Participation in Social Programs by Consumers and Companies: A Nationwide Analysis of Participation Rates for Telephone Lifeline Programs

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We examine a unique public assistance program, the Lifeline Program, to consider why people do not participate in a program that provides them with financial benefits. Lifeline is a nationwide program created by the Federal Communications Commission to provide price discounts to low-income telephone subscribers. Recently there has been concern that program participation rates are low and that there is great variation in participation across states. Using state-level panel data, we consider reasons Lifeline participation varies among states and why only approximately one third of eligible households nationwide enroll in the program. We find that participation is actually closely aligned with what is predicted given state characteristics when we control for socio-economic and demographic characteristics. We also find that in addition to the demographic factors affecting participation, telecommunications companies appear to affect Lifeline participation rates.

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I. Introduction

The Lifeline Assistance Program (Lifeline) is a nationwide program created by the Federal Communications Commission (FCC) in 1984 to help low-income households meet the expense of telephone service. By 1989 twenty-six states participated in this discretionary program. In an effort to promote the federal goal of universal service, The Telecommunications Act of 1996 made state participation in Lifeline compulsory; an increase in Lifeline participation should increase telephone penetration. State participation means that the state adopts policies following FCC guidelines that provide price discounts on basic telephone service to low-income customers. The FCC contends that state and federal governments are jointly responsible for ensuring low-income citizens have affordable access to communication services. As such, it mandates a base level of federal support to all states and a matching component to be provided to states that make available funding for the Lifeline program.

Recently there has been interest in the effectiveness of these programs in enrolling participants. As of April 2004, only one-third of eligible households in the United States actually subscribed to the program and states vary greatly in their participation rates: California had a 131.9 percent participation rate and West Virginia had a 3.3 percent participation in 2002 (FCC, 2004).[1] The FCC includes Lifeline statistics in many of its annual telecommunications reports that provide excellent information on the status of the Lifeline program. However, the reports provide only limited analysis of factors that drive the rate of participation.

Currently, the Lifeline program is tangentially addressed in two areas of economics research: the effectiveness and importance of universal service in general, and the economics of welfare participation. Academic papers addressing federal assistance programs designed to

increase telephone penetration rates (typically referred to as universal service programs) have almost unanimously determined that such programs are ineffective and/or inefficient. For example, Roston and Wimmer (2000) find that federal universal service programs (of which Lifeline is one) have little effect on penetration rates, adversely affect the market through large taxes and adversely affect competition. Valletti, Hoernig, and Barros (2002) add that different groups of consumers are affected by universal service programs in different ways, so that determining the actual benefits to society overall is difficult.

With respect to participation in Lifeline, Burton and Mayo (2005) find that bureaucratic costs discourage participation. In a study of Lifeline participation in Florida, Hauge, Jamison, and Jewell (2006) find that demographics, socio-economic factors, and service by specific traditional telephone companies affect Lifeline participation rates. These papers begin to bridge the gap between the usefulness of universal service (and therefore the Lifeline program), and the economics of welfare participation.

Regarding the cost effectiveness of Lifeline specifically, Garbacz and Thompson (1997, 2002, 2003) find that due to small elasticities of demand for participation in the Lifeline program, it requires extremely large expenditures per household on Lifeline to increase the telephone penetration rate. Moreover, these effects have increased over the last decade; they find the Lifeline program to be ineffective, costly, and approximately nine times more expensive than a more targeted program might be. Similarly, Eriksson, Kaserman, and Mayo (1998) focus on targeted versus untargeted subsidies in considering policies to promote universal service, and find that untargeted subsidies such as Lifeline are ineffective in the telecommunications industry. In response to these and other studies, The Progress and Freedom Foundation published a report in 2005 proposing a complete restructuring of federal universal service policy to more adequately align costs and benefits and to reign in this increasingly ineffective program. These

studies concentrate on the cost and effectiveness of the program rather than on the parameters driving participation. While the question of whether the Lifeline program is worthwhile, or more generally whether public assistance should be targeted or untargeted is important, it is not the main focus of this paper. This study is concerned with factors that affect participation in Lifeline, so that we analyze participation given the existence of the program. Whether the program should exist at all is a topic for future debate.

There is a large literature on participation in public assistance programs. Currie (2004) summarizes the literature with respect to the largest means-tested programs in the US. Research on participation in Food Stamps, housing programs such as Section 8, Medicaid, the National School Lunch program (NSL), Supplemental Security Income (SSI), and Temporary Assistance for Needy Families (TANF) is particularly relevant for our research, given that these programs are frequently used to prove eligibility for Lifeline. These studies guide our empirical model and serve as useful references for predicting our results. Generally, the papers find that participation in welfare programs increases with the size of the entitlement, receipt of another welfare benefit, single parenthood, and the number of children. Participation falls with age, education, income level, urban living, white head of household, and work experience. While these effects differ in degree among the various programs, the results generally hold as stated.

Interestingly, many studies searching for reasons for high or low participation rates take into account intangible factors such as lack of information regarding the program and stigma, both of which would decrease participation in welfare programs (Moffitt, 1983). Because education decreases the probability of participation, we might assume that stigma dominates lack of information. Of course, whether either effect or another effect entirely dominates ultimately depends on the specifics of each program. Given the different levels of entitlements and the varying costs to enrollees of participating, we would expect different effects of stigma and lack

of knowledge. To date, no empirical work has been published indicating how these effects apply to the Lifeline program. We are, however, able to make some hypotheses based on the program's characteristics and on surveys conducted regarding the choice of Lifeline participation.

We expect any stigma effect to be small for a number of reasons. First, it is simple for participants to apply and they need not do so in person. Most states include information on Lifeline in a customer's bill, along with a form requesting that the potential participant respond if he receives any of the other welfare programs which qualify him to receive Lifeline, or to submit documentation of low-income. The potential participant does not need to visit an agency or deal with social workers, nor does he have to publicly claim this benefit; it simply appears as a credit on his telephone bill each month. Such anonymity should decrease the stigma effect. Also, if the marginal disutility of enrolling decreases with participation in another program, and the primary way of qualifying for Lifeline is by showing receipt of other welfare, it seems logical that the cost of enrolling in Lifeline should be lower than the cost of enrolling in other welfare programs. For these reasons, we hypothesize that either choice or lack of knowledge is the primary reason for non-participation.

Some research supports either theory. After their review of the main empirical studies of welfare participation, Andrade et al. (2002, p. 310) conclude: "It seems clear that non-participation in welfare programs is, indeed, in most cases, the result of a choice." There is not, however, theoretical research more formally addressing the issue. Future research is needed in this area. With respect to lack of information, we have some limited evidence. The Public Utility Research Center at the University of Florida conducted four surveys analyzing various aspects of participation in Lifeline. These include interviews of Floridians in person and over the telephone, as well as written surveys of households that qualify but do not participate and those that qualify and had disconnected their telephone service.[2] Lack of information was shown to be the main

indicator of lack of participation in Lifeline in Florida. Because telephone companies are responsible for notifying customers of the availability of Lifeline, we expect lack of information to be reflected in the telephone company variables used in our empirical analysis.

Finally, literature regarding re-entry into welfare programs is important. Analyzing families that left welfare, Bruce, Barbour, and Thacker (2004) identify determinants of reentry, similar to our analysis in that we look for characteristics of participants that might indicate an increased propensity to participate in the Lifeline program. The Lifeline program is different, however, in that households do not face time limits on participation; a household may receive Lifeline assistance as long as it meets eligibility requirements. While the household's other welfare benefits may end, such occasion would result only in the household being required to prove eligibility through income rather than participation in another welfare program.

This paper fills a gap in the literature by examining factors that affect participation nationwide for a program that previous studies have not considered. We find gender, education, age, and the relative level of entitlement affect participation. These results lend greater support to other research on participation rates, given the relatively lower expected effect of stigma. It provides a reasonable approximation of low participation rates in the absence of stigma effects, thereby supporting the theory that lack of participation may be a rational choice. While we cannot differentiate a rational choice to not participate from lack of knowledge of a program, we can attribute lack of knowledge to the companies responsible for implementing the program. Some telephone companies appear to experience greater levels of Lifeline participation than other companies, although the magnitudes of these effects are relatively small; specifically, Alltel, BellSouth, SBC, and Sprint are associated with greater Lifeline participation rates, while Verizon is associated with a lower participation rate nationwide, relative to smaller telephone companies.

Our results are important given the goal of universal service. There is a wealth of information regarding the public policy goal of universal service and the debate over this particular universal service program continues. At this time, regulators and the FCC are pushing for increased participation rather than contemplating the effectiveness of the program. Given regulators' emphasis on participation rates, analyzing why these rates vary across states may help regulators resolve that debate and move on to considering whether continuation of the program is reasonable and appropriate. Such research is already beginning. Holt and Jamison (2006) evaluate the FCC's policies in an effort to answer the question of whether Lifeline's role in universal service is worthwhile. They argue that the FCC's focus on participation rates is misdirected and that the program should be transformed to a voucher program that each state would fund itself. Still, our focus is to understand participation rates; an evaluation of the usefulness of the program itself is a topic for another study.

II. Structure of the Lifeline Program

The FCC establishes guidelines for Lifeline funding and enrollment requirements, and provides some funding; however, each state develops its own policies based on the FCC's guidelines (FCC, 2005). States choosing not to contribute funds directly to Lifeline receive lower federal funding, but residents of those states still are entitled to the basic level of support through the FCC. Under the FCC guidelines, there are four tiers of monthly federal Lifeline support. The first tier of federal support is a credit (up to $6.50 per month) available to all eligible subscribers; this represents a waiver of the federal subscriber line charge, which is a charge to telephone subscribers to recover the interstate portion of service provider costs of providing traditional telephone lines.[3] The second tier of federal support is a $1.75 monthly credit also available to all eligible subscribers; this represents a reduction in the basic local rate, and is available if all

relevant state regulatory authorities approve such a reduction, which all now have done. The third tier of federal support is one-half the amount of additional state support up to a maximum of $1.75 per month in federal support. The fourth tier of support, available only to eligible subscribers living on tribal lands, provides an additional credit up to $25.00 per month. Table One lists the states that did not provide additional state support of the federal funding. While the average state support over the years 2000 through 2004 was $2.67 per household per month, the most common amount was $3.50 per month (the highest amount that would incur the highest possible matching federal funding). Of states choosing to contribute, state monthly support ranged from a low of 66 cents (Illinois in 2003) to over $8 per household. Massachusetts provided the greatest state funding, offering $6 per household per month from 2000 through 2003, and $8.25 per household per month in 2004 (FCC *Universal Service Monitoring Report*).

[INSERT TABLE ONE]

According to the FCC guidelines, eligible telecommunications carriers within each state may provide an additional $3.50 monthly credit to Lifeline customers' bills, so that eligible beneficiaries can receive a maximum total monthly credit of up to $13.50, consisting of up to $10.00 ($6.50 + $1.75 + $1.75) in federal support and $3.50 in state support.[4] The telephone subscriber may receive a lesser credit if the subscriber's bill for basic local telephone service is less than the maximum available credit or if the state does not contribute any funds, in which case the third tier of federal support and the additional state support are missing. The fourth tier of support for those living on tribal lands is limited to the extent that the credit does not bring the basic local residential rate below $1.00 per month. At no time is the customer's bill for local service less than zero.

The FCC allows each state some leeway in the administration of the program. Some states choose to accept only one or a few of the federal guidelines, or they may develop their

own standards entirely. For example, Florida's eligibility criteria, like the federal default eligibility criteria, currently include TANF, Medicaid, Food Stamps, SSI, FPHA, LIHEAP, and Bureau of Indian Affairs Programs.)[5] During the time period for our study, California allowed households to self-certify that they were eligible for Lifeline, which resulted in California's participation rate being greater than 100 percent of eligible beneficiaries. In Vermont, Verizon determines eligible beneficiaries by their participation in the federal Food Stamps, Medicaid, SSI, or TANF programs, and accepts an income eligibility criterion of 150 percent of the federal poverty guidelines (FPG). In Texas, Verizon also accepts beneficiaries based on participation in Federal Public Housing Assistance (FPHA) or the Low-Income Home Energy Assistance Program (LIHEAP), but limits the income eligibility criterion to 125 percent of FPG. Within each state, policies may vary among individual telecommunications carriers. In Florida for example, customers of the largest incumbent local exchange companies – BellSouth, Verizon, and Sprint – qualify for Lifeline if their annual household income is no greater than 135 percent of FPG. Furthermore, the larger companies' customers qualify for Lifeline if the household participates in NSL, but this program is not a qualifying criterion for Lifeline for customers of the smaller incumbent local exchange companies.

To increase eligibility and participation, in 2005 the FCC expanded the federal default eligibility criteria. The income-based criterion was raised to 135 percent of FPG from 125 percent. Also, two additional federal means-tested programs were added: NSL and TANF.[6] Lastly, the FCC required states to adopt certification and verification procedures and outreach guidelines for increasing participation in the Lifeline program. The California situation demonstrates that proving eligibility is imperative for Lifeline subscribers. Generally, subscribers must sign under penalty of perjury that they participate in one of the Lifeline eligible programs (which must be identified) or qualify based on household income below a certain percentage of

the federal poverty guidelines. Consistent with the FCC's order, telecommunications companies are to verify annually the continued eligibility of a statistically valid sample of their Lifeline subscribers.

III. Methodology and Data

To analyze Lifeline participation rates, this study uses a theoretical model of household utility maximization and an empirical model that includes state demographic factors and company-specific measures to ascertain the determinants of the Lifeline participation rate. Assume that household *i* located in state *j* maximizes per period utility, given in equation (1), subject to the budget constraint given in equation (2).

(1) $U_{ij} = U[T_{ij}, Z_{ij}]$

(2) $I_{ij} = (P_j \times T_{ij}) + Z_{ij}$

Utility is a function of telephone services (T) and consumption of a composite good (Z). Income (I) and the price of telephone services (P) are exogenous, and the price of the composite good is normalized to one. Further assume that this household is eligible for the Lifeline program, which allows the household to purchase a fixed amount of telephone services (L) at a subsidized price. The price of telephone service when receiving the Lifeline subsidy is the difference between P and the amount of the subsidy (S), which both vary by state. Although we argue in the introduction that stigma effects will be small, there may be stigma attached to Lifeline participation. Assume the Lifeline stigma cost, C, is fixed and must be subtracted from a household's utility if the Lifeline subsidy is accepted, and assume that stigma cost can vary across households.

Under the above assumptions, utility maximization implies the following decision rule for Lifeline participation:

(3) participate if $U[L_{ij}, I_{ij} - (P_j - S_j)\times L_{ij}] - C_{ij} \geq U[T_{ij}, I_{ij} - P_j \times T_{ij}]$ and

do not participate otherwise.

Thus, a household will choose to participate in Lifeline if and only if the total utility associated with participating is greater than or equal to the utility associated with not participating. The model predicts that the probability of Lifeline participation is increasing in *P*, since any increase in the price of telephone services makes the Lifeline program more valuable. Also, since any increase in *S* makes the Lifeline program less expensive, the probability of Lifeline participation is increasing in the amount of the Lifeline subsidy. Furthermore, any increase in stigma costs decreases the utility associated with participation; thus, Lifeline participation is decreasing in *C*. As discussed previously, we expect that lack of information may be an important determinant in the decision to participate in Lifeline. A household that knows little of benefits of the Lifeline program will be less likely to assign a high value to utility associated with participation. Thus, the model predicts that participation will be increasing in the level of knowledge of the program. Label the utility difference in equation (3) y_{ij}, and assume it takes on a linear functional form, so that equation (3) becomes the following:

(4) participate if $y_{ij} = \gamma x_{ij} + e_{ij}$ and

do not participate otherwise.

Note that y_{ij} is unobservable and is, therefore, a latent variable.

With household-level data, models like equation (4) are normally estimated using either probit or logit, depending on the assumed distribution of e**.** Furthermore, the matrix x_{ij} of exogenous variables would include income, the amount of the Lifeline subsidy, the price of telephone services, stigma cost, and knowledge of the Lifeline program, as well as measures that impact utility through the marginal utility of Lifeline participation relative to non-participation and the marginal utility of income. However, we do not observe household Lifeline choices in

our data. Instead, we observe the number of Lifeline participants out of the number eligible within each state.[7] Although we do not observe household decisions, we can use the household utility maximization model discussed above to motivate our state-level empirical analysis. If the data are generated in the manner given in equation (4), then the determinants of Lifeline participation at the state level will be the determinants at the household level (i.e., components of the matrix x_{ij}) aggregated up to the state level. Note that although the determinants at the state level are assumed to be the same as the determinants at the individual-level, the coefficients from our state-level analysis cannot be interpreted as individual-level effects due to aggregation issues. Specifically, we cannot recover the vector γ of household-level parameters.

Dependent Variable

As discussed above, Lifeline subscribers choose to subscribe on a household basis; however, our data set measures the sum of these decisions at the state level. Specifically, we observe the number of positive outcomes (Lifeline subscribers) based on a total number of potential positive outcomes (eligible households). Thus, our outcome variable is grouped in percentage terms: the number of subscribers divided by the number of eligible individuals. Models with grouped data are normally estimated with weighted least squares. Weights are needed to account for the heteroskedasticity associated with observations being clustered by state. We employ a minimum logit chi-square specification in which the dependent variable is the logit of the Lifeline participation rate, i.e., the natural log of the Lifeline participation rate divided by one minus the Lifeline participation rate (Maddala, 1983, p. 30; Papke and Wooldridge, 1996, p. 620; Greene, 2003, p. 687).[8]

We construct our model using a complete panel of observations on 48 states plus the District of Columbia for the years 1998 through 2004. The panel nature of the data allows us to use a random effects estimator.[9] In the random effects model, individual-specific effects

measuring unobservable state characteristics are modeled and estimated as being randomly distributed across states. Our random effects specification is given in equation (5), where *j* indicates state, *t* indicates year, and ρ is the Lifeline participation rate.

$$(5) \qquad \ln(\rho_{jt}/(1-\rho_{jt})) = \alpha + X_{jt}\beta + (u_j + \varepsilon_{jt})$$

The time-invariant, state-specific effect (u_j) is modeled and estimated as part of a well-behaved, normally distributed error term ($u_{ij} + \varepsilon_{jt}$). The matrix X_{jt} contains household and state measures for state *j* in year *t,* and the vector β and the constant term α represent parameters to be estimated. The equation is estimated using weighted feasible generalized least squares (FGLS), allowing the variance of *u* to vary across states to control for heterogeneity across panels (Greene, 2003, pp. 293-298).

Matrix X_{jt} of Explanatory Variables

Given the assumption concerning generation of the Lifeline participation data, the determinants of state-level participation rates should include the measures included in matrix x_i of equation (4), aggregated to the state level. Thus, the matrix X_{jt} of exogenous variables will include state-level measures of variables that are expected to impact individual utility maximization, either through the effect on the marginal utility of income, on the price of Lifeline participation, or on the marginal utility of Lifeline participation relative to other options. Since the participation rate is a ratio of participating households to eligible households, the matrix X_{jt} must also include measures expected to impact variations in the number of eligible households by state. The explanatory variables are divided into two categories: measures of the telecommunications environment and characteristics of the population.[10]

For the first category, we include a series of variables measuring the percentage of each state's telecommunications service that is provided by each company. This allows an estimate of a provider-specific effect for Alltel, BellSouth, Qwest, SBC, Sprint, and Verizon relative to all

other carriers, which are normally small, regional providers.[11] The provider-specific variables are denoted by provider name, for example, the variable *Percent BellSouth* indicates the percentage of a state's total telecommunications service that is provided by BellSouth. The percentage is determined by weighting BellSouth's presence by its total operating revenue in each state for each year. As it is the responsibility of each company to inform customers of the benefits of Lifeline, we expect the provider-specific variables to pick up much of the effect of program knowledge on participation.

The variable *Eligibility* measures the range of eligibility standards for Lifeline qualification across states and varies from 1 to 8, with higher values indicating the existence of more ways to qualify for the Lifeline subsidy. *Eligibility* measures the criteria that each company accepts as compared to the federal default criteria discussed in Section II, weighted by the provider's presence in the state, indicating a given state's "compliance" with respect to the federal default criteria. The weights assigned are based on a company's total operating revenues within that state. For example, there are eight ways to qualify for Lifeline under the federal default guidelines: seven programs and one income based criterion. If each telephone company offering Lifeline service within a state matches the default, *Eligibility* = 8; if companies representing half the total telecommunications services within a state match the default and half accept only four of the programs, *Eligibility* = $(0.5 \times 8) + (0.5 \times 4) = 6$. Eligibility standards should impact the number of eligible households separately from the participation decision. Thus, we expect a smaller dependent variable for a state with more ways to qualify, ceteris paribus, due to a larger number of eligible households.[12]

Given existing research and our theoretical model, we expect the local telephone rate to affect the participation decision. The variable *Local Phone Rate* is the average monthly charge within a state for a single, residential line excluding taxes.[13] For households that purchase

telephone service, higher rates decrease household income available for other goods, which increases the value of the Lifeline discount. Studies of welfare participation overwhelmingly support the assertion that more valuable entitlements increase the probability of participation (Andrade et al., 2002). Therefore, as the local telephone rate increases, an offsetting entitlement should become increasingly attractive.

We also include a variable that reflects each state's support of the Lifeline program each year. States that contribute to the Lifeline program are eligible to receive additional federal funding as described in above. The variable *Lifeline Subsidy* is the monthly amount of total support a household can receive under the Lifeline program by state and year, including federal support and additional state support. From the theoretical model, we expect that greater funds received would increase participation for two reasons. First, a greater subsidy implies greater entitlements, which increase participation as described above. Second, the level of a state's participation in the Lifeline program reflects the overall level of support for that program. That support may be reflected in the manner in which the state regulates telecommunications providers and how strongly the state requires providers to actively recruit Lifeline participants.

The second category of variables is composed of characteristics of each state's population that are expected to influence either the number of eligible households or the utility of Lifeline participation relative to the utility of non-participation. Studies evaluating participation in other welfare programs have concluded that participation falls with education (Andrade et al, 2002). Therefore, we control for the percentage of the population that finished high school but has no further education (*Percent High School*) and the percentage of the population that has a college degree (*Percent College*), with the excluded category the percentage with less than a high school education. In keeping with prior studies, we expect that race and gender may affect costs and preferences (Blundell, Fry, and Walker, 1988; Blank and Ruggles, 1996; Hoynes, 1996). We

control for the percentage of the population that is white (*Percent White*, excluded category other races) and the percentage of the population that is female (*Percent Female*). Some studies of welfare program participation focus on female heads of households (e.g., Blank, 1985; Blank and Ruggles, 1996; Fraker and Moffit, 1988; Moffit, 1983). In general, these studies find that factors other than gender more frequently determine participation; among such factors is single-parenthood. Since over 80 percent of single parents are women, we expect Lifeline participation to be positively correlated with the percentage of the population that is female.[14]

Preferences and costs may vary with age, so we include the median age of the population (*Median Age*). Results of prior studies generally find that participation in welfare programs declines with age (Blundell, Fry, and Walker, 1988; Stuber and Kronebusch, 2004). We might expect a positive correlation between age and participation given the assumed lower transaction costs of enrollment among the elderly; however, a combination of lack of knowledge about the program, stigma associated with welfare, and perceived lack of need for the subsidy would lead us to predict a negative effect. States with more urban inhabitants (*Percent Urban*) may differ from more rural states. An eligible urban household may not enroll due to available substitutes for phone service such as family or friends with telephone service in close proximity.[15] Given the nature of the Lifeline program and the availability of substitutes for the subsidized good, we predict a negative correlation between Lifeline participation and urban living.

On a broader scale, poor states may differ from rich states in participation rates. We capture this effect with two measures: the percentage of households on government assistance (*Percent Welfare*) and median household income (*Median Income*). Past research has found that participation in welfare programs is higher in states with relatively more recipients of any government assistance program (McGarry, 1995; Yelowitz, 2000). Because of the manner in which Lifeline participants frequently prove eligibility (by proving receipt of another welfare

program) and because of the wealth of other studies reporting such correlation, participation in Lifeline should be positively correlated with the percentage of the population receiving some form of government assistance. Welfare stigma costs are a function of many of the same variables that influence the Lifeline participation decision. However, we expect that *Percent Welfare* may capture a substantial part of the effect of stigma in our data; once one has applied for any type of welfare assistance, the marginal disutility of applying for additional government assistance falls. Research generally shows a negative correlation between median household income and participation in welfare programs (Blank and Ruggles, 1996; Blundell, Fry, and Walker, 1988); we expect the same relationship with respect to the Lifeline program.

While studies of other welfare programs are inconclusive regarding the effect of the length of time a household has remained in a particular residence, we expect that housing tenure will affect the participation decision, as most telephone service is directly tied to a customer's home. *Percent Transient* is the percentage of households that have moved from one residence to another residence within the past five years. We expect a more transient population to have lower participation in the Lifeline program simply due to the necessity of repeating the enrollment process each time new telephone service is established. Summary statistics for the variables used in this study are in Table Two below.[16]

[INSERT TABLE TWO]

IV. Results

The results of the weighted FGLS estimation of equation (5) are presented in Table Three. Due to the non-linear construction of the dependent variable, the coefficients cannot be interpreted as marginal effects of the independent variables on the Lifeline participation rate. In non-linear estimations, there are two methods commonly used to produce marginal effects:

compute the marginal effects at sample means, or simulate marginal effects. We simulate marginal effects by changing the relevant independent variable by 10 percent and comparing the pre-change and the post-change predicted participation rates using the coefficients from Table Three. In this way, we can compute the marginal effect and report it in elasticity terms. Specifically, the reported marginal effects are interpreted as the percentage change in the participation rate associated with a one percent change in the independent variable, i.e., the elasticity of Lifeline participation with respect to the independent variable.

[INSERT TABLE THREE]

With respect to measures of the telecommunications environment, the results from Table Three indicate that the provider-specific effects are statistically significant for all except Qwest. States in which Alltel, BellSouth, SBC, and Sprint have a larger portion of the telephone market relative to smaller telephone providers have higher participation rates, although the marginal effects show that the impact on the participation rate is small. A stronger Verizon market presence appears to have a negative effect relative to service by smaller companies. Given our dependent variable, we cannot distinguish between the effect of the provider-specific variables on participation and on the number of eligible households. Clearly the provider's efforts might affect the number of participating households; however, we also are aware that the provider might simply be located in a state with lower participation and therefore the provider-specific effect might reflect a state effect. Our models attempt to distinguish these possibilities. Focusing on the effect of the provider-specific variables on participation, if we consider lack of knowledge of the Lifeline program a cause for non-participation, the results suggest that Alltel, BellSouth, SBC, and Sprint may be more effective at publicizing Lifeline than other eligible telecommunications carriers. *Eligibility* is insignificant, indicating that the expansion of eligibility requirements has had little effect on participation rates, or that the state-level random

effects or some combination of the state-level socio-economic variables are picking up the effect of Lifeline eligibility standards on the number of eligible households.

As expected, *Local Phone Rate* is a significantly positive determinant of the state-level Lifeline participation rate, and the participation rate appears to be inelastic with respect to changes in the cost of phone service. Entitlements of greater value increase the probability of participation; however, our results indicate that the Lifeline subsidy must increase dramatically in order for participation in the program to increase slightly for given eligibility standards. This finding supports the studies by Garbacz and Thompson (1997, 2002, 2003). Similarly, a larger subsidy is positively related to the participation rate, and the participation rate is shown to be roughly unit elastic with respect to changes in *Lifeline Subsidy*. This suggests that states' policies can significantly influence the participation decisions of telephone companies, and that the efforts of public service commissions to promote Lifeline within their states may prove to be effective. However, the Lifeline subsidy would have to increase substantially to have a meaningful effect in policy terms on the participation rate.

With the exception of *Percent Urban*, characteristics of the population are significant determinants of the Lifeline participation rate; in addition, the marginal effects show that participation is elastic with respect to the significant characteristics, in some cases highly elastic. Positive and significant coefficients are found for *Percent High School*, *Percent College*, *Percent White*, *Percent Female*, and *Percent Welfare*. States with relatively more educated populations have significantly higher participation rates, possibly because educated persons are comparatively better at finding, understanding, and applying for support. In addition, more educated populations imply fewer eligible households, which would also increase the participation rate. If welfare stigma were a dominant determinant of participation, we would expect the participation rate to decrease with education as associations with more highly-

educated persons would discourage peers from applying for welfare (termed “peer group stigma effect” by Blundell, Fry and Walker, 1988). Thus, this result supports our initial prediction of a small stigma effect due to the structure of the Lifeline program and supports the notion that lack of knowledge is the predominant reason for low participation.

Percent White is positive and significant. While some studies indicate race may be associated with welfare participation, the results seem to be dependent on the characteristics of each welfare program. Our Lifeline participation results are in agreement with Blank and Ruggles (1996) study of AFDC. Also in agreement with our initial prediction, states with relatively higher percentages of females have greater participation rates, a result which agrees with a number of other studies (e.g., Bruce, Barbour, and Thacker, 2003). The relatively large marginal effect for *Percent Female* is indicative of the importance that gender has on the participation rate. Again, we cannot be certain whether states with proportionally more females have more participants or fewer eligible households. However, given the previously cited prevalence of females as heads of single-parent households, once could conjecture that the observed coefficient is due to greater participation rates among women. Receiving government assistance of another form has a positive and significant effect on a state’s Lifeline participation as expected. Since states with proportionally more welfare recipients will also have more eligible households, the significantly positive effect of *Percent Welfare* suggests that as the number of eligible households rises, the number of these households that choose to participate increases at a greater rate. This result is expected since both the stigma effect and costs of applying for welfare are decreasing in receipt of welfare.

Negative and significant coefficients are found for *Median Age, Median Income,* and *Percent Transient*. Since welfare participation is frequently found to decrease with age and income, the first two results are not surprising. Since the number of eligible households should

be lower in states with higher median incomes, we can infer that the effect of income on participation is larger in absolute value than the coefficient. States with populations that move more frequently have lower participation rates, suggesting that transience implies fewer connections to the community (by which one might learn of public assistance programs), and less incentive to invest in housing services. The coefficient on *Percent Urban* is insignificant, possibly due to offsetting effects on participation and household eligibility.

The results presented in Table Three are estimated with state-level random effects. Given that many of our independent variables are also state-level indicators, one might suggest that the random effects are redundant. To address this concern, we present weighted OLS estimates in Table Four excluding state-level random effects. In this case, observations are weighted by the number of eligible households to control for heteroskadasticity. The signs, magnitude and significance levels for this model are remarkably similar to the FGLS model, with the OLS results being somewhat less strong in terms of overall fit. Additionally, the coefficients and marginal effects in Table Four are generally larger in absolute value as might be expected, although this is not the case for all variables. Only two variables are distinctly impacted in terms of statistical significance. *Percent BellSouth* is not significant in the OLS model, which is not troubling as the magnitude of the BellSouth effect in the FGLS model is small. More importantly, *Eligibility* is marginally significant in the OLS model. Because the OLS model excludes state-level effects, the *Eligibility* variable may be picking up differences among the states that in the FGLS model were attributed to the random effects. The strong similarities between the two models generate increased confidence in our results.[17]

[INSERT TABLE FOUR]

V. Conclusion

The Lifeline participation rate nationwide is exceptionally low, especially considering the costs to beneficiaries of receiving the subsidy are small. This study provides insight into the types of policies that might serve to increase the effectiveness of the Lifeline program in promoting universal telecommunications service. Economic analysis might conclude that the Lifeline program is not attractive to eligible households because the benefit is less than the cost of receiving the Lifeline subsidy. An obvious policy response would be to increase the subsidy. To get a rough approximation of the dollar costs of increasing the Lifeline subsidy, consider the averages from Table Two and the estimated marginal effects from Table Three. If the federal government wanted to increase the participation rate nationwide to 25 percent of eligible households (an increase of 7.8 percent from the sample average of 0.232), it would have to increase the average subsidy by 6.7 percent or 70 cents (based on the sample average of $10.53). Given the current number of eligible households, the government would have to increase spending on Lifeline by $31.1 million annually. Arguably, policymakers would not be satisfied with such an incremental change in Lifeline participation, and a more politically meaningful change would cost much more. For instance, an increase in Lifeline participation to 30 percent of eligible households would cost $142 million annually, while an increase to 40 percent would cost $467.7 million annually.

However, there is reason to believe that a lack of knowledge about the Lifeline program on the part of eligible households may be a more important factor in the low participation rate. Before considering increased funding for a subsidy program that may have limited benefits, states may consider addressing the low participation rate by increasing awareness of Lifeline. For instance, our results indicate that states with proportionally more educated citizens have higher Lifeline participation rates. Since education is often correlated with knowledge of public programs, states may be able to increase Lifeline awareness and participation by targeting the

less educated population in a campaign to increase knowledge of the program. Furthermore, our results suggest that states with proportionally more welfare recipients have higher Lifeline participation rates. Given the low marginal stigma cost of Lifeline participation once a household has already applied for welfare, states may be able to increase Lifeline participation by allowing welfare applicants to simultaneously enroll in Lifeline. Focusing on increasing awareness and facilitating access to the Lifeline program could be low cost alternatives to increasing the subsidy to achieve the FCC's goal of increasing Lifeline participation.

Because universal service is an essential concern of the FCC and the federal government, this research is of great consequence in policy circles. The cost effectiveness of subsidies and the type of subsidy that would most benefit the goal of universal residential telephone service must be considered in light of these results. Our research supports the findings of other research with respect to household characteristics that are associated with increased participation in public assistance programs. This study also supports the conclusion that the Lifeline program is costly and as an untargeted subsidy, increasing the effectiveness of the program is exceedingly complicated. These questions must continue to be asked and analyzed on a broad scale to determine the future of the Lifeline program and of the goal of universal service generally.

Table One
States Providing Zero Lifeline Support

State	2000	2001	2002	2003	2004
Arkansas	●	●	●		
Delaware	●	●	●		
Hawaii	●	●	●	●	●
Iowa	●	●	●		
Illinois	●	●	●		●
Louisiana	●	●	●	●	●
Minnesota	●	●	●	●	
Missouri	●	●	●		
New Hampshire	●	●	●	●	●
New Jersey	●	●	●		
Ohio	●	●	●		
South Dakota	●	●	●	●	

Table Two
Summary Statistics
N = 294

Variable	Mean	Std. Dev.	Min.	Max.
Lifeline Subscribers	62,415.64	97,414.25	606	657,267
Eligible Population	298,000.1	333,399.8	22,168	1,752,323
Lifeline Participation Rate	0.232	0.187	0.013	0.933
Logit of Participation Rate	-1.48	1.14	-4.36	2.63
Percent BellSouth	14.79	32.13	0	100
Percent Sprint	3.95	11.14	0	68.46
Percent Verizon	30.42	41.06	0	100
Percent Qwest	25.25	40.62	0	100
Percent Alltel	1.70	6.70	0	36.56
Percent SBC	12.42	28.90	0	100
Eligibility	4.87	2.02	1	8
Local Phone Rate	20.68	5.70	7.45	35.55
Lifeline Subsidy	10.53	2.58	5.25	18.45
Median Income/1000	41.31	6.27	29.70	55.15
Median Age	35.50	1.83	27.10	38.90
Percent High School	34.46	5.12	22.94	47.40
Percent College	17.75	2.95	10.69	23.53
Percent White	73.68	11.89	27.66	89.16
Percent Female	50.90	0.83	48.27	53.01
Percent Urban	71.41	14.73	33.57	100
Percent Transient	67.61	5.82	40.76	75.18
Percent Welfare	3.44	1.22	1.71	8.67

Table Three
Weighted FGLS Results Including Random State-Level Effects
Dependent Variable = Logit of Lifeline Participation Rate
N = 294

	Coefficient (Standard Error)	**Marginal Effect**
Percent Bell South	0.004*** (0.001)	0.059
Percent Sprint	0.023*** (0.003)	0.076
Percent Verizon	-0.004*** (0.001)	-0.110
Percent Qwest	0.004 (0.006)	0.005
Percent Alltel	0.006*** (0.002)	0.120
Percent SBC	0.011*** (0.002)	0.112
Eligibility	-0.025 (0.017)	-0.097
Local Phone Rate	0.011** (0.005)	0.176
Lifeline Subsidy	0.135*** (0.013)	1.166
Median Income/1000	-0.034*** (0.010)	-1.064
Median Age	-0.080*** (0.025)	-1.831
Percent High School	0.065*** (0.012)	1.942
Percent College	0.230*** (0.022)	3.638
Percent White	0.025*** (0.005)	1.576
Percent Female	0.190*** (0.070)	10.187
Percent Urban	-0.003 (0.003)	-0.192
Percent Transient	-0.064*** (0.009)	-3.017
Percent Welfare	0.440*** (0.044)	1.244
constant	-14.322*** (3.531)	
pseudo R^2	0.553	

*** Significant at 1%
** Significant at 5%

Table Four
Weighted OLS Results Excluding Random State-Level Effects
Dependent Variable = Logit of Lifeline Participation Rate
N = 294

	Coefficient (Standard Error)	**Marginal Effect**
Percent Bell South	-0.001 (0.003)	0.010
Percent Sprint	0.025*** (0.006)	0.084
Percent Verizon	-0.006** (0.002)	-0.129
Percent Qwest	0.006 (0.008)	0.008
Percent Alltel	0.005** (0.002)	0.092
Percent SBC	0.008*** (0.002)	0.081
Eligibility	-0.053* (0.029)	-0.205
Local Phone Rate	0.012* (0.008)	0.204
Lifeline Subsidy	0.124*** (0.021)	1.061
Median Income/1000	-0.056*** (0.017)	-1.692
Median Age	-0.146*** (0.040)	-3.475
Percent High School	0.099*** (0.018)	3.030
Percent College	0.277*** (0.038)	4.410
Percent White	0.014** (0.007)	0.862
Percent Female	0.243** (0.102)	13.697
Percent Urban	0.005 (0.005)	0.290
Percent Transient	-0.057*** (0.013)	-2.718
Percent Welfare	0.470** (0.070)	1.310
constant	-15.313*** (5.242)	
adjusted R^2	0.495	

*** Significant at 1%
** Significant at 5%
* Significant at 10%

Appendix
Weighted FGLS and OLS Results
Dependent Variable = Lifeline Participation Rate
(standard errors in parentheses)
N = 294

	FGLS With State Effects	**OLS Without State Effects**
Percent Bell South	0.0006*** (0.0002)	-0.0002 (0.0004)
Percent Sprint	0.0021*** (0.0005)	0.0027*** (0.0009)
Percent Verizon	-0.0006*** (0.0002)	-0.0010*** (0.0004)
Percent Qwest	-0.0003 (0.0008)	0.0001 (0.0013)
Percent Alltel	0.0009*** (0.0003)	0.0009** (0.0004)
Percent SBC	0.0012*** (0.0002)	0.0009*** (0.0003)
Eligibility	-0.0057** (0.0024)	-0.0083* (0.0045)
Local Phone Rate	0.0008 (0.0006)	0.0019 (0.0012)
Lifeline Subsidy	0.0156*** (0.0017)	0.0180*** (0.0034)
Median Income/1000	-0.0037** (0.0015)	-0.0063** (0.0027)
Median Age	-0.0057* (0.0036)	-0.0166** (0.0066)
Percent High School	0.0073*** (0.0017)	0.0129*** (0.0028)
Percent College	0.0274*** (0.0032)	0.0345*** (0.0057)
Percent White	0.0039*** (0.0008)	0.0023** (0.0012)
Percent Female	0.0286*** (0.0104)	0.0452*** (0.0167)
Percent Urban	-0.0010** (0.0004)	0.0002 (0.0008)
Percent Transient	-0.0117*** (0.0015)	-0.0104*** (0.0020)
Percent Welfare	0.0534*** (0.0071)	0.0633*** (0.0071)
constant	-1.4347*** (0.5189)	-2.1934*** (0.8558)
pseudo R^2	0.5128	
adjusted R^2		0.5073

*** Significant at 1%
** Significant at 5%
* Significant at 10%

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Endnotes

[1] California instituted its own eligibility requirements and its own method for determining eligibility, including self-certification of eligibility, which resulted in California's participation rate being greater than 100 percent of eligible beneficiaries during our study period.

[2] Surveys available at www.purc.ufl.edu.

[3] These funds come from fees assessed on telecommunications providers. Some providers collect monies for these fees by placing surcharges on customer bills.

[4] All incumbent local exchange carriers are designated eligible telecommunications carriers; they provide Lifeline and are entitled to receive federal support. Eligible telecommunications carrier status may also apply to wireless service providers whose petitions for eligible telecommunications carrier status have been approved by the FCC and competitive local exchange carriers whose petitions have been approved by the appropriate state regulator.

[5] Eligible consumers living on tribal lands qualify if they participate in Tribal TANF, NSL, or Head Start Subsidy.

[6] The federal default eligibility criteria are used if a state does not establish its own eligibility criteria. Prior to this FCC decision, the federal default eligibility criteria required the customer to participate in at least one of the following federal programs: Medicaid, Food Stamps, SSI, FPHA, or LIHEAP.

[7] The FCC (2005) provided the number of Lifeline participants and eligible households.

[8] The weights are $1/[n_i p_i(1-p_i)]$, where n_i is the total eligible households of state i and p_i is the logit probability of Lifeline participation rate in state i. As discussed by Greene (2003, pp. 686-688), p_i must be estimated, since it is a function of unknown parameters. Following the proscribed procedure, we estimate p_i using OLS in a first stage, because all that is needed is a consistent estimate of p_i. The weights are then computed and used in a second-stage FGLS

estimation. Several specifications of the dependent variable are available. We choose the minimum logit chi-square estimator due to its similarity to the well-known logit dichotomous choice model. To test robustness, we estimated the model using another commonly employed specification in which the dependent variable is simply the log of the participation rate, finding no major differences between the two specifications.

[9] Observations on California and Maine are deleted because these two states have Lifeline participation rates greater than 100 percent. A Hausman test indicates that the assumption of the random effects model concerning the orthogonality of the random effects and the regressors is appropriate. The chi-square statistic (2 degrees of freedom) is 0.33, which is insignificant at any conventional level. Thus, we cannot reject the null of no correlation between the random effects and the regressors. Complete results of this test are available from the authors. We choose the random effects model because it allows the inclusion of time-invariant regressors and is more efficient than a fixed-effects model.

[10] Based on how the data are generated, we expect that characteristics of the eligible population will influence the decision to participate in the Lifeline program. Unfortunately, characteristics of each state's eligible population are not available at the state level. Instead, the measures used in this study reflect the characteristics of each state's total population. Therefore, because we control for total population characteristics, our results should be viewed with some caution. For instance, if a state's total racial diversity is widely divergent from the racial diversity of its eligible population, our results with respect to the racial categories will be biased.

[11] A complete list of other carriers by state is available from the authors.

[12] In the following section, we discuss the expected effects of the measures of population characteristics. Although *Eligibility* is the only measure expressly included to measure variation

in the number of eligible households, the population measures may also affect the number of eligible households. For example, greater education and income levels may affect both the participation decision and the number of eligible households. For brevity, we only discuss the expected effects of population characteristics on the participation decision. The potential effects of population measures on the number of eligible households are addressed in the results section.

[13] The telecommunications environment measures are gathered from government sources. Total operating revenue data were obtained from FCC Report 43-01: the ARMIS Annual Summary Report for each year. Lifeline US and state support payment data were obtained from FCC Universal Service Monitoring Reports prepared for the Federal-State Joint Board on Universal Service. Local residential phone rates are monthly averages from the Bureau of Labor Statistics raw data rate surveys.

[14] There are approximately 11.9 million single parents in the US, 9.8 million of whom are women (www.singleparent.com).

[15] State level cell phone penetration rates were included in initial regression estimates; however, due to incomplete data, inclusion of these rates eliminated several states from the model. Because the cell phone coefficient was not significant and did not influence other results, we chose to not to include cell phone data in the estimations presented in this paper.

[16] State-level population characteristics are from the US Census (2005). Multicollinearity can be a problem with this type of data. To investigate, we examine the variance inflation factors (VIF) of the independent variables (Greene, 2003, p. 57). It is common to use the informal rule of thumb that VIF greater than 10 indicates evidence of multicollinearity (although Greene, p. 58, quotes a VIF threshold of 20). There appears to be no such problem in our data, since all VIF are

below 10; the largest VIF is 6.27 for *Median Income*. Complete VIF results are available from the authors.

[17] The Appendix presents results of both the FGLS model with state effects and the OLS model without state effects with the dependent variable the Lifeline participation rate. These results generally uphold the models in which the dependent variable is the logit of the participation rate.