Appendix A: Matching

We perform 1-to-1 optimal Mahalanobis matching to select a group of independent facilities that are more similar to the acquired facilities on observed dimensions in year $\tau_i - 1$, i.e. one year before mergers. The distance between nursing homes is computed as the Mahalanobis distance based on the following variables

- variables defined in section 3.4
- the count of health deficiency citations
- the count of any deficiency citations
- number of residents
- direct-care staff hours per resident day[21]
- the ratio of registered nurses divided by registered nurses plus licensed practical nurses

All these variables are lagged by one year. To control the potential quality trend differences between the acquired and control facilities before mergers, we include in matching the lagged difference of the following two continuous variables

- the count of health citations
- the count of any deficiency citations

Also, we require that the control facility selected has the same profit status (for-profit, non-profit, or government) as the acquired facility and is present in the data for all the years that the acquired facility is present. The matching is implemented year by year.

With 1-to-1 optimal Mahalanobis matching, each acquired facility is matched by its closest counterpart. The results of covariate balancing are summarized in Figure A1. Here we show the absolute standardized differences of covariates between the acquired and control facilities in the year $\tau_i - 1$, both for the full control sample (in circle) and the matched control sample (in diamond).[22] Before matching, there are significant differences between the acquired and control facilities in health deficiencies, profit status, government ownership and wage. After matching is implemented, the differences for those covariates are significantly reduced and fall below the 0.1 threshold.[23] Overall, the matching mitigates the confounding effects caused by the differences in observables between acquired and control facilities prior to mergers.

[21] Direct-care staff include registered nurses (RNs), licensed practical nurses (LPNs), and certified nursing assistants (CNAs).

[22] The absolute standardized difference is calculated as the absolute difference in means divided by the standard deviation.

[23] Previous studies suggest that absolute standardized difference less than 0.1 is typically viewed as small differences between groups (Schmitt, 2017).

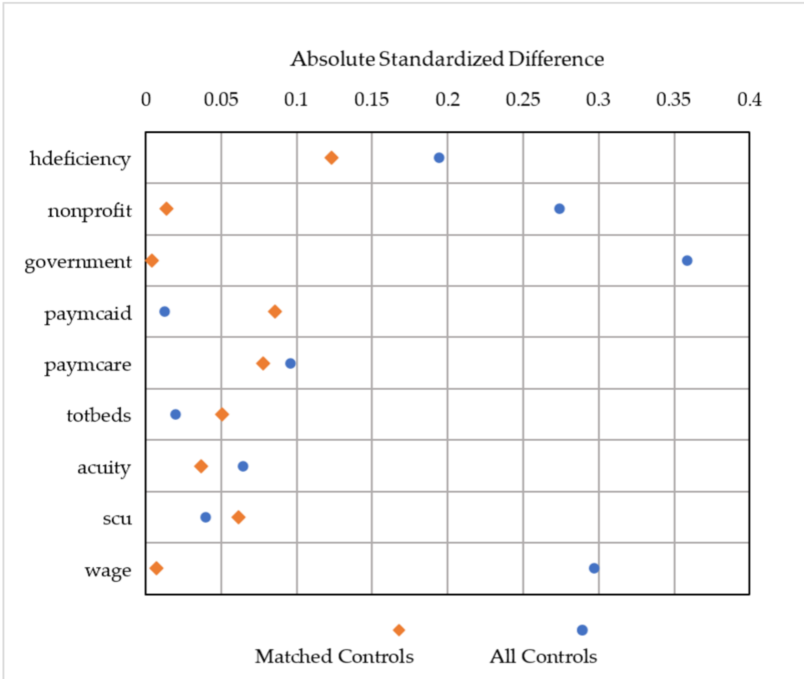
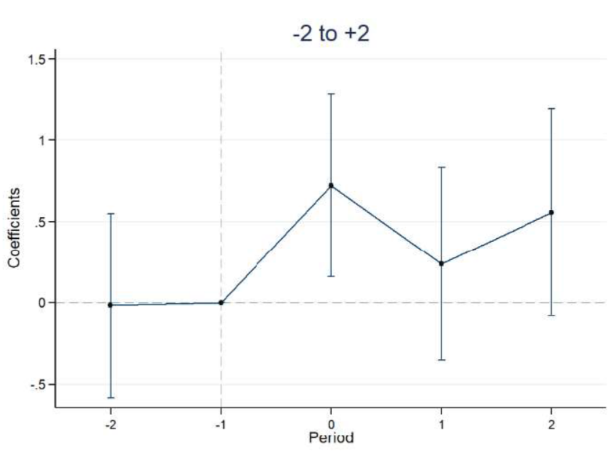
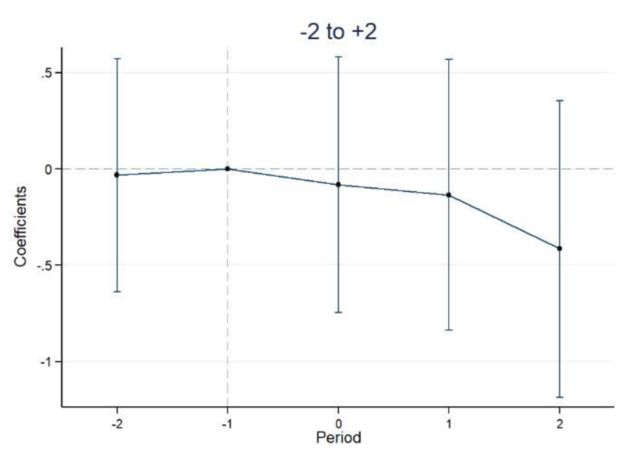


Figure A1: Covariate Balance Before and After Matching
Note: The absolute standardized difference is defined as the absolute difference in means divided by the standard deviation between the acquired and control facilities. The values are computed for the year $\tau_i - 1$.

Appendix B: Supporting Results



(a) Divestiture



(b) Chain-to-Chain

Figure B1: Coefficient Plot of Divestiture/Chain-to-Chain Event Study

Table B1: Heterogeneity Results Continued

	(1) Within	(2) Cross	(3) Large	(4) Small	(5) High	(6) Low	(7) PE	(8) Non-PE	(9) Serial	(10) Non-serial
Panel A: Event Window -2 to +3										
$\mathbf{1}[i \in T, t \geq \tau_i]$	-0.445	-0.561***	-0.361	-0.679***	-0.877***	-0.172	0.805	-0.583***	-0.536**	-0.496**
	(0.315)	(0.211)	(0.257)	(0.231)	(0.210)	(0.272)	(0.774)	(0.197)	(0.264)	(0.223)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	7716	10253	8827	9142	9069	8900	6237	11732	8915	9054
R^2	0.036	0.036	0.034	0.038	0.037	0.039	0.045	0.031	0.034	0.037
Panel B: Event Window -2 to +4										
$\mathbf{1}[i \in T, t \geq \tau_i]$	-0.508	-0.748***	-0.619**	-0.717***	-0.762***	-0.545*	0.556	-0.725***	-0.888***	-0.441*
	(0.333)	(0.224)	(0.273)	(0.248)	(0.218)	(0.299)	(0.829)	(0.209)	(0.285)	(0.235)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	7455	9769	8430	8794	8753	8471	5999	11225	8481	8743
R^2	0.039	0.036	0.035	0.038	0.038	0.039	0.046	0.032	0.036	0.037

Robust standard errors clustered at the facility level are reported in parentheses. Significance level:
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A (Panel B) results are based on the sample of facilities with a 3-year (4-year) post period.
The following control variables are included in the regressions: nonprofit, government, scu, wage. The following county-level variables are included in the regressions: number of beds in market per 1,000 individuals aged 65+, mean paymcare, mean paymcaid, and mean acuity index across all facilities in market.
A within-market merger happens when the acquirer has affiliates in the same county as the target facility. A cross-market merger happens when the acquirer enters a new market by acquiring a facility outside of its service counties. A large (small) chain is defined as a chain owning more than (less than) five facilities. High-quality chains are defined as those chains with less than six health deficiency citations. PE ownership is identified through internet searches of firms mentioned in company websites, government reports and media coverage, supplemented by those mentioned in previous literature. An acquiring chain is defined as a serial acquirer if it has completed at least one merger transaction in year $\tau_i - 1$.

Appendix C: Demand Model

The demand model is based on seniors' choice of nursing homes for long-term care. We assume that a senior i decides between an outside good ($j = 0$) and nursing homes ($j = 1, 2, ..., J_m$) in her residing county m to maximize her utility. Examples of the outside good include long-term care delivered to the senior's home by informal caregivers (family members, relatives, or friends) or formal care by home care agencies. Individual i's utility from facility j in year t is defined as

$$U_{ijt} = \delta_{jt} + v_{ijt} \tag{5}$$

where the mean utility δ_{jt} is specified as follows

$$\delta_{jt} = X_{jt}\beta + \alpha q_{jt} + \lambda_m + \lambda_t + \xi_{jt}$$

The q_{jt} is the quality of care for facility j measured by the number of health deficiency citations. X_{jt} denotes a vector of facility characteristics affecting the mean utility, λ_m (λ_t) represents county (year) specific fixed effects, ξ_{jt} denotes unobserved facility characteristics. Following Berry (1994),

$$v_{ijt} = \zeta_{igt} + (1 - \sigma)\varepsilon_{ijt} \tag{6}$$

follows an i.i.d. extreme value distribution which generates a nested logit structure (see equation (9) below). The advantage of a nested logit structure is that it allows for closer substitution within a nest. We assume that all facilities are placed in a single nest but they are separated from the outside good (placed in another nest). $0 < \sigma < 1$ measures the correlation among choices within the nursing home nest. A higher σ implies higher homogeneity within the nursing home nest, i.e. choices within the nursing home nest are closer substitutes for a nursing home than the outside good.

Note that price is omitted in the mean utility function for the following reasons. Price competition is limited in the nursing home industry as the majority of the nursing home revenues come from Medicare and Medicaid enrollees whose nursing home stays are paid by federal or state governments. In our sample, 60% of the residents are covered by Medicaid, and 13% are covered by Medicare. Payments for these residents are competition at state or federal levels.

Aggregating the nursing home choices across consumers, the market share of facility j is given by the within-group shares ($s_{jt|gt}$, the share of residents in facility j out of all residents in nursing homes within county m) multiplied by the group share (s_{gt}, the total number of nursing home residents in county m divided by total number of seniors in county m):

$$s_{jt} = s_{jt|gt} \cdot s_{gt} \tag{7}$$

$$= \frac{e^{\delta_{jt}/(1-\sigma)}}{V_{mt}^{\sigma}(1 + V_{mt}^{1-\sigma})} \tag{8}$$

where $V_{mt} = \sum_{k \in J_t} e^{\delta_{jt}/(1-\sigma)}$.

Therefore, demand for facility j can be written as $M_{mt} \cdot s_{jt}$ where M_{mt} equals the total number of seniors in county m.

Assuming the mean utility from the outside good to be 0, with equation (8), the following expression holds.

$$\ln(S_{jt}/S_{0t}) = X_{jt}\beta + \alpha q_{jt} + \sigma \ln(S_{jt|gt}) + \lambda_m + \lambda_t + \xi_{jt} \tag{9}$$

Since our demand model only requires facility-level characteristics as explanatory variables, we only utilize information from CASPER dataset for the demand estimation analysis.

C.1 Instruments

The unobserved facility characteristics ξ_{jt} are likely to be correlated with both quality and within group share. To address this endogeneity concern, we employ an instrumental variables approach following Berry (1994). We use observable and exogenous product characteristics of facilities' local competitors to instrument for quality and within-group share. Here the instruments are the number of beds and the share of Medicare residents of local competitors. These variables do not affect consumers' demand decisions directly. However, they affect the rival's costs, staffing, and quality choice and thereby have an indirect effect on the quality choice of a nursing home when it competes with other facilities.

C.2 Demand Estimates

Table C1 reports the results of demand estimation using 2SLS. The F-statistics on the instruments is 82.52, suggesting a rejection of weak instruments. All the coefficients are significant and have expected signs. Demand rises in correlation with the percentage of Medicaid residents, the number of beds, the presence of a special care unit, and nursing homes' capability of taking care of sicker residents (measured by residents' acuity index). Further, consumers value chain ownership, while showing less preference for nonprofit, government or hospital-based facilities.

The coefficient of $hdeficiency$ is negative and significant. A higher number of health deficiency citations decreases demand, i.e. consumers value quality of care when selecting nursing homes for long-term care and support services. The average own elasticity with respect to the number of health deficiency citations is -0.27. The interpretation is that when the number of deficiency citations increases by 1 (or around 10% of the full sample mean of $hdeficiency$), market share decreases by 2.7 percent. Further, the coefficient of the within-group share is 0.693, and significant. It implies a closer substitution among nursing homes than between a nursing home and the outside good.

Table C1: Demand Estimation

	(1) lnshareratio
hdeficiency	-0.0152***
	(0.00264)
lshare_g	0.693***
	(0.0101)
nprofit	-0.00996***
	(0.00273)
government	-0.0343***
	(0.00334)
chain_own	0.0137***
	(0.000947)
hospbase	-0.132***
	(0.00444)
paymcaid	0.00185***
	(0.0000753)
paymcare	-0.000266***
	(0.0000598)
totbeds	0.00242***
	(0.0000623)
acuity	0.00407***
	(0.000357)
scu	0.0281***
	(0.00124)
N	327852
R^2	0.920

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Model is estimated using the 2SLS method with the number of beds and share of Medicare residents of local competitors as instruments.