The Price That Inmates Pay*

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Abstract

Incarcerated individuals in the United States purchase goods and services from monopoly vendors selected by their correctional authority. We study the price that inmates pay for phone calls, which the Federal Communications Commission has characterized as "exorbitant." We specify an auction model of procurement and estimate it using data from public records requests. Our results indicate that market power contributes to high prices but that more important are kickbacks (or "commissions") that providers give to the correctional authority. Regulation that substantially lowers price and eliminates commissions can more than double inmate surplus and simultaneously enable providers to recover their costs.

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1 Introduction

In the United States, two million people are incarcerated in prisons and jails, representing nearly one percent of the adult population.[1] These individuals use telephone calls to maintain contact with family, friends, and counsel. For this, they rely on a provider of *inmate telecommunications services* (ITS), which installs and maintains phone systems, monitors compliance with rules and regulations, and charges prisoners on a per-call and per-minute basis. An ITS provider is selected by the correctional authority of each prison system and jail, and incarcerated individuals cannot use an alternative provider. A nonprofit advocacy group estimated in 2019 that a typical 15-minute call costs about $6.00 in local jails and about $1.75 in state prisons.[2] The Federal Communications Commission (FCC) recently characterized these prices as "exorbitant" and well exceeding their understanding of providers' costs.[3]

Given these prices, the frequency and duration of calls, and the sheer number of incarcerated individuals, ITS is big business. The press has placed total revenue at more than one billion dollars annually.[4] Three providers—Securus, GTL, and IC Solutions—account for 58% of facility contracts. These contracts tend to be with the state prison systems and the larger local jails, and they cover approximately 78% of the incarcerated population. For the other side of the market, the FCC has summarized evidence and claims that the prices charged by ITS providers place unreasonable burdens on one of the more disadvantaged segments of society, leading prisoners' families to incur debt, reducing social contact between prisoners and the outside world, including their children, and ultimately making it more difficult for incarcerated individuals to reintegrate into communities once their sentence is completed.[5]

In this paper, we study the price that incarcerated people ("inmates") pay to make telephone calls. We focus specifically on the contracting process used by correctional authorities to select a provider and determine price. The broad contours of this process are understood. It starts when a correctional authority issues a request for proposals (RFPs). The responses of prospective suppliers typically are evaluated following a predetermined scoring rule. The outcome is a contract, typically with a duration of 3-5 years, that dictates financial terms. Often the selected ITS provider agrees to share some of the revenue obtained from inmates with the correctional

[1] Information sourced from the "Census of State and Federal Adult Correctional Facilities, 2019" and the "Census of Jails 2005-2019" reports published by the Bureau of Justice Statistics and "Estimates of the Total Resident Population and Resident Population Age 18 Years and Older for the United States, States, and Puerto Rico" published by the U.S. Census Bureau.

[2] See the press release of the Prison Policy Initiative titled "State of Phone Justice: Local Jails, State Prisons, and Private Phone Providers," written by Peter Wagner and Alexi Jones, and dated February 2019.

[3] Federal Communications Commission, "Third Report and Order, Order on Reconsideration, and Fifth Further Notice of Proposed Rulemaking," released May 24, 2021.

[4] Todd Shields, "Prison Phones Prove Captive Market for Private Equity," *Bloomberg Businessweek* (October 4, 2012), available at `https://www.bloomberg.com/news/articles/2012-10-04/prison-phones-prove-captive-market-for-private-equity`, last accessed December 9, 2020.

[5] Federal Communications Commission, "Third Report and Order, Order on Reconsideration, and Fifth Further Notice of Proposed Rulemaking," released May 24, 2021.

authority. Such payments are reasonably characterized as kickbacks but, in industry parlance, they are known as "commissions." As a result, correctional authorities can benefit financially from the contract that they sign with their ITS provider.

To make empirical progress, we issued public records requests to all 50 states and the District of Columbia. Specifically, we requested documents pertaining to the RFPs issued over 2000-2019, the associated responses of prospective suppliers, how those responses were evaluated, and the contracts that were signed as a result. We also requested documents on call volumes and the size of inmate populations. Compliance with our public records requests was mixed. We received at least some documents from 43 states and, of these, 26 states provided a complete set of documents on at least one procurement event. Most information provided was in the form of hundreds of pages of scanned documents. We converted these into a digitized database with approximately 40 procurement events and demand information (e.g., the number and duration of calls) for 15 states. These data supplement what has been obtained previously by nonprofit advocacy groups, and constitute our first contribution.[6]

We formulate an empirical model of ITS procurement to make use of the data. In the model, the correctional authority issues an RFP that dictates how a scoring rule will be applied to evaluate the quality, commission, and prices proposed by prospective suppliers. The model accommodates that some authorities prescribe the commission or the price; that component then receives zero weight in the scoring rule. Heterogeneous ITS suppliers observe the RFP and submit bids—a combination of a commission and a price—that maximize profit, balancing for example that a higher commission increases the likelihood of being selected but reduces profit conditional on being selected. Finally, inmates observe the resulting price and determine how many calls to place. In estimation, we take the RFPs and scoring rules as given, and focus on the second and third stages of the model. Then, using counterfactual simulations, we explore how alternative scoring rules and regulatory actions affect outcomes.

For the demand-side of the model, we focus specifically on New Jersey and New York, for which we obtained call volume and inmate population data that span exogenous reductions in price imposed by the states in order to obtain more equitable outcomes for inmates. In New Jersey, we observe that the price of a 15-minute call fell from $4.95 before 2014 to around $2.00 dollars in 2014, and then again to $0.66 in 2015 and afterward. In New York, the price fell from $2.30 before 2010 to $0.72 in 2010 and afterward. The average monthly number of calls per inmate increased from eight to 26 in New Jersey and from nine to 16 in New York. Therefore, these data indicate that inmates respond to the price of calls. With these data, we estimate a linear demand function that connects the price of a call to the revenue that ITS providers (and the states, via commissions) receive from their prisoners.

For the supply-side of the model, we apply the parametric first-score auction framework dis-

[6]Estimates of call costs are available from the Prison Policy Initiative (PPI) and Prison Phone Justice (PPJ), and commission rates for many states are available from PPJ.

cussed in Miller (2014). We observe the state-specific scoring rules and the proposed commissions and prices of each prospective supplier in the data. We also observe how the correctional authority evaluates the quality of prospective suppliers, and we use that as our measure of quality. The structural parameters to be estimated convert the commissions, prices, and qualities into comparable units, and also scale their contributions relative to a logit error term. The logit error term incorporates an element of subjectivity, and rationalizes that we sometimes observe employees differ in their evaluations of the same bid. We estimate the structural parameters using maximum likelihood, based on a loss function that compares the probability with which a prospective supplier wins the auction to whether the same supplier is actually selected. Consistent with expectation, our results indicate that proposals with lower prices, higher commissions, and higher quality are more likely to be awarded contracts.

We impute the marginal cost of providing ITS from the providers' first-order conditions for profit maximization, following standard practice in empirical industrial organization. The results corroborate that prices are, indeed, well above providers' costs. The gap between price and cost comprises two components: an oligopolistic markup of the provider, representing its market power, and the commission that is paid to the correctional authority. Of these, the commission typically is much larger. This result flows from the raw data, as commissions often account for more than 60% of the revenue that the ITS provider obtains. Thus, looking broadly across states, we find that the practice of soliciting commissions contributes substantially more to "the price that inmates pay" than does the market power of ITS providers.

We explore counterfactual policies using a series of simulations that reveal economically interesting interplay between regulatory policy and antitrust enforcement. We focus on a procurement event in one particular state in which there were four prospective suppliers, the winning supplier provided a commission of 60%, and the state predetermined prices for a 15-minute call of $2.36 (if collect) and $1.78 (if prepaid). First, we show that adding competition in this setting benefits the state, as prospective suppliers increase their proposed commissions, but that inmates do not benefit. Second, simply eliminating commissions transfers money from the state to the ITS provider, as again inmates do not gain unless prices also fall. Third, a policy that reduces price by 50% substantially decreases state revenues, both because less revenue is obtained from inmates and because prospective providers decrease their proposed commissions. Inmates surplus, however, nearly doubles. Fourth, a policy that reduces price by 76% and eliminates commissions improves inmate surplus by 230%—and the ITS provider still obtains sufficient revenue to cover its cost. These and other results that we develop may be relevant for regulators at the FCC and policy-makers at the state and local levels.

Our results are based on a limited sample size that reflects a best effort to collect data in a predominantly confidential market. The FCC has collected a vast amount of information from correctional authorities and ITS providers over the course of a regulatory effort that has spanned parts of the three most recent administrations. These data, however, are not pub-

licly available. We observe that even summary statistics are largely redacted from published FCC materials. Our data and results have heightened value in this context. It is possible that economists at the FCC or elsewhere could confirm our results, or extend them for example by relaxing our parametric assumptions (e.g., based on Asker and Cantillon, 2008).

Our research relates to a large literature on government procurement practices. Among recent articles, Kang and Miller (2021) use a principal-agent model to investigate the implications of low levels of competition, with an application to information technology and telecommunications contracts. Takahashi (2018) and Bolotnyy and Vasserman (2021) use auction models to study government procurement by state-level Departments of Transportation. Takahaski examines the effects of uncertainty in procurement auctions, and Bolotnyy and Vasserman study scaling auctions. Slattery (2020) studies proposals submitted by local governments to companies considering where to place their headquarters. Similar to these articles, we examine an interesting and special case of procurement auctions—one in which the contracting process allows procurement entities to receive compensation from providers, with the final consumers of the product being unable to influence contract outcomes.

There is a similarly large literature on prisons and their effects on incarcerated individuals that we cannot fully describe here. Among recent contributions, Bhuller et al. (2021) and Rose and Shem-Tov (2021) determine that incarceration reduces further criminal behavior, with the first article using a random judge research design and the second exploiting discontinuities in North Carolina's sentencing thresholds. Mukherjee (2021) provides evidence that privately-owned prisons delay the release of inmates based on exogenous capacity shocks at prisons in Mississippi. Notably, at least three articles look at how the conditions *within* prisons affect outcomes. Hjalmarsson and Lindquist (2022) finds that incarceration in high-quality prisons improves health and decreases mortality, Mastrobuoni and Terlizzese (2022) finds that "open" prisons that allow for inmates greater freedom and responsibility lower recidivism, and Tobón (2022) finds that recidivism is lower for inmates assigned to newer facilities.

We organize our paper as follows. Section 2 describes the market for ITS, the data collection process, and details on the data. Section 3 presents the model, develops selected comparative statics, and discusses identification and estimation. Section 4 evaluates alternate policies that could improve outcomes for incarcerated individuals. Finally, Section 5 concludes.

2 Inmate Telecommunications Services

2.1 The Competitive Landscape

In the 1990s, at the height of competition in the market, almost 30 different ITS providers vied for prison and jail contracts. Over time, the market has experienced significant consolidation, mainly through mergers and acquisitions by the current market leaders: Global Tel*Link (GTL) and Securus. In recent merger activity, GTL acquired Telmate in 2018 and a proposed acquisi-

Table 1: ITS Providers and Estimated Market Shares

	GTL	Securus	CenturyLink	ICSolutions	Telmate	Paytel
# of Contracts	377-586	635-794	6-20	129-288	101-157	151
Market Share	46.0%-52.9%	15.0%-19.4%	10.6%-11.5%	3.7%-6.3%	1.9%-3.1%	1.3%

Notes: Based on PPI data collected in July 2017. Ranges are shown because some providers had outdated information on their websites. Market shares are measured based on the inmate population served. Providers with a market share less than 1% include: NCIC, Legacy Inmate, Regent, AmTel, and Reliance. See the August 28, 2017 press release titled "Prison Phone Giant GTL Gets Bigger, Again," by Peter Wagner.

tion of IC Solutions by Securus in 2019 was blocked by the Department of Justice on antitrust grounds. Table 1 provides estimates of market shares published by PPI in 2017. Securus, GTL, and CenturyLink—the three largest providers—collectively account for most state-level prison contracts and many of the jail contracts. The smaller providers, including IC Solutions, tend to have jail contracts.

Outside of proposed mergers, federal regulation of the ITS industry has taken the form of Orders issued by the FCC. In response to multiple campaigns to reduce the costs to inmates and their families, the FCC in 2013 instituted rate caps and regulated the ancillary fees often associated with making phone calls from prison. At the time, the FCC set rate caps of $0.25 per minute for collect calls and $0.21 per minute for prepaid and debit calls. In 2017, the District of Columbia Court of Appeals ruled that the FCC did not have the authority to regulate rates within a state, but the across state rate caps (interstate rates) remained in place. In 2021, the FCC further reduced these rate caps to $0.12 per minute for prisons and $0.14 per minute for larger jails. However, due to the Court of Appeals ruling, intrastate rates remain at the discretion of the states.

Individual states have made progress in reducing call rates. Eleven states—New York, Rhode Island, New Jersey, Maryland, South Carolina, Ohio, Illinois, Nebraska, Colorado, New Mexico, and California—and DC have each passed laws to eliminate commissions in contracts that provide services to state facilities. Additionally, some states have placed their own caps on call rates: in 2022 Indiana capped call rates at $0.12 per minute, in 2021 California capped intrastate call rates at $0.07 per minute, and in 2020 Connecticut declared prison phone calls would be free of charge. Despite this progress, commissions remain in 39 states, and many of the aforementioned changes only apply to state prison facilities, but not county jails.

On multiple occasions ITS providers have been accused of predatory practices. In the initial 2013 investigation, the FCC found that in addition to high per minute call rates, the ancillary fees associated with making a call increased costs to inmates and their families by as much as 40 percent. Although the 2013 interstate rate caps remained in place, the FCC noted that as of 2021, 34 percent of prisoners' families are going into debt just to stay in touch. Recently, GTL settled a 2022 class action lawsuit alleging that the company had seized money from prepaid accounts following a brief period of inactivity. During the trial it was disclosed that over a

Figure 1: An Application of a Scoring Rule in Missouri

					For DPMM Use Only
NAME OF OFFEROR	Experience And Reliability (Max. 20 Pts.)	Proposed Method of Performance (Max. 30 Pts.)	TOTAL SUBJECTIVE POINTS (Max. 50 Pts.)	COST POINTS INSERTED BY PURCHASING (Max. 50 Pts.)	TOTAL POINTS (Max. 100 Pts.)
1. MCI Worldcom	20	30	= 50 +	50	TOTAL = 100
2. Public Communications Service	15	25	= 40 +	47.75	TOTAL = 87.75

seven-year period GTL took $121 million from these “inactive" customer accounts.

2.2 Procurement Process

ITS providers enable inmates to make phone calls from a prison or jail. This involves installing physical infrastructure such as phones and cable lines, as well as certain technological features that allow the facility to monitor calls in order to ensure that, for example, the correct person is being called. Most inmates reside in state prisons and county jails. Usually, the entities that procure ITS for these facilities are state-level Departments of Corrections (DOCs) and county governments, respectively.[7]

The contracting process begins when a procuring entity issues an RFP, which typically outlines a set of technical and cost requirements, and describes how proposals will be evaluated. Prospective suppliers often have the opportunity to ask clarifying questions, and participate in a joint “walk through” of the facilities. Thus, each supplier has good information about the opportunity and the identity of its competitors prior to submitting its bid. Although the evaluation of bids varies, most RFPs assign a numerical value to certain elements of the bid—often the phone rates, commission, and a measure of technical quality. Using these criteria, an evaluation committee reviews all proposals and assigns a score to each element. The bidder with the highest overall score wins the contract, which is typically 3-5 years in length and adopts the terms outlined in the RFP and the winning proposal. Figure 1 provides an example from the Missouri DOC procurement process in 2000.[8]

[7]The largest individual accounts, however, are the Federal Bureau of Prisons (FBP) and Immigration Customs Enforcement (ICE). We did not solicit data from either the FBP or ICE.

[8]We obtained the scoring sheet along with other documents using a FOIA request. In most cases the evaluation criteria for technical quality, proposed call rates, and commissions were clearly delineated. We do not include in our analysis the few cases where call rates and commissions were jointly considered and assigned a single score. More detail on our data collection effort is provided in Section 2.3.

2.3 Data Collection and Descriptive Analysis

The data we use come from public records requests that we submitted over 2020-2021 to all 50 states and Washington, DC. Thus, the data pertain to state-level prison systems. Our public record requests included six specifications:

(i) Requests for proposals (RFPs) related to ITS from 2000-2019, including the evaluation criteria for RFPs.

(ii) For each RFP issued, all of the corresponding responses received from ITS providers, including those from providers that did not win the contract.

(iii) Corresponding documents, reports, and spreadsheets that evaluate responses to the RFPs, including any scoring of the responses.

(iv) Contracts with ITS providers over 2000-2019, and any modifications to those contracts.

(v) Detailed inmate call volume information, including the number of calls and total minutes of use for Local, InterLATA, IntraLATA, and Interstate calls for each facility, for each month, over 2000-2019.

(vi) Average daily population of inmates, on a monthly basis, at each prison facility over 2000-2019.

Specifications (i)-(iii) are designed to cover the ITS procurement process from beginning to end, and specifications (iv)-(vi) are designed to help us estimate the relationship between phone usage and call prices. Together, the specifications request the information needed to estimate an auction model of procurement.

The responses that we received from the states reflect their specific compliance requirements, their willingness to engage with our request, and their document retention practices. We received at least some documents from 43 states. Of these, 26 states provided a complete set of documents on at least one procurement event (i.e., specifications (i)-(iv)). Only nine states provided information on multiple procurement events. For call volumes and inmate populations, most states provided a limited, time-bound snapshot (specifications (v)-(vi)). Few states provided a longer time-series of data. Among this smaller set, the data we obtain from New York and New Jersey span an exogenous change in price imposed by the states and so are useful in understanding how prices affect call volumes. Across all of the specifications, the documents we received were (mostly) not digitized and came in a myriad of different formats. Processing the documents and constructing a usable database was time intensive.

The data that we use to estimate the model of procurement features 137 proposals submitted in response to 35 RFPs. Thus, the average RFP generated 3.9 proposals. The years of the earliest and latest RFPs are 2000 and 2019, respectively, the year of the median RFP is 2014,

and we observe multiple RFPs in every year over 2012-2019. Securus bids in response to 28 of the RFPs and wins eight times; GTL bids in response to 28 of the RFPs and wins 11 times. The RFPs to which Securus and GTL do *not* bid tend to occur earlier in the sample, before those firms reached their current size.

We observe that 17 RFPs (49% of the sample) specify that bids will be evaluated in part based on the proposed commission. For these RFPs, the average proposed commission among all bidders is 64% of revenue, and this increases to 65% for those bidders that ultimately are selected. Another seven RFPs simply dictate a preset commission to prospective suppliers; in only 11 instances is no commission obtained.

With regard to prices, we observe that 25 RFPs (71%) specify that bids will be evaluated in part based on the prices they propose to charge inmates (with lower prices being desired). For these RFPs, the average proposed price of a 15-minute local collect call is $1.32, taking into account connection charges and per-minute charges. For the remaining RFPs, the average price of a 15-minute collect call is $1.91.

Before turning to the model, we provide some qualitative evidence regarding how prospective suppliers adjust their bids based on the terms of the RFP. Figure 3 features two panels. In the left panel, we plot the weight that the RFP places on the commission in the scoring rule (horizontal axis) against the proposed commission (vertical axis). The orange triangles show winning bids and the blue circles show other bids. A positive relationship between the weight placed on the commission and the proposed commissions is evident, and the bivariate correlation statistic is 0.73. The right panel shows the analogous relationship for prices, specifically for the price of a 15-minute local collect call. Although it is less clear visually, a negative relationship exists, and the bivariate correlation statistic is -0.18. Putting the panels together, the data are consistent with higher weights on the commission and on prices, respectively, leading prospective suppliers to submit bids with higher commissions and lower prices.

3 Empirical Model of Procurement

3.1 Overview

The model features three types of agents: Departments of Corrections (DOCs), ITS providers, and inmates. Within each state, a DOC issues a request for proposals (RFP) for ITS. The RFP specifies how providers will be evaluated, and in particular the relative weight that the DOC will place on the commission to be paid to the state, the price to be charged inmates, and the quality of the providers. The RFP may also impose the commission, the price, or both. We take the RFPs as given. Procurement then unfolds as follows:

1. Providers observe the RFP and submit proposals.

2. DOCs observe the proposals and select a provider.

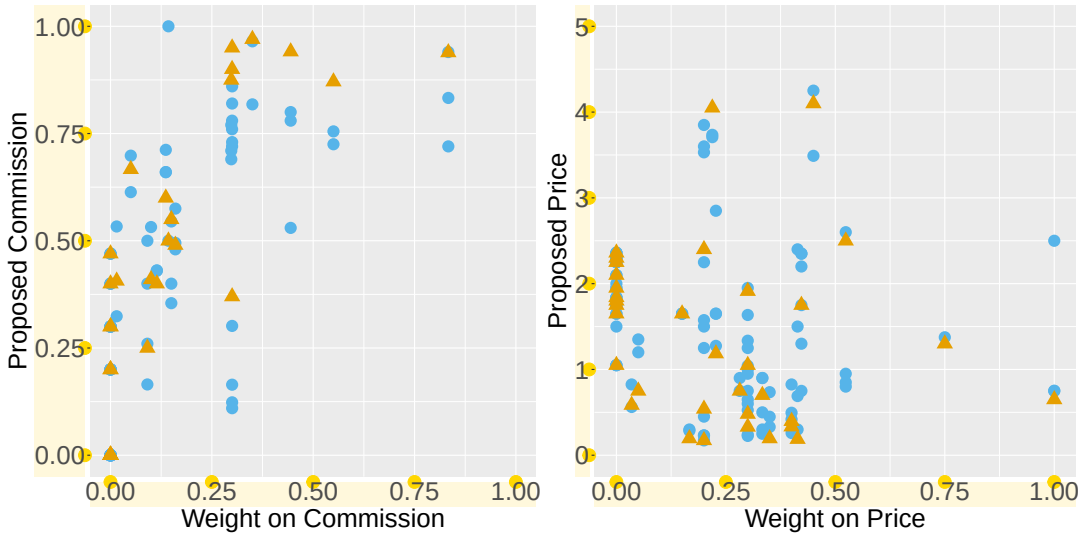

Figure 2: Proposed Commissions and Prices

Notes: Each symbol represents a proposed commission (left panel) or a proposed price (right panel). The symbols are orange triangles if the proposal was selected by the DOC and blue circles otherwise. The horizontal axis is the weight that the DOC placed on the commission (left panel) or price (right panel) in the scoring rule. The data are from 137 proposals in response to 35 different RFPs.

3. Inmates observe the price and determine how many calls to place.

The second and third stages of the model are non-strategic because the decision of one DOC does not affect other DOCs and inmates are price-takers. Nonetheless, they guide the trade-offs faced by providers as they determine the commissions and prices to submit with their proposals in the first stage. We assume that the (state-specific) costs and qualities of providers are common knowledge and exogenously determined. Therefore, the solution concept that we apply for the first stage is Nash equilibrium. We now consider each stage of the model in turn, proceeding in reverse order.

3.2 Inmates' Demand for Calls

We specify a demand function that connects the price of a 15-minute phone call to the number of calls that inmates place. In practice, this price often incorporates an upfront connection charge and a per-minute charge, and furthermore these charges can vary based on whether the call is local, intrastate (within the state), or interstate (between states). We construct a state-specific price based on a typical call length and average across different types of calls (with weights based on the number of calls). The data indicate a strong relationship between our measure of price and the number of calls that inmates place.

Figure 3 plots price and quantity over time for New Jersey (left panels) and New York (right panels). We measure quantity using the average number of calls placed per inmate in a given month. Among the states for which we have data, New Jersey and New York are distinct because (1) a long time-series of price and quantity data are available and (2) we observe

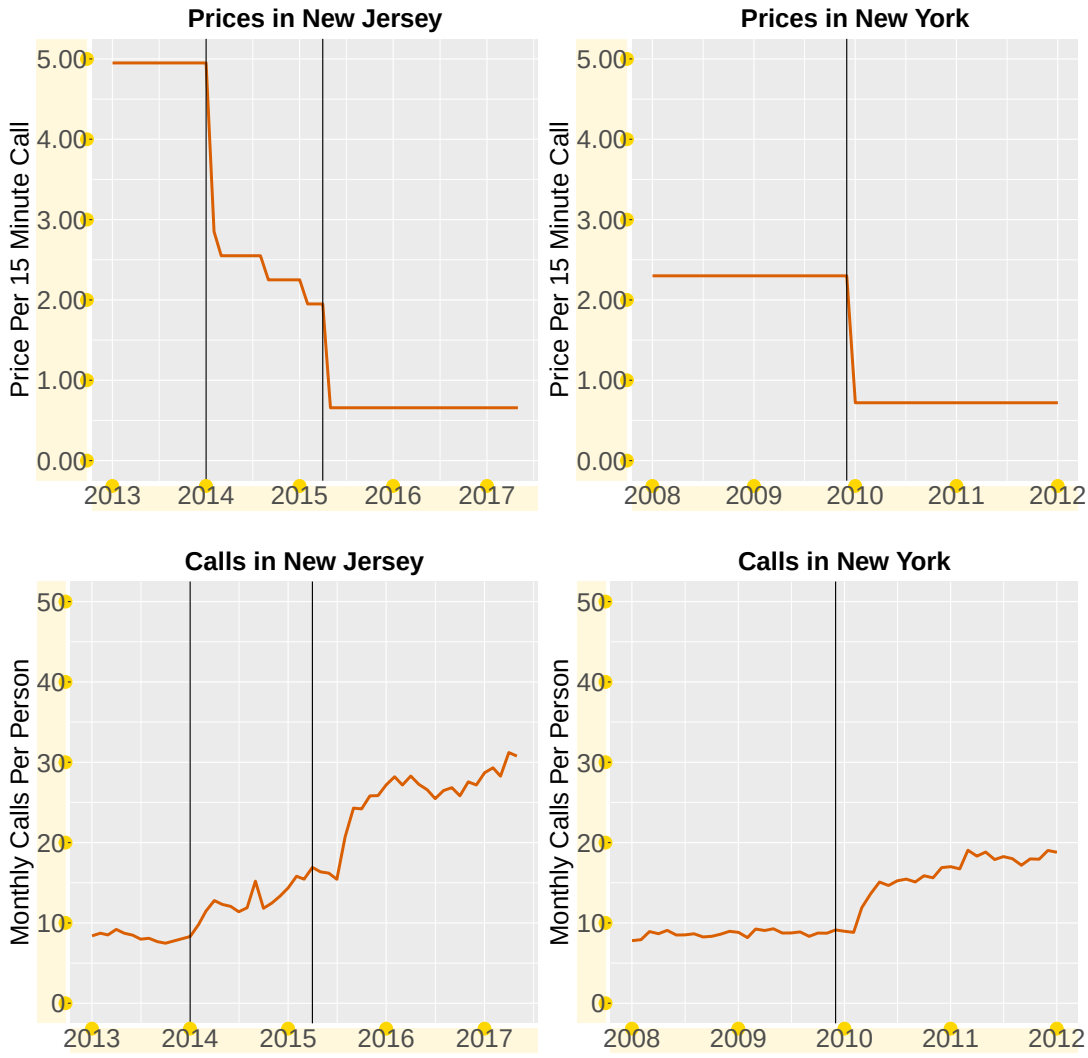

Figure 3: Prices and Quantities in New Jersey and New York

changes in price that occur for reasons that are unrelated to any changes in inmate demand for calls. In New Jersey, the DOC stopped accepting commissions in 2014 and imposed a series of price reductions. The state then passed a law that lowered prices once again in 2015. In New York, price fell in 2010 in conjunction with a change in ITS providers from GTL to Unisys, which resulted in a price decrease.

A visual inspection confirms that these price reductions are associated with an increase in the number of calls. In New Jersey, the average number of calls per inmate-month rises from an average of 8.32 before the first price reduction to 26.46 after the last. In New York, it rises from 8.66 to 16.09. This pattern corroborates our understanding that the price of calls is an important consideration for many inmates in their phone usage.

In the model, we assume that demand is linear and of the form $q(p_i, \boldsymbol{\beta}) = \beta_0 + \beta_1 p_i$, where i

Table 2: Inmate Demand for Calls

	(i)	(ii)	(iii)	(iv)
Price	-2.72	-3.51	-3.53	-3.39
	(0.37)	(0.31)	(0.35)	(0.49)
Constant	19.54	·	24.11	16.61
	(1.22)		(1.34)	(1.13)
NJ Constant	·	24.07	·	·
		(1.24)		
NY Constant	·	16.79	·	·
		(0.66)		
Sample	NJ/NY	NJ/NY	NJ	NY
# Observations	63	36	38	25

Notes: The dependent variable is the number of calls divided by the average daily population of inmates. Observations are at the state-month level. The sample for New Jersey runs from February 2013 to May 2015. The sample for New York runs from January 2009 to January 2011. Standard errors are adjusted to account for heteroskedasticity and reported in parentheses.

indexes the state, q_i is the number of calls per inmate-month, p_i is the price of a 15-minute call, and $\boldsymbol{\beta} = (\beta_0, \beta_1)$ contains the demand parameters. We assume that demand does not depend on the ITS provider for reasons other than price. This is consistent with our understanding that quality differentiation among providers relates to various types of security provisions (e.g., call monitoring) rather than latency or other issues that would have a direct effect on the experience of inmates.

To estimate the demand parameters, we specify an econometric version of the demand system that allows for changes in prices and quantities over time:

$$q_{it} = \beta_0 + \beta_1 p_{it} + v_{it} \tag{1}$$

where v_{it} captures seasonal and idiosyncratic changes in call volumes. We use ordinary least squares and estimate on the monthly data from New Jersey and New York, including 24 months on either side of the price changes. The OLS coefficients are unbiased if the changes in price are orthogonal to the error term.

The results are summarized in Table 2. The baseline specification is estimated in column (i). The coefficients indicate that if the cost of a 15-minute call increases by one dollar then the average number of calls placed per inmate-month decreases by nearly three. This corresponds to a mean price elasticity of demand of -0.53 in New Jersey and -0.42 in New York. With linear demand, this elasticity of demand is larger in magnitude if price is higher, all else equal. Indeed, the mean elasticity of demand in New Jersey falls from -1.62 (before the price decreases begin) to -0.07 (once they are finished). The corresponding mean elasticities in New York are -0.72 and -0.12.

A reduction in the price of a call saves money for inmates and for their families and friends, who often bear the financial burden of calls. Increasing the number of calls that can be afforded also supports greater contact between inmates and their social networks. It is unclear to us whether these benefits can be reliably measured by integrating under the demand curve to obtain "inmate surplus." However, if we do so, we find that the price reductions observed in New Jersey increase the monthly surplus of inmates by $1.27 million and the price reductions observed in New York increase the monthly surplus of inmates by $1.37 million.

Table 2 also shows the results that we obtain using a state-specific intercept (column (ii)) and state-level subsamples (columns (iii) and (iv)). Although some differences in the calling patterns between these two states exist, they are not different enough to matter substantially for the results that follow. Henceforth, we assume that the parameters shown in column (i) characterize the demand curve that we use in the model.

3.3 The DOCs' Procurement of ITS

Within each state, the DOC must select an ITS provider. We assume that the DOC evaluates providers based on the commissions they would pay the state, the prices they would charge inmates, and the quality of their service. The DOC commits to a scoring rule prior to the procurement process that is used to weight each of these factors. We assume that some subjectivity exists in the scoring process, consistent with the fact that we observe variation in how the same proposal is scored by different DOC employees. The DOC selects the provider that receives the highest score.

Letting i index the state and j index the provider, the scoring rule takes the form:

$$score_{ij} = \alpha^p \omega_i^p p_{ij} + \alpha^k \omega_i^k \overline{k}_{ij}(p_{ij}; \boldsymbol{\beta}) + \alpha^x (1 - \omega_i^k - \omega_i^p) x_{ij} + \epsilon_{ij} \tag{2}$$

where p_{ij} is the proposed price of a 15-minute phone call, $\overline{k}_{ij}(p_{ij}; \boldsymbol{\beta})$ is the commission as a function of the price, and x_{ij} is the quality of the provider. These terms are weighted by ω_i^k, ω_i^p, and $(1 - \omega_i^k - \omega_i^p)$, respectively, with each of the weights between zero and one. The parameters to be estimated, $\boldsymbol{\theta} = (\alpha^p, \alpha^k, \alpha^x)$, convert the elements of the scoring function into comparable units, and scale contributions relative to the subjective component of the scoring, which we incorporate through an additive shock, ϵ_{ij}. As we observe that DOCs prefer lower prices, higher commissions, and higher quality, we expect: $\alpha^p < 0$, $\alpha^k > 0$, and $\alpha^x > 0$.

Our formulation of the scoring rule allows the model to accommodate the heterogeneity that we observe in the data. For instance, in some procurement settings, the DOC imposes the price *ex ante*, and evaluates providers based on their proposed commission and their quality.[9] In the model, that would imply $\omega_i^p = 0$ and $p_{ij} = \tilde{p}_i$ for some $\tilde{p}_i$ selected by the DOC. Analogously,

[9] An example is Georgia in 2015, which imposed a price schedule for all bidders that set the cost of a 15-minute local collect call at $1.95, and selected a provider that would pay 97% of revenues to the state as a commission.

in some other procurement settings, the DOC imposes the commission *ex ante* and evaluates providers based on their prices and qualities. Further, as the weights that the DOC applies are available in the data, these scenarios are easily accounted for in the empirical implementation.

Reflecting industry practice, we allow the commission to feature fixed payments and also to depend on prices, through the revenue that is obtained from inmates:

$$\overline{k}_{ij}(p_{ij};\boldsymbol{\beta}) = k^0_{ij} + q(p_{ij};\boldsymbol{\beta})p_{ij}k^1_{ij} \tag{3}$$

where $q(p_{ij};\boldsymbol{\beta})$ is a demand function that characterizes the number of calls an average inmate places per month (as specified in the previous section), $k^0_{ij} \geq 0$ is a fixed payment per inmate-month, and $k^1_{ij} \in [0,1]$ is the fraction of revenue that the provider proposes to pay the state.[10] Most typically, DOCs specify that commissions must be paid as a fraction of revenue (i.e., they dictate *ex ante* that $k^0_{ij} = 0$ for all j). However, we observe instances in which DOCs specify the opposite (i.e., $k^1_{ij} = 0$ for all j), or specify some nonzero level of fixed payment and allow providers to select the fraction of revenue to pay the DOC. Again, the model accommodates this heterogeneity.

Finally, we assume that ϵ_{ij} is a stochastic term with a Type I extreme value distribution. We assume that draws from this distribution are realized after providers submit proposals, but that the distribution itself is common knowledge. Therefore, letting the objective portion of the scoring rule be given by

$$\delta_{ij}(\boldsymbol{\theta}, \boldsymbol{w}_{ij}) \quad = \quad \alpha^p \omega^p_i p_{ij} + \alpha^k \omega^k_i \left(k^0_{ij} + q(p_{ij};\boldsymbol{\beta})p_{ij}k^1_{ij}\right) + \alpha^x(1-\omega^k_i-\omega^p_i)x_{ij} \tag{4}$$

where $\boldsymbol{w}_{ij}$ collects the data associated with provider j and state i, the *ex ante* probability with which provider j is selected in state i is

$$s_{ij}(\boldsymbol{\theta}, \boldsymbol{W}_i) = \frac{\exp(\delta_{ij}(\boldsymbol{\theta}, \boldsymbol{w}_{ij}))}{\sum_n \exp(\delta_{in}(\boldsymbol{\theta}, \boldsymbol{w}_{in}))} \tag{5}$$

The denominator sums across all prospective providers, and the matrix $\boldsymbol{W}_i$ contains all the data relevant for state i (we will let $\boldsymbol{W}$ combine data across states).

We estimate the parameters of the model using maximum likelihood. In doing so, we treat the commission, prices, scoring weights, and demand-side parameters (i.e., $\boldsymbol{\beta}$) as data. We use the quality score assigned to each provider as a measure of quality, and similarly treat it as data. The log-likelihood function is given by

$$\ln L(\boldsymbol{\theta}|\boldsymbol{y}, \boldsymbol{W}) = \sum_i \sum_j y_{ij} \ln(s_{ij}(\boldsymbol{\theta}, \boldsymbol{W}_i)) \tag{6}$$

[10] With Idaho in 2014, the contract stipulates a payment of \$20 per inmate per month. The fixed payments that appear in other contracts are not tied explicitly to the inmate population, and we convert using data on ADP.

Table 3: Estimation of the Scoring Rule

	Parameter	Point Estimate	Std. Error
Price	α^p	-1.90	(1.88)
Commission	α^k	2.17	(1.03)
Quality	α^q	49.11	(13.21)

Notes: The table summarizes the results of maximum likelihood estimation. The estimation sample uses data on a total of 137 proposals, submitted in response to 35 RFPs.

where y_{ij} equals one if provider j is selected in state i, and zero otherwise. Estimation is based on the sample described in Section 2.3. In total, there are 137 proposals submitted in response to 35 different RFPs.

Table 3 summarizes the results. The parameter estimates have the expected signs. The magnitudes of each parameter determine the extent to which a change in the corresponding element of the proposal affects the likelihood of being selected. Under the maintained parametric assumptions, we have

$$\frac{\partial s_{ij}}{\partial \delta_{ij}} = s_{ij}(1 - s_{ij}) \tag{7}$$

and also

$$\frac{\partial s_{ij}}{\partial k^0_{ij}} = \frac{\partial s_{ij}}{\partial \delta_{ij}} \alpha^k \omega^k_i \tag{8}$$

$$\frac{\partial s_{ij}}{\partial k^1_{ij}} = \frac{\partial s_{ij}}{\partial \delta_{ij}} \alpha^k \omega^k_i q(p_{ij}) p_{ij} \tag{9}$$

$$\frac{\partial s_{ij}}{\partial p_{ij}} = \frac{\partial s_{ij}}{\partial \delta_{ij}} \left[\alpha^p \omega^p_i + \alpha^k \omega^k_i \frac{\partial q(p_{ij})}{\partial p_{ij}} p_{ij} k^1_{ij} + \alpha^k \omega^k_i q(p_{ij}) k^1_{ij} \right] \tag{10}$$

The first two expressions are positive: the score of a provider increases at least weakly with the commissions it provides. The third expression can be positive or negative. To the extent that the DOC considers price in the scoring rule, there is a direct effect through which higher prices reduce the probability that the provider is selected. This is represented by the first term inside the brackets. However, price also can have an indirect effect, through the revenue that is obtained from inmates. This is represented by the second and third terms inside the brackets. Through the indirect effect, higher prices increase the probability of being selected if prices are on the inelastic portion of the demand curve, and decrease the probability of being selected otherwise.

3.4 ITS Providers' Responses to RFPs

We assume that the expected profit of a prospective supplier, heading into a procurement event, is given by

$$\pi_{ij}(k_{ij}^0, k_{ij}^1, p_{ij}) \quad = \quad s_{ij} \underbrace{\left[((1-k_{ij}^1)p_{ij} - \gamma_{ij})q(p_{ij}) - k_{ij}^0\right]}_{\equiv A_{ij}} \tag{11}$$

where s_{ij} is the probability with which the provider is selected (as previously defined) and A_{ij} is the profit per inmate-month conditional on selection. The profit function embeds that the provider obtains revenue from the price that it charges inmates, and that some of that revenue is transferred to the state in the form of a commission.

The profit function includes another term, γ_{ij}, that represents the per-call cost of service less any ancillary revenues that the provider obtains from fees.[11] Prisons with larger populations typically have multiple facilities and require more physical phone installations and have greater maintenance requirements. Inmate phone calls can also require per-call costs such as live call monitoring, continuous voice analytics, preventing three-way calling, voice-to-text, etc. Thus, it is reasonable to assume that the cost of service is proportional to the number of calls that will be placed (given price). As we maintain the same assumption for ancillary revenue, we have:

$$\text{cost}_{ij} - \text{ancillary revenue}_{ij} = \gamma_{ij} q(p_{ij}; \boldsymbol{\beta}) \tag{12}$$

where cost and ancillary revenue are per inmate-month. The value of γ_{ij} is larger if costs are higher and if ancillary revenues are lower.

Depending on the RFP, providers may be able to select their commission, their price, or both. We assume that, in doing so, they maximize expected profit conditional on the choices of other providers. We assume the existence of a Nash equilibrium.

In choosing the commission—either the fixed payment or the fraction of revenue—each provider balances that a higher commission increases the probability of being selected by the DOC, but reduces profitability in the event that it is selected. Whether one differentiates the profit function with respect to the fixed payment (k_{ij}^0) or the revenue-based payment (k_{ij}^1), the same first order condition obtains:

$$\underbrace{(1-k_{ij}^1)p_{ij}q(p_{ij}) - k_{ij}^0}_{\text{Retained Revenue}} \quad = \quad \underbrace{\gamma_{ij}q(p_{ij})}_{\text{Cost Less Ancillary Revenue}} + \underbrace{\left(\frac{1}{\alpha^k \omega_i^k}\frac{1}{(1-s_{ij})}\right)}_{\text{Markup}} \tag{13}$$

[11] As we discuss in Section 2, there are variety of fees that can be imposed on inmates and their families, including charges for adding money to an account and charges for making collect calls. These fees can be difficult for the DOC to observe, and our public records requests did not provide systematic information on the fees that different providers apply.

The left hand side is the portion of revenue obtained from inmates that is retained by the provider after payments to the state have been made ("retained revenue"). The right hand side is additive in the provider's cost, the ancillary revenues it obtains, and a profit-maximizing markup term.[12]

We assume that equation (13) holds if providers can choose at least one of their commission terms. This allows us to recover each γ_{ij}, and thus the net of providers' costs and ancillary revenues, as the other terms in the equation depend on data and already-estimated parameters. We obtain a median retained revenue of \$9.15, a median cost (less ancillary revenue) of \$4.32, and a median markup of \$3.68, each measured on a per inmate-month basis. For comparison, the median amount to be paid to the state in (proposed) commissions is \$14.45 per inmate-month.

We now consider how providers determine the price to be charged to inmates. Differentiating the profit function obtains the following first order condition:

$$\frac{\partial s_{ij}}{\partial p_{ij}} A_{ij} + s_{ij} \left((1 - k_{ij}^1) q(p_{ij}) + [(1 - k_{ij}^1) p_{ij} - \gamma_{ij}] \frac{\partial q(p_{ij})}{\partial p_{ij}} \right) = 0 \tag{14}$$

We assume that this equation holds if the DOC permits providers to choose price in their RFP responses. This provides another path to recovering the γ_{ij} terms. However, we find that any such inferences are sensitive to the (imprecisely estimated) α^p parameter, and so we rely instead on equation (13).

For providers that choose price, a somewhat complicated set of trade-offs arises. To tease this out, assume for the moment that price does not affect the choice of provider (i.e, $\partial s / \partial p = 0$). In that case, the model simplifies to a standard monopoly pricing problem, albeit one in which cost (less ancillary revenue) is inflated by the commission:

$$p_{ij} = \left(\frac{1}{1 - k_{ij}^1} \right) \gamma_{ij} - \left(\frac{\partial q(p_{ij})}{\partial p_{ij}} \right)^{-1} q(p_{ij}) \tag{15}$$

The price that solves this simplified condition must fall along the elastic portion of the demand curve.[13] It exceeds the price that would maximize profit without the commission; it also exceeds the price that would maximize the revenue obtained from inmates. From this baseline, any

[12] Equation (13) reveals that our model of procurement is comparable to a standard, one-shot oligopoly pricing game with logit demand. The first order conditions of that game can be expressed as

$$p = mc - \frac{1}{\alpha} \frac{1}{1 - s}$$

where p is the price to consumers (analogous to net revenue in our model), mc is marginal cost, $\alpha < 0$ is the price parameter in the logit demand function (analogous to $\alpha^k \omega_i^k$ in our model), and s is a market share (analogous to the selection probability in our model).

[13] With the linear demand curve specified in the previous section, $q(p) = \beta_0 + \beta_1 p$, the price that solves equation (15) equals $\frac{1}{2} \left(-\frac{\beta_0}{\beta_1} + \frac{\gamma_{ij}}{1 - \kappa_{ij}^1} \right)$. The revenue-maximizing price is $-\frac{1}{2} \frac{\beta_0}{\beta_1}$.

effect of price on the selection probability must exert downward pressure on price. The reason is that a lower price would directly increase the score and would obtain more revenue from inmates (to be shared with the DOC). The extent to which price falls below the baseline level depends at least on the commission, which itself may be a choice variable of the provider, and the scoring rule.

An implication of this analysis is that revenue-based commissions can induce providers to set prices higher than they otherwise would, and these prices can exceed what would maximize providers' profit and what would maximize the revenue obtained from inmates. On this point, the example of New Jersey is salient. Given our demand estimates, the price that maximizes revenue is $2.83 per 15-minute call. Yet Figure 3 shows that prices were well above that level before the New Jersey DOC changed its procurement practices in 2014. During the period of high prices, New Jersey received 41% of the revenue obtained from its provider of ITS.

4 Policy Evaluation

We use the procurement of ITS in one selected state to explore the economic effects of various regulatory interventions in the market.[14] The RFP describes a scoring rule in which providers would be evaluated based on their commission (with a weight of 14%) and their quality of service (with a weight of 86%). The RFP also dictates prices based on payment type. The price for all collect calls incorporates a $0.86 surcharge and a $0.10 per-minute charge, which amounts to $2.36 for a 15-minute call. The price for prepaid calls incorporates a $0.65 surcharge and a $0.075 per-minute charge, which amounts to $1.78 for a 15-minute call. These prices are the same for local, intralata, interlata, and interstate calls.

Table 4 summarizes the bids of the four providers that responded to the RFP—GTL, Securus, IC Solutions, and Telmate—and the implications for revenue and profit that are implied by the model. The DOC evaluated the quality of GTL, Securus, and ICS as being much higher than that of Telmate, and assigned the highest quality rating to GTL, at 98% of the available quality points. The four providers proposed commissions of 60%, 71%, 66%, and 66%, respectively. For GTL, which won the contract, those commissions imply a payment to the state of $18.59, a retained revenue of $12.39, and a profit of $4.99 (all per inmate-month).

Our results indicate that Securus, and to a lesser extent IC Solutions, benefit from a lower "Cost Less Ancillary Revenue" than GTL. The model infers this in order to rationalize the higher proposed commissions of Securus and IC Solutions, given the quality scores. As we have already described, a lower "Cost Less Ancillary Revenue" value can reflect lower costs or higher fees, as the two are not separately identifiable in the model. However, we are not aware that either Securus or IC Solutions has a substantial cost advantage in the market. Furthermore, in

[14] The results presented in this section are based on our initial modeling and should not be interpreted (yet) as reliable characterizations of any actual or counterfactual procurement event.

Table 4: Procurement in a Selected State

Provider	Commission	Quality Score	Payment to State	Retained Revenue	Cost Less Ancillary Revenue	Profit
GTL	0.60	0.98	18.59	12.39	7.41	4.99
Securus	0.71	0.96	22.06	8.92	2.48	6.44
IC Solutions	0.66	0.95	20.45	10.53	6.34	4.19
Telmate	0.66	0.48	20.45	10.53	7.17	3.37

Notes: The table summarizes the data and modeling results for the procurement of ITS in a selected state. The commission is the fraction of revenues that the provider proposed to give to the state. The commission score and the quality score show the percentage of the maximum possible points each provider was awarded. The scoring rule placed a 14% weight on commissions and an 86% weight on quality. Prices were mandated and received no weight in the scoring rule. Payment to the state, retained revenue, cost less ancillary revenue, and profit are expressed in dollars per inmate-month. We calculate payment to the state based on the data on commission and prices and the estimated demand function. Retained revenue is calculated based on prices and the estimated demand function (which obtain gross revenue) less the payment to the state. Cost less ancillary revenue is inferred from the model. Profit is calculated as the difference between retained revenue and cost less ancillary revenue.

its evaluation of the providers, the DOC explicitly mentioned that Securus' fees were notably higher than those of IC Solutions, and that GTL was not imposing any fees. Therefore, we interpret the modeling results as consistent with heterogeneity among the providers in their fee structure.[15] The value of $7.41 for GTL—which may represent the cost of service per inmate-month—corresponds to $0.025 per minute if the average inmate places twenty calls each month, each with a duration of 15 minutes.

Table 5 considers a number of counterfactual policy scenarios. For each, we obtain the expected number of calls, inmate surplus, commission, revenue from inmates, provider profit, and payment to the state. We obtain the expectations by averaging across the four providers, weighting by their choice probability. Inmate surplus is calculated by integrating under the demand curve. We report it for completeness but have reservations about whether it captures the myriad of benefits that inmates and their families and friends may gain from phone calls (see Section 3.2). The revenue obtained from inmates does not include fees, though fees are implicitly included in provider profit through "cost less ancillary revenue." Aside from the commission, all numbers are per inmate-month.

[15] Securus planned to impose a bill statement fee of $3.49 for collect calls, a transaction processing fee of $6.95 for prepaid collect debit on credit/debit card transactions, a return check charge fee of $20.00 for all call types, a wireless administration fee of $2.99 applicable to account with wireless numbers; and a Federal Regulatory Recovery Fee of $3.49 for Interstate calls. IC Solutions planned to impose a prepaid account funding fee of $2.00 per deposit of $50.00 or less and a FUSF recovery fee for interstate calls at a rate of 3.2% of interstate collect call charges.

Table 5: Counterfactual Policy Evaluation

Provider	Baseline (*)	No Fees (i)	Double Competition + No Fees (ii)	No Commission + No Fees (iii)	50% Price Reduction + No Fees (iv)	No Commission + 67% Price Reduction + No Fees (v)	No Commission + 76% Price Reduction + No Fees (vi)	Free Calls + No Fees (vii)
Number of Calls	12.85	12.85	12.85	12.85	17.19	18.67	19.46	21.54
Inmate Surplus	22.40	22.40	22.40	22.40	40.13	47.32	51.42	62.98
Revenue from Inmates	30.32	30.32	30.32	30.32	20.29	14.54	10.98	0
Commission	0.66	0.59	0.62	0	0.26	0	0	0
Provider Profit	5.51	5.28	4.16	23.07	5.28	4.01	0	-12.15
Payment to State	20.06	17.79	18.91	0	5.31	0	0	0

To provide a baseline, column (*) provides the statistics for the procurement event as it actually occurred.

In column (i) we consider a scenario in which the fees of Securus and IC Solutions are removed. We do so by assuming that "Cost Less Ancillary Fees" for those two providers equals that of GTL. Within the model, this change does not affect the demand for calls or the scores that are assigned to the prospective suppliers. The commission falls from 66% to 59% because Securus and IC Solutions benefit less from winning the contract. Still, profit decreases relative to baseline, from \$5.51 to \$5.28, due to the loss of fees. The payment to the state decreases from \$20.06 to \$17.79. There is a benefit to inmates but this is not captured in the model. In all of the remaining counterfactuals, we maintain the assumption that providers do not charge fees.

In column (ii) we "double" the amount of competition. We do so by cloning each of the four prospective suppliers and including the clones in the model. Thus, there are two providers with the cost and quality of GTL, for example. As prices are set by the DOC, they do not decrease with more competition. Instead, the effect of competition is to increase the proposed commissions. We compute that the (expected) commission increases to 62%. Profit decreases to \$4.16 and the payment to the state increases to \$18.91. The scenario highlights that, with commissions, inmates may not benefit from greater competition. As a general matter, the effect of competition within the model depends on whether the DOC allows prospective providers to compete on price and, if there is price competition, the weight that the DOC places on low prices in the scoring rule.

In column (iii) we eliminate commissions. Inmates do not benefit because we hold prices fixed at the level set by the DOC. Without commissions, profit increases to \$23.07 and payments to the state no longer occur. The scenario highlights that eliminating commissions alone does benefit inmates. However, as doing so substantially increases the profitability of the provider, service could be provided profitably at much a lower price. We explore price changes next.

In column (iv) we decrease the price by 50% and recompute equilibrium. At the lower prices, the number of calls that inmates place increases from 12.85 to 17.19 and inmate surplus increases from \$22.40 to \$40.13. Less revenue is obtained from inmates so the providers decrease the commissions they offer; in expectation this falls to 26%. The price change leaves provider profit at exactly the same level as in column (i). Thus, we interpret it as consistent with a long run equilibrium in which providers must obtain some amount of profit to recover fixed costs outside the model. The payment to the state decreases substantially, to \$5.31, which reflects lower revenue and a lower commission.

In columns (v) and (vi) we eliminate commissions and also decrease the price by 67% and 76% percent, respectively. The first change leaves provider profit slightly lower than the setting in column (ii) where providers face increased competition. The second price change eliminates profit entirely. We find that the number of calls increases to 18.67 and 19.46, respectively,

and inmate surplus increases to $47.32 and $51.42. The scenarios in (iv)-(vi) highlight how profitable service can be provided at much lower prices if commissions are eliminated.

Finally, in column (vii) we consider free calls. The number of calls increases to 21.54 and inmate surplus increases to $62.98. In this scenario, providers obtain no revenue, and thus lose money. We calculate a profit of -$12.15. Implementing this scenario likely would require reversing the flow of payments. That is, the state could pay providers to provide service, and the procurement process could balance service quality and the cost of that service.

5 Conclusion

In this paper we conduct an empirical examination of the inmate telecommunications services market. Correctional authorities that operate prisons and jails select a monopolist service provider based on the authorities' preferences for quality, phone rates, and the percent of revenue returned as a commission. Inmates and their families are at the mercy of the quality and prices of a provider that is determined without their input. We study this market using a dataset meticulously collected from public records requests to every state and the District of Columbia. First, we use exogenous price changes observed in two states to estimate inmate demand for calls as a function of phone call prices. Incorporating these estimates into a first-score auction model, we recover structural model parameters that enable us to impute ITS provider costs. We find that prices are substantially higher than costs, and that these elevated prices are due to RFP incentives to offer commissions as well as the limited number of ITS providers competing in the market. Lastly, we run counterfactual analyses in a specific state to demonstrate how surplus shifts to different parties under alternate regulatory environments or increased competition. We find that a procurement process in which the correctional authority sets reduced phone rates (a 76% reduction) and eliminates commission more than doubles consumer surplus and allows ITS providers to profitably provide services.

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Appendix

A Additional Figures and Tables

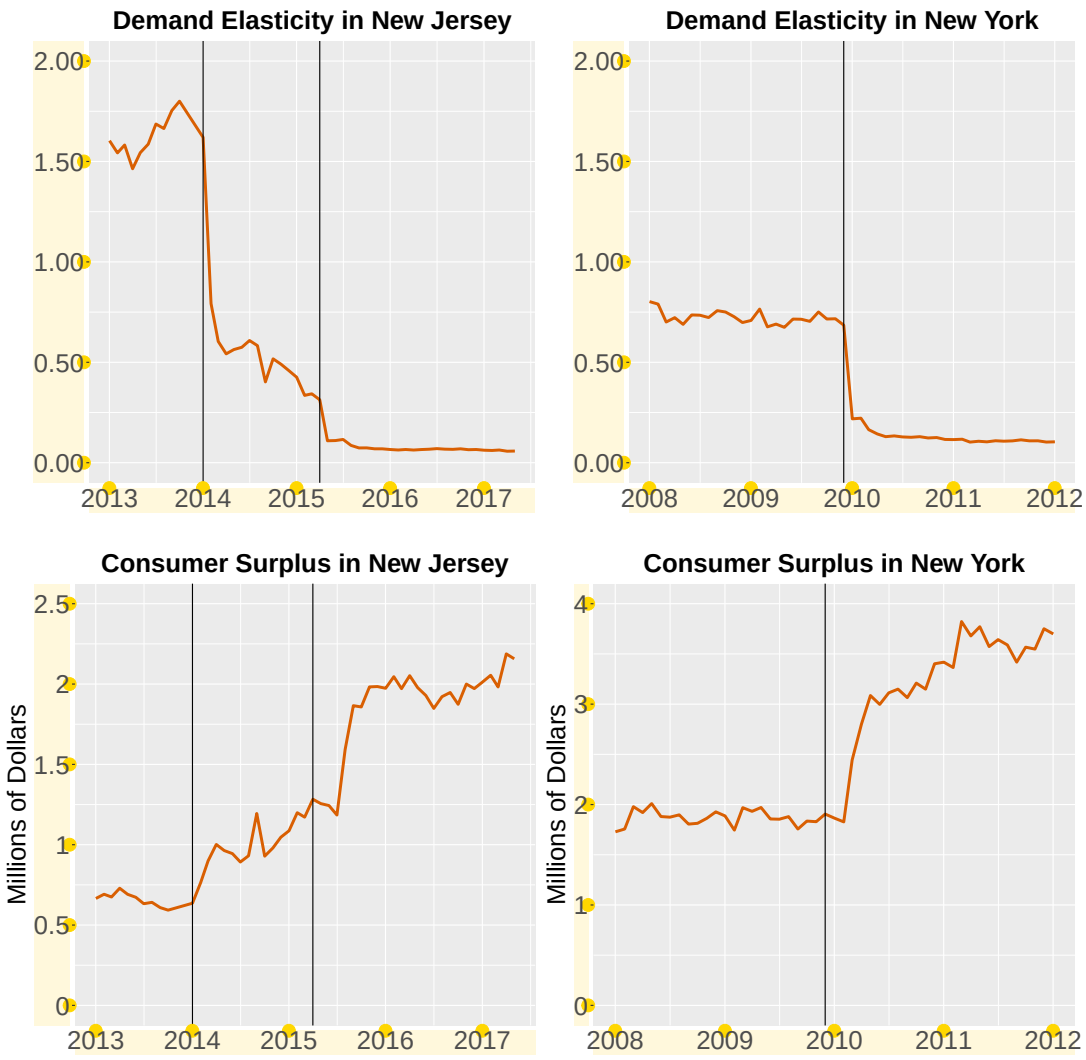

Figure A.1: Price Elasticity of Demand and Consumer Surplus