and small telephone companies than for BellSouth, Sprint, Qwest, and SBC (Holt and Jamison 2006). The map shown in Figure 2 above also shows that states where Qwest provides telephone service seem to have less penetration decline. This may be due to the telephone companies' different efforts in outreach or providing general information to consumers particularly in collections and other interactions potentially indicating financial difficulty. Telephone company strategies in marketing toll and value-added services or bundled services may also impact subscribership, as discussed above. Table 5 shows that the recent change in penetration (ch_penetr~05) is not highly correlated with the telephone service providers, except for Qwest. Qwest has a higher correlation of .46, showing increases in penetration. The Verizon correlation of -.33 also is worth noting, showing a decrease in penetration. Once we correct for other factors in our analysis below, this may be a meaningful driver of change.

Table 5 appears here

Inadequate Consumer Protection Laws

Consumer protection may be an important part of understanding the decline in penetration. Since disconnections are often caused by unpredictable charges, and large fees, deposits and/or outstanding unpaid balances are similarly obstacles to reconnection, consumer protection laws may help households remain connected, or reconnect. In fact, consumer protection laws may determine how the other potential drivers of penetration have contributed to the recent penetration decline. If income has decreased for many households in the country, states with strong consumer protection laws can dampen the effect on penetration. Similarly, fewer disconnects (and resulting barriers to reconnection) from unexpected charges, from increased bundled sales by telephone companies, aggressive marketing of advanced pay-by-use services, or from substitution to mobile, will occur when there is a higher level of consumer protection.

If our hypothesis is correct, then we would expect to find differences in the consumer protection policies of the states which experienced declines in penetration and those that did not. While one possibility for the decline is that there was a change in consumer protection laws, another is that there was a change in other behavior by households in their consumption of telephone service and some consumer protection laws were better able to preserve penetration under these circumstances than others.

A Model of Penetration Change by State

Data

In this section we develop an empirical model of changes in penetration by state in order to test our hypothesis of the importance of strong consumer protection to maintain penetration and thus universal service in times of innovative new products and the inevitable instability of experimentation and adoption by consumers. The dataset includes differences for years 2003 and 2005 for most variables, and for years 2002 and 2004 for variables where data for 2005 is unavailable.

Based on the discussion above, we have created a regression model to predict the change in state penetration between 2003 and 2005. Table 6 provides a list and description of the explanatory variables contained in this model.

Table 6 appears here

The variables used in this model of state telephone penetration correspond with the factors of penetration discussed in the previous section. As income is consistently found to be a significant and important predictor of penetration, it is captured by change in the percent of households below 135% of the federal poverty level and change in bankruptcies. Change in real income per capita is not included as it was not significant. We expect increases in poverty and bankruptcies to be significant and negatively related to penetration. The uncollectibles variable is also an indicator of households facing uncertain and/or unmanageable expenses in general. The change in uncollectibles should also be negatively related to the change in penetration. Income is also reflected in demographic variables often associated with lower income households, such as the change in Black households and the change in recent immigrant households. Despite prior

findings that elasticity with respect to monthly price for basic service and connection charge is very low, we include the changes in these prices to consider the possibility of a relationship to the recent decline in telephone service.

Intermodal competition is captured by the wireless variables. As the penetration variable is based on the CPS question described above, it includes wireless as well as wireline. The sign of this coefficient could be positive or negative. If it is significant and positive, it may reflect disconnected households reconnecting with wireless phones, thus increasing penetration. An insignificant coefficient for change in wireless will indicate that wireless is not contributing or dampening penetration. This may be because the added wireless phones complement wireline, or because they substitute for wireline in connected households. A significant negative coefficient would indicate that increased use of wireless phones results in an increase of disconnects from any telephone. This may be possible as wireless is our only variable that reflects unpredictability of monthly bills, known to decrease penetration as discussed above.

Note that wireless is treated as an exogenous variable. One might argue that household wireline and wireless decisions are made simultaneously. However, most wireless use is complementary to wireline. Also, when a new phone is purchased for one member of a household where there is an existing wireline telephone, our wireless variable increases while penetration is not changed.. Since most wireless decisions are independent of wireline decisions, the change in wireless is exogenous to the change in penetration.

Lifeline and Link-Up program effectiveness by state is captured by the change in Lifeline and change in Link-Up variables, which capture the change in enrollment for these programs as a percentage of eligible households. This would capture the end result of the states' outreach efforts, enrollment procedures, and other aspects of the programs that help them keep low-income households connected. A significant positive coefficient for these variables would indicate that the programs are effectively contributing to universal service, mitigating the recent decline in penetration. This would indicate that the Lifeline and Link-Up users would otherwise not be connected to the network and the programs are truly targeting the marginal users. Insignificant coefficients for these programs would indicate that even as they become more effective, they are not preventing the recent increase in disconnections, perhaps not reaching the true marginal consumer who would not subscribe without the benefits of these programs.

The effect of Qwest's practices on penetration is captured by the dummy variable that distinguishes the states where Qwest provides telephone service. We include this to capture the differences in change in penetration seen in Qwest states versus the states where other ILECs provide service in Figure 2 above. A significant coefficient for this dummy variable will indicate that the company practices impact telephone penetration, and the sign indicates if the effect is to increase penetration or decrease it.

The effect of state consumer protection laws is captured by the two dummy variables for requiring connection without a deposit to hook up service for a customer who agrees to block toll calls (State_rule), and for allowing a consumer to be disconnected for non-payment of any non-basic service (Disconnect_nonbasic). These two laws appear to be the most critical in low-

income households obtaining and maintaining their telephone service. A significant positive coefficient for State_rule would indicate that this law helps more households connect to the telephone network. A significant negative coefficient for Disconnect_nonbasic would indicate that forbidding disconnection for non-payment of nonbasic service helps low-income households stay connected to the network. The effect of these laws on how damaging uncollectible balances are is captured by the interactive variables. If the interactive variable multiplying State_rule by Uncollectibles is significant and positive, then the law helps dampen the effect of increased uncollectible balances on penetration. A significant and negative coefficient on the interactive variable multiplying Disconnect_nonbasic by Uncollectibles would indicate that allowing such disconnections increases the negative effect of unpaid balances on penetration.

Results of Econometric Model

The results of the econometric estimation of change in state penetration are shown in Table 7.

Table 7 appears here

Model 1 provides a baseline model to predict the change in telephone penetration from 2003 to 2005, containing variables indicating income, demographics, monthly and connection prices, wireless use, Link-Up enrollment, Qwest as an incumbent telephone service provider (ILEC), and consumer protection rules. The model has adjusted R^2=.40. The price variables included are not individually or jointly significant. When we exclude these variables from the model, as in Model 2, its predictive power improves, with adjusted R^2 of .55. The model also

becomes more efficient, adding more observations and eliminating two explanatory variables, an additional variable becomes significant at the 10% level, and two of the consumer protection law variables become significant at the 5% level. Also, the coefficients of the other variables do not change much when the price variables are excluded, indicating omitted variable bias is not introduced by removing these variables from the model. We continue by evaluating Model 2, as it is superior model and because we are trying to identify the most salient factors that drive demand.

The results of Model 2, shown on Table 7, provide an indication of the factors most relevant to explaining the recent decline in penetration. The change in percent of retail uncollectibles, per cap income, and bankruptcy are not included as they are not significant. Age of household was also considered and found statistically insignificant. Change in poverty and change in recent immigrant population are not significant, but the change in Black is significant.[7] The coefficients for this variable is negative, indicating an increase in Black households is associated with a decrease in state penetration. Thus, while increases in poverty are not driving the penetration decline, increases in traditionally lower-income households are contributing to the decline. The effect of competitive telephone providers (CLECS) was also considered. Different measures of competition were included in Model 2 (versions not reported here) and were not significant and did not substantially change the coefficients or significance of other variables.

The universal service policy variables apparently are not driving the recent change in penetration. The Lifeline variable is not included as it is not significant, indicating the program

[7] Significance is determined based on one-tailed tests.

does not explain the recent decline in penetration. This may be an indication of the program reaching customers after they already subscribe to telephone service, rather than reaching households that are not connected. The Link-Up variable is included and significant at the 10% level, indicating that increases in effectiveness of this program (% eligible who are enrolled) may help explain the recent change in penetration, and thus universal service, to a lesser extent than the other significant variables. Surprisingly, though, the coefficient of Link-Up is negative, indicating that increases in Link-Up enrollment are associated with decreases in penetration. This may reflect greater use of Link-Up in states where penetration is lower. The coefficient and significance (individual and joint) of Lifeline and Link-Up did not change when California was excluded.[8] Similarly, the change in amount of USF support received was not statistically significant.

The consumer protection laws do appear to have an impact on the change in state penetration. The effect of allowing telephone service providers to disconnect basic service for nonpayment of non-basic services is clear. Both the dummy and interactive variables for this law are significant and negative. This means that allowing such disconnections contributes to declines in penetration, all else equal, and that uncollectibles will increase penetration declines more in states with this law. The effect of state rules requiring service be connected without a deposit if the subscriber agrees to toll blocking is less significant but still potentially important. The coefficient for the dummy variable for this law is significant at the 15% level and positive, indicating it is possible that this law contributes to increases in state penetration. The interactive variable for this law is significant at the 10% level and has a positive coefficient, indicating that

[8] California is often considered an anomaly in Lifeline and Link-Up programs as eligibility is self-reported without verification. In unreported variations of Models 1 and 2. California was removed and the coefficient and significance of Lifeline and Link-Up did not change.

uncollectible balances contribute to penetration declines less for states with this law. These four consumer protection law variables are jointly significant at the 10% level.

The effect of the change in wireless on penetration change indicated by this model is difficult to understand. The change in wireless is significant with a negative coefficient, indicating increases in wireless telephones result in decreases in penetration. This is puzzling, as penetration includes wireless telephones. If the increase in wireless telephones was predominantly for households substituting for wireline telephones, increases in wireless would result in no change or an increase in penetration, as some of these households may have had no telephone before. If the wireless increase is complementary to wireline use, then there should be no impact on penetration.

We offer three possible explanations for the relationship between wireless change and penetration change found in Model 2. The first possible explanation is that increased wireless use indicates increased purchase of services that are charged by use, increasing the unpredictability of the telephone bill, leading to disconnection. This may be increasingly common as telephone service providers pursue more aggressive marketing and promotion efforts. Consumers who purchase wireline and wireless from the same provider can be disconnected from both for nonpayment of their wireless bill in states that do not have a law preventing this (i.e. Disconnect_nonbasic=0). Second, the increase in wireless may be substitution by low income households, who then find their telephone bills are not lower and/or are less predictable and must discontinue service. Third, it is possible that, despite the specific mention of mobile phones in the survey question, respondents misunderstand the question and answer based on wireline

telephone only. However, we do not think such misunderstanding would vary systematically by state, and thus think this third explanation, while possible, is not likely.

To further explore the possibility that the increase in wireless substitution later leads to disconnection, we created Model 3, replacing the change in wireless variable used in Model 2 with one that indicates the prior change. Table 7 shows the results of Model 3, where the change in wireless variable is included as lagged variable, reflecting the change from 2003 to 2004. Note that the explanatory power of this model is the same as for Model 2. The change in black households remains significant with a negative coefficient. In this model, change in Link-Up effectiveness remains significant at the 10% level. The effect of allowing disconnection of service for nonpayment of non-basic services remains a significant and negative driver of penetration change and of how uncollectibles impact penetration. The state rule requiring connection without deposit with toll blocking remains insignificant, and its effect on how uncollectibles impact penetration change is significant at the 10% level. The four consumer protection law variables are jointly significant at the 10% level.

When we look at change in wireless use on a lagged basis. Switching from change in wireless 2003-2005 to change in wireless 2003-2004, the coefficient of the Qwest dummy variable changes and it becomes significant. This shows that there is a relationship between the change in wireless variables and Qwest. Also, in the lagged wireless model (Model 3), Qwest is significant and positive, meaning states where Qwest provides service have a more positive change in penetration. As this is related to the increased wireless use, it may be due to the fact that Qwest is the only ILEC that dos not own its own wireless network. Qwest is a reseller of

wireless service. Qwest, then, is likely to be less aggressive in marketing wireless service to its landline customers, which may be why its states have less penetration decline. This may support the hypothesis that more aggressive marketing of additional service, including wireless, by telephone companies, which are increasingly multi-product companies, may be making bills less predictable and pushing people off the network.

The lagged change in wireless is significant with a negative coefficient, providing evidence that the second explanation of the wireless relationship above, substitution leading to disconnection, is possible. A closer look at wireless use in the U.S. population provides additional support for this explanation. Table 8 shows 2004 U.S. wireless subscription by age. Wireless penetration is 85% in 2004 for ages 20 through 49. Thus, any additional wireless penetration growth is from the very young, those older than 50, or the more marginal customers age 20 through 49. These customers are more likely to have lower incomes, find themselves unable to continue to pay for the service, and, if they are using wireless telephony as a substitute for wireline, lose their connection to any telephone network.

Table 8 appears here

These preliminary results suggest that the recent decline in U.S. penetration is driven by an increase in Black populations, telephone service provider marketing and sales practices, inadequate consumer protection laws, and increases in wireless telephones per capita.[9] The states where Qwest, the only ILEC that does not own its own wireless network, operates seem to have

[9] Our qualitative results are invariant to the use of weighted or unweighted least squares. We have reported unweighted least squares coefficient estimates.

less drop in penetration than most other states. Lifeline does not appear to have any effect on the change in penetration, while Link-Up may have a limited effect. More in-depth study of state telephone use and disconnection, both wireless and wireline, is necessary to fully understand this unexpected relationship between wireless telephones and penetration.

Conclusion

Telephone penetration has been declining in the United States since 2003. What we find most remarkable about this trend is that it has received so little attention. Acknowledgements of the decline seem to be limited to two reactions: (1) this is expected as people increasingly substitute wireless for wireline telephone service, and (2) Lifeline and Link-Up effectiveness should be improved. As this study shows, both responses are misguided.

The first reaction is based on careless disregard of the definition of penetration. Wireless substitution should not lead to penetration declines, as wireless telephone use is included in measures of penetration. If penetration declines are in fact the result of wireless substitution, then policymakers must remember that the disconnected households no longer have use of a wireless phone. This reaction indicates lack of concern for a decline in universal service that may cause serious hardships for households with no ability to access emergency services or use a telephone to obtain employment.

Efforts to improve the effectiveness of Lifeline and Link-Up, such as the recent "Lifeline Across America" initiative, are being implemented without evidence that they are likely to

address the recent decline in penetration. In fact, this study shows that the effectiveness of Lifeline does not explain the recent decline in penetration, meaning greater success in enrolling Lifeline-eligible consumers into the program has not improved a states' recent penetration decline. The effect of Link-Up effectiveness on the recent penetration decline is not clear. It is necessary to first understand the cause of the decline in universal service in order to develop an effective remedy. This study shows that improved consumer protection laws are more likely to reverse the universal decline than improvements to the take-up of Lifeline and Link-Up programs.

The recent surge of over $600m in high-cost support has coincided with a decline in the household penetration rate. This paradox suggests that the FCC should take a closer look at the effectiveness of its current programs.

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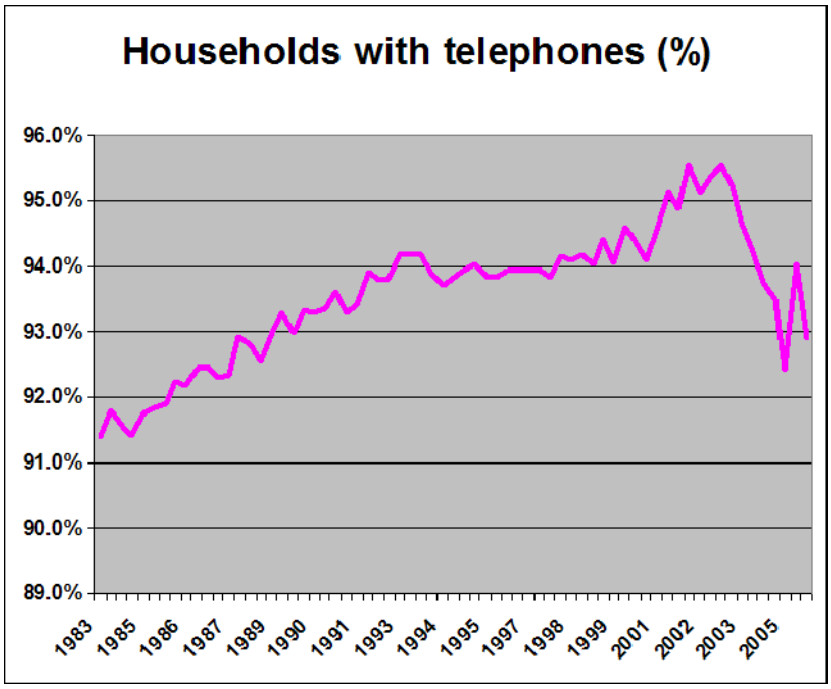
Figure 1: U.S. Telephone Penetration 1983-2005



Source: FCC

Figure 2: State Telephone Penetration Changes 2003-2005

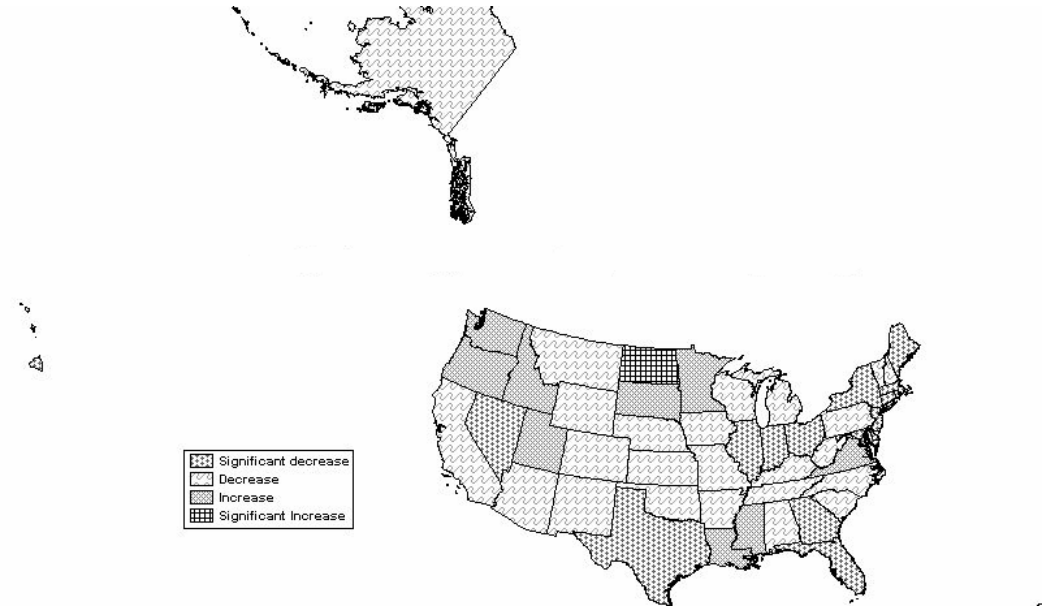
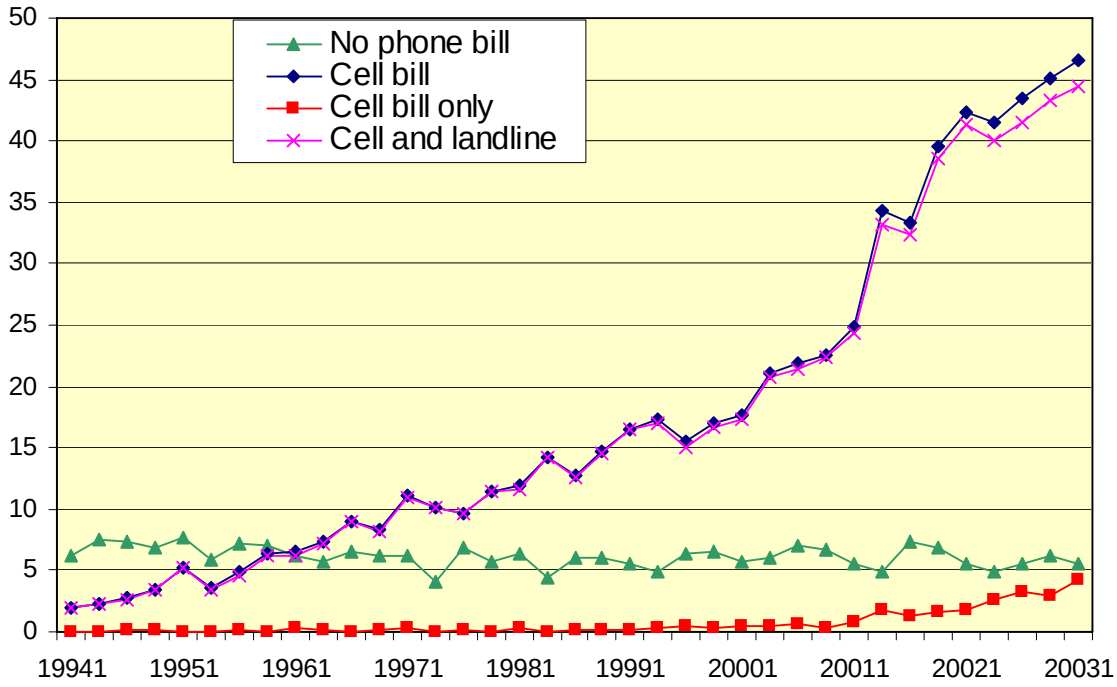


Figure 3: Estimates of percentage of households reporting telephone service between 1994 and the first quarter of 2003, by type of service



Source: Consumer Expenditure interview Survey, Bureau of Labor Statistics (Tucker et al 2005)

Figure 4: State Change in Household Penetration and Change in Federal High-Cost Support

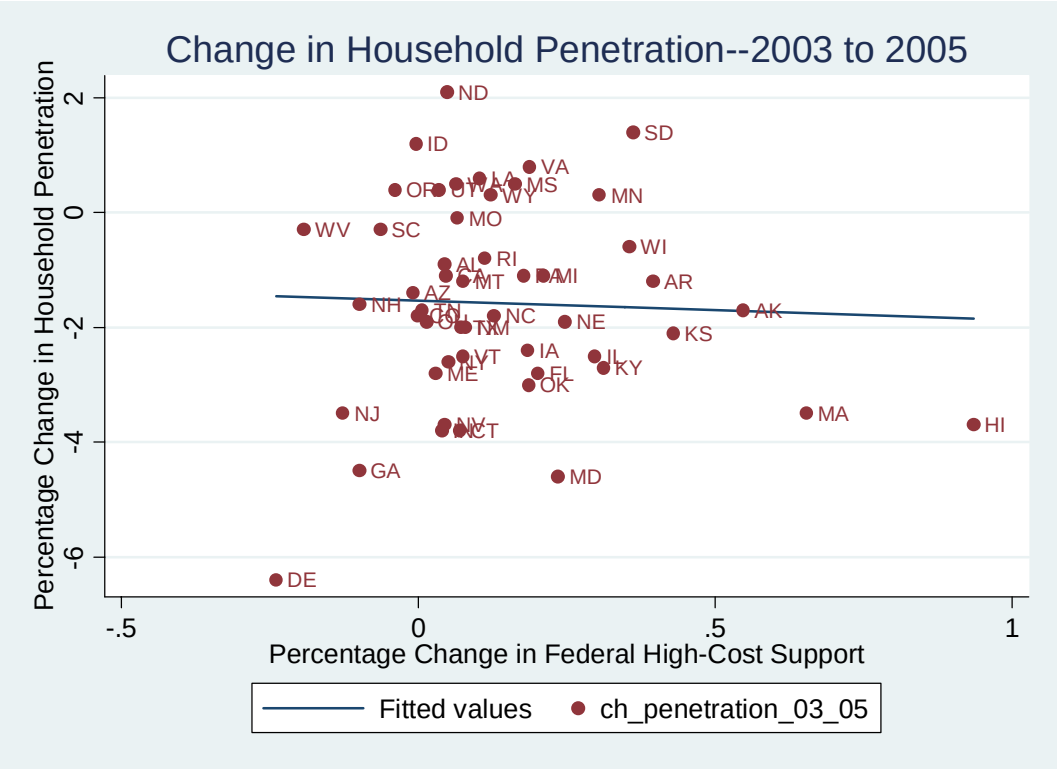


Table 1: Telephone Penetration Trends for Selected Countries				
% Households with fixed or mobile telephone service in home				
	Penetration	**Penetration**		
Country	**12/1/2003[1]**	**12/1/2005[2]**	**Change**	
Luxembourg	100.0%	100.0%	0.0%	
The Netherlands	100.0%	100.0%	0.0%	
Finland	98.0%	100.0%	2.0%	
Sweden	99.0%	100.0%	1.0%	
France	97.0%	99.0%	2.0%	
Austria	91.0%	99.0%	8.0%	
Denmark	99.0%	98.0%	-1.0%	
Greece	99.0%	98.0%	-1.0%	
Ireland	98.0%	98.0%	0.0%	
UK	99.0%	98.0%	-1.0%	
Belgium	93.0%	98.0%	5.0%	
Germany	98.0%	97.0%	-1.0%	
Spain	97.0%	97.0%	0.0%	
Italy	97.0%	96.0%	-1.0%	
Portugal	90.0%	91.0%	1.0%	
EU Average	97.0%	97.0%	0.0%	
Canada[3]	98.8%	98.8%	0.0%	
US[4,5]	94.7%	92.9%	-1.8%	
[1] Source: European Commission, 2004. *Telecoms Services Indicators.*				
[2] Source: European Commission, 2006. *E-Communications Household Survey.*				
[3] Source: CRTC, 2006. *Telecommunicaitons Monitoring Report*; Statistics Canada, 2006. *The Daily*, May 5.				
[4] As of November.				
[5] Source: FCC, 2006.				

Table 2: U.S. Household Telephone Penetration			
	Mar-03	**Nov-05**	**Change**
Total U.S. Households	95.5%	92.9%	-2.6%
Household Size:			
1 Person	92.6%	90.0%	-2.6%
2-3 People	96.6%	93.9%	-2.7%
4-5 People	97.0%	94.1%	-2.9%
6+ People	94.2%	92.8%	-1.4%
Householder's Age:			
15-24 Years Old	90.4%	86.1%	-4.3%
25-54 Years Old	95.1%	92.6%	-2.5%
55-59 Years Old	96.9%	94.5%	-2.4%
60-64 Years Old	97.3%	94.1%	-3.2%
65-69 Years Old	97.0%	95.2%	-1.8%
70-99 Years Old	97.2%	94.4%	-2.8%
Labor Force Status:			
Employed	96.7%	94.2%	-2.5%
Unemployed	92.5%	89.7%	-2.8%
Not in Labor Force	95.7%	92.7%	-3.0%
Income:			
Under $5000	80.5%	79.4%	-1.1%
$5000-$7499	86.5%	82.2%	-4.3%
$7500-$9999	89.7%	85.2%	-4.5%
$10,000-$12,499	91.6%	88.1%	-3.5%
$12,500-$14,999	92.0%	90.1%	-1.9%
$15,000-$19,999	93.6%	90.6%	-3.0%
$20,000-$24,999	94.0%	92.3%	-1.7%
$25,000-$29,999	95.8%	94.2%	-1.6%
$30,000-$34,999	96.7%	94.8%	-1.9%
$35,000-$39,999	98.0%	95.3%	-2.7%
$40,000-$49,999	98.0%	95.9%	-2.1%
$50,000-$59,999	98.6%	96.4%	-2.2%
$60,000-$74,999	98.8%	97.2%	-1.6%
$75,000+[1]	99.3%		
[1] Not available for Nov 05 based on changed categories			
Source: FCC, 2006.			

Table 3: Average U.S. Telephone Connection Charges 2002-2005

Year	Obs	Mean	Std. dev.	Max
2002	42	36.05	11.89	61.56
2003	42	36.37	12.23	60.30
2004	41	36.81	10.70	58.98
2005	41	35.62	10.35	57.22

Table 4: Average Percentage of U.S. Households in Poverty 2002 – 2004

Year	Obs	Mean	Dev.	Min	Max
2002	51	11.79	3.18	5.8	19.8
2003	51	11.85	3.01	5.8	18.1
2004	51	12.08	2.98	5.4	18.6

Table 5: Correlation of RBOCs with Change in Penetration from 2003-2005

	bellso~h	Sbc	verizon	Qwest	ch_pe~05
bellsouth	1				
Sbc	-0.24	1			
verizon	-0.29	-0.38	1		
qwest	-0.24	-0.31	-0.38	1	
ch_penetr~05	-0.01	-0.10	-0.33	0.46	1

Table 6: Variable Definitions

Ch_Penetration_03_05	Change in percentage households with telephone service in the housing unit from 2003 to 2005
Ch_immigrant_02_04	Change in percent of foreign-born residents arrived in U.S. 2000 or later from 2002 to 2004
Ch_Poverty_02_04	Change in percent of population with income less than 135% of federal poverty level from 2002 to 2004
Ch_Uncollectibles_03_05	Change in percent of ILEC retail uncollectibles from 2003 to 2005
Ch_Black_03_05	Change in percentage of households that are Black from 2003 to 2005
Ch_Wireless_03_04	Change in percent of wireless phones per capita from 2003 to 2004
Ch_Wireless_03_05	Change in percent of wireless phones per capita from 2003 to 2005
Ch_Phone_03_05	Change in basic telephone monthly rate from 2003 to 2005
Ch_Connect_03_05	Change in basic telephone connection charge from 2003 to 2005
Bellsouth	Dummy variable equal to 1 in states where BellSouth provides local service; 0 otherwise
SBC	Dummy variable equal to 1 in states where SBC provides local service; 0 otherwise
Verizon	Dummy variable equal to 1 in states where Verizon provides local service; 0 otherwise
Qwest	Dummy variable equal to 1 in states where Qwest provides local service; 0 otherwise
Ch_Lifeline_take_02_04	Change in percentage of eligible consumers enrolled in Lifeline from 2002 to 2004
Ch_Linkup_take_02_04	Change in percentage of eligible consumers enrolled in Link-Up from 2002 to 2004
State_rule	Dummy variable equal to 1 in states where no deposit is required for telephone connection if customer agrees to toll blocking; 0 otherwise
State_rule_uncollectibles	State_rule * Uncollectibles
Disconnect_nonbasic	Dummy variable equal to 1 in states where customer can be disconnected for non-payment of non-basic services; 0 if customer can only be disconnected for non-payment of basic service
Disconnect_uncollectibles	Disconnect_nonbasic * Uncollectibles

Tabel 7: Regression Results: Change in Penetration 2003-2005

(Standard errors in parentheses)

	Model 1	Model 2	Model 3
Adj R^2	0.4042	0.5452	0.5555
Ch_immigrant_02_04	-0.4507852	-0.5118278	-0.3323932
	(0.4892)	(0.4158)	(0.4298)
Ch_Poverty_02_04	0.0593955	0.0892832	0.0894278
	(0.1537)	(0.1090)	(0.1089)
Ch_Black_03_05	-1.361673	-1.260123	-0.9784949
	(0.4624) *	(0.3958) *	(0.3579) *
Ch_Wireless_03_04			-0.1834637
			(0.0504) *
Ch_Wireless_03_05	-0.1693453	-0.1491016	
	(0.0451) *	(0.0407) *	
Ch_Phone_03_05	0.084565		
	(0.2174)		
Ch_Connect_03_05	-0.0067397		
	(0.1521)		
Qwest	-0.0397122	0.704537	1.220385
	(0.5737)	(0.4768)	(0.4512) *
Ch_Linkup_take_02_04	0.0060156	-0.0583993	-0.0741866
	(0.0728)	(0.0439) **	(0.0445) **
State_rule	1.082593	2.07076	1.474008
	(1.7758)	(1.6946)	(1.7059)
State_rule_uncollectibles	139.81	182.5674	149.9148
	(114.9920)	(112.0829) **	(112.4460) **
Disconnect_nonbasic	-2.004187	-1.513095	-1.858654
	(1.0428) **	(0.6917) *	(0.6750) *
Disconnect_uncollectibles	-100.4382	-102.186	-121.0716
	(64.0506) **	(44.2950) *	(42.6594) *
Observations	39	47	46

* indicates significant at the 5% level for 1-tailed test (two-tailed test for dummy variables)

** indicates significant at the 10% level for 1-tailed test (two-tailed test for dummy variables)

Table 8: U.S. Wireless Penetration by Age

U.S. Wireless Industry Subscriber Forecast (in thousands)

Age Group	Pop.	2004 Wireless Pen.	2004 Wireless Subs.	2010E Pop.	Est. 2010 Wireless Pen.	2010E Wireless Subs.
Under 5 years	19,977	0%	0	21,183	0%	0
5 to 9 years	20,315	5%	1,016	21,542	50%	10,771
10 to 14 years	21,282	35%	7,449	22,568	77%	17,480
15 to 19 years	21,404	68%	14,630	22,697	90%	20,428
20 to 24 years	20,341	85%	17,290	21,569	93%	20,059
25 to 29 years	18,836	85%	16,010	19,973	93%	18,575
30 to 34 years	19,971	85%	16,975	21,177	93%	19,695
35 to 39 years	22,055	85%	18,746	23,387	93%	21,750
40 to 44 years	23,770	85%	20,205	25,206	93%	23,442
45 to 49 years	22,140	85%	18,819	23,477	93%	21,834
50 to 54 years	19,521	80%	15,617	20,700	93%	19,251
55 to 59 years	15,860	75%	11,895	16,818	93%	15,641
60 to 64 years	12,358	65%	8,033	13,105	93%	12,187
65 to 69 years	10,209	55%	5,615	10,826	93%	10,068
70 to 74 years	8,970	50%	4,485	9,512	80%	7,609
75 to 79 years	7,777	43%	3,344	8,246	65%	5,360
80 to 84 years	5,488	25%	1,372	5,819	50%	2,910
85 to 89 years	3,017	15%	452	3,199	50%	1,599
90 to 94 years	1,360	10%	136	1,442	50%	721
95 to 99 years	425	10%	42	450	50%	225
100 years and over	86	10%	9	91	50%	46
Total	**295,160**	**61.7%**	**182,140**	**312,989**	**79.8%**	**249,651**

Source: CTIA; Bear, Stearns & Co. Inc. estimates.