Effects of Market Concentration and Simulated Chain Consolidation on Pennsylvania Nursing Homes: Prices, Quality and Markups

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Outline

- Part I:

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  - The effect of merger and acquisition simulations on prices and markups.

Part I

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- Long-term care providers include: assisted-living, family care, in-home care, and nursing homes.
- Nursing homes provide extensive long-term care.
- Nursing home types: Public and Private (profit vs. nonprofit).

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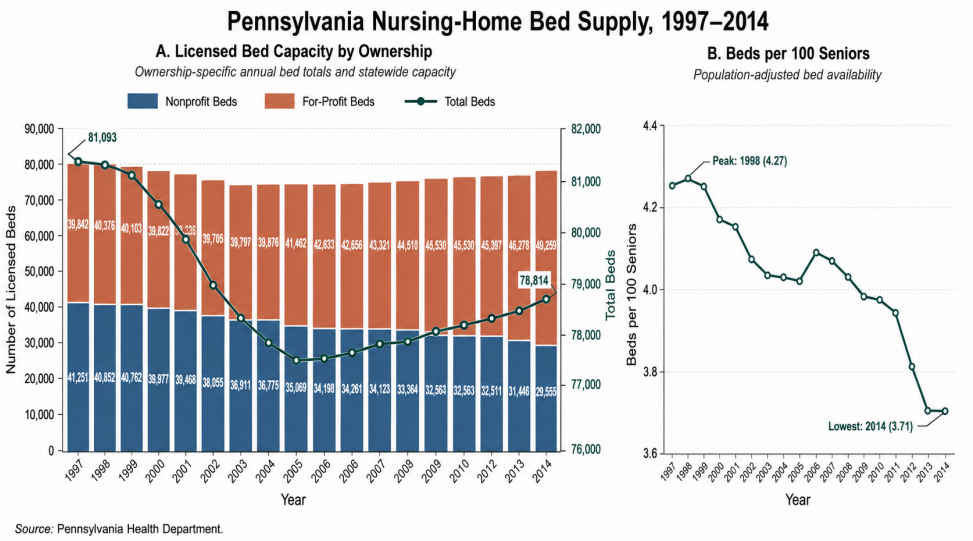
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  - To test whether higher market concentration raises private-pay nursing home prices reflects market power rather than a shortage of beds or excess demand.

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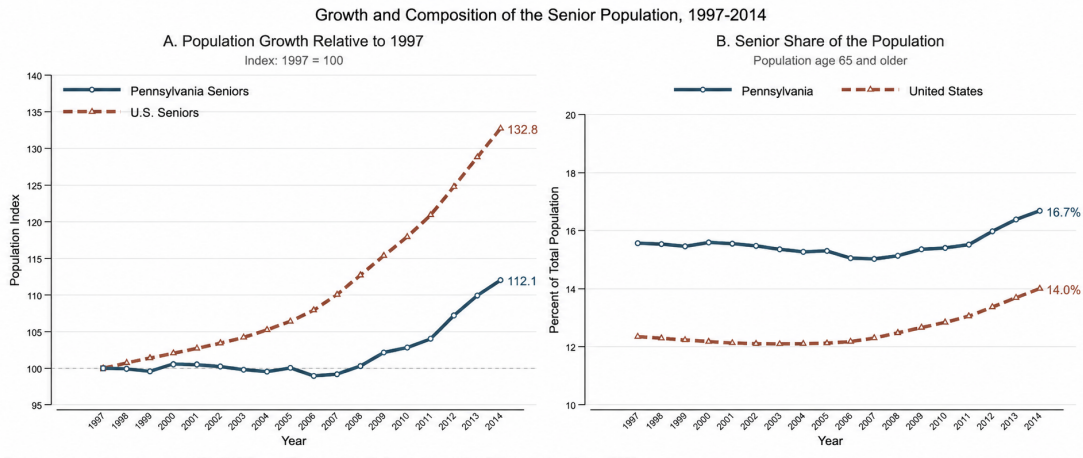
Illustrations

Supply



Source: Pennsylvania Health Department.

Demand



Source: Pennsylvania Health Department.

Definitions

Market Concentration & Market Definitions

Herfindahl–Hirschman Index (HHI)

- HHI is a standard measure of market concentration.
- Captures the relative size distribution of firms in a market.

$$\text{HHI}_{mt}^{k} = \sum_{j=1}^{J_{mt}} \left(s_{jmt}^{k}\right)^2, \qquad k \in \{B, \text{PD}\}.$$

- Market is defined at the **county** level. There are 67 **counties**.
- In the robustness check, **alterative measurements of HHI** are assessed, in addition to an alternative **market definition**. **What drives market concentration.**

Data

Data Sources

- **Pennsylvania Department of Health**
  Private room prices, beds, patient days, staffing, and ownership.
- **Federal Reserve Economic Data (FRED)**
  Per capita personal income and the seniors density.
- **U.S. Bureau of Labor Statistics: QCEW**
  Average annual pay in education and health services.
- **Hackmann (2019), American Economic Review**
  Firm latitude and longitude for distances and geographic markets.
- **IPUMS-CPS: CPS ASEC, 1997-2014**
  Survey data covering 7,526 Pennsylvania respondent-year records, including personal income and age.

Firm Characteristics and Summary Statistics

A. Summary statistics: 11,131 observations

Variable	Total	Nonprofit	For-profit
Private-room daily rate ($/day)		**232.85**	221.04
Skilled nurses per patient (%)		**33.30**	28.63
Number of beds		110.23	**124.46**
Patient days (×1000)		36.837	**40.269**
Avg distance between firms (km)	18.00	—	—

719 homes, 1997–2014:
Active throughout: 76.5% (550); Entry: 10.8% (78); Exit: 12.7% (91).

B. Firm Characteristics



Ownership
- Nonprofit **50.7%**
- For-profit **49.3%**



Chain affiliation
- Independent **87.6%**
- Chain-affiliated **12.4%**



Facility size
- $<$ 120 beds **51.4%**
- $\geq$ 120 beds **48.6%**



Facility age
- $<$ 7 years **50.5%**
- $\geq$ 7 years **49.5%**

C. Individual-level demographics

(%) aged 65–74	(%) aged 75–84	(%) aged 85+	Per-capita income
51	**38**	**11**	**37,656**

7,526 observations

Methodology

The Static Effect of HHI on Price & Quality

Reduced-form model: Two-way fixed effects

$$\ln y_{jt}^{k} = \beta_{hhi}\, \ln\left(\widehat{hhi}_{mt}^{\,\tau}\right) + \boldsymbol{\beta}_{X}^{'}\mathbf{X}_{mt} + \boldsymbol{\beta}_{\boldsymbol{F}}^{\prime}\boldsymbol{F}_{\boldsymbol{jt}}^{\boldsymbol{g}} + \theta_m + \mathbf{d}_t + \varepsilon_{jt}$$

- y_{jt}^{k}, where $k \in \{\text{price, quality}\}$
- θ_m, τ_t: market, year fixed effects
- $\boldsymbol{F}_{\boldsymbol{jt}}^{\boldsymbol{g}}$: firm characteristics
- hhi_{mt}: market concentration where $\tau \in \{\text{beds, patient days}\}$
- $\mathbf{X}_{mt}$: market characteristics

First stage: Two-step system GMM

$$h_{mt}^{\phi} = \beta_{hhi}^{\phi}\, h_{m,t-1}^{\phi} + \boldsymbol{\beta}_{X}^{\phi\prime}\mathbf{X}_{mt} + \theta_m^{\phi} + \mathbf{d}_t^{\prime}\boldsymbol{\gamma}^{\phi} + \eta_{mt}^{\phi}, \qquad h_{mt}^{\phi} \equiv \ln(HHI_{mt}^{\phi}).$$

$$Z_{mt}^{\phi} \equiv \left[Z_{mt}^{D,\phi}, Z_{mt}^{L,\phi}\right].$$

$$\mathbb{E}\left[(Z_{mt}^{D,\phi})^{\prime}\Delta\eta_{mt}^{\phi}\right] = 0, \qquad \mathbb{E}\left[(Z_{mt}^{L,\phi})^{\prime}(\theta_m^{\phi} + \eta_{mt}^{\phi})\right] = 0.$$

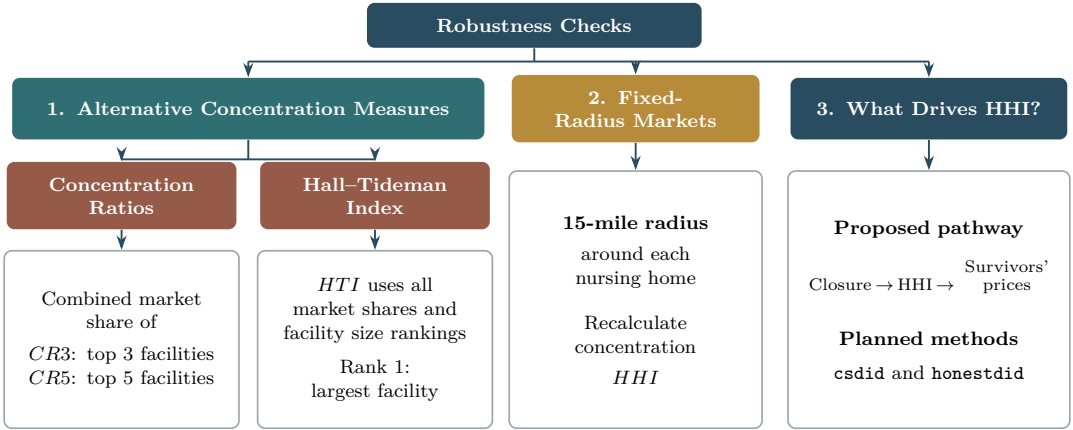
Market Concentration: First and Second Stage Results

	First stage Dynamic system GMM		Second stage Log private-room price		Second stage Log nurse–patient ratio	
	HHI^B (1)	HHI^{PD} (2)	HHI^B (3)	HHI^{PD} (4)	HHI^B (5)	HHI^{PD} (6)
Lagged ln HHI	0.873***	0.986***				
	(0.138)	(0.034)				
Fitted ln HHI			0.128†	0.130*	-0.209†	-0.127
			(0.072)	(0.057)	(0.111)	(0.081)
ln Senior density			0.236**	0.225**	-0.066	-0.035
			(0.086)	(0.085)	(0.095)	(0.094)
ln Per-capita income			-0.305**	-0.314**	-0.239†	-0.223
			(0.105)	(0.103)	(0.132)	(0.134)
ln Average annual pay			0.0086†	0.0082†	0.0087	0.0085
			(0.0045)	(0.0044)	(0.0125)	(0.0127)
Nonprofit			0.135***	0.135***	0.169***	0.170***
			(0.029)	(0.029)	(0.035)	(0.035)
Chain affiliation			0.110*	0.109*	0.064	0.064
			(0.048)	(0.048)	(0.053)	(0.053)
Large firms (beds ≥ 120)			-0.093***	-0.093***	-0.258***	-0.259***
			(0.021)	(0.021)	(0.025)	(0.025)
Aged firms (age > 7)			-0.056	-0.056	-0.141*	-0.141*
			(0.038)	(0.038)	(0.055)	(0.055)
Constant			7.863***	8.017***	1.123	1.036
			(1.173)	(1.143)	(1.491)	(1.503)
Observations	1,139	1,139	10,988	10,988	11,802	11,802
County markets	67	67	67	67	67	67
Model F-statistic			13.25	13.01	46.46	45.74

First-stage diagnostics	Instruments	AR(1) p	AR(2) p	Hansen p
HHI^B (1)	24	0.0036	0.4523	0.3898
HHI^{PD} (2)	23	0.0009	0.3652	0.5751

Standard errors in parentheses, clustered by county. Blue coefficients: † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Robustness Checks



Bed-based and patient-day market shares throughout.
Assess sensitivity of the price and quality estimates.

Robustness Checks: Price & Quality

- **CR3 and CR5:** Price coefficients are positive. Only patient-day CR5 is significant at 5% (0.2353*); the other price estimates are significant at 10%. Staffing-quality effects are not statistically significant.

Coefficients are elasticities. Inference is conditional on fitted concentration; lag selection is exploratory. Significance: $*p < 0.05$, $**$ $p < 0.01$, $***p < 0.001$.

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Part II

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- The average number of firms per chain rose **by 11%** for the largest chains.
- How do common ownership and acquisitions affect prices and markups?

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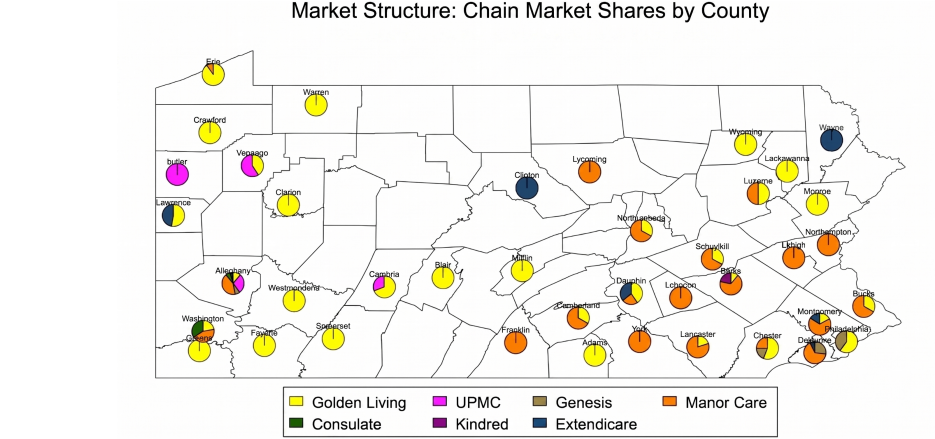
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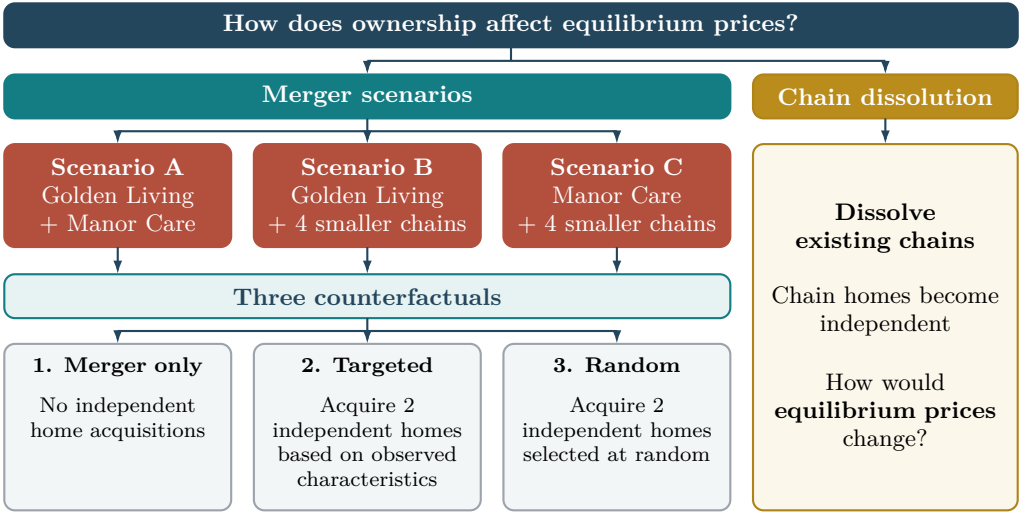
- Having recovered demand parameters and validated the computed marginal costs, we turn to counterfactual merger analysis.

Chain Distribution Across Markets



Source: Pennsylvania Health Department

Counterfactual Ownership Scenarios



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  - **Two old nonprofit homes:** In Scenario A, the average price increase rises from **$0.23** with the merger alone to **$3.09** with the acquisitions.
- **Dissolving existing chains:** Average simulated prices fall from **$218.02** to **$217.77**, a reduction of **$0.25**.

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- Our findings do not rule out the presence of market power, but they provide strong evidence that competition plays an important role in Pennsylvania's nursing home market.
- Marginal cost is **correlated** with the Medicaid rate.
- The merger of Golden Living and Manor Care generates the **largest** price impact, regardless of the merger scenario.

Thank you!