

Quality choice with reputation effects: Evidence from hospices in California

Rubaiyat Alam

Boston University

Motivation

Hospices provide palliative care to dying patients.

1. Large industry, deficiencies in quality.
2. Insightful for regulated-price healthcare markets.
3. Quality choice under reputation effects.
 - Reputation of a firm reflects its past quality choices.
 - Current quality $\uparrow \implies$ reputation $\uparrow \implies$ future sales \uparrow

This paper shows:

1. Hospices choose quality to build reputation, gain market share.
2. Counterfactual policies \implies better hospice quality.

Hospice industry

1. Serve dying patients at residences.
 - Regular visits for pain-control, living arrangements.
2. Patient's choice aided by social worker/physician/community.
3. More visits \implies higher quality.
 - Measure of hospice quality = Average visits-per-patient.
4. No price competition: Paid fixed rate per-patient per-day by Medicare.
5. Hospice reputation \rightarrow patient's choice.
 - Quality not contractible: hospice unilaterally decides visits.
 - Goodwill and name recognition.
 - Good track record \implies better known and suggested \implies higher market share.

Structural model

Estimate structural model of hospice industry.

Reputation of a hospice = stock of its current and past quality choices, partially depreciates every period.

1. Demand: Consumers choose among hospices in market.
 - Hospice characteristics and reputations → choice.
2. Supply: Hospices choose quality every year.
 - Dynamic oligopoly model.
 - Trade off improving reputation with higher cost.

Structural model

Data:

- Home Health Agencies And Hospice Annual Utilization Reports.
- Restrict to 28 counties in California.
- Panel data on hospices at the [firm level](#).
- Annual data covering 2002-2018.
- For each hospice-year: total patients served, total visits made by staff, hospice characteristics, etc.

Descriptive statistics:

- Total hospices in market: 1–23.
- Average visits-per-patient: 15–60.
- Moderate entry, little exit.

Structural model: Demand

Demand model: Discrete choice (with outside option), nested logit.

The utility of consumer i for hospice j in period t is given by:

$$u_{ijt} = \alpha_{m(j)} + X'_{jt}\beta + \psi_{jt} + \xi_{jt} + \zeta_i + (1 - \sigma_n)\tilde{\varepsilon}_{ijt}$$
$$\xi_{jt} = \rho\xi_{jt-1} + \epsilon_{jt}$$

- $\alpha_{m(j)}$ = county FE.
- X_{jt} = observed hospice characteristics.
- ψ_{jt} = hospice j 's reputation.
- ξ_{jt} = Persistent unobserved hospice characteristic.
- ϵ_{jt} = innovation distributed independently with mean zero.

Structural model: Demand

Reputation follows a stock transition equation:

$$\psi_{jt} = (1 - \tau)\psi_{jt-1} + \eta a_{jt}$$

where a_{jt} = average-visits-per-patient by hospice j in period t .

Assuming $\psi_{j0} = 0$:

$$\psi_{jt} = \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

Combining:

$$u_{ijt} = \alpha_{m(j)} + X'_{jt}\beta + \xi_{jt} + \zeta_i + (1 - \sigma_n)\tilde{\varepsilon}_{ijt} + \\ \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

$$\xi_{jt} = \rho\xi_{jt-1} + \epsilon_{jt}$$

Results: Demand

Using Berry (1994), with BLP IVs and fuel-cost:

$$\ln(s_{jt}) - \ln(s_{0t}) = \alpha_m + X'_{jt}\beta + \sigma_n \ln(s_{j|gt}) + \xi_{jt} + \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

$$\xi_{jt} = \rho \xi_{jt-1} + \epsilon_{jt}$$

	Demand
τ	0.530 (0.156)
ρ	0.756 (0.072)
σ_n	0.597 (0.034)
η	0.012 (0.003)

Structural model: Supply

Intuition: marginal cost is increasing linearly in quality choice.

Cost of serving each patient at quality a_j :

$$MC_j(a_j) = \gamma_0 + \left(\gamma_1 + \gamma_{fp}FP_j + \gamma_{rural}RURAL_j \right) a_j$$

- a_j = average visits-per-patient.
- FP_j = For-profit status.
- $RURAL_j$ = Rural hospice indicator.

All patients of hospice j receive quality a_j .

Structural model: Supply

Hospice j 's per-period profit:

$$\bar{\pi}(a_j, a_{-j}, x_m; \theta) = M_m s_j(a_j, a_{-j}, x_m) [P_m^{MCAR} - MC_j(a_j; \theta)]$$

- θ = cost parameters.
- MC = marginal cost.
- x_m = state variable in market m .
- a_{-j} = actions of rivals.
- M_m = market size.
- $s_j(\cdot)$ = hospice j 's market share.
- P^{MCAR} = Medicare payment over length-of-stay

Structural model: Supply

Hospice quality choice:

- Has dynamic effect through reputation stock.
 - Current quality \rightarrow future profits.
 - Embed per-period profit into value function.
- Simultaneous-move dynamic oligopoly.
 - Discrete time (year), infinite horizon.

Dynamic game estimation:

- Aim: Recover hospice cost function.
- Firm and market state variables.
- Entry and exit of rivals.
- Method: Bajari, Benkard and Levin (2007).

Dynamic game estimation:

1. Additional visit per patient costs the hospice \$200.
 - Includes staff wages, cost of medical supplies and operation.
2. For-profits more efficient than non-profits by \$93 per visit.
3. Rural hospices suffer cost disadvantage of \$22 per visit.

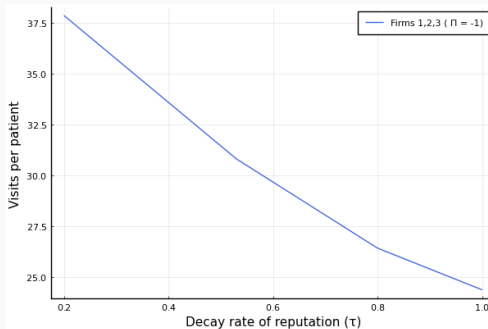
Study counterfactual policies that may improve hospice quality.

- Representative market.
- 3 identical hospices.
- No entry/exit.
- Calculate equilibrium quality choices via policy iteration.

Counterfactuals: reputation persistence

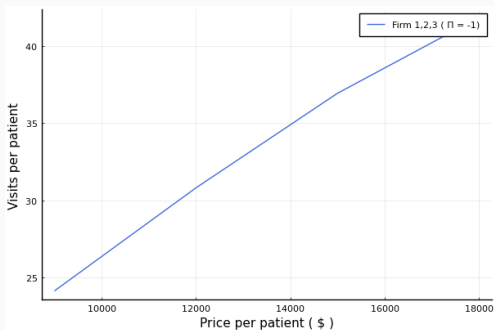
Study impact of **changing the persistence of reputation (τ)**.

Mimics policies like online review sites that make quality information widely available and easier to find.



Counterfactuals: Medicare prices

Study how hospice quality changes as Medicare rates increase:



Counterfactuals: contract design

Tying reimbursement to quality choice:

The following contract structures all achieve 29 average visits-per-patient:

Per-day rate	Per-visit rate	Medicare cost
186.7	0.0	1.0
150.0	50.0	0.93
100.0	110.0	0.82
50.0	170.0	0.71

1. Importance of reputation for i) patients choosing medical providers and ii) medical providers choosing quality.
2. Contribute to a very sparse literature on hospices in Economics.
3. Estimate novel structural model of reputation accumulation through quality choice.

Conclusion

1. Reputation \rightarrow consumer choice and hospice quality.
2. Build structural model of reputation accumulation through quality choice, recover hospice cost function.
3. Policy counterfactuals:
 - Persistence of reputation \uparrow and Medicare prices $\uparrow \implies$ hospice quality \uparrow .
 - A hybrid per-day and per-visit reimbursement scheme achieves the same quality as the current per-day scheme at nearly 30% lower spending.