A Denial a Day Keeps the Doctor Away: Appendix

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A Data Construction and Auxiliary Empirical Evidence

This appendix describes in detail how we transform the original IQVIA dataset into our estimation sample. We also provide empirical evidence supporting the use of the SK&A survey to measure physicians' willingness to accept patients, and motivating our maintained assumption that physicians do not adjust services to the probability of denials.

A.1 Details of Data Construction

To convert the original IQVIA data into an analysis dataset, we apply some straightforward pre-processing steps to determine resubmissions of previously submitted claims.

For a single visit, we can observe multiple claims, each with multiple line items. We determine a patient visit based on anonymized physician and patient identifiers and the date of service. For each claim, we observe the date at which the claim was submitted to the insurer by the physician's office, the date at which the insurer paid or declined reimbursement for this claim, and the amount that was authorized in case of approval.

In order to avoid overestimating the ensuing costs of this process, we determine resubmissions by their timeline—so that submissions that were not a response to an insurer's decision are not counted—rather than using claim identifiers provided by IQVIA. In particular, we only count a submission as a resubmission of a previously submitted claim of that visit if the submission in question occurs after a decision about a previous submission has been made by the insurer. By doing this we avoid overestimating the costs of the billing-process due to submissions that were not submitted in response to an insurer's decision.

Finally, we drop Medigap and other secondary insurers, claims with values of $< \$0$ or $> \$1,000,000$, the bottom and top one percent of line item values within each CPT code-insurer-year combination, and line items valued at $< \$0.01$.[1] To eliminate outliers, we drop visits in the top one percent of CIP values after estimating resubmission costs.

[1]The step that drops claims valued at $> \$1,000,000$ drops 483 observations, representing \$9.754 billion out of \$131.9 billion in spending in the raw data. The second step drops the top and bottom 1 percent of line item amounts by procedure code, year and payer. For line items above the 99th percentile, this drops 1,642,260 observation which represent \$692.7 million in spending. For line items below the first percentile,

Merging Data Sources. Our key data sources—the remittance data, the MD-PPAS physician administrative data, and the SK&A survey—all provide the physician's National Provider Identifier (NPI). We use this to merge them.

A.2 Inferring the Insurer-Physician Contract

An inherent challenge in data of this form is that we naturally do not observe the allowed amounts for line items that are denied payment within a claim.

For the line items for which these amounts are not observed, we use a three-step algorithm to impute the contractual amounts that would have been collected by the provider, had the claim been approved and processed smoothly, and fully paid.

Step 1: Whenever possible we impute the contractual amount as the average allowed amount for claims processed smoothly by same insurer, when paying the same physician for the exact same procedure (HCPCS code).

Step 2: When there are no claims available matching the criteria required for step 1, we impute the claim value based on the average markup between the insurer's allowed amounts to the provider and standard fee-for-service Medicare rates across all other HCPCS codes. We compute this markup and then impute the contractual amount to be the fee-for-service Medicare rate for the specific line item, multiplied by this insurer-provider-specific markup.

Step 3: In the few instances in which we lack the data required for either step 1 or 2, we compute the average discount from the billed charges to the allowed amounts specific to the insurer-provider pair. Then, we impute the contractual amount by applying this insurer-physician-specific discount to the observed billed charges for the specific line item. (This is the one exception mentioned in footnote 8.)

A.3 Medicaid Acceptance: Representativeness and Variation

The key outcome of our analysis is the probability that a physician accepts patients covered by Medicaid. We observe this variable in a near-universal survey of physicians; however, it is self-reported so potentially imperfect.

In this appendix we compare the distribution of Medicaid acceptance probability across states using the SK&A survey against the same object directly inferred from the (smaller) IQVIA sample. Figure A.1 shows the state-level correlation. For most states, the survey matches very closely the probability of accepting Medicaid observed in the remittance data.[2]

A second possible concern in using survey data is that observed changes in Medicaid acceptance result from changes in measurement rather than behavior. This would be particularly concerning if we observed no variation in behavior in non-moving physicians. Table A.1 shows that this is not the case. Every year, 4.8 percent of physicians who do not move across states switch their decision regarding accepting Medicaid patients. For movers (not surprisingly) this churn is higher, at 8.3 percent.

Our analysis in Section 4 uses two strategies. In one, we treat physicians as the decision maker. In the other, we leverage the fact that the physician's group may have a big influence on Medicaid acceptance decisions. We include both strategies for two reasons: (1) this

this drops 1,362,479 observation which represent $43.2 million in spending.

[2]Some exceptions include California, the District of Columbia, Rhode Island, and Hawaii.

Figure A.1: Surveyed vs. Sampled Medicaid Acceptance

NOTE: This figure compares the state average Medicaid acceptance measured in the SK&A survey (vertical axis) to the average Medicaid acceptance in the IQVIA data (horizontal axis). The latter is measured by constructing an indicator for every physician taking value one if we observe at least one Medicaid visit. We then take the average across physicians in the state.

Table A.1: Changes in Medicaid Acceptance: Move and Non-Move Years

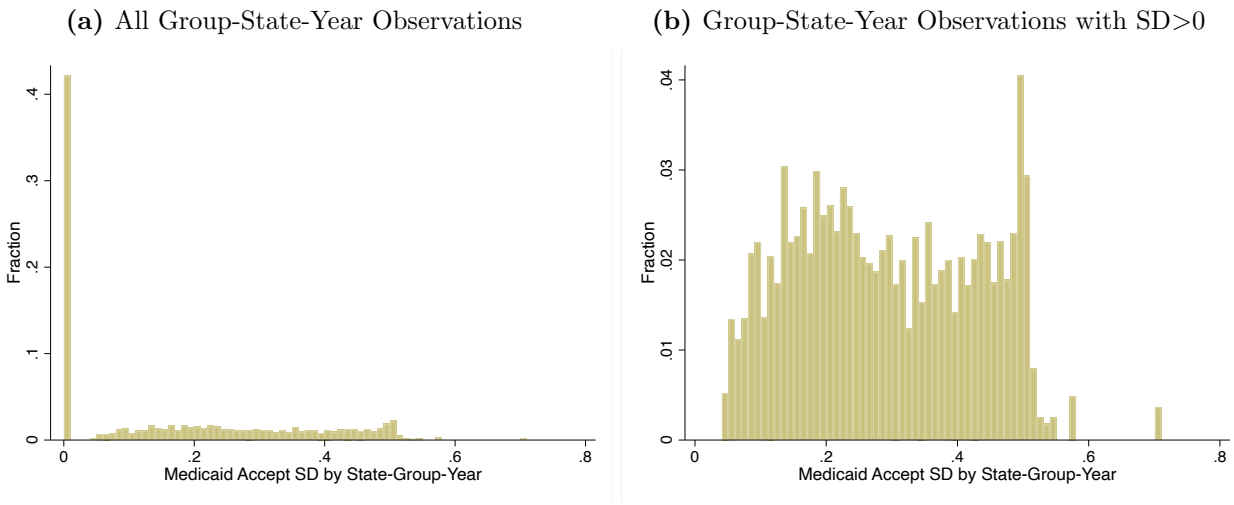
	Fraction with no Change	Fraction Switching to Accept Medicaid	Fraction Switching to not Accept Medicaid
Move Year	0.917	0.040	0.043
Non-Move Year	0.952	0.024	0.024

NOTE: This table compares one-year changes in Medicaid acceptance between moving and non-moving physicians.

demonstrates the robustness of our findings to alternative assumptions, and (2) the data provide partial support for both assumptions.

Figure A.2 shows that for over 40 percent of group-year-state observations, there is no variation in Medicaid acceptance within group. For observations with some variation, the standard deviation of acceptance across physicians within the group-state-year is distributed approximately uniformly between 0.1 and 0.5. Figure S.2 shows a version of this figure in which each group is weighted by the number of physicians in the group.

Figure A.2: Medicaid Acceptance Within Group-Year



NOTE: This figure contains histograms of the group-state-level standard deviation of Medicaid acceptance across physicians within the group-state. Panel (a) includes all groups, and Panel (b) includes only groups with variation in Medicaid acceptance within group-state.

A.4 Billing Hurdles and Intensity of Care

Our analysis in this article focuses on physicians' extensive margin decisions of whether to accept Medicaid patients. Throughout, we take as given the care that patients receive, assuming physicians' treatment decisions do not respond to billing hurdles. If physicians were to adjust their treatment decisions in response to treatment-specific denial rates, our results would miss a key mechanism through which billing hurdles affect supply of care.

In this appendix we use the richness remittance data to verify that intensive margin adjustments of this sort do not seem to pose a first order concern. We show that, conditional on a very large set of observables, physicians are not differentially likely to administer a given procedure to patients covered by different payers. Moreover, to the extent that the intensity of care differs across payers, these differences are not correlated with differences in the probability of a denial.

In order to conclude this, we consider the most common one thousand combinations of diagnosis and Charlson severity index; index these by x (not to be confused with X_j in the main text). We then consider the twenty most common procedures being administered to each x, say $p_{1,x}, p_{2,x}, \ldots, p_{20,x}$. We then estimate the following relationship:

$$\text{Probability that procedure } p_{k,x} \text{ is administered } = \frac{e^{a_{k,x}+b_x \mathbb{1}[\text{Medicaid patient}]}}{1+e^{a_{k,x}+b_x \mathbb{1}[\text{Medicaid patient}]}}.$$

Rather than focusing on parameters, we construct point estimates and confidence intervals for the difference between the probability that a procedure is supplied to Medicaid patients and the probability that the same procedure is supplied to non-Medicaid patients.

Table A.2: Correlation between Δ P(administered) and Δ P(denial)

	Δ P(administered)
Δ Denial Probability	0.0082***
	(0.0010)
N	19529
R^2	0.00367

NOTE: This table shows the OLS regression coefficient corresponding to the right panel of Figure A.3. The dependent variable is the estimated difference between the probability of the procedure conditional on diagnosis-severity in Medicaid relative to Medicare and commercial insurance. The independent variable is the difference in the denial probability between Medicaid vs. Medicare or commercial insurance.

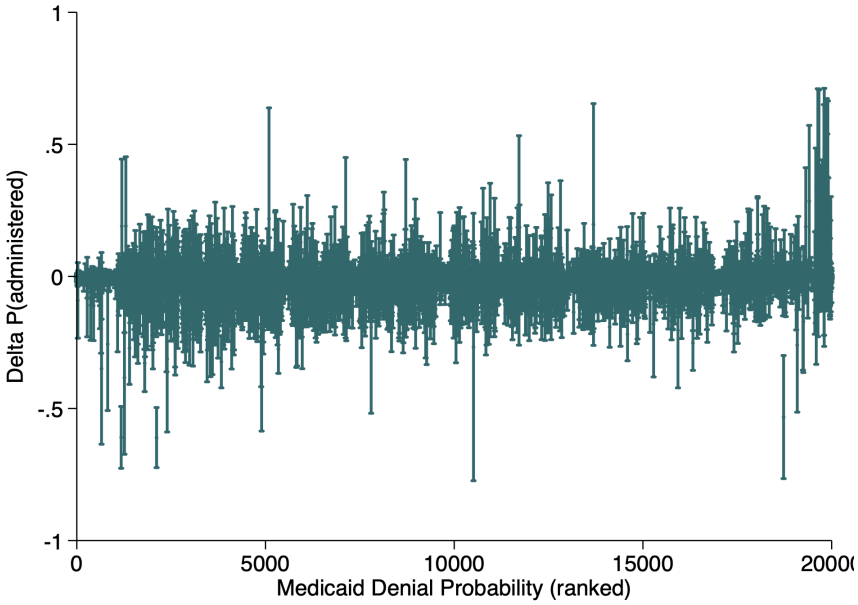
In Figure A.3 we explore whether these differences, if any, are significantly different from zero, and whether they correlate with the probability that a claim is denied. This tells us if physicians are systematically deviating from observed care patterns when they treat a Medicaid-insured patient. If there is no difference, then the difference between the likelihood that a procedure is administered for Medicaid and non-Medicaid should equal zero.

Across the 20,000 combinations we consider, in 47 cases we reject the null in favor of higher intensity of care for Medicaid patients. Conversely—and suggesting the importance of further research—in 4,056 cases we reject the null in favor of less intensity of being care provided to this group. Differences in levels are accounted for in our analysis, since we treat payers separately throughout. However, we further assume that the types of visits and the procedures are exogenous to the denial process, and this is testable.

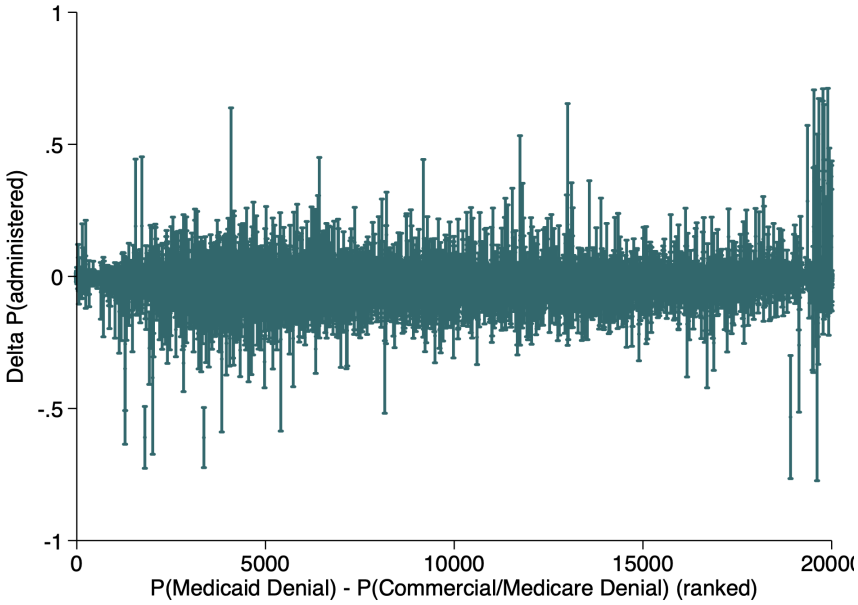
In Table A.2 we regress the difference in the probability that a specific treatment is administered between non-Medicaid and Medicaid on the difference in the probability that a specific procedure is denied. The resulting coefficient is a precisely estimated near-zero effect: a ten percent increase in denial probability (which would be very large) predicts an increase in the probability of a procedure by 0.082 percent. We see this as strong evidence that, at least in our data, once "the patient is in the room" the physician is not substantially affected by within-payer differences in billing hurdles across procedures.

Figure A.3: Variation in Probability of Denial and Probability of a Procedure

(a) Medicaid vs. Denial Probability



(b) Medicaid vs. Difference in Denial Probability



NOTE: This figure illustrates the relationship between denial probability and difference in the probability of administering a procedure in Medicaid vs. Medicare or Commercial insurance, conditioning on diagnosis and Charlson severity index. In Panel (a), the left axis ranks from 1 to 20,000 the combinations of procedure-diagnosis-severity we consider in Appendix A.4 based on the probability of denial in Medicaid. Each value on the vertical axis (shown along with 95% confidence intervals) corresponds to the estimated difference between the probability of the procedure conditional on diagnosis-severity in Medicaid relative to Medicare and commercial insurance. In Panel (b) the vertical axis is the same, while the horizontal axis is the (ranked) difference in the probability of denial between Medicaid vs. Medicare or commercial insurance.

B Maximum Likelihood Estimation of Resubmission Costs

In this appendix we provide the details of the model and maximum likelihood estimation of resubmission costs. We also illustrate the corresponding identifying variation.

B.1 Optimal Resubmission Decisions

After visit j with characteristics X_j takes place, the physician i (with characteristics Z_i) submits an initial claim. This action is outside of our model, since the remittance data "begins" with the initial insurer response recorded in the EDI 835 (as Section 2.1 describes). The initial claim consists of the set of line items L_j: for every $\ell \in L_j$ the physician expects a payment π_ℓ, and the total value of the initial claim is $\pi(L_j) = \sum_{\ell \in L_j} \pi_\ell$.

If the insurer denies the payment for a subset of line items $D_j \subset L_j$, the denial has an associated reason code ρ. If the physician decides to not resubmit a claim, she does not incur any additional cost, but the visit revenue is $\pi(L_j - D_j)$—where the minus sign indicates difference between sets; $L_j - D_j = L_j \cap D_j^{\mathrm{c}}$—rather than $\pi(L_j)$; in this case, the realized CIP is $\pi(L_j) - \pi(L_j - D_j) = \pi(D_j)$.

The physician can instead decide to resubmit any subset of the denied items and try to recover the corresponding revenues. Formally, she can choose any $R_j \subset D_j$, and, after paying the resubmission cost $C_{ij}(R_j)$, continue the process to the next period. The insurer can then accept to pay $\pi(R_j)$, or deny payment for any subset $D'_j \subset R_j$. This process then continues recursively.

Physicians have correct beliefs about the probability

$$\Pr\left[D'_j \middle| R, X_j, Z_i, \rho\right] \tag{B.1}$$

that a subset D'_j of line items is denied for any resubmitted set of line items $R \subset D_j$. Then, the resubmission decision R_j solves

$$R_j = \underset{R \subset D_j}{\arg\max} - C_{ij}(R) + \delta \mathcal{V}(R, X_j, Z_i, \rho), \tag{B.2}$$

$$\mathcal{V}(R, X_j, Z_i, \rho) = \mathbb{E}\left[\pi(R - D') + \max_{R' \subset D'} \left\{-C_{ij}(R') + \delta \mathcal{V}(R', X_j, Z_i, \rho)\right\} \middle| R, X_j, Z_i, \rho\right], \tag{B.3}$$

where the expectation in (B.3) is taken with respect to D', using the probability in (B.1).

B.2 Assumptions and Estimation

We parameterize the resubmission cost as shown in equation (3):

$$C_{ij}(R) = \mu\left(|R|, X_j, Z_i, \rho\right) + \varepsilon_{ij}, \tag{B.4}$$

where, in our most flexible estimation,

$$\mu\left(|R|, X_j, Z_i, \rho\right) = \mu^0_{\text{insurer}_j, \text{state}_j, \text{practice size}_i, \rho} + \mu^1_{\text{insurer}_j, \text{practice size}_i, \rho} \times |R|, \tag{B.5}$$

and ε_{ij} is an i.i.d. draw from a Type 1 extreme value distribution.

Then, following the well-known results derived in Hotz and Miller (1993), since choosing not to resubmit $R_j = \emptyset$ implies null continuation payoff with certainty, the following holds:

$$\begin{aligned}\mathcal{V}(R, X_j, Z_i, \rho) = \mathbb{E}\left[\pi(R - D')|R, X_j, Z_i, \rho\right] \\ - \mathbb{E}\left[\ln\left(\Pr\left[R' = \emptyset|D', R, X_j, Z_i, \rho\right]\right)|R, X_j, Z_i, \rho\right] + \omega,\end{aligned} \tag{B.6}$$

where $\omega \approx 0.5772$ is Euler's constant.

The remittance data presented in Section 2.2 allows us to derive an empirical counterpart for $\mathcal{V}$, denoted $\widehat{\mathcal{V}}$, estimated using the empirical probability of denials after resubmission conditional on X_j, Z_i, ρ. We denote this empirical probability as

$$\widehat{\Pr}\left[D'_j\middle|R, X_j, Z_i, \rho\right].$$

To limit dimensionality issues, and considering that more than 50 percent of denied claims only contain one line item:

$$\Pr\left[D'_j\middle|R, X_j, Z_i, \rho\right] = \prod_{\ell \in D'_j} \Pr\left[\{\ell\}|R, X_j, Z_i, \rho\right] \times \prod_{\ell \in R - D'_j} \left(1 - \Pr\left[\{\ell\}|R, X_j, Z_i, \rho\right]\right). \tag{IND}$$

In words, denials are independent across line items within a resubmitted claim, conditional on X_j, Z_i, ρ. Under (IND), we can estimate

$$\widehat{\Pr}\left[\{\ell\}|R, X_j, Z_i, \rho\right] \equiv \frac{\sum_{j\ell} \mathbb{1}\left[\ell \in R \cap D'_j, X_j, Z_i, \rho\right]}{\sum_{j\ell} \mathbb{1}\left[\ell \in R, X_j, Z_i, \rho\right]}, \quad \text{and} \tag{B.7}$$

$$\widehat{\Pr}\left[D'_j\middle|R, X_j, Z_i, \rho\right] = \prod_{\ell \in D'_j} \widehat{\Pr}\left[\{\ell\}|R, X_j, Z_i, \rho\right] \times \prod_{\ell \in R - D'_j} \left(1 - \widehat{\Pr}\left[\{\ell\}|R, X_j, Z_i, \rho\right]\right). \tag{B.8}$$

Assumption (IND) ensures that we observe a sufficiently large number of observations in the denominator of (B.7). This assumption is only relevant for situations in which more than one line item is denied; in Table S.1 we estimate our model on the subsample of claims for which only one line item was denied, relaxing (IND).

The last assumption that we impose in our baseline specification is also motivated by the need to avoid the curse of dimensionality when estimating

$$\widehat{\Pr}\left[R' = \emptyset|D', R, X_j, Z_i, \rho\right],$$

which is the last object needed to obtain $\widehat{\mathcal{V}}$. For this we require that, conditional on insurer, state, and reason code, a physician decision to stop the billing process for a given visit ($R' = \emptyset$) depends only on the number of denied line items and the total denied amount, while it does not depend on more granular visit characteristics such as diagnosis and primary procedure.

Formally, letting $\widetilde{X}_j$ collect insurer, state, and reason code, we simplify estimation by assuming that

$$\Pr\left[R' = \emptyset|D', R, X_j, Z_i, \rho\right] = \Pr\left[R' = \emptyset\middle||D'|, \pi(D'), |R'|, \pi(R'), \widetilde{X}_j, Z_i, \rho\right]. \tag{SUF}$$

We can then compute the empirical analogue $\widehat{\Pr}\left[R' = \emptyset | D', R, X_j, Z_i, \rho\right]$ as we did for the denial probabilities in (B.7).

As with assumption (IND), we impose (SUF) to limit noise in estimating the probability physicians stop the billing process, deciding to not incur additional billing costs and to not recover any further revenues from the visit. However, this assumption is not required, and results in Table S.2 show that our estimates of resubmission costs are robust to relaxing (SUF), estimating $\Pr\left[R' = \emptyset | D', R, X_j, Z_i, \rho\right]$ conditional on diagnosis and primary procedure of the visit j, in addition to $\widetilde{X}_j$.

Equipped with the estimates of $\widehat{\Pr}\left[R' = \emptyset | D', R, X_j, Z_i, \rho\right]$ and $\widehat{\Pr}\left[D'_j \middle| R, X_j, Z_i, \rho\right]$ we can compute $\widehat{\mathcal{V}}$, and express the probability of observing the resubmission decision R_j as a function of the parameters $\boldsymbol{\mu} = (\boldsymbol{\mu}^0, \boldsymbol{\mu}^1)$, the resubmission cost parameters which are the target of our estimation (equation (B.5)). We then obtain the maximum-likelihood estimates of these parameters by solving

$$\max_{\boldsymbol{\mu}^0, \boldsymbol{\mu}^1} \prod_j \frac{\exp\left[-\mu(|R_j|, X_j, Z_i, \rho) + \delta \widehat{\mathcal{V}}(R_j, X_j, Z_i, \rho)\right]}{\sum_{R' \subset D_j} \exp\left[-\mu(|R'|, X_j, Z_i, \rho) + \delta \widehat{\mathcal{V}}(R', X_j, Z_i, \rho)\right]}. \tag{B.9}$$

This procedure selects the resubmission cost parameters that maximize the probability to observe the resubmission decisions in the remittance data as the solution of the optimal resubmission problem described in Section B.1.

B.3 Identifying Variation

Table B.1 adds to Figure 3 in the main text to illustrate the variation leading to our estimates of resubmission costs (Table B.2 below), highlighting differences across insurers. In the top panel of Table B.1, we compare the maximum continuation value (taken over possible resubmission decisions) from resubmission of a claim between instances in which we observe a resubmission and instances in which we do not.

When providers forego future visit revenues by deciding not to resubmit a claim, we estimate that the maximum continuation value from resubmitting averages \$9.53 in Medicaid, \$10.91 in Medicare, and \$10.26 in commercial insurance. Intuitively, providers' administrative costs for resubmitting claims must be higher than these amounts. When providers decide to resubmit, we estimate that the maximum continuation value from resubmitting would be \$20.14 in Medicaid, \$18.65 in Medicare, and \$32 in commercial insurance. Administrative costs for resubmitting a claim must be, on average, lower than these amounts.

The marginal resubmission cost per line item is identified by comparing the value of the chosen options to other non-empty alternatives. The bottom panel of Table B.1 focuses on instances in which a resubission takes place: the continuation values for the resubmitted sets of line items are significantly higher than for the non-chosen alternatives.

Table B.1: Continuation Values and Resubmission Decisions

	Medicaid	Medicare	Commercial
Panel a: Maximum Continuation Value of Claims			
Instances in which providers do not resubmit claims	9.53	10.91	10.26
Instances in which providers resubmit claims	20.14	18.65	32.00
Panel b: Continuation Value of Resubmission			
Not resubmitted set of line items	5.65	7.63	9.44
Resubmitted set of line items	19.09	17.59	30.71

NOTE: This table summarizes the variation in continuation values from resubmission across observed and counterfactual resubmission decisions. It highlights that the remittance data are consistent with providers being forward-looking and profit-maximizing, and it showcases the variation we leverage to identify resubmission costs. Panel (a) shows the maximum continuation value across all viable resubmission options, which includes the option not to resubmit. That is, Panel (a) compares the maximum continuation value from resubmission between instances in which the provider chooses to resubmit a set of denied line items, and instances in which the provider chooses to forego visit revenues for the denied items. Panel (b) shown the continuation value conditional on instances in which providers resubmit claims. That is, Panel (b) compares the sets of line items that are resubmitted to their feasible alternatives for instances in which a resubmission is observed.

Table B.2: Estimates of Resubmission Costs, CIP, and τ

	Medicaid					Medicare					Commercial				
	All phys.	All phys.	All phys.	Small group.	Large group.	All phys.	All phys.	All phys.	Small group	Large group	All phys.	All phys.	All phys.	Small group	Large group
Average τ	0.141 (0.0001)	0.174 (0.0001)	0.176 (0.0001)	0.183 (0.0003)	0.174 (0.0002)	0.033 (0.0000)	0.047 (0.0000)	0.047 (0.0000)	0.059 (0.0001)	0.044 (0.0000)	0.019 (0.0000)	0.024 (0.0000)	0.024 (0.0000)	0.031 (0.0001)	0.023 (0.0000)
Average CIP	9.75 (0.011)	12.43 (0.012)	12.50 (0.012)	13.06 (0.024)	12.30 (0.014)	2.66 (0.003)	3.94 (0.003)	3.93 (0.003)	4.97 (0.007)	3.60 (0.004)	1.79 (0.002)	2.36 (0.003)	2.37 (0.003)	2.95 (0.006)	2.19 (0.003)
μ^0, all		10.65 (.03)					8.29 (.02)					10.18 (.04)			
μ^1, all		5.95 (0.01)					-0.96 (0.01)					0.54 (0.01)			
μ^0, Admin. ρ			15.59 (.06)	15.28 (.07)	15.05 (.05)			10.03 (.03)	8.70 (.04)	11.45 (.04)			18.96 (.07)	18.04 (.09)	19.32 (.07)
μ^1, Admin. ρ			4.84 (0.02)	5.28 (0.04)	4.63 (0.03)			6.65 (0.03)	4.47 (0.04)	7.87 (0.03)			16.16 (0.05)	12.82 (0.10)	16.83 (0.05)
μ^0, Contr. ρ			8.54 (.03)	6.91 (.06)	9.52 (.04)			7.32 (.03)	6.37 (.03)	7.75 (.03)			9.15 (.05)	7.23 (.04)	8.41 (.05)
μ^1, Contr. ρ			4.36 (0.01)	4.69 (0.02)	4.18 (0.02)			-5.55 (0.02)	-2.43 (0.03)	-7.08 (0.02)			3.35 (0.01)	-0.27 (0.03)	-0.54 (0.02)
μ^0, Cov. ρ			13.89 (.05)	12.41 (.07)	14.25 (.05)			10.84 (.03)	10.90 (.05)	12.22 (.03)			20.98 (.07)	20.01 (.1)	20.09 (.09)
μ^1, Cov. ρ			8.45 (0.03)	8.38 (0.05)	8.69 (0.03)			0.42 (0.02)	2.67 (0.06)	1.01 (0.02)			-0.28 (0.06)	-6.69 (0.17)	1.88 (0.07)
μ^0, Dup. ρ			20.69 (.07)	17.56 (.1)	19.33 (.07)			11.16 (.04)	12.39 (.06)	11.12 (.05)			21.78 (.09)	19.66 (.11)	21.65 (.08)
μ^1, Dup. ρ			0.30 (0.08)	-0.62 (0.19)	1.07 (0.10)			-0.26 (0.03)	-2.57 (0.07)	0.15 (0.03)			9.56 (0.11)	6.55 (0.26)	9.00 (0.11)
μ^0, Info. ρ			13.94 (.06)	11.86 (.08)	13.85 (.05)			9.91 (.03)	8.22 (.05)	11.66 (.04)			18.08 (.1)	16.78 (.11)	19.76 (.12)
μ^1, Info. ρ			8.03 (0.03)	9.19 (0.06)	7.60 (0.04)			-0.22 (0.03)	0.79 (0.05)	-0.60 (0.04)			2.53 (0.07)	-2.37 (0.15)	3.58 (0.08)
Number of visits	6,027,010	6,027,010	6,027,187	1,613,342	4,413,721	36,747,260	36,747,260	36,742,044	8,960,588	27,786,758	37,791,328	37,791,328	37,789,820	8,178,196	29,612,420
Log Likelihood	n.a.	-1,836,620	-1,510,561	-380,366	-1,154,172	n.a.	-3,255,214	-3,116,276	-802,555	-2,200,290	n.a.	-1,889,432	-1,676,225	-424,229	-1,338,197

NOTE: This table summarizes the resubmission cost parameters from equation (B.5) estimated via maximum likelihood. Each of the three panels corresponds to a different payer. Within each panel, the first model ignores resubmission costs, so τ and CIP are simply determined by the average lost revenue. The second model ignores reason codes and practice size, and the third model ignores practice size. The fourth model computes estimates for small groups of one or two physicians, while the fifth model corresponds to groups with three or more physicians. Each value shown in the table is the average of parameters across states. Robust standard errors are in parentheses.

C First Stage

Table C.1 reports the first stages of the 2SLS estimation used in columns (2) and (4) of Tables 6 and 7.

Table C.1: First Stage: Instrumenting for CIP Index with Denial Rate Index

(a) Movers Strategy First Stage

	Post-move $\times\Delta\tau$ index	
	(1)	(2)
Post-move $\times\Delta$ denial rate index	0.9361***	0.9282***
	(0.0227)	(0.0626)
Post-move $\times\Delta \log \pi$ index	-0.0307***	-0.0633***
	(0.0114)	(0.0200)
Subsample Accepting Medicare	Yes	Yes
N. Physicians	8,182	8,182
N. Physicians-Years	47,806	47,806
Physician FE	Yes	Yes
Controls	Yes	Yes
τ index:		
Physician FE	No	No
Selection Correction	Yes	Yes

(b) Cross-State Groups First Stage

	τ Index	
	(1)	(2)
Denial rate index	0.9273***	0.8988***
	(0.0207)	(0.0519)
Log π index	-0.0302**	-0.0472**
	(0.0118)	(0.0195)
Subsample Accepting Medicare	Yes	Yes
N. Physicians	232,590	232,590
N. Physicians-Years	807,599	807,599
Group FE	Yes	Yes
Controls	Yes	Yes
τ index:		
Physician FE	Yes	No
Selection Correction	No	Yes

NOTE: This table reports the first stages of the 2SLS estimation used in columns (2) and (4) of Tables 6 and 7. Panel (a) shows the first stage for the movers specification, corresponding to equation (14). Panel (b) is the analogue for the cross-state group specification. In each panel, column (1) uses the indices incorporating the selection correction, which is the first stage for column (4) of Tables 6 and 7, respectively. Column (2) uses the indices estimated conditional on physician fixed effects, which is the first stage for column (2) of Tables 6 and 7, respectively.

S Supplementary Results

Figure S.1 uses word clouds to illustrate the content of the reason codes leading to the five reason categories used in the analysis.

Table S.1 shows the estimates of the model parameters (analogous to Table B.2) obtained from the subsample of visits for which only one line item was denied, relaxing Assumption IND (described in Appendix B).

Table S.2 shows the estimates of the model parameters (analogous to Table B.2) obtained by adding the diagnosis and primary procedure of a visit to the set of conditioning observables, relaxing Assumption SUF (described in Appendix B).

Table S.3 shows summary statistics for variants of our π and τ indices, computed using different samples, controls, and weighting schemes.

Table S.4 shows summary statistics for the changes in our π and τ indices that moving physicians experience, where the indices are computed using different samples, controls, and weighting schemes.

Tables S.5 and S.6 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when fee indices are constructed separately for primary care physicians and specialists.

Tables S.7 and S.8 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when we use a τ index obtained using model-free estimates of CIP, which are only based on lost revenues and ignore resubmission costs.

Tables S.9 and S.10 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when we weight observations in the index regressions. The τ index is weighted by fees, the fee index is weighted by RVUs.

Tables S.11 and S.12 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when we do not restrict our sample to physicians accepting Medicare.

Table S.13 adds interactions with the size of the physician group, measured as the number of other physicians in the group besides the index physician (i.e. total group size minus 1). We include the -1 term in this definition so that the main effects of Post-Move $\times\Delta\tau$ and Post-Move $\times\Delta \log \text{Fee}$ can be interpreted as the coefficients applicable to sole practitioners.

Table S.14 adds group-by-year fixed effects to the cross-state group specification.

Table S.15 adds controls for the share of primary care physician in each group-by-state to the cross-state group specification.

Tables S.16 and S.17 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when adding controls for commercial insurance reimbursements in the market (in changes or levels, as appropriate).

Tables S.18 and S.19 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when we use a CIP index in dollars instead of the τ index.

Tables S.20 and S.21 show results from both of our empirical strategies, analogous to Tables 6 and 7 in the paper, when we use a CIP index in dollars instead of the τ index and an index of π rather than $\log \pi$.

Tables S.22 and S.23 account for differences between Medicaid MCOs and Medicaid fee-for-service. We estimate the model separately for Medicaid MCO and FFS plans. Since we cannot see the physician's acceptance decision separately for MCO and FFS Medicaid, we construct a state-level index by aggregating the model estimates up to the state level, averaging between the MCO and FFS claims. We then repeat both of our empirical strategies using the regressors constructed in this more granular way.

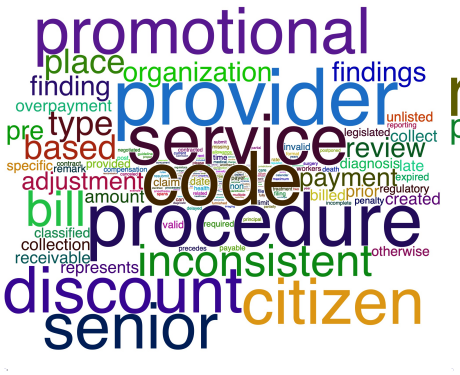
Tables S.24 and S.25 change the dependent variable in the cross-state groups strategy to the share of Medicaid patients.

Figure S.2 shows the variation in Medicaid acceptance decisions within a group-state-year cell, weighting cells by group size. This is analogous to Figure A.2 but with weights. For this Figure, we first compute the standard deviation of physicians' Medicaid acceptance decisions within each group-state-year cell. Each panel plots the distribution of these standard deviations, with a few variations. Panel (a) shows the distribution across all observations, weighted by group size (the number of physicians in the group). Panel (b) excludes the mass point with zero standard deviation—i.e. where all physicians make the same choice—to highlight the variation among the rest. Panel (a) shows that there is certainly a large share at this zero point, i.e. just over 40 percent of physicians make the same decision within the cell in question. But this still leaves a lot of individual variation—60 percent of physicians are in groups where there appears to be some scope for individual choice.

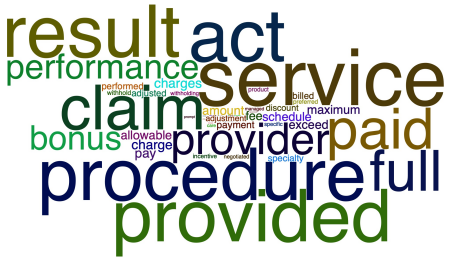
Figure S.3 shows level curves for the function $\tau(\pi, d)$. The origin for both axes is normalized to the observed level in the data, and each value on the vertical (horizontal) axis corresponds to a relative change in d (π). The figure shows that, as expected, higher values of d increase τ. More importantly, the model predicts that increases in π lower τ: physicians resubmit more, ceteris paribus, and this reduces CIP; this increase is on average larger than the increase in the denominator of (2).

Figure S.1: Frequent Words in the Reasons for Denial, by Category

(a) Administrative



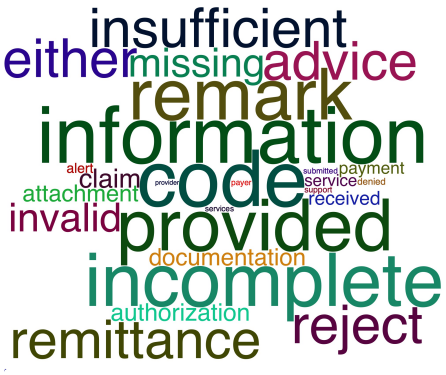
(b) Contractual



(c) Coverage

(d) Duplicate

(e) Information



NOTE: Each word cloud summarizes the text description of the reasons for denials observed in the IQVIA remittance data. We observe over 350 different reason codes, each associated with a brief description of the issue raised by the payer. After grouping these codes in the five categories that we use for our analysis, we count the frequency of each (non elementary) word in the corresponding descriptions. The word clouds weight each such word by the frequency in which it appears in the descriptions of the corresponding category.

Table S.1: Model Estimates When Relaxing Assumption IND

	Medicaid					Medicare					Commercial				
	All phys.	All phys.	All phys.	Small group.	Large group.	All phys.	All phys.	All phys.	Small group	Large group	All phys.	All phys.	All phys.	Small group	Large group
Average τ	0.142	0.178	0.179	0.185	0.177	0.033	0.049	0.049	0.060	0.045	0.019	0.025	0.025	0.031	0.023
	(0.0001)	(0.0001)	(0.0002)	(0.0003)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Average CIP	9.80	12.73	12.76	13.31	12.56	2.68	4.07	4.08	5.11	3.75	1.78	2.38	2.39	3.01	2.22
	(0.011)	(0.013)	(0.013)	(0.025)	(0.015)	(0.003)	(0.003)	(0.003)	(0.008)	(0.004)	(0.002)	(0.003)	(0.003)	(0.006)	(0.003)
μ^0, all		13.01					8.26					11.04			
		(.03)					(.02)					(.03)			
μ^0, Admin. ρ			16.03	14.27	16.50			10.37	9.38	12.38			21.31	17.00	21.65
			(.05)	(.07)	(.06)			(.03)	(.05)	(.04)			(.07)	(.09)	(.09)
μ^0, Contr. ρ			9.24	8.05	10.15			6.74	6.66	7.00			8.34	7.61	8.75
			(.04)	(.07)	(.05)			(.02)	(.04)	(.03)			(.04)	(.05)	(.05)
μ^0, Cov. ρ			14.70	13.45	14.89			12.21	12.59	12.47			21.76	20.66	21.55
			(.05)	(.08)	(.04)			(.03)	(.05)	(.03)			(.11)	(.1)	(.09)
μ^0, Dup. ρ			20.14	17.85	19.18			11.45	12.99	11.77			21.84	19.87	21.16
			(.08)	(.11)	(.07)			(.04)	(.07)	(.05)			(.11)	(.22)	(.11)
μ^0, Info. ρ			14.47	12.20	14.45			10.15	8.42	11.66			19.23	17.42	14.15
			(.06)	(.08)	(.05)			(.03)	(.06)	(.04)			(.15)	(.15)	(.36)
Number of visits	6,029,937	6,029,937	6,029,891	1,614,217	4,415,661	36,754,828	36,754,828	36,754,792	8,963,123	27,791,668	37,781,944	37,781,944	37,781,800	8,177,426	29,604,242
Log Likelihood	n.a.	-792,957	-620,615	-176,799	-514,699	n.a.	-1,751,666	-1,686,528	-389,028	-1,224,408	n.a.	-679,952	-530,858	-121,811	-506,640

NOTE: This table is analogous to Table B.2, but it is estimated on the subsample of visits with only one line item denied. This relaxes Assumption IND in Appendix B.

Table S.2: Model Estimates When Relaxing Assumption SUF

	Medicaid					Medicare					Commercial				
	All phys.	All phys.	All phys.	Small group.	Large group.	All phys.	All phys.	All phys.	Small group	Large group	All phys.	All phys.	All phys.	Small group	Large group
Average τ	0.142 (0.0001)	0.172 (0.0001)	0.173 (0.0001)	0.180 (0.0003)	0.171 (0.0002)	0.033 (0.0000)	0.047 (0.0000)	0.047 (0.0000)	0.058 (0.0001)	0.044 (0.0000)	0.019 (0.0000)	0.024 (0.0000)	0.024 (0.0000)	0.031 (0.0001)	0.023 (0.0000)
Average CIP	9.79 (0.011)	12.53 (0.013)	12.58 (0.013)	13.15 (0.025)	12.38 (0.015)	2.68 (0.003)	4.04 (0.003)	4.04 (0.003)	5.08 (0.008)	3.71 (0.004)	1.78 (0.002)	2.37 (0.003)	2.37 (0.003)	2.99 (0.006)	2.20 (0.003)
μ^0, all		3.67 (.04)					2.67 (.02)					2.59 (.02)			
μ^1, all		0.62 (0.03)					-24.83 (0.03)					-21.94 (0.03)			
μ^0, Admin. ρ			6.38 (.05)	3.96 (48.42)	7.10 (.06)			3.71 (.03)	1.85 (16.55)	4.91 (.05)			7.24 (.06)	4.22 (57.87)	8.30 (.06)
μ^1, Admin. ρ			-0.05 (0.09)	1.81 (0.17)	-0.69 (0.10)			3.40 (0.07)	5.87 (0.14)	2.26 (0.08)			8.29 (0.22)	1.26 (0.39)	8.85 (0.23)
μ^0, Contr. ρ			1.30 (.04)	-2.48 (214.7)	1.62 (.06)			0.98 (.02)	0.40 (.05)	1.06 (.03)			1.66 (.02)	-1.16 (78.5)	1.91 (.02)
μ^1, Contr. ρ			1.31 (0.05)	4.02 (0.22)	0.90 (0.06)			-38.83 (0.05)	-21.23 (0.11)	-39.28 (0.05)			-22.76 (0.04)	-23.70 (0.16)	-22.70 (0.04)
μ^0, Cov. ρ			5.64 (.05)	4.79 (.1)	5.59 (.05)			5.21 (.03)	3.61 (10.1)	5.88 (.05)			6.66 (.07)	3.09 (.31)	6.74 (.07)
μ^1, Cov. ρ			-0.04 (0.23)	1.80 (0.39)	0.39 (0.26)			-1.10 (0.07)	5.28 (0.42)	-1.82 (0.07)			3.60 (0.79)	3.53 (7.75)	3.78 (0.92)
μ^0, Dup. ρ			5.44 (.07)	7.29 (.1)	4.72 (.08)			5.34 (.04)	4.17 (.15)	6.22 (.05)			8.37 (.08)	4.30 (64.18000000000001)	9.17 (.09)
μ^1, Dup. ρ			-2.52 (1.12)	0.00 (.)	-2.91 (1.13)			-4.01 (0.09)	-1.09 (0.40)	-4.24 (0.10)			-7.60 (0.60)	0.00 (.)	-9.83 (0.65)
μ^0, Info. ρ			5.51 (.05)	0.20 (232.91)	5.94 (.07)			3.17 (.03)	2.38 (.06)	3.63 (.05)			4.66 (.07)	3.58 (69.18000000000001)	4.88 (.09)
μ^1, Info. ρ			-1.31 (0.12)	3.79 (0.45)	-1.40 (0.12)			-0.97 (0.13)	-1.78 (0.22)	-0.54 (0.17)			-14.60 (0.85)	-16.27 (1.12)	-11.68 (0.78)
Number of visits	6,033,469	6,033,469	6,023,408	1,613,437	4,408,601	36,747,968	36,747,968	36,732,980	8,961,190	27,772,512	37,782,828	37,782,828	37,782,072	8,177,086	29,604,392
Log Likelihood	n.a.	-793,688	-640,521	-137,420	-483,817	n.a.	-1,085,620	-908,881	-191,441	-710,133	n.a.	-470,817	-381,530	-65,316	-312,767

NOTE: This table is analogous to Table B.2, but it is obtained by adding the diagnosis and primary procedure of a visit to the set of conditioning observables, relaxing Assumption SUF (described in Appendix B).

Table S.3: Variation in Fee and CIP Indices Across Alternative Specifications

	Mean	SD	10th Percentile	50th Percentile	90th Percentile	Observations
Panel a: π Indices						
$\log \pi_\ell$	3.25	0.20	2.99	3.25	3.47	50
$\log \pi_\ell$ (PCP specialty specific)	3.25	0.21	3.00	3.26	3.50	50
$\log \pi_\ell$ (including imputations)	3.23	0.19	3.00	3.24	3.45	50
$\log \pi_\ell$ (RVU weighted)	4.56	0.22	4.26	4.58	4.82	50
π_ℓ	46.75	15.89	30.72	47.72	65.44	50
Panel b: τ and CIP Indices (Physician Fixed Effects)						
τ	0.18	0.10	0.07	0.15	0.33	50
τ (RVU weighted)	0.13	0.09	0.05	0.11	0.24	50
τ (first visit only)	0.18	0.10	0.08	0.16	0.28	50
τ (first visit excluded)	0.18	0.11	0.06	0.15	0.36	50
τ (local income control)	0.18	0.10	0.07	0.15	0.33	50
τ (ICD9 codes only)	0.18	0.10	0.07	0.16	0.33	50
τ (pregnant patients only)	0.18	0.14	0.08	0.15	0.27	50
Denial Rate Index	0.21	0.11	0.10	0.20	0.38	50
CIP	12.51	8.85	5.61	10.43	19.78	50
Panel c: τ and CIP Indices (Heckmann Correction)						
τ	0.18	0.11	0.08	0.15	0.30	50
τ (RVU weighted)	0.13	0.09	0.05	0.10	0.23	50
τ (first visit only)	0.18	0.11	0.08	0.15	0.27	50
τ (first visit excluded)	0.18	0.11	0.07	0.15	0.33	50
τ (local income control)	0.18	0.11	0.07	0.15	0.31	50
τ (ICD9 codes only)	0.18	0.10	0.07	0.15	0.30	50
τ (pregnant patients only)	0.18	0.13	0.08	0.15	0.27	50
CIP	12.51	9.14	5.71	9.95	18.51	50

NOTE: This table provides the summary of the τ and log-π indices used as the main dependent variables in Tables 6 and 7 in the paper. Panel (a) contains the baseline log-π index, and alternative versions used in robustness checks. Panel (b) contains the baseline τ index, and alternative versions used in robustness checks. Additionally, the Denial Rate Index in Panel (d) corresponds to the instrumental variable used in the 2SLS specifications. Panel (c) repeats Panel (b) using the selection correction.

Table S.4: Changes in Fee and CIP Indices Experiencd by Movers Across Alternative Specifications

	Mean	SD	10th Percentile	50th Percentile	90th Percentile	Observations
Panel a: $\Delta \log \pi$ Index						
$\Delta \log(\pi(\ell)$	0.008	0.24	-0.29	0.01	0.30	23953
$\Delta \log(\pi(\ell))$ (PCP specialty specific)	0.011	0.25	-0.29	0.01	0.30	23953
$\Delta \log(\pi(\ell))$ (including imputations)	0.008	0.23	-0.28	0.01	0.30	23953
$\Delta \log(\pi(\ell))$ (RVU weighted)	0.003	0.27	-0.35	0.01	0.35	23953
Panel b: $\Delta\tau$ Index (Physician Fixed Effects)						
$\Delta\tau$	-0.002	0.13	-0.17	-0.00	0.17	23953
$\Delta\tau$ (RVU weighted)	-0.002	0.11	-0.13	-0.00	0.13	23953
$\Delta\tau$ (first visit only)	-0.002	0.12	-0.14	-0.00	0.13	23953
$\Delta\tau$ (first visit excluded)	-0.002	0.15	-0.19	-0.00	0.20	23953
$\Delta\tau$ (local income control)	-0.002	0.13	-0.17	-0.00	0.17	23953
$\Delta\tau$ (ICD9 codes only)	-0.002	0.13	-0.17	-0.00	0.17	23953
$\Delta\tau$ (pregnant patients only)	-0.002	0.14	-0.11	-0.00	0.11	23953
Δ Denial Rate Index	-0.001	0.14	-0.18	-0.00	0.17	23953
Panel c: $\Delta\tau$ Index (Heckmann Correction)						
$\Delta\tau$	-0.006	0.14	-0.15	-0.00	0.14	23953
$\Delta\tau$ (RVU weighted)	-0.006	0.12	-0.12	-0.01	0.11	23953
$\Delta\tau$ (first visit only)	-0.005	0.13	-0.13	-0.00	0.12	23953
$\Delta\tau$ (first visit excluded)	-0.008	0.15	-0.17	-0.00	0.17	23953
$\Delta\tau$ (local income control)	-0.006	0.14	-0.15	-0.00	0.14	23953
$\Delta\tau$ (ICD9 codes only)	-0.006	0.13	-0.15	-0.00	0.15	23953
$\Delta\tau$ (pregnant patients only)	-0.004	0.12	-0.13	-0.00	0.12	23953

NOTE: This table provides the summary of the difference between the pre-move and post-move τ and log-π indices, $\Delta\tau$ and Δlog-π, used as the main dependent variables in Table 6 in the paper. This table summarizes these differences at the physician level, so that the number of observations corresponds to the number of physician movers. Panel (a) contains the baseline log-π index, and alternative versions used in robustness checks. Panel (b) contains the baseline τ index, and alternative versions used in robustness checks. Additionally, the Denial Rate Index in Panel (d) corresponds to the instrumental variable used in the 2SLS specifications. Panel (c) repeats Panel (b) using the selection correction.

Table S.5: Mover estimates, using separate fee indices by specialty

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0746***	-0.0819***	-0.0779***	-0.0820***
	(0.0219)	(0.0248)	(0.0187)	(0.0239)
Post-move $\times\Delta \log \pi$ index	0.0255**	0.0252*	0.0249*	0.0248*
	(0.0126)	(0.0126)	(0.0125)	(0.0126)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses indices estimated separately across PCPs and specialists.

Table S.6: Cross-state group estimates, using separate fee indices by specialty

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1560***	-0.1623***	-0.1307**	-0.1667***
	(0.0529)	(0.0478)	(0.0544)	(0.0484)
$\log \pi$ index	0.0635*	0.0633	0.0637*	0.0628
	(0.0379)	(0.0378)	(0.0378)	(0.0377)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses indices estimated separately across PCPs and specialists.

Table S.7: Mover estimates, no resubmission costs

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0764***	-0.0883***	-0.0815***	-0.0903***
	(0.0209)	(0.0283)	(0.0177)	(0.0283)
Post-move $\times\Delta \log \pi$ index	0.0285**	0.0270**	0.0261**	0.0248*
	(0.0129)	(0.0134)	(0.0128)	(0.0134)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses a τ index that ignores resubmission costs. This corresponds to the first column in Table B.2, which estimates CIP and τ considering only lost revenues.

Table S.8: Cross-state group estimates, no resubmission costs

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1291**	-0.1635***	-0.1009*	-0.1717***
	(0.0512)	(0.0474)	(0.0599)	(0.0496)
$\log \pi$ index	0.1110***	0.1063***	0.1143***	0.1042***
	(0.0188)	(0.0195)	(0.0205)	(0.0206)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses a τ index that ignores resubmission costs. This corresponds to the first column in Table B.2, which estimates CIP and τ considering only lost revenues.

Table S.9: Mover estimates, weighted indices

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0673**	-0.0964***	-0.0675***	-0.0953***
	(0.0290)	(0.0310)	(0.0224)	(0.0299)
Post-move $\times\Delta \log \pi$ index	0.0264**	0.0245**	0.0250**	0.0227**
	(0.0107)	(0.0111)	(0.0106)	(0.0112)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses a log-π index weighted by RVUs, and a τ index weighted by fees.

Table S.10: Cross-state group estimates, weighted indices

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1580**	-0.1829***	-0.1319*	-0.1926***
	(0.0691)	(0.0553)	(0.0736)	(0.0567)
$\log \pi$ index	0.0892***	0.0875***	0.0899***	0.0838***
	(0.0176)	(0.0177)	(0.0185)	(0.0187)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses a log-π index weighted by RVUs, and a τ index weighted by fees.

Table S.11: Mover estimates, unrestricted sample

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0562**	-0.0660**	-0.0555**	-0.0661**
	(0.0259)	(0.0288)	(0.0234)	(0.0283)
Post-move $\times\Delta \log \pi$ index	0.0289**	0.0279**	0.0271**	0.0257*
	(0.0136)	(0.0139)	(0.0134)	(0.0140)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	No	No	No	No
N. Physicians	9,748	9,748	9,748	9,748
N. Physicians-Years	56,886	56,886	56,886	56,886
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it does not restrict the sample to physicians accepting Medicare.

Table S.12: Cross-state group estimates, unrestricted sample

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1090*	-0.1247**	-0.0703	-0.1278**
	(0.0617)	(0.0588)	(0.0679)	(0.0599)
$\log \pi$ index	0.1259***	0.1242***	0.1292***	0.1219***
	(0.0229)	(0.0232)	(0.0238)	(0.0237)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	No	No	No	No
N. Physicians	283,204	283,204	283,204	283,204
N. Physicians-Years	974,156	974,156	974,156	974,156
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it does not restrict the sample to physicians accepting Medicare.

Table S.13: Mover Estimates With Heterogeneity by Group Size

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.084***	-0.101***	-0.087***	-0.107***
	(0.025)	(0.029)	(0.025)	(0.030)
Post-move $\times\Delta\tau$ index $\times$ Other Physicians in Group	0.000045	0.000073	0.000035	0.000083
	(0.000046)	(0.000048)	(0.000044)	(0.000051)
Post-move $\times\Delta\log\pi$ index	0.047***	0.045***	0.045***	0.043***
	(0.014551)	(0.015)	(0.014)	(0.015)
Post-move $\times\Delta\log\pi$ index $\times$ Other Physicians in Group	-0.000079**	-0.000074**	-0.000084**	-0.000073**
	(0.000035)	(0.000034)	(0.000036)	(0.000034)
Other Physicians in Group	0.000028***	0.000028***	0.000028***	0.000028***
	(0.000006)	(0.000006)	(0.000006)	(0.000006)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Two-Way Interactions	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it includes interaction of our main coefficients of interest with an indicator for the number of other physicians in the group (the total group size minus one).

Table S.14: Group-by-year fixed effects

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1043**	-0.1099**	-0.0890	-0.1118**
	(0.0482)	(0.0441)	(0.0532)	(0.0436)
$\log \pi$ index	0.1129***	0.1123***	0.1128***	0.1102***
	(0.0188)	(0.0190)	(0.0197)	(0.0194)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	806,449	806,449	806,449	806,449
Group-Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses group-by-year fixed effects rather than group fixed effects.

Table S.15: Cross-state group estimates, controlling for the specialty composition of a group's doctors within each state

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1318***	-0.1465***	-0.1047*	-0.1512***
	(0.0464)	(0.0429)	(0.0529)	(0.0435)
$\log \pi$ index	0.1154***	0.1139***	0.1165***	0.1112***
	(0.0200)	(0.0201)	(0.0211)	(0.0210)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but adds a control for the share of primary care physicians in a group within each state.

Table S.16: Mover estimates, controlling for change in commercial fees

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0637***	-0.0733***	-0.0697***	-0.0732***
	(0.0228)	(0.0257)	(0.0190)	(0.0246)
Post-move $\times\Delta \log \pi$ index	0.0335**	0.0326**	0.0309**	0.0305**
	(0.0130)	(0.0133)	(0.0128)	(0.0133)
Post-move $\times\Delta$ mean log commercial fee	-0.0174	-0.0170	-0.0200	-0.0200
	(0.0127)	(0.0128)	(0.0128)	(0.0128)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Controlling for Commercial Fees	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it also controls for the average commercial fee in the state.

Table S.17: Cross-state group estimates, controlling for commercial fees

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1395***	-0.1555***	-0.1044*	-0.1574***
	(0.0486)	(0.0448)	(0.0537)	(0.0450)
$\log \pi$ index	0.1137***	0.1120***	0.1159***	0.1098***
	(0.0201)	(0.0203)	(0.0216)	(0.0215)
Mean log commercial fee	0.0263	0.0276	0.0188	0.0207
	(0.0202)	(0.0201)	(0.0197)	(0.0201)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it also controls for the average commercial fee in the state.

Table S.18: Mover estimates, using CIP index

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta$ CIP index	-0.0009***	-0.0011***	-0.0009***	-0.0011***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Post-move $\times\Delta \log \pi$ index	0.0404***	0.0409***	0.0379***	0.0379***
	(0.0126)	(0.0127)	(0.0123)	(0.0125)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses a CIP index in dollars instead of the τ index.

Table S.19: Cross-state group estimates, using CIP index

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
CIP index	-0.0016**	-0.0021***	-0.0012	-0.0021***
	(0.0007)	(0.0006)	(0.0008)	(0.0006)
$\log \pi$ index	0.1325***	0.1336***	0.1296***	0.1304***
	(0.0235)	(0.0235)	(0.0234)	(0.0238)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses a CIP index in dollars instead of the τ index.

Table S.20: Mover estimates, using CIP index

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta$ CIP index	-0.0009***	-0.0011***	-0.0008***	-0.0011***
	(0.0003)	(0.0004)	(0.0003)	(0.0004)
Post-move $\times\Delta\pi$ index	0.0004**	0.0004**	0.0003**	0.0003*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses a CIP index in dollars instead of the τ index and an index of π in dollars rather than $\log \pi$ index.

Table S.21: Cross-state group estimates, using CIP index

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
CIP index	-0.0014*	-0.0021***	-0.0009	-0.0021***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
π index	0.0011***	0.0011***	0.0011***	0.0010***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	232,590	232,590	232,590	232,590
N. Physicians-Years	807,599	807,599	807,599	807,599
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses a CIP index in dollars instead of the τ index and an index of π in dollars rather than $\log \pi$ index.

Table S.22: Movers Estimation; Separate Indices by MCO/FFS

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
Post-move $\times\Delta\tau$ index	-0.0755***	-0.0846***	-0.0783***	-0.0857***
	(0.0234)	(0.0264)	(0.0205)	(0.0260)
Post-move $\times\Delta \log \pi$ index	0.0276**	0.0267*	0.0248*	0.0237*
	(0.0133)	(0.0136)	(0.0132)	(0.0137)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	8,182	8,182	8,182	8,182
N. Physicians-Years	47,806	47,806	47,806	47,806
Physician FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Control for State Level MCO Share	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 6 in the main text, but it uses indices estimated separately by MCO and FFS Medicaid visits.

Table S.23: Cross-State Group Estimation; Separate Indices by MCO/FFS

	Accept Medicaid Patients?			
	(1)	(2)	(3)	(4)
τ index	-0.1228***	-0.1359***	-0.1020*	-0.1415***
	(0.0440)	(0.0402)	(0.0511)	(0.0406)
$\log \pi$ index	0.1152***	0.1138***	0.1161***	0.1113***
	(0.0191)	(0.0192)	(0.0201)	(0.0200)
Estimator	OLS	2SLS	OLS	2SLS
Subsample Accepting Medicare	Yes	Yes	Yes	Yes
N. Physicians	249,996	249,996	249,996	249,996
N. Physicians-Years	1,154,997	1,154,997	1,154,997	1,154,997
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Control for State Level MCO Share	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but it uses indices estimated separately by MCO and FFS Medicaid visits.

Table S.24: Impact on Medicaid Share of Patients: Unconditional

	Share of Medicaid Patients			
	(1)	(2)	(3)	(4)
τ index	-0.1569	-0.2192**	-0.1887**	-0.2329**
	(0.0951)	(0.0976)	(0.0911)	(0.1045)
$\log \pi$ index	0.1521	0.1462	0.1482	0.1437
	(0.1048)	(0.0995)	(0.1032)	(0.0990)
N. Physicians	17,562	17,562	17,562	17,562
N. Physicians-Years	25,777	25,777	25,777	25,777
Estimator	OLS	2SLS	OLS	2SLS
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

NOTE: This table is analogous to Table 7 in the main text, but the dependent variable is the physician's share of Medicaid patients (relative to the total in the year).

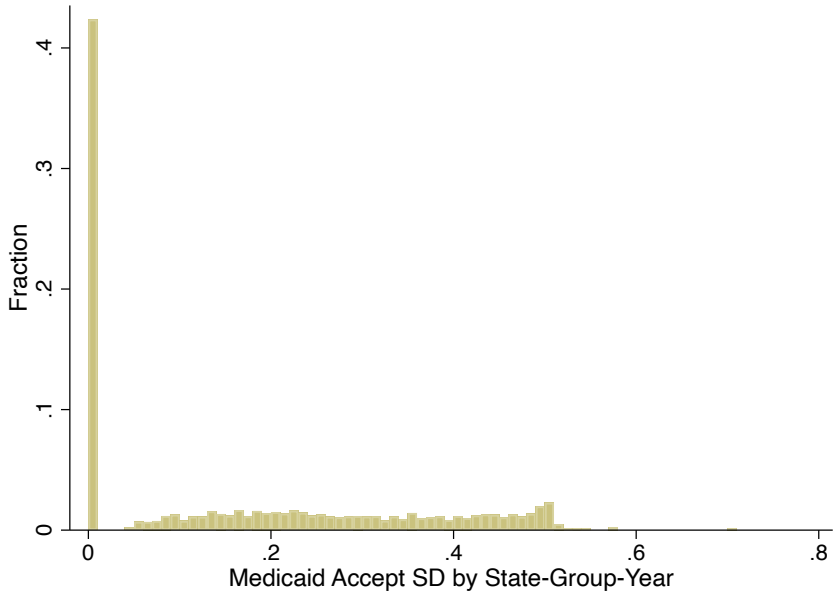
Table S.25: Impact on Medicaid Share of Patients: Conditional on Positive Medicaid Share

	Share of Medicaid Patients			
	(1)	(2)	(3)	(4)
τ index	-0.1764	-0.1837	-0.1940	-0.1957
	(0.1634)	(0.1701)	(0.1655)	(0.1802)
$\log \pi$ index	0.0085	0.0078	0.0078	0.0077
	(0.0739)	(0.0740)	(0.0734)	(0.0745)
N. Physicians	7,038	7,038	7,038	7,038
N. Physicians-Years	9,733	9,733	9,733	9,733
Estimator	OLS	2SLS	OLS	2SLS
Group FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
τ index:				
Physician FE	Yes	Yes	No	No
Selection Correction	No	No	Yes	Yes

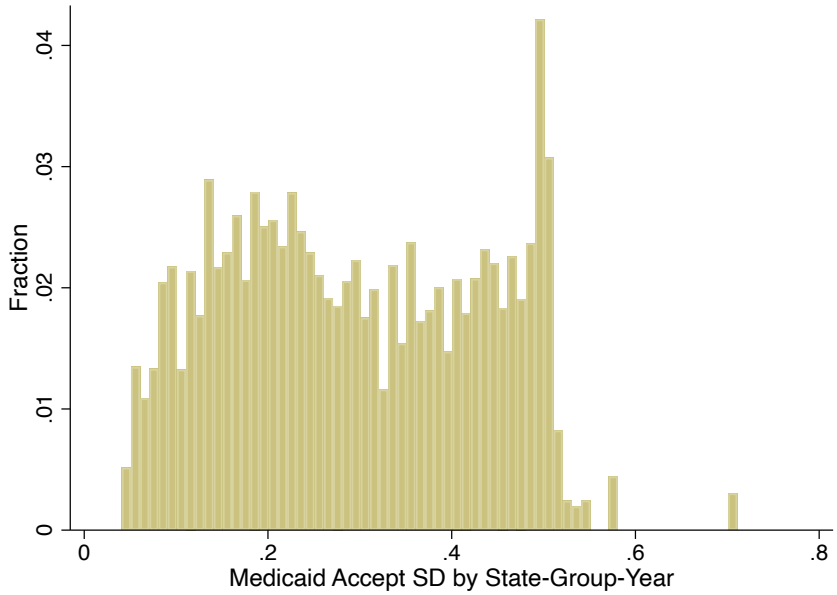
NOTE: This table is analogous to Table 7 in the main text, but the dependent variable is the physician's share of Medicaid patients (relative to the total in the year), restricting the sample to the physicians for which this share is nonzero.

Figure S.2: Medicaid Acceptance Within Group-Year (Weighted by Group Size)

(a) All observations, weighted by group size

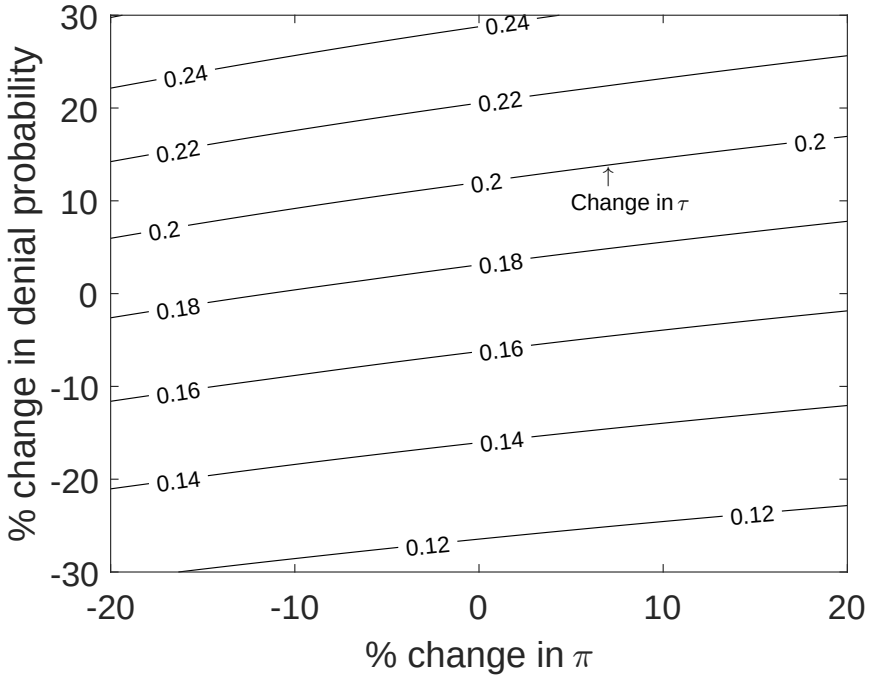


(b) Excluding SD=0, weighted by group size



NOTE: This figure is analogous to Figure A.2, weights each group by the number of physicians in the group.

Figure S.3: Changes in τ Induced by Changes in Fees and Denial Probabilities



NOTE: This figure shows level curves for the function $\bar{\tau}(F)$, obtained as detailed in footnote 34. The origin for both axes is normalized to the observed level in the data, and each value on the vertical axis corresponds to a percentage change in d, while each value on the horizontal axis corresponds to a percentage change in π. Precisely, a value of $+10$ on the vertical axis means that we change the distribution $F(\pi, d)$ to obtain, for each visit, a denial probability of $1.1d$ rather than d; i.e. it becomes $F(\pi, 1.1d)$. We do the same for the horizontal axis in terms of π. The figure shows that, as expected, higher values of d increase τ. More importantly, the model predicts that increases in π lower τ: physicians resubmit more claims, *ceteris paribus*, and this reduces CIP. This increase is on average larger than the increase in the denominator of (2).