Should Physicians Choose Their Reimbursement Rate? Menu Design for Physician Payment Contracts

Jori Barash

UT Austin

March 2025

Motivation

Central challenge in healthcare: physicians know more than patients and insurers

- How should physicians be reimbursed for treatment?

Motivation

Central challenge in healthcare: physicians know more than patients and insurers

- How should physicians be reimbursed for treatment?

Physicians usually face identical incentives in one of two revenue models

- Variable fee ("Fee-For-Service"): may incentivize **over**-utilization $\rightarrow$ wasteful spending
- Flat fee ("Capitation"): may incentivize **under**-utilization $\rightarrow$ avoidable mortality

Motivation

Central challenge in healthcare: physicians know more than patients and insurers

- How should physicians be reimbursed for treatment?

Physicians usually face identical incentives in one of two revenue models

- Variable fee ("Fee-For-Service"): may incentivize **over**-utilization $\rightarrow$ wasteful spending
- Flat fee ("Capitation"): may incentivize **under**-utilization $\rightarrow$ avoidable mortality

Some settings use a mixed contract to balance incentives

Motivation

Central challenge in healthcare: physicians know more than patients and insurers

- How should physicians be reimbursed for treatment?

Physicians usually face identical incentives in one of two revenue models

- Variable fee ("Fee-For-Service"): may incentivize **over**-utilization $\rightarrow$ wasteful spending
- Flat fee ("Capitation"): may incentivize **under**-utilization $\rightarrow$ avoidable mortality

Some settings use a mixed contract to balance incentives

- But, physicians might be **heterogeneous** $\rightarrow$ could do better?
- Screening on observed differences may be infeasible or inadequate

Motivation

Central challenge in healthcare: physicians know more than patients and insurers

- How should physicians be reimbursed for treatment?

Physicians usually face identical incentives in one of two revenue models

- Variable fee ("Fee-For-Service"): may incentivize **over**-utilization → wasteful spending
- Flat fee ("Capitation"): may incentivize **under**-utilization → avoidable mortality

Some settings use a mixed contract to balance incentives

- But, physicians might be **heterogeneous** → could do better?
- Screening on observed differences may be infeasible or inadequate

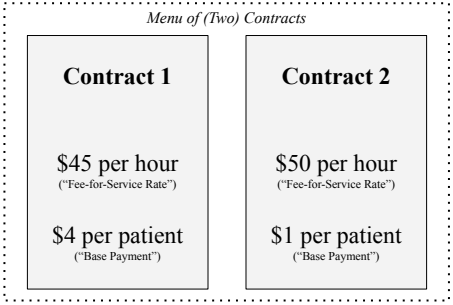
Theory: A physician's **choice of contract** can convey private information

Research question

Should a regulator offer a menu of reimbursement contracts instead of a uniform contract?

Two Contracts **Sometimes** Better Than One

Two Contracts **Sometimes** Better Than One



This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need

This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need
- **Not obvious** if a menu outperforms a uniform contract
- Efficiency depends on dispersion and correlation in physician parameters

This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need
- **Not obvious** if a menu outperforms a uniform contract
- Efficiency depends on dispersion and correlation in physician parameters

Empirical Setting: Norwegian primary care physicians, 2008-2017

- Regulated single-payer system with uniform contract
- Administrative data: treatment of all 5M residents ($775 M/year)

This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? ▸ Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need
- **Not obvious** if a menu outperforms a uniform contract
- Efficiency depends on dispersion and correlation in physician parameters

Empirical Setting: Norwegian primary care physicians, 2008-2017

- Regulated single-payer system with uniform contract
- Administrative data: treatment of all 5M residents ($775 M/year)

Research Design: exploit sudden variation in regulated payments

- Test for physician heterogeneity with DiD and quasi-random assignment

This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? ▸ Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need
- **Not obvious** if a menu outperforms a uniform contract
- Efficiency depends on dispersion and correlation in physician parameters

Empirical Setting: Norwegian primary care physicians, 2008-2017

- Regulated single-payer system with uniform contract
- Administrative data: treatment of all 5M residents ($775 M/year)

Research Design: exploit sudden variation in regulated payments

- Test for physician heterogeneity with DiD and quasi-random assignment
- Estimate structural model of treatment $\rightarrow$ distribution of physician parameters

This Paper

Research Question

Could a menu of reimbursement contracts improve patient health at the same cost? Contribution

Model: heterogeneous physicians choose **reimbursement contract** and **treatment hours**

- Physicians' private information: altruism, cost of **effort**, and patient need
- **Not obvious** if a menu outperforms a uniform contract
- Efficiency depends on dispersion and correlation in physician parameters

Empirical Setting: Norwegian primary care physicians, 2008-2017

- Regulated single-payer system with uniform contract
- Administrative data: treatment of all 5M residents ($775 M/year)

Research Design: exploit sudden variation in regulated payments

- Test for physician heterogeneity with DiD and quasi-random assignment
- Estimate structural model of treatment $\rightarrow$ distribution of physician parameters
- Derive **budget-neutral** menu of contracts to maximize **perceived** health

Main Empirical Findings

Physicians drive meaningful variation in treatment

- Reduced-form: physician-specific effects span 0.38 standard deviations
- Structural: **correlated** heterogeneity in physician parameters

Main Empirical Findings

Physicians drive meaningful variation in treatment

- Reduced-form: physician-specific effects span 0.38 standard deviations
- Structural: **correlated** heterogeneity in physician parameters

Budget-neutral menu **increases** treatment hours by 6% (mean = 11 minutes/month)

- Less under-utilization: low-hours physicians choose high fee-for-service rates
- Physicians **perceive** added benefit to patients of \$0.50 (5% of spending)

Main Empirical Findings

Physicians drive meaningful variation in treatment

- Reduced-form: physician-specific effects span 0.38 standard deviations
- Structural: **correlated** heterogeneity in physician parameters

Budget-neutral menu **increases** treatment hours by 6% (mean = 11 minutes/month)

- Less under-utilization: low-hours physicians choose high fee-for-service rates
- Physicians **perceive** added benefit to patients of \$0.50 (5% of spending)

All physicians and >99% of patients would be better off

- Largest gains for patients of physicians with **high opportunity cost** and **low altruism**
- Narrows urban-rural disparity, especially for most severe patients

Main Empirical Findings

Physicians drive meaningful variation in treatment

- Reduced-form: physician-specific effects span 0.38 standard deviations
- Structural: **correlated** heterogeneity in physician parameters

Budget-neutral menu **increases** treatment hours by 6% (mean = 11 minutes/month)

- Less under-utilization: low-hours physicians choose high fee-for-service rates
- Physicians **perceive** added benefit to patients of \$0.50 (5% of spending)

All physicians and >99% of patients would be better off

- Largest gains for patients of physicians with **high opportunity cost** and **low altruism**
- Narrows urban-rural disparity, especially for most severe patients

Asymmetric information remains quite costly: \$350M per year for full population

- Limited gains from further increasing contract flexibility

Heterogeneous Physicians Choose Hours of Treatment

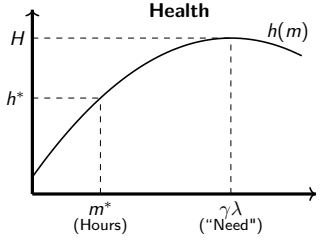
Physicians have additive preferences (e.g., Ellis and McGuire, 1986)

- **Observed**: treatment hours m_{ij}, fee-for-service rate p_{ij}

$$\max_{m \geq 0} \underbrace{(p - c)\, m}_{\text{Profit}} + \alpha \underbrace{\left(H - \tfrac{1}{2}(m - \gamma\lambda)^2\right)}_{\text{Health}}$$

Decision involves three physician-specific **parameters**

- **Altruism** α is the weight on patient health
- **Cost** of effort c decreases private profit, all else equal
- **Productivity** γ^{-1} increases patient health, all else equal



First-Order Condition

$m_{ij}^*(p, \lambda) = \max\{0, \frac{p_{ij} - c_j}{\alpha_j} + \gamma_j\, \lambda(X_i, \epsilon_{ij})\}$

Measuring Physician Heterogeneity

Data: Hours m_{ijt}, Fee-for-Service Rate p_{it}, and X_{it}, for patient i, physician j, month t

- X_{it} includes chronic illness, gender, disability, income, tenure, month, age, and lags

Parameters to estimate:

- Altruism α_j: physicians' responsiveness to increased fee-for-service rate

Estimating Equation

$$m_{ijt} = \max\{0, \frac{p_{it} - c_j}{\alpha_j} + \gamma_j \exp\left(\vec{\beta} X_{it} + \sigma \epsilon_{ijt}\right)\} \mid \lambda > 0$$

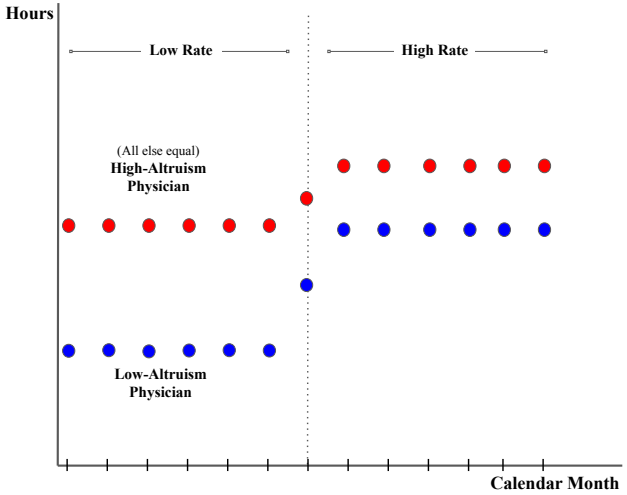
Estimated parameters maximize the likelihood of observed treatment hours

Measuring Physician Heterogeneity

$$\max_{m \in \text{Hours}} \ \text{Profit}(m) + \ \textbf{Altruism} \times \text{Health}(m) \quad \Rightarrow \quad \frac{dm}{d\ \text{Rate}} \approx \frac{1}{\text{Altruism}}$$

High-Altruism PCPs Respond Less to Increased Fee-for-Service Rate

Stylized Example with All Else Equal



Measuring Physician Heterogeneity

Data: Hours m_{ijt}, Fee-for-Service Rate p_{it}, and X_{it}, for patient i, physician j, month t

- X_{it} includes chronic illness, gender, disability, income, tenure, month, age, and lags

Parameters to estimate:

- Altruism α_j: physicians' responsiveness to increased fee-for-service rate
- Cost c_j: physicians' persistent difference in hours (e.g., young patients)

Estimating Equation

$$m_{ijt} = \max\{0, \frac{p_{it} - c_j}{\alpha_j} + \gamma_j \exp\left(\vec{\beta} X_{it} + \sigma \epsilon_{ijt}\right)\} \mid \lambda > 0$$

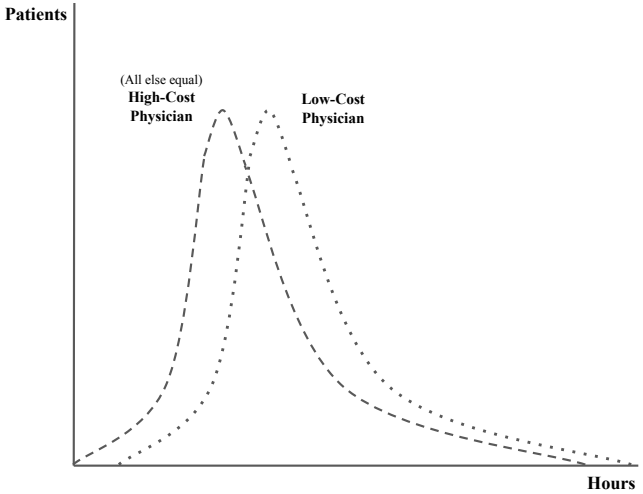
Estimated parameters maximize the likelihood of observed treatment hours

Measuring Physician Heterogeneity

$$\max_{m \equiv \text{Hours}} \ \textbf{Profit}(m) + \ \text{Altruism} \times \text{Health}(m) \quad \Rightarrow \quad \frac{d\,\text{Profit}}{d\,\text{Cost}} < 0$$

High-Cost PCPs Persistently Treat Additively Less

Stylized Example with All Else Equal



Measuring Physician Heterogeneity

Data: Hours m_{ijt}, Fee-for-Service Rate p_{it}, and X_{it}, for patient i, physician j, month t

- X_{it} includes chronic illness, gender, disability, income, tenure, month, age, and lags

Parameters to estimate:

- Altruism α_j: physicians' responsiveness to increased fee-for-service rate
- Cost c_j: physicians' persistent difference in hours (e.g., young patients)
- Productivity γ_j: physicians' persistent diff-in-diff in hours (e.g., old vs. young patients)

Estimating Equation

$$m_{ijt} = \max\{0, \frac{p_{it} - c_j}{\alpha_j} + \gamma_j \exp\left(\vec{\beta} X_{it} + \sigma \epsilon_{ijt}\right)\} \mid \lambda > 0$$

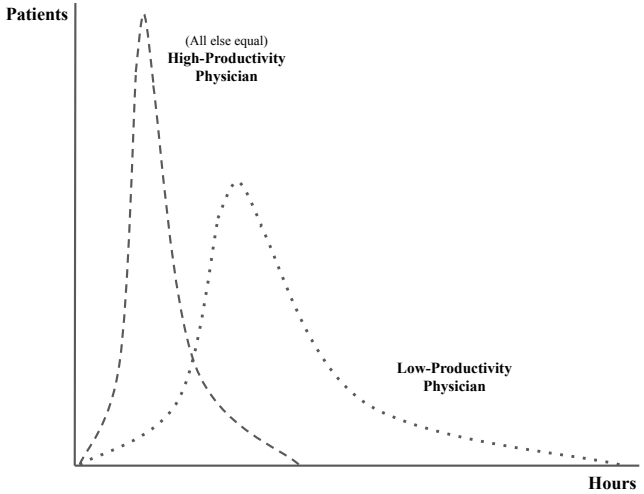
Estimated parameters maximize the likelihood of observed treatment hours

Measuring Physician Heterogeneity

$$\max_{m \equiv \text{Hours}} \ \text{Profit}(m) + \ \text{Altruism} \times \textbf{Health(m)} \quad \Rightarrow \quad \frac{d\,\text{Health}}{d\,\text{Productivity}} > 0$$

High-Productivity PCPs Persistently Treat Multiplicatively Less

Stylized Example with All Else Equal



Measuring Physician Heterogeneity

Data: Hours m_{ijt}, Fee-for-Service Rate p_{it}, and X_{it}, for patient i, physician j, month t

- X_{it} includes chronic illness, gender, disability, income, tenure, month, age, and lags

Parameters to estimate:

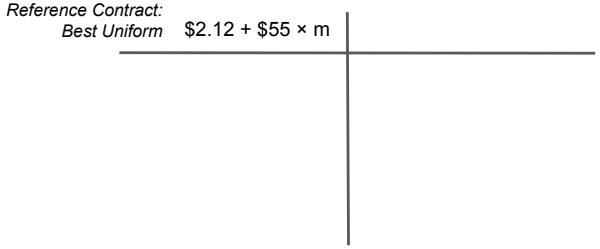
- Altruism α_j: physicians' responsiveness to increased fee-for-service rate
- Cost c_j: physicians' persistent difference in hours (e.g., young patients)
- Productivity γ_j: physicians' persistent diff-in-diff in hours (e.g., old vs. young patients)
- Patient Severity $\lambda \sim F(\vec{\beta}, \sigma)$: correlations and variance of residual treatment

Estimating Equation

$$m_{ijt} = \max\{0, \frac{p_{it} - c_j}{\alpha_j} + \gamma_j \exp\left(\vec{\beta} X_{it} + \sigma \epsilon_{ijt}\right)\} \mid \lambda > 0$$

Estimated parameters maximize the likelihood of observed treatment hours

Imperfect Information: a Two-Contract Menu **May** be Preferable



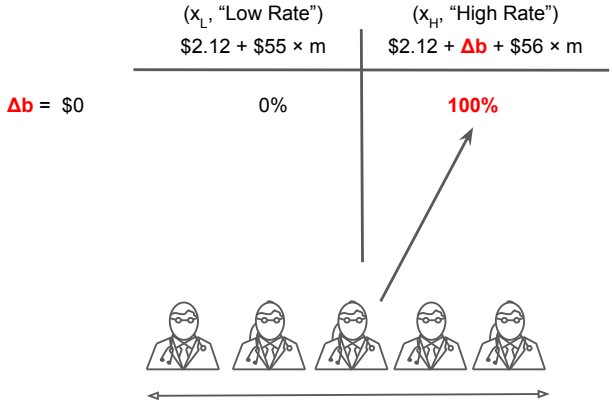
Imperfect Information: a Two-Contract Menu **May** be Preferable

Fix both fee-for-service rates	(x_L, "Low Rate")	(x_H, "High Rate")
	$2.12 + $55 × m	$2.12 + **Δb** + **$56** × m

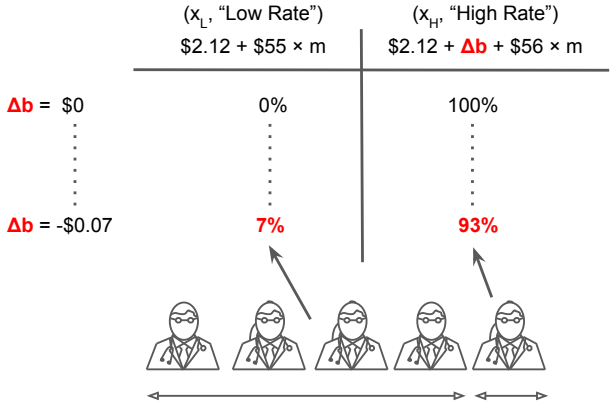
Imperfect Information: a Two-Contract Menu **May** be Preferable

Fix both fee-for-service rates	(x_L, "Low Rate")	(x_H, "High Rate")
	$2.12 + $55 × m	$2.12 + **Δb** + $56 × m
Δb = $0		
Vary the incremental base payment		

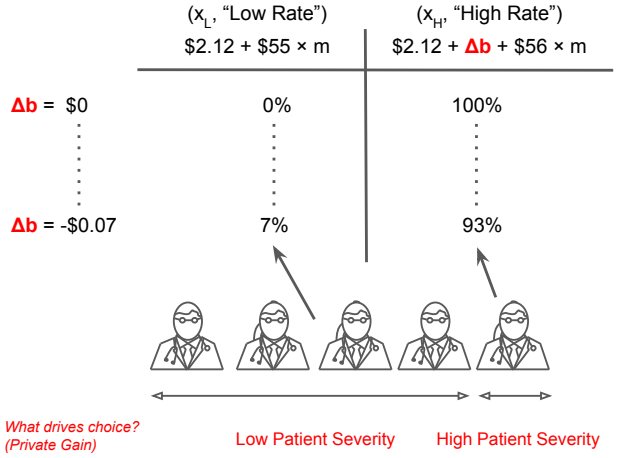
Imperfect Information: a Two-Contract Menu **May** be Preferable



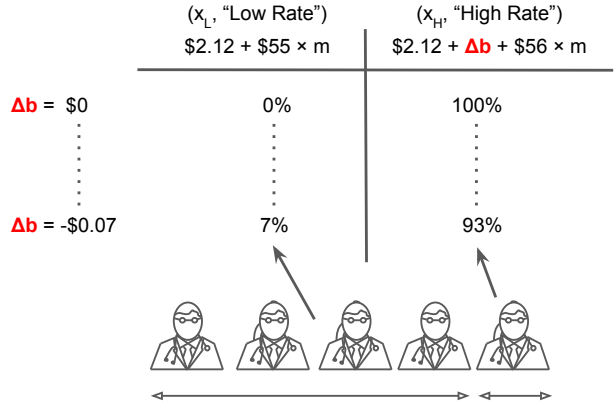
Imperfect Information: a Two-Contract Menu **May** be Preferable



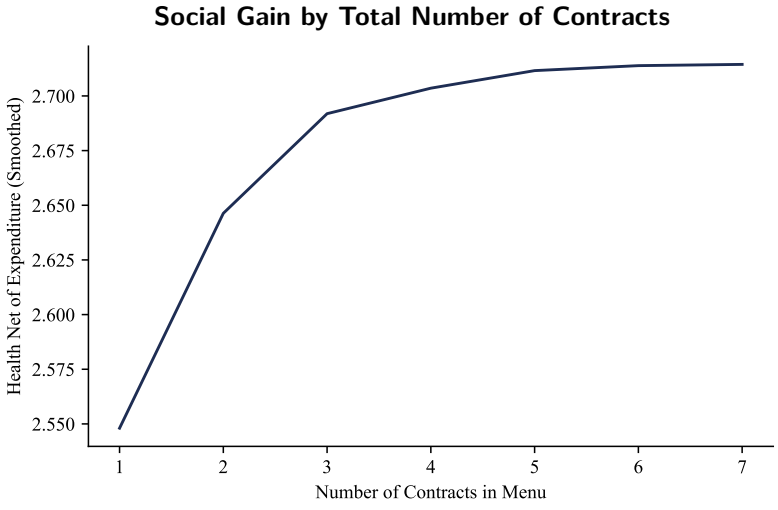
Imperfect Information: a Two-Contract Menu **May** be Preferable



Imperfect Information: a Two-Contract Menu **May** be Preferable

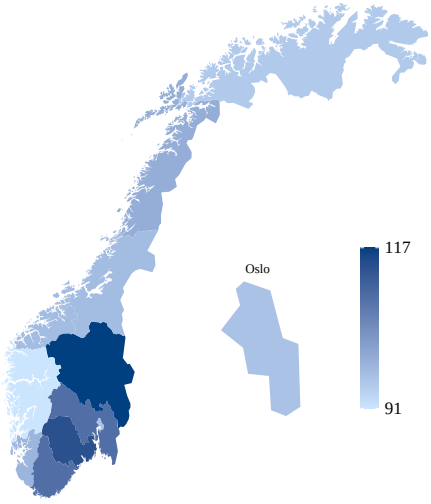


More Than Two Contracts is Even Better

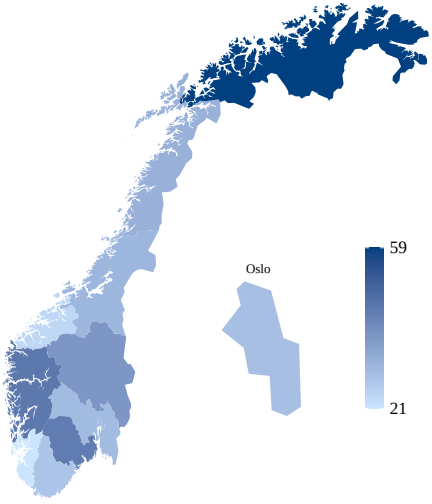


Patients with High Unmet Need Benefit Most

Mean Annual Spending ($)



Annual Health Gain from Menu ($)



Conclusion: Should Physicians Choose Their Reimbursement Rate?

Physicians hold **private information** about their heterogeneity and patients' needs

- Asymmetric information is costly $\rightarrow$ contract choice can **sometimes** help
- **Correlated** heterogeneity helps align private and social gains

Policy implication: a simple, voluntary, budget-neutral menu can improve health

- Recent reform: higher base payments for high-need patients

Other settings might benefit from menu design

- Testable with panel variation in incentives
- Implications for U.S. reforms: value-based care and site-neutral payment
- Uniform flat-fee contracts common in public service

Contribution

Contract Design: **(Theory)** Ellis and McGuire, 1986; Jack, 2005; Choné and Ma, 2011; Naegelen and Mougeot, 2011; Barham and Milliken, 2014; Allard, Jelovac and Léger, 2014; Ji, 2021; Wu, Chen and Li, 2017; Fang and Wu, 2018; Wu, 2020. **(Empirical)** Fortin et al., 2021; Gaynor et al., 2023. **(Insurance Menus)** Azevedo and Gottlieb, 2017; Marone and Sabety, 2022; Ho and Lee, 2023. **(Other Menus)** Bellemare and Shearer, 2013; D'Haultfœuille and Février, 2020; Taburet et al., 2024

- Portable **empirical** framework for menu design with unobserved outcomes

Physician heterogeneity: Epstein and Nicholson, 2009; Hennig-Schmidt, Selten and Wiesen, 2009; Doyle, Ewer and Wagner, 2010; Godager and Wiesen, 2013; Douven, Remmerswaal and Zoutenbier, 2017; Gowrisankaran, Joiner and Léger, 2017; Galizzi et al., 2015; Einav et al., 2021; Chan and Chen, 2022

- **Correlated** cost, altruism, and patient need $\rightarrow$ targeted policy

Physician response to financial incentives: Gaynor, Rebitzer and Taylor, 2004; Clemens and Gottlieb, 2014; Brekke et al., 2017, 2020; Einav, Finkelstein and Mahoney, 2018; Eliason et al., 2018; Song et al., 2019; Xiang, 2021

- Connect treatment response to both spending and **patient health**

Back

Physicians Vary in Multiple Ways

What patterns of physician heterogeneity should be in the empirical model?

Physicians Vary in Multiple Ways

What patterns of physician heterogeneity should be in the empirical model?

1. When fee-for-service rate increases, PCPs increase treatment hours
   - Stacked differences-in-differences with patient fixed effects
   - Some more than others

   $$Y_{ijt} = \beta_j \left(Post_{jt} \times Certified_j \right) + \boldsymbol{\beta}_x \boldsymbol{X}_{jt} + \gamma_i + \gamma_{y(t)} + \gamma_{m(t)} + \epsilon_{ijt}$$

Physicians Vary in Multiple Ways

What patterns of physician heterogeneity should be in the empirical model?

1. When fee-for-service rate increases, PCPs increase treatment hours
   - Stacked differences-in-differences with patient fixed effects
   - Some more than others

   $$Y_{ijt} = \beta_j \left(Post_{jt} \times Certified_j \right) + \boldsymbol{\beta}_x \boldsymbol{X}_{jt} + \gamma_i + \gamma_{y(t)} + \gamma_{m(t)} + \epsilon_{ijt}$$

2. Some PCPs persistently treat similar patients more intensively than others
   - Histogram of fixed effects from regression

Physicians Vary in Multiple Ways

What patterns of physician heterogeneity should be in the empirical model?

1. When fee-for-service rate increases, PCPs increase treatment hours
   - Stacked differences-in-differences with patient fixed effects
   - Some more than others

   $$Y_{ijt} = \beta_j \left(Post_{jt} \times Certified_j\right) + \boldsymbol{\beta}_x \boldsymbol{X}_{jt} + \gamma_i + \gamma_{y(t)} + \gamma_{m(t)} + \epsilon_{ijt}$$

2. Some PCPs persistently treat similar patients more intensively than others
   - Histogram of fixed effects from regression

3. PCPs causally affect treatment and adverse outcomes, e.g., two-year mortality
   - Random patient assignment after nearby PCP exits (Ginja et al., 2022)
   - New evidence: dispersed effects on spending and avoidable hospitalizations

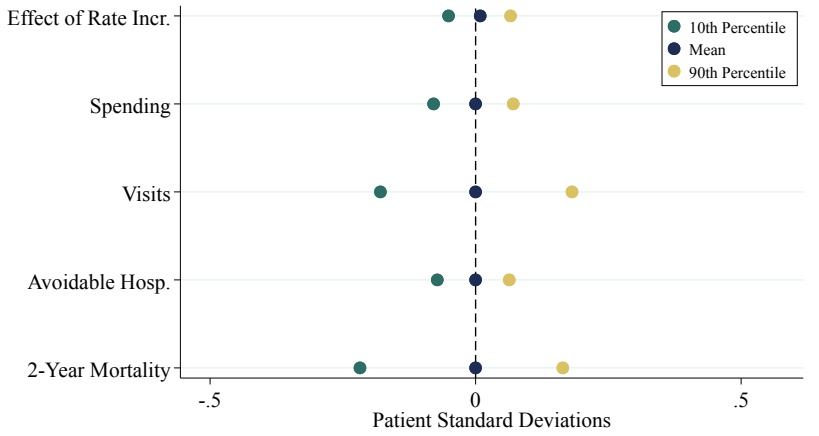
   $$Y_{ij} = \beta_j + \beta_{j_0(i)} + \beta_x X_j + \epsilon_{ij}$$

Back

Dispersion in Physician-Specific Effects

Moving from the 10th to 90th percentile of physicians

- Equivalent to 12-38 percent of a standard deviation across patients
- Bayesian shrinkage adjusts for estimation error



Details