

Compliance and Competition with Heterogeneous Service Providers: The Federal Lifeline Program*

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Abstract

This paper studies how compliance behavior varies across competing service providers in the Lifeline phone subsidy program and assesses whether enlarging the set of providers improves program outcomes. In markets where firms compete to provide government benefits or services directly to individuals, the most productive firms—in terms of service quality or operating costs—survive and serve the market. However, imperfect enforcement of program rules may weaken competitive pressures through non-compliance, allowing less productive firms to maintain market share. I exploit institutional features of the Lifeline program, state-level variation in regulatory environments and a one-time reform, to empirically document the importance of provider heterogeneity following a 2008 expansion of Lifeline. The presence of low-compliance providers in particular markets drives the largest state-level differences in wasteful or inefficient program spending. Qualitatively, these providers appear to select into state markets with looser enforcement of program rules. In counterfactual simulations, excluding low-compliance providers prevents 500,000 ineligible enrollments, while only reducing eligible enrollments by 100,000. Further restrictions come at a higher cost, reflecting the trade-off of compliance and competition.

JEL Codes: L11, H42, L51, L33

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1 Introduction

Many government benefits and services are provided through private markets, either by direct contract or subsidy. This arrangement is motivated by the idea that competition and industry expertise can reduce the costs of provision and improve outcomes. However, when oversight is imperfect, providers have an incentive to cut costs on compliance or other difficult-to-monitor aspects of service. Such non-compliance or waste can reduce the gains of privately provided services (Hart, Shleifer and Vishny, 1997; Levin and Tadelis, 2010). In markets where providers may vary in their compliance behavior, this paper asks whether enlarging the set of competing providers improves program outcomes. Within the context of the federal Lifeline program, I first document substantial variation in compliance across providers. I then estimate that while additional providers generally improve program outcomes, non-compliance weakens the competitive forces that could otherwise winnow out less productive providers.

Since 1984, the Lifeline program has subsidized phone service for low-income households, traditionally through discounted monthly service sold by approved private providers.¹ Beginning in 2008, program enrollment expanded substantially as providers with a new business model offering free cell phone service were first approved. Annual program spending, after leveling off near \$800 million prior to 2008, exceeded \$2 billion by 2012.

Alongside this growth came evidence of program rule violations—households received service for which they were ineligible.² By law, providers must determine eligibility before enrolling a household. The Federal Communications Commission (FCC) responded to evidence of these violations with its 2012 Reform Order, which required a one-time verification of all enrolled subscribers, removing ineligible households and households with multiple enrollments.

The expansion and reform of Lifeline demonstrate policymakers’ competing goals: the program aims to provide service to as many eligible households as possible, while avoiding wasteful or inefficient spending on ineligible enrollments. The data in this study is particularly suited to studying the role of competing providers, as providers’ compliance with the eligibility rules and their program enrollments can be directly measured due to three key institutional features. First,

¹See Eriksson, Kaserman and Mayo (1998) and Riordan (2002) for early studies of Lifeline and subsidized universal telephone service programs more broadly.

²“Millions Improperly Claimed U.S. Phone Subsidies,” *The Wall Street Journal*, February 11th, 2013; “Who Gets Rich Off ‘Free’ Government Phones?” *CNN Money*, October 26th, 2012.

both the enforcement of eligibility rules and the set of providers admitted varies at the state-level, as determined by state regulators. Second, providers compete to enroll subscribers across multiple separate state markets. Third, the 2012 federal reform removed ineligible subscribers nationwide, reducing program enrollment by 35%. In my primary empirical analysis, I document that compliance varies greatly across providers, and this across-provider variation is much larger than the within-provider variation observed across states. For example, several providers had over 80% of subscribers removed in every state they operated in, while others retained a majority of subscribers in every state. As a result, state-level differences in compliance are strongly influenced by the presence or absence of particular providers.

The composition of providers in a market influences not only the level of compliance in a state, but also the number of eligible subscribers. States with more providers had both higher eligible enrollment and higher ineligible enrollment (lower compliance). This highlights the potential trade-off of competition and compliance: additional competing providers may bring more eligible enrollments, but also more waste. To estimate the balance of this trade-off, the second part of my empirical analysis uses the post-reform enrollment data to estimate a nested logit model of consumer demand, quantifying the substantial heterogeneity between firms in their ability to enroll eligible subscribers, and the degree to which additional providers increase total program enrollment. Based on the patterns of compliance revealed from the initial analysis, I then model and estimate how compliance behavior varies across firms and states using the drop in enrollments due to the reform. These estimates are combined to simulate the effects of simple counterfactuals restricting the number of providers admitted into each market.

The results suggest that while additional providers take some market share from their competitors, they do improve program outcomes by increasing total eligible enrollments. However, as with compliance, individual providers' ability to enroll eligible subscribers varies more across-firm than within-firm, with a minority of low compliance firms enrolling very few eligible subscribers in any market.

Furthermore, these providers with few eligible enrollees and poor compliance appear to select into markets which, qualitatively, have looser enforcement and oversight of program rules. In the counterfactual simulations, excluding the lowest compliance providers reduces ineligible enrollments by 500,000, while only preventing 100,000 eligible enrollments. However, the balance of the trade-

off depends on the compliance and service quality offered by the marginal admitted provider. Simulations further restricting the number of providers prevent additional ineligible enrollments, but these come at an increased cost as firms offering higher service quality—and the more numerous eligible enrollments these firms generate—are excluded.

I provide a stylized model of these forces in Section 3.1. To profitably participate in a given state market, Lifeline providers must be able to enroll enough subscribers to cover their costs. Providers compete through advertising, outreach, and service quality to attract eligible potential subscribers. All else equal, additional competitors will lower the number of subscribers a given firm can enroll. This will require the heterogeneous firms to have some minimum productivity—which can be thought of as a combination of offered service quality, marketing ability, and costs—to operate.³ Given imperfect enforcement, however, firms can reduce these competitive pressures through non-compliance, by enrolling additional ineligible customers and likely reducing operating costs.

I contribute to previous work by providing empirical results showing how compliance behavior varies across firms and states, and how it affects program outcomes through the margin of firm participation.⁴ Why don't all firms cut costs on compliance and offer low quality service? Competition rewards firms for providing higher quality, which explains some of the story. Additionally, more productive firms have a continued benefit of remaining in the market, since they can remain profitable even when non-compliance may be limited by more rigorous enforcement. These incentives are in line with those highlighted in early literature on firm contracts and fraud, in which the expected benefit of the continued business relationship is the main deterrent to deviations from contracts (Darby and Karni, 1973; Klein, Crawford and Alchian, 1978). Anecdotally, the largest providers participating in the Lifeline program (TracFone and Virgin Mobile) publicly advocated for stricter oversight of low compliance providers.⁵ As long as profitable firms perceive some threat of removal or fines for non-compliance with program rules, they may generally adhere to higher

³Related literature on imperfect competition with heterogeneous firms has shown how minimum productivity thresholds of this type fall with product differentiation and search frictions (Dinlersoz and Yorukoglu, 2012; Hortacsu and Syverson, 2004; Syverson, 2004a,b).

⁴This paper focuses on the efficient use of government funds to achieve program enrollment goals, where decreasing returns from firm entry come from service provided to unintended beneficiaries. This is in contrast to the literature documenting socially inefficient levels of entry which arise from the sunk costs of additional entrants (Berry and Waldfogel, 1999; Hsieh and Moretti, 2003; Mankiw and Whinston, 1986; Wolinsky, 1984).

⁵See “Comments of Sprint Nextel Corporation” and “Comments of TracFone Wireless Inc.,” FCC Docket No. 11-42, April 21st, 2011.

standards. This incentive does not hold for less productive firms. For them, removal from the program or strict compliance with program rules both yield zero profits.

A number of recent empirical papers have used government policy shifts to study aspects of the trade-off between competition and compliance in consumer-facing markets. Polsky, David, Yang, Kinoshian and Werner (2014) study state-level entry regulations in the home healthcare market, finding that regulated states have more concentrated markets, but that health outcomes do not differ substantially from those in unregulated states. The authors note the possibility that negative outcomes in a few unregulated states with anecdotal evidence of fraud may “cancel out” with any negative effects of reduced competition in regulated states. In a study of a disclosure enforcement change in consumer lending markets, Stango and Zinman (2011) find that looser enforcement increased price discrimination but also lowered overall prices, potentially due to an increase in supply and reduced compliance costs for providers.⁶ These papers make note of possible provider heterogeneity in compliance, but unlike in the Lifeline program, they cannot observe it directly. Outside the context of government enforcement changes, recent empirical studies find evidence of heterogeneity in willingness to commit fraud by financial firms (Egan, Matvos and Seru, 2019; Griffin and Maturana, 2016) and restaurants (Luca and Zervas, 2016). In line with the results of this paper, Egan, Matvos and Seru (2019) find that some firms specialize in hiring employees who were disciplined for violations in their prior employment, and Luca and Zervas (2016) find a negative correlation between a firm’s reputation and its willingness to commit fraud, as well as a higher incidence of fraud under increased competitive pressures. I contribute to and bridge these literatures by documenting variation in compliance across competing providers in the context of a government benefit program, and highlighting how oversight may be leveraged to improve outcomes.

Finally, the patterns documented in this paper add to our understanding of competition and demand in the Lifeline program. Previous research has found that consumers are unlikely to have full information about the set of Lifeline services available, attributing low take-up rates during the pre-expansion period to lack of information, unstable living situations among eligible households, and preference for wireless phones (Burton, Macher and Mayo, 2007; Hauge, Jamison and

⁶While not directly consumer-facing, the costs of particularly strict oversight have been shown in the realm of charitable foundations: tax reforms aimed at stopping the misuse of funds substantially reduced entry by charitable foundations and genuine gifts to the groups, with larger effects in states with weaker pre-reform rules (Marx, 2015).

Jewell, 2007, 2008). Lifeline’s expansion to providers offering free wireless service increased enrollment substantially, reducing household expenditures on phone service (Conkling, 2018) while only marginally increasing the share of the population with telephone access (Ukhaneva, 2015). These findings may reflect the already high rates of telephone access prior to the expansion, alongside strong demand for wireless service and multiple phone lines within households (Macher, Mayo, Ukhaneva and Woroch, 2017). The estimates from this paper suggest additional admitted providers increase enrollment rates, consistent with consumers potentially learning of program offerings from the outreach of new providers. Given imperfect enforcement and a lack of out-of-pocket costs to consumers, providers may be seeking out consumers as much as consumers are seeking out services. In this context, competition is unlikely to be a substitute for oversight in deterring the participation of low compliance providers.⁷ Given these conditions, restricting Lifeline participation to providers with ongoing business in the broader unsubsidized market—and thus a higher opportunity cost of non-compliance—may be warranted.

Evidence of these dynamics is presented here for the Lifeline program, but this interplay between compliance and competition could be important in many markets. Similar incentives are likely to exist whenever the government pays the bill, firms compete to enroll customers, quality or prices are imperfectly known, and enforcement is costly. In the conclusion, I discuss parallels in markets for healthcare, education, and consumer financial services.

Section 2 provides background on the Lifeline program and the data. Section 3 presents descriptive evidence on the importance of firm heterogeneity, the forces driving enrollment and compliance, and a stylized model. Based on this evidence, Section 4 lays out the estimation equations used to quantify demand and compliance. Section 5 presents and discusses the estimation results, and Section 6 simulates counterfactuals restricting the set of participating providers. Section 7 concludes.

⁷Rosston and Wimmer (1998, 2000); Valletti, Hoernig and Barros (2002) have addressed issues of compliance, competition, and entry in earlier landline universal service programs, but these papers consider scenarios where the regulations are a cost imposed on providers, rather than a profitable business opportunity.

2 Lifeline Background

2.1 Establishment, Expansion, and Growth

The federal Lifeline program was established in 1984 with the goal of promoting universal access to telephone service. Lifeline provides a monthly subsidy (averaging \$9.25) to approved private providers for each low-income household they enroll in telephone service. Program rules limit each household to only one subsidized phone line, and eligibility is based on income or participation in other benefit programs.⁸ To participate in the Lifeline program, telephone service providers submit applications to a state regulator, and once approved can begin enrolling eligible households (more details on the application process below).

Prior to 2008, the Federal Communications Commission (FCC) restricted the program to landline and facilities-based wireless service providers, the latter group consisting of firms that own their own networks of towers (e.g., AT&T, Verizon). In this era, the full value of the subsidy was typically passed through to households in the form of a discounted monthly bill. Program spending had leveled off to about \$800 million per year, and a substantial literature covering this period has studied Lifeline's program design and incentives (Eriksson, Kaserman and Mayo, 1998; Rosston and Wimmer, 1998, 2000; Valletti, Hoernig and Barros, 2002), relatively low take-up rates (Burton, Macher and Mayo, 2007; Hauge, Jamison and Jewell, 2007, 2008) and telephone access gains (Ackerberg, DeRemer, Riordan, Rosston and Wimmer, 2014).⁹

In 2008, the FCC approved the first non-facilities-based Lifeline provider, TracFone Wireless, the largest wireless reseller in the United States at that time.¹⁰ As the name implies, resellers pay facilities-based providers for the use of their networks and resell the services under their own brands.¹¹ State regulators quickly followed suit, approving numerous low-cost wireless resellers as Lifeline providers.

As seen in Figure 2.1, the entry of these resellers greatly expanded the program. Following the

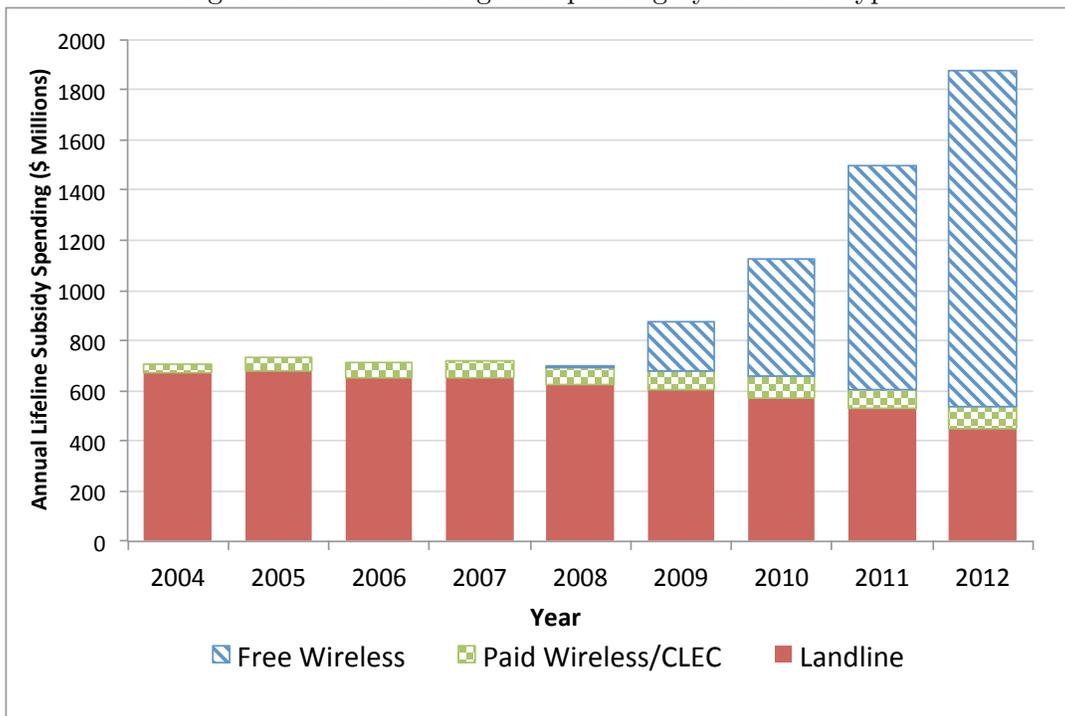
⁸In most states, a household is eligible if its income is below 135 percent of the federal poverty guidelines or if it is enrolled in Medicaid, SNAP (food stamps), SSI, or one of several other means-tested benefit programs.

⁹In addition, Rodini, Ward and Woroch (2003) and Ward and Woroch (2010) estimate cross-price elasticities between landline and wireless service from household bill data, with the latter paper explicitly using the availability of landline Lifeline subsidies as a natural experiment.

¹⁰TracFone ETC Designation, April 9th, 2008 in FCC Docket No. 96-45. TracFone's exemption from the facilities-based requirement was granted by the TracFone Forbearance Order, September 6th, 2005, FCC Docket No. 96-45.

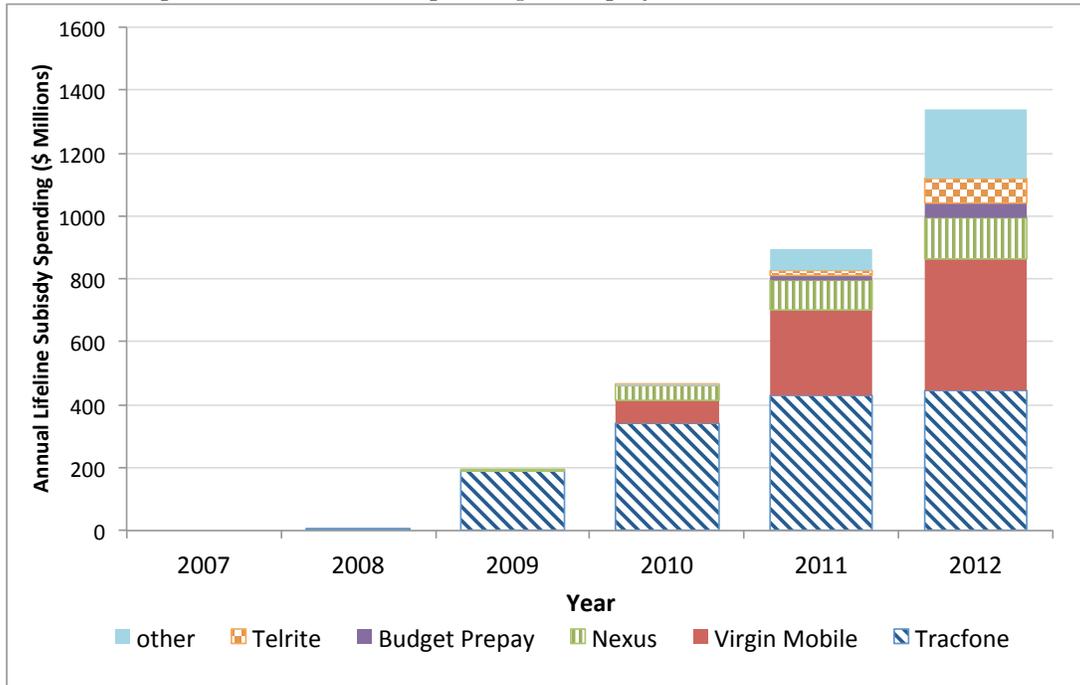
¹¹This arrangement allows relatively low fixed costs of establishing a new wireless brand.

Figure 2.1: Annual Program Spending by Provider Type



Note: Annual subsidy claims to the Universal Service Administrative Company. Excludes Tribal Lifeline claims, and all claims from Oklahoma and Alaska. Free Wireless providers are defined by author as those providers offering a wireless service plan at no monthly cost to consumers (see Section 2.4 for details).

Figure 2.2: Annual Program Spending by Free Wireless Providers



Note: Annual subsidy claims to the Universal Service Administrative Company. Excludes Tribal Lifeline claims, and all claims from Oklahoma and Alaska. Free Wireless providers are defined by author as those providers offering a wireless service plan at no monthly cost to consumers (see Section 2.4 for details).

business model first implemented by TracFone, these providers offered monthly Lifeline service at no cost to consumers, usually providing a free handset as well. The free monthly service saved costs on billing, and the steady subsidy reimbursements replaced the high turnover typical in unsubsidized prepaid wireless services. Figure 2.2 breaks down the growth by provider in the “free” segment on the industry, with the category “other” encompassing an additional eighteen smaller firms. These free providers constituted nearly all of the growth in the Lifeline market as a whole. These providers are the focus of this paper due to their critical role in Lifeline’s growth during these years, and the potentially heightened compliance risks stemming from their service offered at no out-of-pocket cost to consumers. TracFone and Virgin Mobile were the two largest competitors during this period. By 2012 annual program spending exceeded \$2 billion, and the growth attracted significant attention from legislators and media outlets.¹²

¹²The data in this paper (including Figures 2.1 and 2.2) exclude Oklahoma and Alaska, due to differences in their Lifeline rules and extensive participation in the Tribal Lifeline program. This is why the 2012 subsidy spending number is below \$2 billion in Figure 2.1. For example media coverage and legislative proposals, see “Obama Phones’ Subsidy Program Draws New Scrutiny On The Hill,” The Washington Post, April 9th, 2013; H.R. 176 - Stop Taxpayer Funded Cell Phone Act of 2011, introduced in 113th Congress, January 4th, 2013.

The existing research on the wireless Lifeline expansion has found that only a small number of households gained access to telephone service for the first time due to free wireless Lifeline enrollments (Ukhaneva, 2015), and that the new enrollments occurred largely in addition to existing paid wireless market growth (Conkling, 2018).¹³ The latter paper finds that these Lifeline enrollments did crowd out a sizable amount of household wireless spending on the intensive margin, suggesting that to the extent that Lifeline’s growth impacts non-Lifeline providers, it is through their revenue-per-subscriber.

2.2 Oversight and Provider Application Process

Despite being a federal program, many important regulatory decisions are left to state regulators, typically public utilities commissions. States have latitude to choose criteria like eligibility thresholds, proof-of-eligibility documentation rules, audit requirements, etc. As examples, the range of eligibility enforcement methods includes (but is not limited to) enrollee self-certification with no documentation requirements (AL, LA, MD), customer provided documentation (MO, PA, SC), some access to state databases on enrollment or eligibility for other programs (FL, NE, TX, WA, WI), and purpose-built Lifeline databases (OR).¹⁴ States also choose which firms to admit as Lifeline service providers, enabling the firms to claim Lifeline subsidies.¹⁵ I use the term oversight to encompass both states’ enforcement of eligibility rules and their discretion over provider approval.

To operate as a Lifeline provider in a state, firms must first submit an application to the state regulator, in which they describe their planned Lifeline offering. These applications typically include the number of minutes, texts, or other features included; assurances of the ability to provide a basic level of service; and an appeal to the choice- and competition-enhancing benefit that their entry would bring to the market.¹⁶ The regulator either immediately approves the application (as tends to happen in more lenient states) or requests additional clarifications and assurances, asks

¹³These findings are consistent with those in Macher, Mayo, Ukhaneva and Woroch (2017), which estimates households have strong demand for multiple phone connections. Simulations in that paper suggest the Lifeline program could significantly increase enrollments by moving from a one-per-household to one-per-person restriction.

¹⁴For additional details, see FCC (2012) and “Comments of TracFone Wireless Inc.,” FCC Docket No. 11-42, April 21st, 2011.

¹⁵An important exception are the eleven states which defer decisions on provider admittance to the FCC. The included states are AL, CT, DC, DE, FL, MA, NC, NH, NY, TN, and VA.

¹⁶Lifeline providers do compete on plan quality, particularly the number of minutes and texts included. However, this largely takes place at the national level, and during the period studied in this paper, nearly all providers were offering the same 250 minutes per month. For additional details on plan offerings and applications, see Conkling (2018).

for revisions of the offering, seeks out responses from consumer groups, schedules hearings, or other actions along these lines. The stricter the regulator, the more costly and time-consuming these clarifications and revisions tend to be. Relatively few rejections of applications are observed, which suggests that firms know the relative stringency of each state’s oversight, and therefore where their applications have a chance of being approved.

The effective result of these regulatory choices leaves some states with as many as sixteen free wireless Lifeline providers, and others with none.

2.3 Over-Enrollment and Reform

As numerous providers entered and competed to enroll households in states across the country, evidence of households receiving multiple phones began to surface.¹⁷ In particular, since at the time there was almost no state or federal tracking of enrolled subscribers, providers often could not verify if their customers already had Lifeline phones from another provider. These violations of the program’s one-per-household rule were considered the largest source of over-enrollment or fraud.¹⁸ Although these incidents violate program rules, it can be unclear whether the fault lies with the provider, the household, or some combination of the two. It’s possible that a) consumers were asked if they had another Lifeline subscription and lied, b) consumers didn’t understand the one-per-household requirement, c) consumers volunteered that they had another Lifeline subscription and a provider still enrolled them, or d) providers didn’t ask and consumers didn’t volunteer the information. Cases (a) and (c) can safely be called fraud, while (b) and (d) are less definitive, though likely still indicate lax compliance on the part of providers.

Regardless of the mechanism or the assignment of fault, the FCC responded to evidence of these violations with its 2012 Reform Order. This order required a one-time verification of all enrolled subscribers, with providers required to submit full subscriber lists so that the FCC could identify and remove households with multiple enrollments. In such cases, households were notified by mail or telephone and were allowed to choose which enrollment to keep. In cases of household non-response, all subscriptions were terminated (FCC, 2012). The exact timing of the subscription terminations

¹⁷“Millions Improperly Claimed U.S. Phone Subsidies,” *The Wall Street Journal*, February 11th, 2013; “Who Gets Rich Off ‘Free’ Government Phones?” *CNN Money*, October 26th, 2012.

¹⁸Cases of ineligible households receiving benefits also occurred but were considered a less urgent priority than cases of duplicative or multiple enrollment (FCC, 2011).

varied somewhat by state and provider, so I define pre-reform subscribers for a state-provider combination as the maximum number of subscribers claimed during the first three quarters of 2012, and I define post-reform subscribers as the minimum number of subscribers claimed between the third quarter of 2012 and the third quarter of 2013. On the whole, free Lifeline subscribers fell from a high of 14.35 million in the second quarter of 2012 to 9.28 million in the first quarter of 2013. Given an effective verification and removal process, only eligible subscribers should remain in the post-reform period. The reductions in subsidy claims due to the reform then identify how the portions of eligible consumers varied by state and by provider.

2.4 Data and Market Definition

The primary enrollment data come from publicly available filings posted by the Universal Service Administrative Company (USAC), which handles the subsidy claims and disbursements for the Lifeline program. The filings document the subsidy dollars received by each provider in each state during each month. Claims are sometimes reported only quarterly in the data, so I use within-quarter monthly averages throughout this paper. USAC also provides data on the per-subscriber subsidy size by state, firm, and month. There was a small amount of state-by-state variation in subsidy sizes in the earlier years of the program, but these were standardized as part of the 2012 Reform Order. Dividing the total subsidy claims by the subsidy-per-subscriber yields the total number of subscribers.

Firms are defined as free providers if they offer any wireless Lifeline plan that has zero monthly cost. This information is gathered from a combination of legal documents (provider applications and compliance plans), consumer-oriented web resources (official state government Lifeline guides and unofficial websites), and firms' advertisements and press releases. More specifically, I initially compiled a set of potential free Lifeline providers through a search of official and unofficial consumer-oriented websites, as well as by identifying Competitive Local Exchange Carriers—the carrier type including wireless resellers—newly claiming Lifeline benefits in the USAC data. The details of these providers' Lifeline offerings was then confirmed by referencing the providers' websites and their legal documents filed with state regulators. These free service plans were offered only to households enrolled in Lifeline; some providers also offered standard pre-paid wireless plans to non-Lifeline customers.

Some firms, such as Budget Prepay and Nexus, were landline Lifeline providers in addition to offering free wireless Lifeline. In such cases, the firm is only defined as a free provider in states where it was approved for wireless service, and only after its application was accepted. In states where the firm provided both landline and free wireless Lifeline, only the combined subscriber numbers are observed. Although the number of subscribers with free wireless service greatly exceeds the number with landline service for these firms, it is acknowledged that this will introduce some measurement error in the data. Similarly, a few of the smaller companies offered paid plans that require a monthly fee, and any subscribers to these plans would be included in the total firm subscriber numbers. These types of plans were not very common, and firms offering no free plan generally did not see anywhere near the growth of free providers during this period.¹⁹ In addition, this approach omits landline Lifeline carriers, who generally saw steady or declining enrollments over this period. Obtaining pricing and plan information for these smaller, more numerous landline providers is more difficult, and this paper focuses on the Lifeline program's expansion to new wireless resellers, acknowledging the well-developed literature studying landline providers.²⁰

In total, the set of free providers includes all such firms that entered at least one market by Q1 2012, when the Reform Order was announced.²¹

To estimate the number of eligible households in each market, I use the American Community Survey (ACS), which provides detailed information on income and program participation.²² The survey does not include participation data on every program used for Lifeline eligibility, but it does include Medicaid, SNAP, and SSI, the three most commonly used programs (FCC, 2012). Additionally, in most states consumers can qualify through income levels, and the cutoff is usually more lenient than for the additional programs not included in the survey. Households are defined as eligible if their reported income lies below the qualification threshold in their state or they report participation in a qualifying benefit program.

The next section presents key relationships in the data from before and after the Lifeline reform,

¹⁹One exception is Cricket Wireless, which offered Lifeline plans with unlimited usage for set monthly fees and had sizable enrollment. Given the narrow market definition in this paper, households enrolling with Cricket would be observed in the outside option.

²⁰See Eriksson, Kaserman and Mayo (1998) and subsequent literature cited in Section 2.1 for detailed studies of the period prior to the entry of free Lifeline providers.

²¹All free providers of significant size have been accounted for, though it is possible that some very small providers have been omitted.

²²The FCC uses these Census Bureau datasets for their own estimates of the number of eligible households (GAO, 2010).

offering a rare, quantifiable look at levels of enrollment and non-compliance in a market where government-subsidized benefits are provided through competing private providers.

3 Evidence on Compliance and Stylized Model

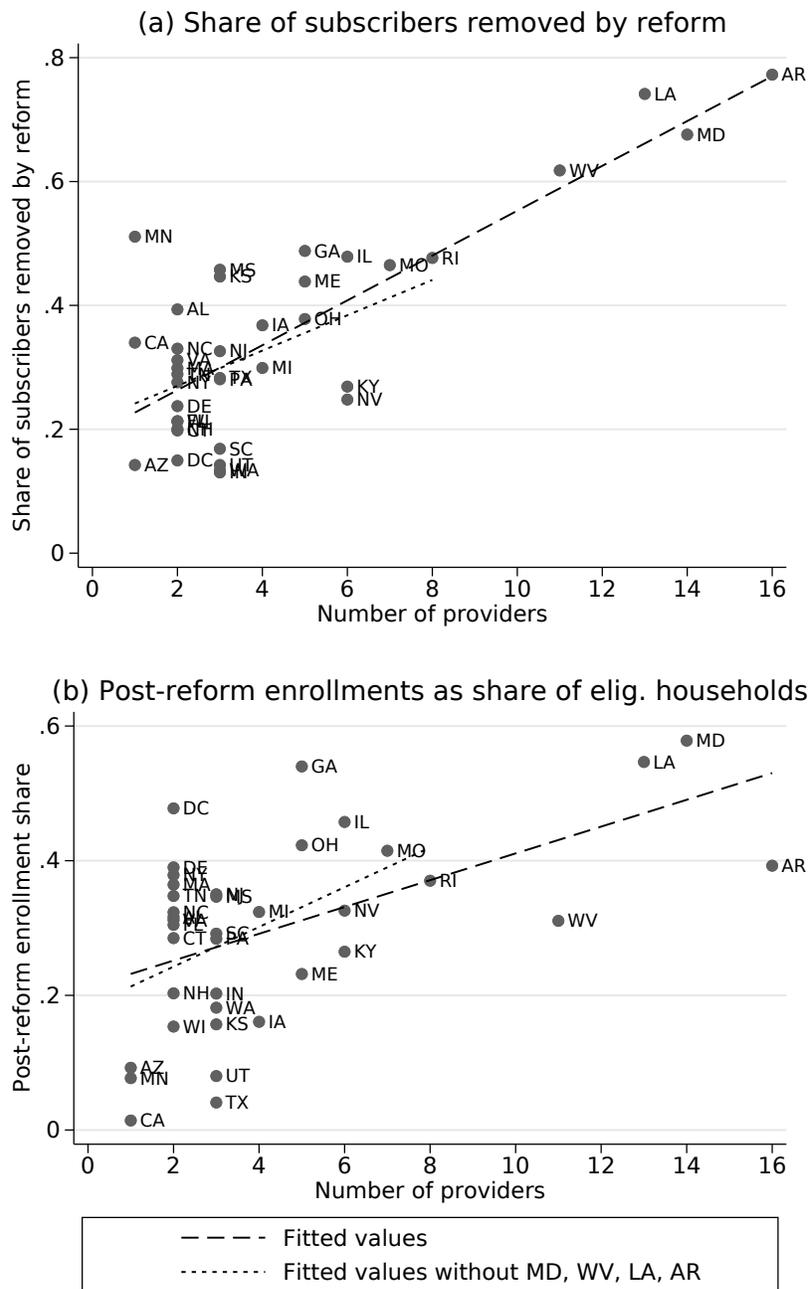
The three key sources of variation in the data are differences in where providers operated, in how many subscribers they lost due to the 2012 Reform Order, and in the number of eligible subscribers they retained after the reform.

For each state with at least one free Lifeline provider, Figure 3.1 plots the average share of subscribers removed by the 2012 reform (panel (a)) and the share of eligible households enrolled post-reform (panel (b)). On the horizontal axis, states are plotted according to their count of participating Lifeline providers. States with more providers had both higher shares of subscribers removed by the reform—fraud or waste—but also higher take-up of eligible enrollments post-reform. While this highlights the potential trade-off for states in admitting additional providers, the next two figures demonstrate the importance of heterogeneity across providers in explaining these patterns.

For each of the twenty-three firms in the free Lifeline market, Figure 3.2 plots the unweighted across-state average share of subscribers removed by the 2012 reform (panel (a)) and the market share of eligible households enrolled post-reform (panel (b)). The firms are ordered on the horizontal axis by the number of state markets in which they operated. The first key pattern from this figure is the large range of subscriber removal shares in panel (a); the firms near the top lost all or nearly all their subscribers, while those at the bottom lost only 20 to 30 percent. The negative relationship between share removed and number of states entered suggests that firms with lower levels of compliance operated in a more limited set of state markets. However there is still substantial variation in share removed among firms operating in few markets. Panel (b) shows that firms participating in more markets not only had lower shares of their subscribers removed due to the reform, but also enrolled larger shares of the eligible population.

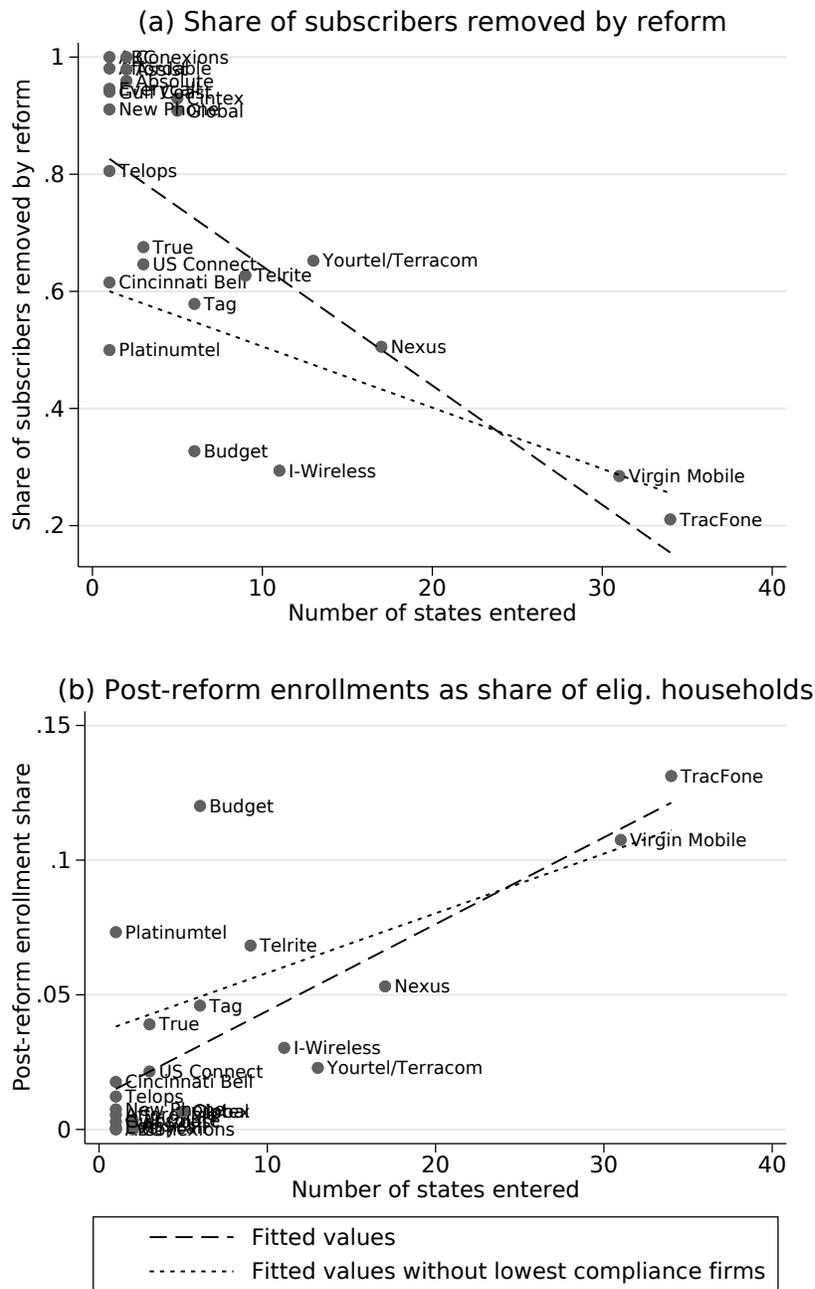
There are two potentially competing explanations for the observed correlations that firms in more markets have lower shares of subscribers removed and higher eligible enrollments. First, firms' share removed and eligible enrollments could be a function of state-level factors like enforcement and demand, with all firms operating in states with many providers (e.g., AR, LA, MD, WV)

Figure 3.1: Average Share Removed and Post-Reform Enrollment, by State



Note: For each state market with at least one free Lifeline provider by Q1 2012, panel (a) plots the share of pre-reform free Lifeline subscribers removed due to the Reform Order, and panel (b) plots the number of post-reform subscribers as a share of all eligible households (the eligible take-up rate). The horizontal axis shows the number of providers in each state market.

Figure 3.2: Average Share Removed and Post-Reform Enrollment, by Provider



Note: For each free Lifeline provider, panel (a) plots the share of pre-reform free Lifeline subscribers removed due to the Reform Order, and panel (b) plots the number of post-reform subscribers as a share of all eligible households (the eligible market share). The horizontal axis shows the number of states into which each provider was admitted. Lowest compliance firms defined as those which lost at least eighty percent of subscribers due to the reform.

having large shares removed and high eligible enrollments. Under this scenario, the outcomes should vary little across firms operating within a state, but with substantial variation within firms operating across states. Alternatively, the state-level outcomes could be driven by firm-level factors like compliance behavior, in which case the pattern should be reversed: substantial heterogeneity across firms, but limited variation within firms across markets.

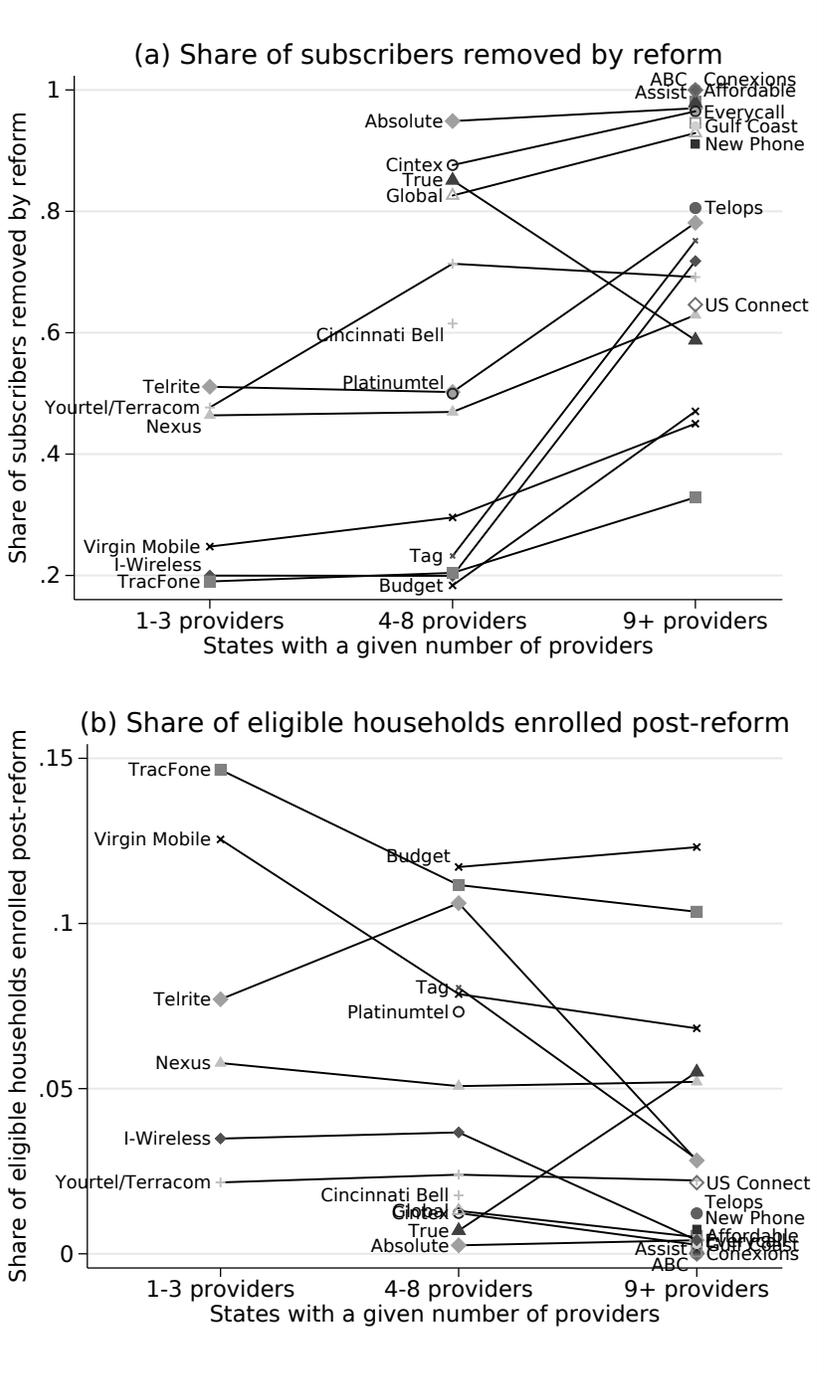
To disentangle these explanations, Figure 3.3 bins state markets according to the number of providers participating, and again plots firms' average shares of subscribers removed (panel (a)) and market shares of eligible households (panel (b)) within these bins. The results suggest that heterogeneity across firms within a market is substantially larger than the within-firm variation in either compliance or eligible enrollments. Firms at the top of panel (a) consistently lost over 80 percent of subscribers, even when operating in states with fewer competitors. In addition, the wide variation in outcomes across firms seen in Figure 3.2 persists even within narrower bins of state markets.

While differences across firms appear to be the dominant source of variation, the within-firm share removed does tend to increase with the number of providers in a state (positive slopes in panel (a)) while the eligible share enrolled tends to decrease (negative slopes in panel (b)). The pattern in panel (a) suggests some role for within-firm variation in compliance, while that in panel (b) may indicate increased competition for eligible enrollees. Both of these factors are incorporated into the model and counterfactuals below.

Figure 3.3 also shows that firms with high average shares removed (low compliance) appear largely concentrated in a handful of markets which are highly saturated with providers. This suggests that such firms may either select into these states with laxer oversight, or that stricter oversight may prevent their profitable operation in other states. To examine how looser enforcement in the pre-reform period influenced competitive forces, Figure 3.4 shows average pre- and post-reform enrollment for each firm, sorted on the horizontal axis according to the average number of providers in the state markets in which they operated. Panel (a) shows that in the pre-reform period, there is essentially no correlation between enrollments and number of competitors. By contrast, for the post-reform period shown in panel (b), firms operating in more competitive markets had lower average enrollments.

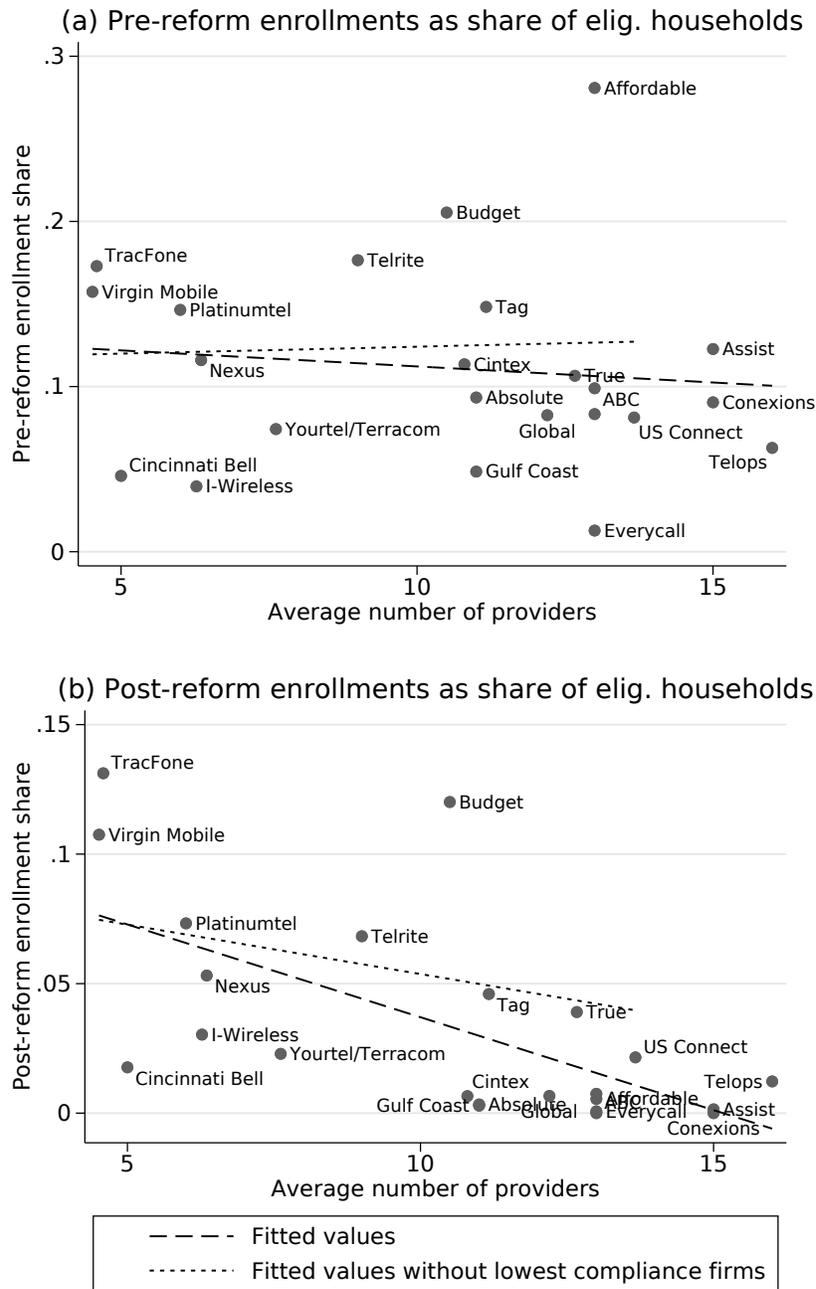
These correlations suggest that looser enforcement in the pre-reform period may have allowed

Figure 3.3: Provider Share Removed and Post-Reform Enrollment, by State Bins



Note: For each free Lifeline provider, panel (a) plots the share of pre-reform free Lifeline subscribers removed due to the Reform Order, and panel (b) plots the number of post-reform subscribers as a share of all eligible households (the eligible market share). Outcomes are shown separately for states with 1-3, 4-8, or 9+ providers on the horizontal axis.

Figure 3.4: Average Pre- and Post-Reform Enrollment, by Provider



Note: For each free Lifeline provider, panel (a) plots the number of pre-reform (eligible and ineligible) subscribers as a share of all eligible households, and panel (b) plots the number of post-reform subscribers as a share of all eligible households (the eligible market share). Providers are plotted on the horizontal axis according to the average number of providers (competitors + 1) in the states in which the provider operated. Lowest compliance firms defined as those which lost at least eighty percent of subscribers due to the reform.

low compliance firms to insulate themselves from competitive forces by enrolling ineligible households. After laying out a stylized model, the remainder of this paper aims to quantify competition and compliance in the Lifeline market, and simulates outcomes under counterfactual regimes in which the participation of some providers is restricted.

3.1 Summary and Stylized Model

The patterns seen in the data depend on the regulatory choices made by states, and firms' responses. State regulators choose how Lifeline will function on both the intensive margin (e.g., enforcement of proof-of-eligibility rules, databases, audits) and the extensive margin (choosing which firms' applications to approve). Intensive margin enforcement choices will put real restrictions on the post-entry behavior of firms, while the extensive margin choices will not. However, both types of oversight will screen incoming firms. Stricter intensive margin enforcement will impose compliance costs on firms and reduce ineligible enrollments, lowering their expected profits. On the extensive margin, additional requirements will impose legal costs through the application process, or directly exclude firms at the regulator's discretion. Through either mechanism, regulators' choices vary access to and the profitability of their market for potential providers.

Based on Figure 3.2, there must be heterogeneity across firms in their ability to enroll eligible subscribers and in their compliance behavior. However, the more limited within-firm variation in retained subscribers (Figure 3.3) suggests that they operate in a fairly consistent manner across states, potentially due to firm-level standards of record keeping, employee training, and compliance effort. If firms expect a reform, fear repercussions for rule violations, or generally have higher reputational concerns, they may exert higher compliance effort regardless of market differences in enforcement.

3.1.1 Model of Profits, Enrollments, and Compliance

Firms apply to participate in a market if they can earn positive profits. For simplicity, this model assumes that firms make separate participation decisions for each state, and having a presence in one state does not change costs or revenues in any other state.²³ Let the per-month profits of firm

²³An implicit assumption here is that the firm is a potential entrant in all markets. This assumption is supported by the evidence in the Lifeline market, but the general idea does not depend on it. As long as there is a similar distribution of potential entrants in each market, the same results will follow.

j in state s be defined as:

$$\pi_{js} = (p - c_{js}(r_s))Q_{js}(r_s) - F_{js}(r_s)$$

where p is the per-subscriber subsidy and $c_{js}(r_s)$ is a per-subscriber marginal cost, assumed to vary by firm and as a function of the laxness of state enforcement r_s . The number of pre-reform enrollments is $Q_{js}(r_s)$, which includes both eligible and ineligible subscribers. Finally, $F_{js}(r_s)$ represents per-period fixed costs, also assumed to be a function of r_s .

If the regulator in a given state loosens enforcement (increases r_s), the impact on profits can be described by

$$\frac{\partial \pi_{js}}{\partial r_s} = \underbrace{(p - c_{js}(r_s)) \frac{\partial Q_{js}}{\partial r_s}}_{\text{Due to change in enrollments}} - \underbrace{\left(Q_{js} \frac{\partial c_{js}}{\partial r_s} + \frac{\partial F_{js}}{\partial r_s} \right)}_{\text{Due to change in compliance costs}}$$

where looser enforcement is assumed to weakly lower firms' costs ($\frac{\partial c_{js}}{\partial r_s} \leq 0$ and $\frac{\partial F_{js}}{\partial r_s} \leq 0$). Let total enrollments for a given firm be defined as:

$$Q_{js} = \underbrace{D_{js}(r_s)E_s}_{\text{Eligible enrollments}} + \underbrace{f(\gamma_j, r_s)D_{js}(r_s)E_s}_{\text{Ineligible enrollments}}$$

where E_s is the eligible population in state s , $D_{js}(r_s)$ is the firm's eligible market share, and ineligible enrollments are assumed to scale with eligible enrollments as a function, f , of enforcement r_s and a firm-specific compliance parameter γ_j . The compliance parameter reflects a firm's willingness to enroll (or inability to screen out) ineligible subscribers. Enforcement r_s influences firm j 's eligible market share $D_{js}(r_s)$ by changing the set of competitors that can profitably operate in the market. This means looser enforcement has two opposing marginal effects on a given firm's enrollments:

$$\frac{\partial Q_{js}}{\partial r_s} = \underbrace{\left(1 + f(\gamma_j, r_s)\right) \frac{\partial D_{js}}{\partial r_s} E_s}_{\text{Due to changes in set of competitors}} + \underbrace{\frac{\partial f(\gamma_j, r_s)}{\partial r_s} D_{js} E_s}_{\text{Due to non-compliance and ineligible enrollments}}$$

As enforcement becomes looser, firms' ineligible enrollments increase, raising revenue. Combined with falling costs, there are likely to be additional potentially profitable providers in the market. If the regulator admits these additional providers (the extensive margin of oversight), their entry will lower eligible market shares for each individual firm due to competitive effects ($\frac{\partial D_{js}}{\partial r_s} < 0$). Whether

these negative competitive effects for a firm are outweighed by the increased enrollment of ineligible households depends on the parameters of demand and the firm’s level of non-compliance.

Under most standard models of demand, the expanded set of providers, $J' > J$, will at least weakly increase total program enrollment:

$$\sum_{j \in J'} D_{js} \geq \sum_{j \in J} D_{js}$$

As a result, looser enforcement will increase both eligible enrollments and ineligible enrollments at the overall market level. The balance of the trade-off between these two forces depends on the characteristics of the marginal entering firm and the degree to which new providers expand eligible enrollments versus take eligible market share from existing competitors. To quantify these effects, the next section adds further structure to the demand (D) and compliance (f) functions to estimate the distribution of firm- and state-specific parameters and the enrollment expanding effects additional providers. The paper concludes with counterfactual simulations imposing extensive margin restrictions on the number of providers admitted in each market.

4 Estimation Model

This section lays out more detailed functions of firms’ post-reform market shares and pre-reform enrollments. The parameters of competition and heterogeneity in firm quality are estimated from post-reform market shares.²⁴ Firm compliance and state enforcement parameters are estimated from the enrollment drops due to the Lifeline reform.

The behavior of the regulator is taken as exogenous throughout. The choices made by state commissions likely depend on demographic and political characteristics, but modeling these explicitly is beyond the scope of this paper.²⁵

²⁴The demand model is most similar to Berry and Waldfogel (1999), which uses market share data to estimate the parameters of competition in the radio broadcast industry.

²⁵See Besley and Case (1995, 2003); Garvie and Keeler (1994); Poterba (1994); Reed (2006) for examples from the large literature on the determinants of regulations and policy.

4.1 Post-Reform Demand

The demand for free Lifeline service is modeled at the household level, as per program rules. For the post-reform data, I assume program rules are completely followed, so each eligible household can only enroll in a single Lifeline subscription, and no ineligible households are enrolled. Choosing which plan to enroll in is then a standard discrete choice problem.

For the logit model, consumer utility is defined following Berry (1994). The utility for consumer i of choosing Lifeline service from firm j in state s is given by

$$u_{ijs} = \delta_j + \xi_{js} + \epsilon_{ijs}$$

where δ_j are firm-specific mean utility parameters, ξ_{js} is an unobserved firm-market specific demand shock, and ϵ_{ijs} is an i.i.d. type 1 extreme value error term.

In contrast to most product demand models, there is no price term here, since the market by definition only includes providers offering free monthly service. Given the structure of the ϵ_{ijs} error terms, firm market shares D_{js} are

$$D_{js} = \frac{e^{d_{js}}}{1 + \sum_{k \in J_s} e^{d_{ks}}}$$

where J_s is the set of firms active in state s and firm j 's mean utility in the market has been rewritten as

$$d_{js} = \delta_j + \xi_{js}$$

Firm heterogeneity is represented by the parameters δ_j , which I will refer to as firm quality. These parameters will pick up any differences in the handsets and service plans offered, the amount of advertising, the effectiveness of outreach and recruitment efforts, and the quality of customer service. Firms are assumed to offer the same quality in all markets, and in both the pre- and post-reform periods. As discussed in Footnote 16, this is almost always the case for observable plan characteristics like included minutes and text messages. In this specification, any state-level differences in unobservable factors will be attributed to ξ_{js} . For robustness, an alternative specification including state-level demand shifters is also estimated.

The market size is assumed to be the number of eligible households, and the outside share

is then the number of eligible households minus the number of households enrolled with any free Lifeline provider. This outside share includes those who do not enroll in any Lifeline plan, as well as those enrolling in a landline or paid wireless Lifeline plan, and is assumed to offer mean utility of zero in all markets.

The basic logit model imposes a strong assumption about substitution between goods and the outside option. When new products are added to the choice set, it will largely expand the total number of subscribers, especially when the overall share of the outside good is large. To allow for more flexibility in this type of substitution, the primary specification uses a nested logit model, in which all free Lifeline options are part of the same nest. For the nested logit specification only the error structure is different, with consumer utility defined as

$$u_{ijs} = \delta_j + \xi_{js} + v_i(\lambda) + (1 - \lambda)\epsilon_{ijs}$$

where $\lambda \in [0, 1)$ parameterizes the extent to which consumers' choices are driven by their idiosyncratic preferences for each good, ϵ_{ijs} , versus a shared taste $v_i(\lambda)$ which is consumer i 's utility from choosing the any brand of the inside good. $v_i(\lambda)$ has a unique distribution described in Cardell (1997), which collapses to zero if $\lambda = 0$.

This nested logit error structure leads to market shares D_{js} of the form

$$D_{js} = \frac{e^{d_{js}/(1-\lambda)}}{\sum_{k \in J_s} e^{d_{ks}/(1-\lambda)}} \frac{\left(\sum_{k \in J_s} e^{d_{ks}/(1-\lambda)}\right)^{1-\lambda}}{1 + \left(\sum_{k \in J_s} e^{d_{ks}/(1-\lambda)}\right)^{1-\lambda}}$$

As λ approaches one, consumers have no idiosyncratic tastes for different goods, and a new provider will gain subscribers entirely by "stealing" them from incumbent firms, with no change in the total number of Lifeline subscribers. At the other extreme, as λ approaches zero, it implies that the uncorrelated errors (tastes) in the logit model are reasonable, and new products will significantly expand total enrollment. This is the same exercise conducted by Berry and Waldfogel (1999), but I am additionally able to observe the same firms operating across multiple markets, and hence account for firm-specific unobservable utility δ_j .²⁶

²⁶This approach is similar to the estimation of a "crowding" parameter as described in Akerberg and Rysman (2005), which can be used to separately identify crowding effects and cross-price elasticities when the choice model includes product prices.

The estimates from this model help distinguish the roles of competition and heterogeneity in the pattern of increasing eligible enrollments seen in Section 3.

4.2 Compliance and Enforcement

The ability of firms to enroll duplicate or ineligible subscribers can be thought of as a way of expanding the market and easing competitive pressures. The relative quality of products in the consumer's choice set is less important if the consumer can simply take one of each, at a price of zero. This type of behavior is necessary to rationalize the observed entry patterns in which firms with low-quality offerings enter what appear to be fully saturated markets.

I define the number of total subscribers enrolled by firm j in state s as:

$$Q_{js} = (1 + \gamma_j \tilde{r}_s) D_{js} E_s \omega_{js}$$

where D_{js} is the eligible market share of firm j (as defined above), E_s is the population of eligible households in the state, and γ_j is the firm-specific parameter for the willingness to enroll ineligible households. A small value of γ_j represents strict compliance with program rules. \tilde{r}_s is a parameter for the laxness of enforcement (how many ineligible/duplicate subscribers a firm can enroll). Letting enforcement become fully strict after the reform order, it takes the form

$$\tilde{r}_s = \begin{cases} r_s & \text{in pre-reform period} \\ 0 & \text{in post-reform period} \end{cases}$$

Finally, ω_{js} is an unobserved error term in the size of a firm's potential ineligible market, which is assumed to take the form:

$$\omega_{js} = \begin{cases} e^{\varepsilon_{js}} & \text{pre-reform} \\ 1 & \text{post-reform} \end{cases}$$

so that

$$\ln(\omega_{js}) = \begin{cases} \varepsilon_{js} & \text{pre-reform} \\ 0 & \text{post-reform} \end{cases}$$

where ε_{js} is mean zero.

This error specification allows for estimation based on the post-reform drop in enrollments. This is done by comparing the data on the portion of subscribers retained after the reform to the model predictions:

$$\frac{Q_{js}^{\text{post-reform data}}}{Q_{js}^{\text{pre-reform data}}} = \frac{D_{js}E_s}{(1 + \gamma_j r_s) D_{js} E_s \omega_{js}}$$

which, after simplifying, can be rewritten as

$$\varepsilon_{js} = \ln\left(\frac{1}{1 + \gamma_j r_s}\right) - \ln\left(\frac{Q_{js}^{\text{post-reform data}}}{Q_{js}^{\text{pre-reform data}}}\right)$$

Based on the evidence presented in Section 3, the model for total enrollment assumes that firm compliance behavior is largely fixed across markets. Specifically, if $r_s E_s$ is the number of ineligible or duplicate households firms can potentially enroll, then firm j enrolls the same fraction γ_j in every market.

4.3 Identification and Estimation

Firm-specific mean utility δ_j is identified by each firm's post-reform market shares across multiple markets. In the nested logit model, the correlation of idiosyncratic tastes λ is identified by the total size of the inside share across states with different sets of providers, after controlling for firm-quality. The functional forms of the logit choice model allow estimation by OLS regression. Estimation of the nested logit model requires an instrument for a firm's own share of the total inside share. Typical instruments in the literature consist of some function of the characteristics or number of competing products in the market. I use the number of competing free Lifeline providers.

The separate identification of γ_j depends on the differences in enrollment drops between firms within each state. Identification of r_s depends on the differences in enrollment drops within firms across states.²⁷ The parameters for firm compliance, γ_j , and state enforcement, r_s , are estimated by non-linear least squares, where the dependent variable is the portion of subscribers retained at the firm-by-state level.

²⁷I interpret r_s as an enforcement term, but the parameter will also absorb the effects of other state characteristics that influence the number of ineligible enrollments.

Table 1: Demand Model Estimates

	Logit	Nested Logit
Crowding parameter (λ):		
Correlation of firm logit unobservables	-	0.269** (0.132)
Firm Qualities (δ_j):		
Budget Prepay	-1.611*** (0.384)	-1.277*** (0.349)
Global Connection	-4.598*** (0.421)	-3.420*** (0.671)
I-Wireless	-3.391*** (0.284)	-2.665*** (0.423)
Nexus	-2.654*** (0.228)	-2.171*** (0.300)
Tag Mobile	-2.709*** (0.384)	-2.074*** (0.438)
Telrite	-2.328*** (0.314)	-1.824*** (0.353)
TracFone	-1.815*** (0.162)	-1.543*** (0.186)
Virgin Mobile	-1.977*** (0.169)	-1.679*** (0.200)
Yourtel/Terracom	-3.692*** (0.261)	-2.895*** (0.444)
Low Group	-5.978*** (0.235)	-4.440*** (0.780)
Medium Group	-3.226*** (0.314)	-2.433*** (0.464)
Observations	157	157

*** p<0.01, ** p<0.05, * p<0.1

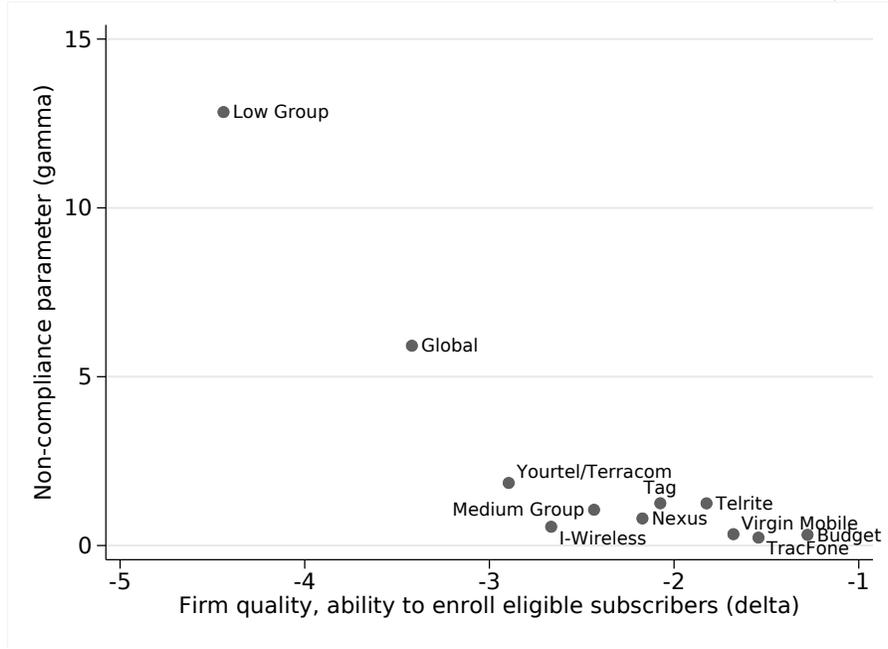
Note: Standard errors in parentheses. Dependent variable is the difference between log market shares for firm j in state s , and the log of the outside share. For nested logit specification, the number of competitors is used as the instrument for own share of the inside good.

5 Estimation Results

The demand model estimates are shown in Table 1. In the nested logit specification with firm heterogeneity, $\hat{\lambda}$ equals 0.269, implying moderately less market expansion from new providers relative to the logit model. Regarding eligible program enrollments, this suggests that admitting additional providers does expand total eligible enrollment (since $\hat{\lambda} < 1$), but less so than under the standard logit model ($\hat{\lambda} > 0$). These estimates are robust to the inclusion of state-level demand shifters including SNAP take-up and population density, shown in Appendix Table A1, suggesting that the expanded total eligible enrollment is not driven by the selection of providers into markets with higher demand among eligible households.

Since these products all have a price of zero, the firm quality parameters are negative to ratio-

Figure 5.1: Firm-Specific Non-Compliance and Quality Estimates, $\hat{\gamma}_j$ and $\hat{\delta}_j$



Note: Estimates of firm-specific non-compliance and quality parameters, identified by post-reform market shares and enrollment drops due to the Lifeline Reform Order. All else equal, the number of eligible subscribers a firm enrolls is increasing along the horizontal axis, and the share of ineligible subscribers is increasing along the vertical axis. Model is detailed in Section 4. Firms with very few observations are grouped (Low Group and Medium Group).

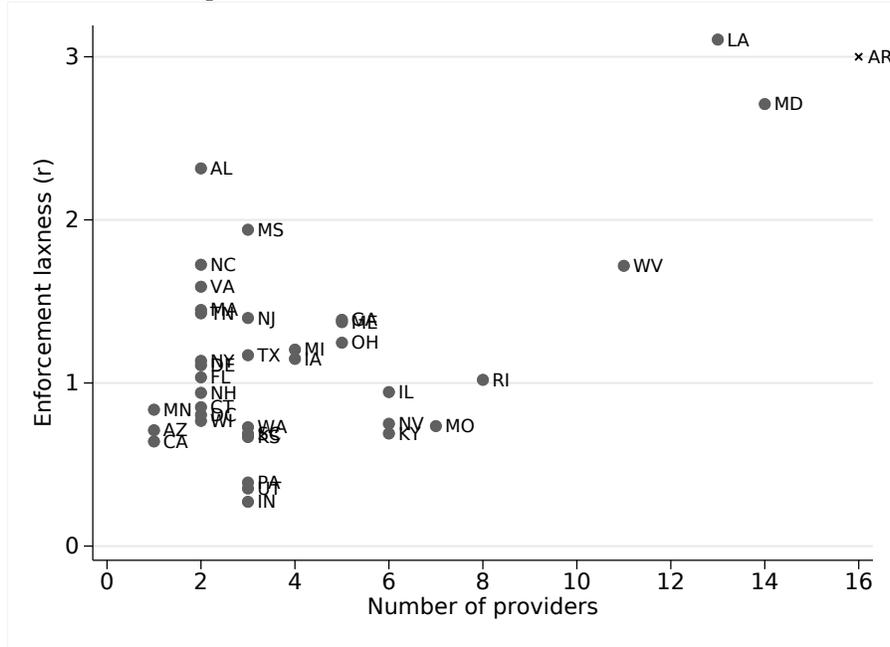
nalize the number of potential subscribers choosing the outside option. The nine firms which retain below 20 percent of subscribers in all markets they enter have been grouped²⁸ (δ_{low}), as have the five firms which have higher retention rates but enter only a few markets²⁹ (δ_{medium}).

The distributions of compliance and enforcement estimates are presented visually in Figures 5.1 and 5.2, with the full table shown in Appendix Table A2. Figure 5.1 plots the relationship between firm quality $\hat{\delta}_j$ and compliance $\hat{\gamma}_j$, with each point representing a firm. There is a negative correlation between γ and δ overall, but significant variation at the firm level. Firms that enroll many eligible subscribers also retain a higher portion of their subscribers after the reform. There is a significant gap between the nine Low Group firms and the others, in both compliance and quality. Even excluding the Low Group, the variation across firms is sizable. For example, the estimates predict that, all else equal, Telrite would enroll only slightly fewer eligible subscribers than Virgin Mobile, but triple the share of ineligible subscribers.

²⁸For the few firm-market combinations with a zero percent retention rate, I assume the firm retained one percent of subscribers, since estimation requires taking the log of market share.

²⁹Cincinnati Bell, Platinumtel, Telops, True Wireless, and US Connect.

Figure 5.2: State Enforcement Estimates \hat{r}_s



Note: State-specific enforcement parameter estimates. Identified by within-firm variation in post-reform retention rates across states. Model is detailed in Section 4. All else equal, higher values indicate a higher share of ineligible enrollments. Value for AR, marked with an X, is the omitted category in estimation.

Figure 5.2 plots the estimated \hat{r}_s for each state, sorted by the number of providers admitted. States with many providers are estimated to have looser enforcement (higher \hat{r}_s), but the relationship is not monotonic. These estimates are based only on the intensive margin of oversight, and the high estimates of \hat{r}_s in markets like Alabama would be consistent with a policy of restricting entry on the extensive margin, but with less policing of firms' post-entry behavior. The estimated distribution of enforcement is consistent with the qualitative evidence in state-level legal filings: the states estimated to be relatively strict include those that place additional requirements on providers in the form of proof-of-eligibility rules, audits, and enrollment databases (see Section 2.2).

6 Counterfactuals

To quantify the tradeoffs that come from admitting additional competing providers into a state market, the counterfactuals in this section impose incremental restrictions on the maximum number of providers admitted. These counterfactuals hold provider characteristics and state intensive margin enforcement fixed, varying only the composition of providers.

Table 2 reports the pre-reform and post-reform enrollments for both the baseline model and a series of incrementally more restrictive counterfactual provider limits. The percentage of enrollments remaining after the reform is reported as the share of subscribers eligible. In the national baseline model, 7.4 million eligible post-reform subscribers remain from a pre-reform base of 12.0 million. For each counterfactual imposing a maximum of N providers, the observed providers with the lowest estimated quality (δ_j) in each state market are removed until N providers remain. The restriction to seven providers reduces pre-reform enrollments by 600,000 (12.0 million to 11.4 million), while only reducing eligible post-reform enrollments by 100,000 (7.4 million to 7.3 million). As a result, it prevents five ineligible enrollments per lost eligible enrollment (500,000 versus 100,000). This counterfactual effectively removes the lowest compliance firms from the market, who also tended to have the lowest estimated quality. Although many ineligible enrollments remain under this counterfactual, the removal of the lowest compliance providers improves program efficiency at relatively low cost, in terms of lost eligible subscribers.

Starting from the restriction to seven providers, further restricting the number of providers, for example to three, removes 1.2 million additional pre-reform subscribers (11.4 million to 10.2 million) but also 300,000 more post-reform subscribers (7.3 million to 7.0 million). This marginal restriction prevents only three ineligible enrollments per lost eligible enrollment (900,000 versus 300,000). Eligible enrollments fall more as moderate quality firms are prevented from entering, but the remaining providers expand their market shares due to the estimated parameters of the nested logit demand model. This competitive effect mitigates the loss of eligible enrollments that would be seen under a standard logit model with weaker crowding or business-stealing effects.

Finally, further taking the most extreme restriction, to a single monopoly provider, prevents an additional 3.4 million pre-reform enrollments at a cost of 1.9 million post-reform enrollments. This not only substantially reduces the overall program take-up, but removes more eligible subscribers than ineligible subscribers (1.9 million versus 1.5 million). Increased eligible enrollments for the remaining monopoly provider are not enough to offset the enrollments prevented by excluding other high quality providers.

The ratios of ineligible to eligible subscribers removed, which are a function of the demand parameters and the quality and compliance of marginal providers, illustrate the trade-off of admitting additional competing providers in the Lifeline market. Depending on a policymaker's preferences

Table 2: Counterfactual Enrollments Restricting Maximum Number of Providers

	Pre-reform enrollments (millions)	Post-reform enrollments (millions)	Share of subscribers eligible (%)
National results:			
Model baseline	12.0	7.4	61.5
10 firms	11.7	7.4	63.0
7 firms	11.4	7.3	64.3
4 firms	10.8	7.2	66.5
3 firms	10.2	7.0	69.1
2 firms	9.2	6.7	71.9
1 firm	6.8	5.1	74.3
States with 9+ providers in data:			
Model baseline	2.3	0.7	29.3
10 firms	2.1	0.7	33.1
7 firms	1.8	0.7	37.0
4 firms	1.4	0.6	42.9
3 firms	1.0	0.5	53.1
2 firms	0.8	0.5	55.8
1 firm	0.6	0.3	53.4
States with 4-8 providers in data:			
Model baseline	3.3	2.1	62.5
7 firms	3.3	2.1	62.5
4 firms	3.1	2.0	63.7
3 firms	2.8	1.9	66.2
2 firms	2.3	1.7	72.4
1 firm	1.5	1.2	79.0
States with 1-3 providers in data:			
Model baseline	6.3	4.6	72.9
2 firms	6.1	4.5	73.9
1 firm	4.7	3.5	75.6

Note: Model baseline reports the model predicted pre- and post-reform enrollments for the observed providers in the data. Counterfactuals restricting to N firms remove the observed providers in each state market with the lowest estimated quality (δ_j) until N firms remain, and re-calculate predicted pre- and post-reform enrollments. Results are reported at the national level, and for groups of states based on their observed number of providers.

over the value of additional eligible enrollments and the costs of ineligible enrollments, such ratios could inform the desired level of provider entry which balances the benefits of competition while limiting costs stemming from low compliance providers.

7 Conclusion

This paper provides an empirical study of competition and compliance in the Lifeline program. The program outcomes depend on a number of interacting factors. The data provide clear evidence of heterogeneous firms, differing in quality and compliance. Admitting additional providers to a market expands total enrollments, but a sizable portion of these enrollees may be ineligible. Compliance behavior varies more across firms than within firms, and looser enforcement of program rules likely weakens competitive pressures, allowing lower quality providers to maintain market share.

The number and types of providers in a market depend on the oversight choices of state regulators. Given that providers with low compliance also tend to enroll few eligible subscribers, counterfactual simulations show that the initial gains from imposing tighter oversight—modeled here through limits on the set of providers participating—will be greatest: barring the lowest compliance providers removes 500,000 ineligible subscribers and only 100,000 eligible subscribers. Additional tightening of oversight leads to a reduced share of ineligible enrollments, but at a higher cost as higher quality firms and the more numerous eligible enrollments they generate are excluded.

The overarching result is that provider heterogeneity matters for policy-making in benefit programs like Lifeline. There should be particular attention placed on the lowest quality providers, who represent the low-hanging fruit for possible reductions in waste. But given imperfect enforcement, this group is unlikely to be deterred or removed from the market without some regulatory influence. Competition in such markets is sometimes seen as a replacement for oversight, with the reasoning that market forces will eliminate any low-quality providers. The demand estimates in this paper show that additional providers expand total program enrollment, which could be consistent with Lifeline enrollees having imperfect information about the set of products available, and potentially learning of program offerings from the outreach of providers themselves. Given these conditions, restricting Lifeline participation to providers with ongoing business in the broader unsubsidized

market—and thus a higher opportunity cost of non-compliance—may be warranted.

These dynamics are likely to appear in a number of other markets. Fraud and abuse are a consistent concern in healthcare provision, with estimates putting losses at hundreds of billions of dollars each year.³⁰ Though this encompasses a wide range of issues, programs which provide care or devices to individuals outside of the hospital system may be particularly susceptible.³¹ Outside of healthcare, there is evidence of excessive fees being extracted from Earned Income Tax Credit beneficiaries by their tax preparers.³² For-profit colleges have also seen charges of misusing federal student loan dollars³³, and concerns have been raised in programs funding early childhood education or pre-K³⁴. In each of these cases, the most severe waste stems from a small segment of low compliance providers exploiting insufficient oversight of quality, prices, or eligibility. Broadly, additional research could improve our understanding of how competition and oversight screen heterogeneous potential providers. The composition of providers could impact the efficiency of any program where the government pays the bill, providers compete to enroll customers, quality or prices are imperfectly known, and oversight is costly.

³⁰“The \$272 billion swindle,” *The Economist*, May 31, 2014.

³¹“Medicaid Shift Fuels Rush for Profitable Clients,” *The New York Times*, May 8th, 2014.

³²“Tax Preparers Targeting Poor with High Fees,” *The New York Times*, April 7th, 2014.

³³“Senate Committee Report on For-Profit Colleges Condemns Costs and Practices,” *The New York Times*, July 29th, 2012.

³⁴“Undercover Testing Finds Fraud and Abuse at Selected Head Start Centers,” *Government Accountability Office*, May 18th, 2010.

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A Appendix - Supplemental Tables

Table A1: Demand Estimates with State-Level Covariates

	Logit	Nested Logit
Crowding parameter (λ):		
Correlation of firm logit unobservables		0.276** (0.126)
Firm qualities (δ_j):		
Budget Prepay	-2.687*** (0.566)	-2.454*** (0.450)
Global Connection	-5.561*** (0.577)	-4.453*** (0.673)
I-Wireless	-4.325*** (0.477)	-3.678*** (0.472)
Nexus	-3.607*** (0.451)	-3.212*** (0.392)
Tag Mobile	-3.691*** (0.558)	-3.144*** (0.498)
Telrite	-3.343*** (0.510)	-2.932*** (0.436)
TracFone	-2.833*** (0.439)	-2.659*** (0.348)
Virgin Mobile	-2.999*** (0.441)	-2.798*** (0.353)
Yourtel/Terracom	-4.650*** (0.468)	-3.932*** (0.488)
Low Group	-7.006*** (0.479)	-5.535*** (0.766)
Medium Group	-4.243*** (0.502)	-3.533*** (0.506)
State-level covariates:		
Population density	0.00581** (0.00280)	0.00616*** (0.00217)
SNAP take-up rate	4.577** (2.089)	5.086*** (1.633)
Observations	157	157

*** p<0.01, ** p<0.05, * p<0.1

Note: Standard errors in parentheses. Dependent variable is the difference between log market shares for firm j in state s , and the log of the outside share. For nested logit specification, the number of competitors is used as the instrument for own share of the inside good. Relative to the primary specification, state-level demand shifters have been added to households' utility function.

Table A2: Compliance and Enforcement Estimates

Firm Non-Compliance Parameter γ_j		State Enforcement Laxness r_s					
Budget	0.317*** (0.0812)	AL	2.316*** (0.431)	KY	0.690*** (0.171)	NC	1.725*** (0.304)
Global	5.917*** (1.353)	AZ	0.710*** (0.132)	LA	3.105*** (0.757)	OH	1.247*** (0.331)
I-Wireless	0.556** (0.217)	AR	3.000 -	ME	1.373*** (0.490)	PA	0.390 (0.318)
Nexus	0.802*** (0.131)	CA	0.642*** (0.105)	MD	2.710*** (0.597)	RI	1.019*** (0.391)
Tag	1.252*** (0.447)	CT	0.851*** (0.223)	MA	1.447*** (0.391)	SC	0.689*** (0.265)
Telrite	1.250*** (0.204)	DE	1.109*** (0.245)	MI	1.205*** (0.208)	TN	1.427*** (0.232)
TracFone	0.234*** (0.0434)	DC	0.804 (0.544)	MN	0.836*** (0.137)	TX	1.170*** (0.196)
Virgin Mobile	0.337*** (0.0565)	FL	1.035** (0.420)	MS	1.939*** (0.321)	UT	0.353 (0.223)
Yourtel/Terracom	1.853*** (0.489)	GA	1.387*** (0.438)	MO	0.736*** (0.230)	VA	1.590*** (0.264)
Low Group	12.84*** (2.296)	IL	0.944*** (0.187)	NV	0.750*** (0.177)	WA	0.728*** (0.235)
Medium Group	1.059*** (0.210)	IN	0.271** (0.109)	NH	0.940*** (0.153)	WV	1.718*** (0.329)
		IA	1.148*** (0.282)	NJ	1.398*** (0.237)	WI	0.768*** (0.228)
		KS	0.668*** (0.198)	NY	1.136*** (0.423)		
Observations	157						

*** p<0.01, ** p<0.05, * p<0.1

Note: Standard errors in parentheses. All coefficients are from a single non-linear least squares regression. The model is described in Section 4.2. The dependent variable is the portion of subscribers retained after the Lifeline reform by firm j in state s . Enforcement for AR is the omitted category, assigned a value of 3.