Long-Term Care Hospitals: A Case Study in Waste

Online Appendix

Liran Einav Amy Finkelstein Neale Mahoney

A Data Appendix

A.1 Defining LTCH Entry

We define LTCH entry using both the Medicare claims in the MedPAR dataset and the Provider of Service (POS) File. We determine the precise timing of entry with the MedPAR data, defining the quarter of entry as the first quarter in which we observe a stay at a given LTCH facility. Appendix Figure A8 confirms that the first stay is a good indicator of facility entrance. There is a large jump in admissions to the entering LTCH in the week of the first stay as the LTCH fills its beds, followed by a more gradual scale up from three to four admissions per week over the course of the LTCH's first six months.

The Medicare claims data do not include facility geography. We rely on the annual POS file, which records characteristics of Medicare-approved facilities, to match each LTCH to a given geography (an HSA in our baseline specification). Because we are using two different data sources, Appendix Figure A9 cross-validates the timing of LTCH entry between our two sources. In both data sets, we define entry as the first time the facility "appears" in the data (the first stay in the MedPAR data and the first entry in the POS file). The size of the dots in Appendix Figure A9 correspond to the number of LTCHs that are defined as entering in a given ($year_{MedPAR}$, $year_{POS}$) pair. The majority of entrances lie on the 45-degree line, indicating that our two data sets generally agree. Nearly all entries that do not align have a lagged date of entry in the POS file, potentially indicating some administrative lag between when an LTCH is established and when it makes its way into the POS File. In these cases, we backfill the geography of the facility from the first instance it appears in the POS data to the quarter we identify the first stay associated with a given LTCH facility.

A.2 Variable Definitions

Discharge Destinations We define a patient as being discharged to a given facility if they are admitted to that facility within one day of discharge from the initiating ACH stay. Although each stay-level record in the MedPAR data contains an indicator for the discharge destination of each patient (e.g., ACH, SNF, home, death), we construct our own definition of discharge destination within a healthcare spell. We do so primarily because the "discharge to LTCH" code was first introduced in 2002; prior to 2002, discharges to LTCHs were grouped into an "other" category. In addition, the destination codes are often unreliable; in many instances following ACH discharge, a patient is immediately admitted at a facility type inconsistent with the recorded discharge destination (Kahn and Iwashyna, 2010). We code the discharge destination for a patient that died at the ACH as "discharged to death." We code the discharge destination for a patient that is still alive following ACH discharge but not making any Medicare payments to an ACH, LTCH, SNF, or IRF as discharged to home without care or to some other care, such as a hospice or home health care.

Spell Definition, Days, and Spending As in Einav, Finkelstein and Mahoney (2018), we define spells as the set of almost-continuous days with a Medicare payment to an acute care hospital, LTCH, SNF, or IRF following an acute care hospital stay. The spell starts on the first day of the ACH stay and ends if there are two consecutive days without any Medicare payments to any of these institutions. Spell days count the number of days in each facility over the course of the spell, including the initiating acute care stay. Spell spending sums Medicare reimbursements, excluding outlier payments, at each facility over the spell, including the initiating acute care stay. Out-of-pocket spending sums the beneficiary coinsurance, inpatient deductible, and blood deductible at each facility over the spell, including the initiating ACH stay.

Patient Outcomes We have three main patient outcome measures. The first is whether the patient is home within 90 days of admission to the initiating acute care hospital stay. If the discharge destination code in the final facility within a spell of continuous days is to home (with either self-care or in the care of a home health association) within 90 days of the date of admission at the initiating acute care stay, the patient is coded as going home within 90 days. The second is an indicator for whether the beneficiary dies within 90 days of the date of admission of the index ACH stay. The third is the amount of out-of-pocket spending owed for the spell – i.e., payments not covered by Medicare; these payments may be covered by the patient's supplemental insurance plan.

LTCHs-in-Training Before a facility can be classified as an LTCH, it must demonstrate a 25-day average length of stay for six months (42 CFR § 412.23, 2011). Because of this regulatory requirement, an LTCH must begin its life as another facility (which we call an "LTCH-in-training"), most commonly acute care hospitals. When an LTCH-in-training is reclassified as an LTCH, it remains the same facility in all operational senses (the same building, the same services, etc.), but its reimbursement schedule changes. As we will show, the vast majority of LTCHs-in-training exist for only the six months required to fulfill the regulatory requirement. Because these facilities are neither true ACHs (since they are operationally an LTCH) nor true LTCHs (since they are not reimbursed as such), we classify them as a separate entity.

The facility's provider identification number changes upon reclassification, leaving no clear link between an LTCH and its associated LTCH-in-training in the data. To address this challenge, we rely on addresses and facility names in the POS data. The quality of the POS addresses is variable; addresses and facility names will often change slightly year over year. Moreover, it is common for multiple facilities to be located at the same address; about half of LTCHs are co-located with an ACH in "Hospitals within Hospitals," rendering a simple match on addresses insufficient. To address these data challenges, we searched for LTCHs-in-training by hand using addresses and facility names in the POS data.

We first analyze the address and facility name data by hand, defining a potential LTCH-in-training as any facility that meets the following two criteria: (1) exists at the same address as an entering LTCH in the year of entry or prior to entry, and (2) vanishes from the data in the year following entry. Using this method, we were able to identify 192 total potential LTCHs-in-training. Encouragingly, these 192 potential LTCHs-in-training have an average length of stay of just over 25 days in the six months prior to entry, as required by CMS regulation. Among the potential LTCHs-in-training we identified by hand, we found that the 158 (82%) are ACHs (the remainder are IRFs). For simplicity, we only consider ACHs that precede LTCHs as LTCHs-in-training. Of these 158 LTCHs-in-training, all facilities had at least one quarter with an average length of stay longer than 20 days, and 90% had at least one quarter with an average length of stay longer than 25 days. We are able to identify the LTCHs-in-training associated with 112 of the 186 first entries we study in our main specification. Appendix Figure A10 presents a histogram of the number of quarters a facility exists for the 158 LTCHs-in-training we were able to identify. Over 90% of the LTCHs-in-training we identified exist for one year or less, implying that the vast majority of LTCHs-in-training are simply a regulatory object that allow a true LTCH to enter a market. Some LTCHs-in-training have longer facility lives, which indicates that a few facilities may have reclassified as LTCHs as their average length of stay increased organically over time.

Our method of identifying LTCHs-in-training is imperfect; we fail to identify the LTCH-in-training associated with 74 of the LTCH entries we study in our baseline analysis. Because the majority of LTCHs-in-training existed as ACHs, this means that there may be up to 74 facilities in our data that we are mischaracterizing as ACHs, when they would be more accurately described as LTCHs-in-training. In our event study analysis, Figure 6 Panel (D) shows some evidence of an increase in discharges to ACHs during the transition period; this may reflect discharges to LTCHs-in-training that we did not classify using our algorithm. To assess this, Appendix Figure A11 presents discharges to ACH restricted to the 112 HSAs in which we were able to identify a credible LTCH-in-training associated with the entering LTCH. This restriction eliminates the increase in discharges to an ACH during the transition period, indicating that the slight increase in Figure 6 Panel (D) may be due to unclassified LTCHs-in-training.

Patient Classifications In Appendix Table 5 we analyze the impact of LTCHs across patients based on the number of days they spent in an ICU or CCU during the initial ACH stay, and whether or not they were ventilated during the initial ACH stay. We identify ventilator use in the MedPAR data using the ICD-9 codes associated with the initial ACH stays. A patient is coded as "ventilated" if the stay has an ICD-9 code included in the "Respiratory intubation and mechanical ventilation" category of the Clinical Classification Software (CCS) procedure codes. Note that there is no way in the data to tell how long a patient was on a mechanical ventilator, so the "ventilated" classification is a rough approximation of the category that will be included in LTCH reimbursement under the new rules (ventilated for over 96 hours), and will include many patients who in fact do not qualify for the LTCH rate.

The number of days in an ICU (intensive care unit) and CCU (coronary care unit) for each stay are reported in the MedPAR data. A spell is included in the "Over 3 (8) days in an ICU/CCU" if the patient spent over 3 (8) days in an ICU or over 3 (8) days in a CCU during the initial ACH stay.

B Additional Results and Robustness

Alternative transition periods: Our baseline specification drops the $r \in [-5, 0]$ transition period. Appendix Figure A14 shows first-stage plots of the effect of LTCH entry on LTCH stays for alternative transition periods. Specifically, we show results for a narrow transition period which drops quarters $r \in [-2, 0]$ and a wide transition period which drops quarters $r = [-5, 5]$. Appendix Table A8 reports our baseline IV estimates for these narrow and wide periods. Both the plots and tables confirm that our results are robust to alternative transition periods.

Alternative specifications: In Appendix Figure A15 and Appendix Table A9, we show first-stage plots and IV estimates that probe the sensitivity of our results to a number of different alternative specifications. Panel A and column 1 show our baseline specification for reference. In Panel B and column 2, we show our results are robust to including all HSAs that already had at least one LTCH as of 1998 as controls. In Panel C and column 3, we restrict the sample to a balanced panel of HSAs where we can observe outcomes +/-3 years around entry. Restricting to a balanced panel allows us to assess whether changes in sample composition (in combination with heterogeneous treatment effects) generate time-trends in our results. A comparison of the balanced panel plot with the baseline specification plot indicates little reason to be concerned about this issue.

In Panel D and column 4, we show our results are robust to including subsequent entries, rather than just the first entry into an HSA, in our event study sample. We construct the data so that HSAs with two entries "appear" twice, with the event-time variable r defined in relation to the entry of interest. We additionally control for the non-focal entry in this specification. In Panel E and column 5, we show that our results are robust to dropping individuals who are dually eligible for Medicaid. Since dual eligibles have their out-of-pocket costs covered by Medicaid, it is interesting that there is a similar increase in the out of pocket costs when these patients are excluded.

The final panel and column shows that our results are robust to defining health care markets at an alternative geographic level. Specifically, in Panel F and column 6, we show results where we redefine our event study to analyze the first entry of an LTCH into a county, and replace the HSA fixed effects with fixed effects at the county level. There are 148 first entries at the county level in comparison to 196 first entries in our baseline HSA level analysis.

Heterogeneous first stage and homogenous second stage: Our baseline specification allowed the first stage of LTCH entry on LTCH discharge to be heterogeneous based on the five $\hat{p}$ groups, but imposed a homogeneous second stage of LTCH discharge on outcomes. Appendix Table A2 shows IV estimates separately for each of the five $\hat{p}$ groups. The IV estimates are similar across the $\hat{p}$ groups, consistent with our homogeneity assumption. Appendix Table A10 shows IV estimates where we impose a homogenous first stage (and maintain the homogenous second stage from our baseline specification). As expected, imposing a homogeneous first-stage results in substantially less precise IV estimates.

Alternative spell definitions: In our baseline sample, we defined a spell as starting on the first day of the ACH stay and ending if there are two consecutive days without Medicare payments to any institution. As a robustness check, we explore an alternative spell definition, where we define a spell as the 365 days post admission to the ACH stay. Appendix Table A11 shows summary statistics with our baseline and this alternative spell definition. With the 365-day spell definition, average LTCH and SNF days and spending are roughly twice as large as under our baseline definition. Appendix Table A12 shows IV estimates on spell days and spending in both samples. The estimates with the 365-day spell sample are twice as large as those in the baseline sample, which is consistent with the twice-as-large averages for this sample.

Decomposing discharges to “home/other": A limitation to our baseline data is that we cannot see any finer granularity on the discharge destination of “home/other.” However, for a subset of our study period (2002-2014), we have separate data on claims for home health and hospice. Using these data, we define two new destinations within the discharge to “home/other" category based upon our methodology defined in Appendix A: a patient is defined as discharged to home health or hospice if the patient has a claim for home health or hospice beginning within one day of discharge from the initiating ACH stay. To further decompose the remaining unclassified patients, we also use the discharge destination codes on each ACH claim to categorize patients as discharged "home with no care." All remaining unclassified patients are categorized as discharged to "other." Column 3 of Appendix Table A12 shows the results. When restricting to stays from 2002-2014, each LTCH discharge reduces discharges to home/other by 32.7 percentage points. We can decompose this decrease into discharges home with no care (which decreases by 11.4 percentage points), home with home health care (which increases by 1.5 percentage points), hospice (decreases by 7.0 percentage points) and other (which decreases by 15.8 percentage points).

Including payments to home health and hospice: A potential limitation of our baseline analysis is that the MedPAR data do not include payments to home health or hospice. We have separate data on such payments from 2002-2014. Appendix Table A11 shows these destinations account for a relatively low share of spell spending (about 10% combined). Column 3 of Appendix Table A12 shows that incorporating home health spending into the analysis does not meaningfully impact our findings.

Including outlier payments: As discussed in Appendix Section A, our baseline measure of Medicare spending does not include outlier payments. In Appendix Table A13 and Appendix Figure A16 we show, in addition to the baseline effects for reference, effects on outlier payments and combined baseline and outlier payments. The point estimates indicate that including outlier payments strengthen our finding that LTCHs leads to excess spending. However, because the effects on outlier spending are very noisy (outlier payments are naturally rare) including them substantially decreases the precision of our results.

C Constructing LTCH Discharge Probabilities ($\hat{p}$s)

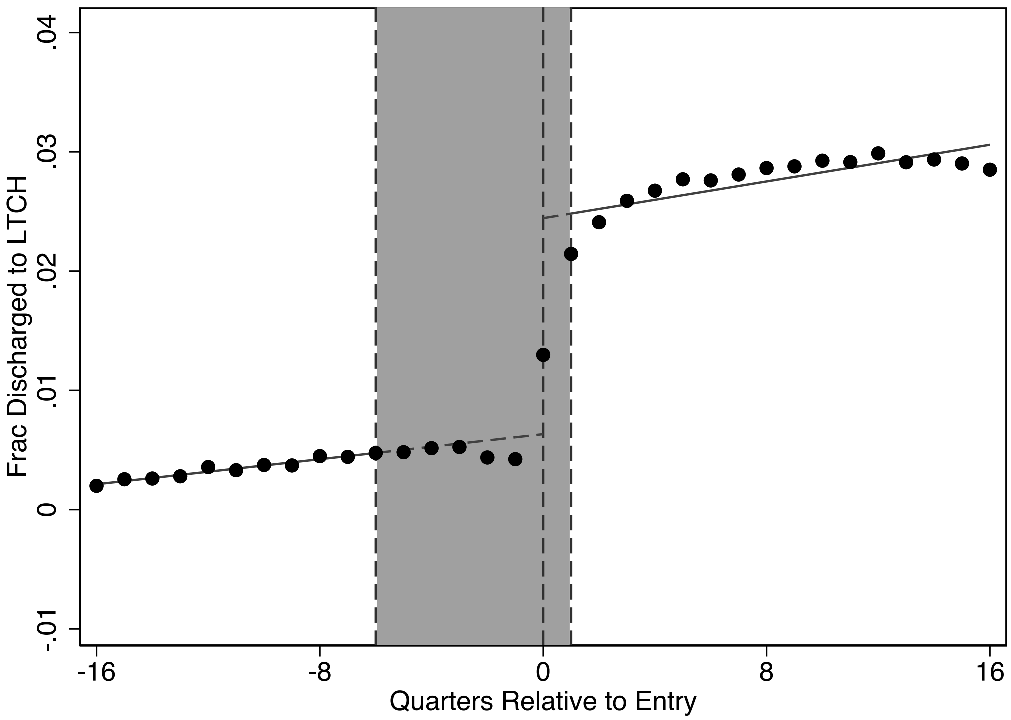
We use a regression tree to generate predicted probabilities of LTCH discharge ($\hat{p}$) conditional on having an LTCH nearby. Each observation in the training and prediction data is an ACH stay from 1998-2014 with an indicator for whether a patient was discharged to an LTCH as the dependent variable. We include as predictors the calendar year of the patient's admission, the patient's age, sex, race, and an indicator for dual enrollment in Medicaid. We also use the ICD-9 diagnoses from the patient's initiating hospital admission as health status indicators. Each ACH stay can have up to 9 distinct diagnoses, and we cluster each diagnosis into 285 mutually exclusive Clinical Classification Software (CCS) codes (HCUP, 2017).

We construct a training set consisting of ACH stays that are "close" to an LTCH. We define close as all ACHs with an LTCH less than five kilometers away, where distance is measured using the latitude-longitude coordinates for each facility reported in the AHA Annual Survey. From 1998-2014, there were 32,724,774 "close" ACH stays. Our final training set for the model uses a 10% random sample of these close stays, resulting in a training set of 3,272,477 ACH stays. We use 5-fold cross validation to choose a complexity parameter to maximize out of sample R^2. The complexity parameter determines how much to "prune" the regression tree; specifically, the complexity parameter is the minimum R^2 each additional leaf of the tree must add to be included in the decision tree. Appendix Figure A12 plots the cross-validated (out of sample) R^2 for different values of the complexity parameter. As the magnitude of the complexity parameters decreases, the size of the tree increases (as more new leaves cross the minimum R^2 threshold). Appendix Figure A12 shows a maximum R^2 is achieved at 3×10^{-5}. We build the optimally pruned tree (complexity parameter = 3×10^{-5}). As anticipated with a small complexity parameter, this creates a very large tree. For ease of visualization, we present a list of selected features in Appendix Table A6 instead of the very complex decision tree. The final predictive model results in an AUC value of 0.82.

Appendix Table A7 presents the distribution of $\hat{p}$ (predicted from our optimally pruned tree) among all ACH stays and among ACH stays with a high $\hat{p}$ ($\hat{p} > 0.15$), and among all "close" ACH stays, the set of ACH stays with an LTCH within five kilometers. Note that the mean $\hat{p}$ among all stays is higher than the share discharged to LTCHs. This is because $\hat{p}$ is the probability of LTCH discharge conditional on having an LTCH nearby; among all close ACH stays, the mean $\hat{p}$ and the share discharged to an LTCH are equivalent.

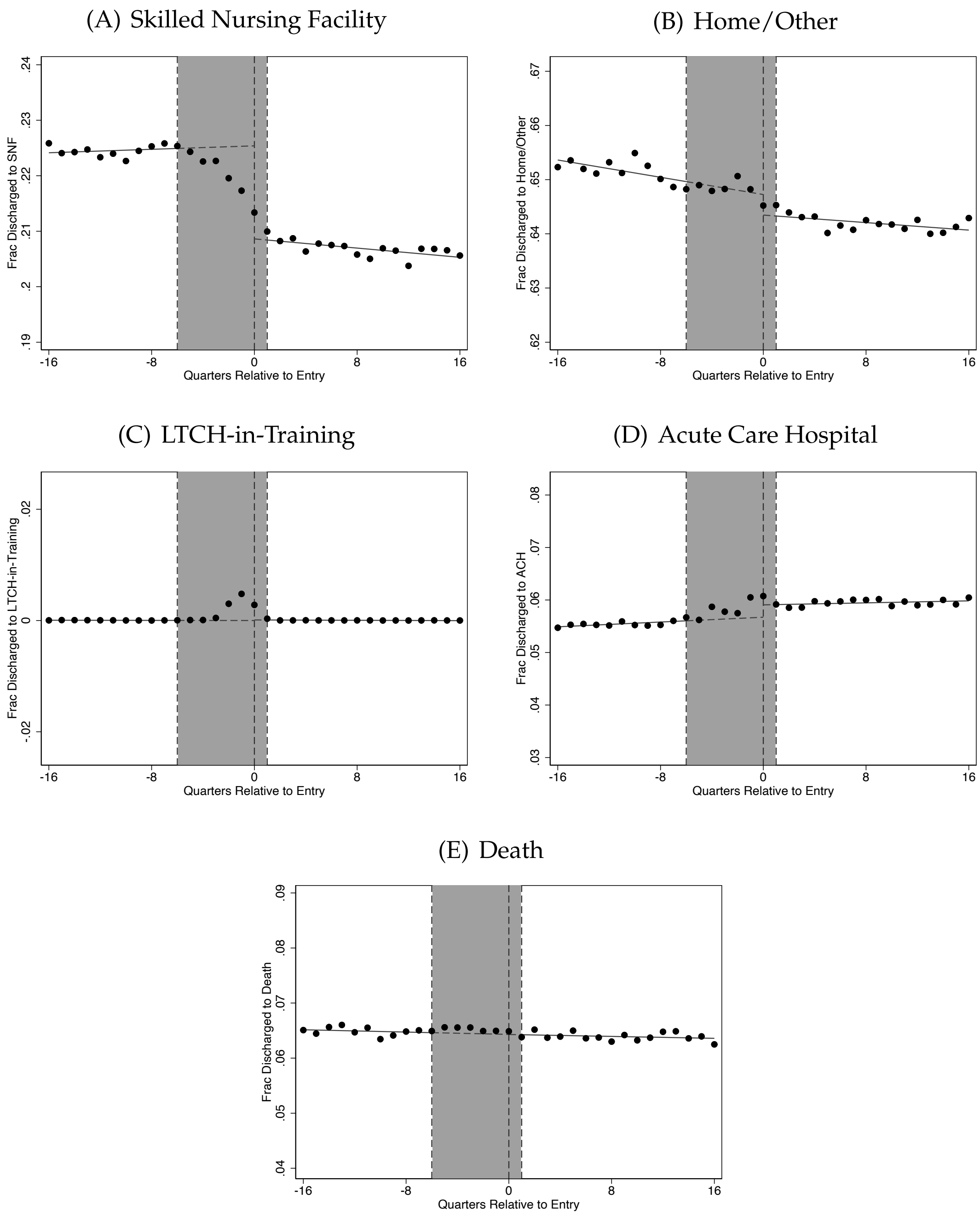
As discussed in the main text, we carefully chose predictors that are plausibly exogenous to the LTCH discharge decision. We excluded any procedures from the set of predictors because certain procedures may become more or less common when there is an LTCH available in the HSA. Panels A and B of Appendix Figure A13 present the probability of receiving a tracheostomy (a procedure to insert a breathing tube into a windpipe for a patient on a mechanical ventilator) and the probability of being on a mechanical ventilator upon LTCH entry estimated among all high $\hat{p}$ stays. Neither tracheostomy nor mechanical ventilation appear to increase upon LTCH entry, but we cannot rule out non-negligible effects.

Figure A1: Discharge to LTCH



Note: Figure reports estimates of equation (1), estimated on baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the discharged to LTCH indicator. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the share discharged to LTCH and is scaled so that the mean at $r = -1$ is equal to the mean at $r = -1$ among HSAs.

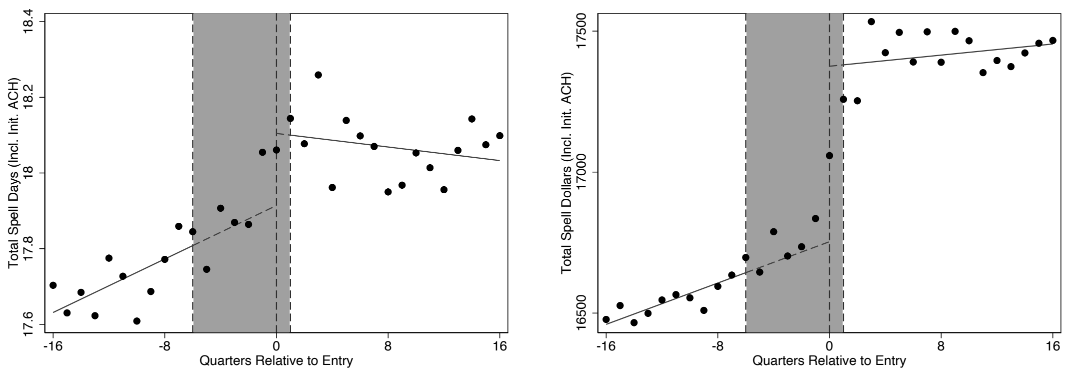
Figure A2: Alternative Discharge Destinations



Note: Figure reports estimates of equation (1), the reduced form impact of LTCH entry, estimated on the baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of each of the discharge destination indicators. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the share discharged to the location indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

Figure A3: Total Spell Utilization

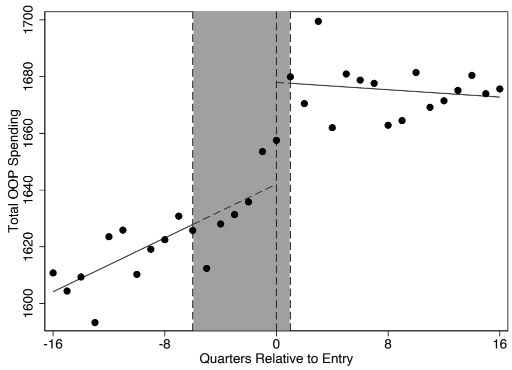
(A) Total Spell Days (B) Total Spell Spending



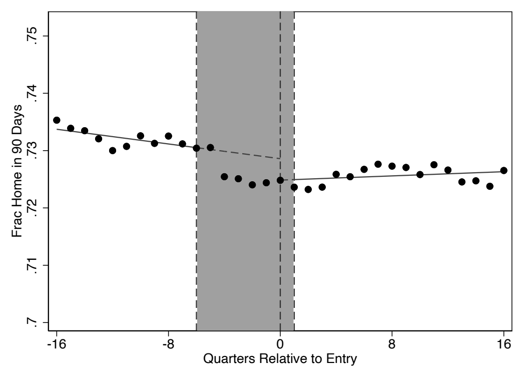
Note: Figure reports estimates of equation (1), the reduced form impact of LTCH entry, estimated on the baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of spell days and spell spending. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the utilization measure indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

Figure A4: Patient Welfare Outcomes

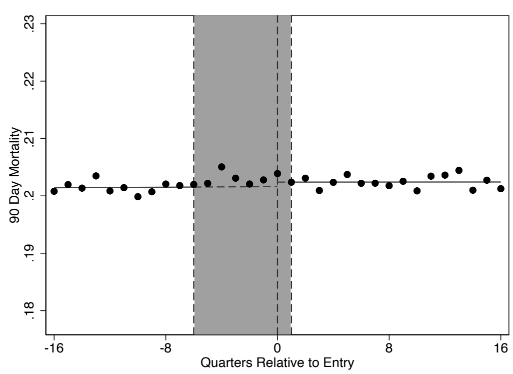
(A) Total Spell Out of Pocket Spending



(B) Home in 90 Days

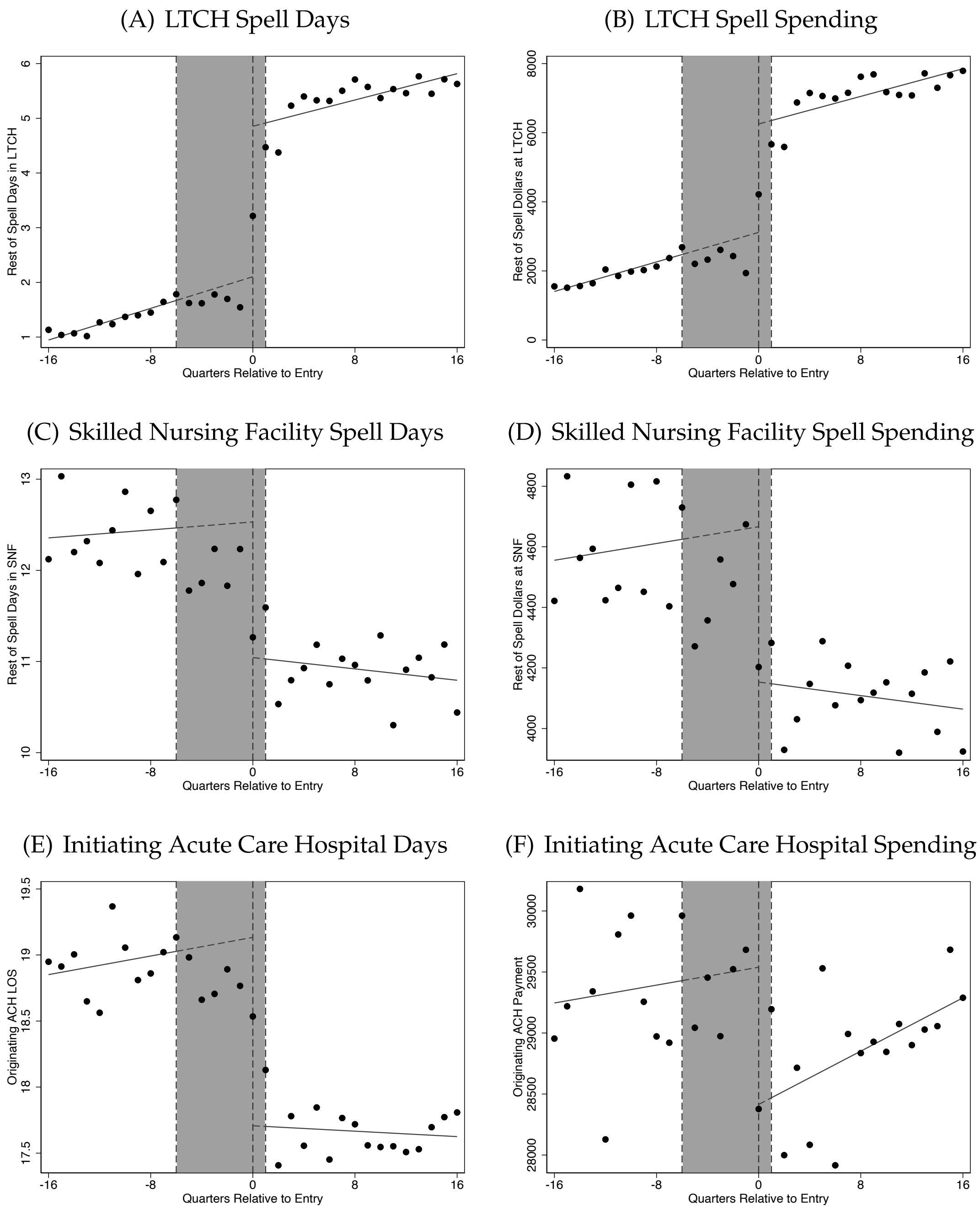


(C) 90-Day Mortality



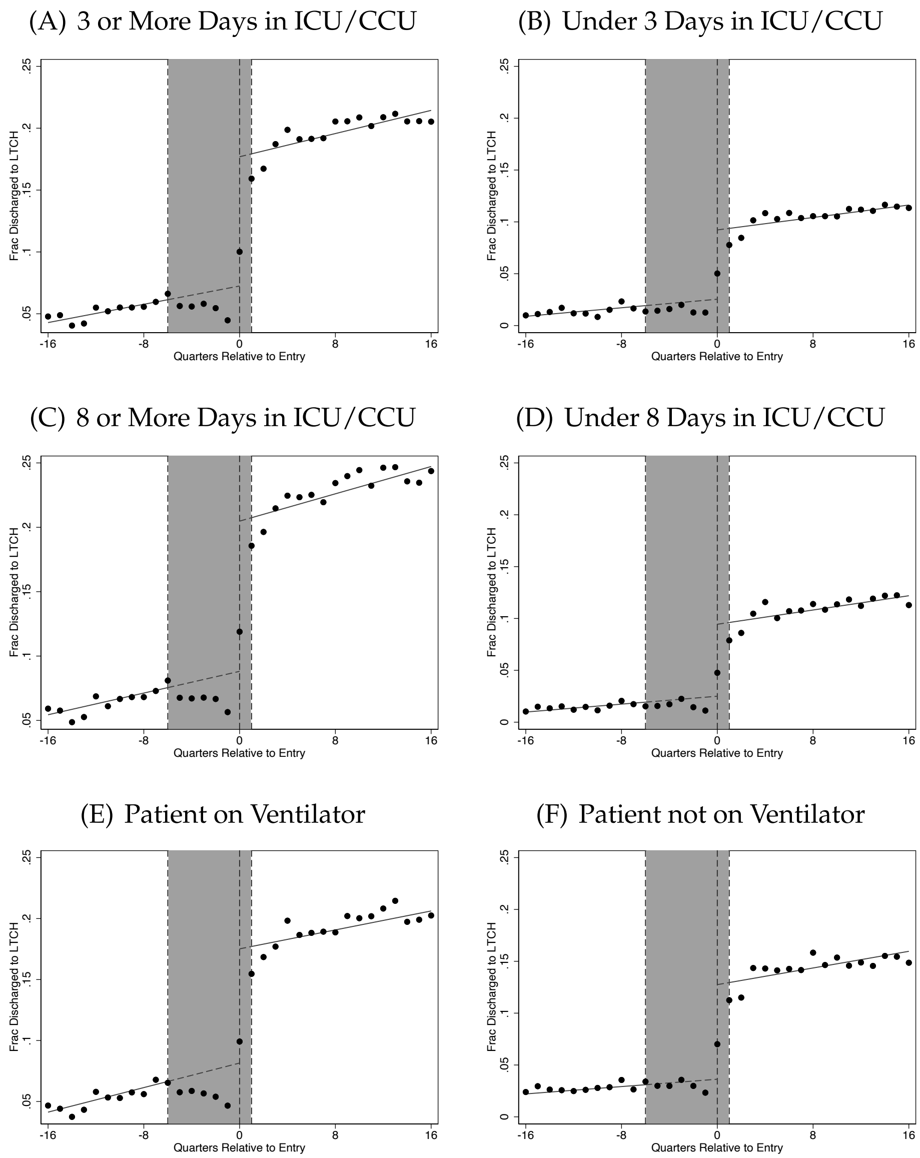
Note: Figure reports estimates of equation (1), the reduced form impact of LTCH entry, estimated on the baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of each of the patient welfare outcomes. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the utilization measure indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

Figure A5: Spell Utilization by Destination



Note: Figure reports estimates of equation (1), the reduced form impact of LTCH entry, estimated on the high $\hat{p}$ sub-sample of the baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the spell utilization by destination. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the spell utilization indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

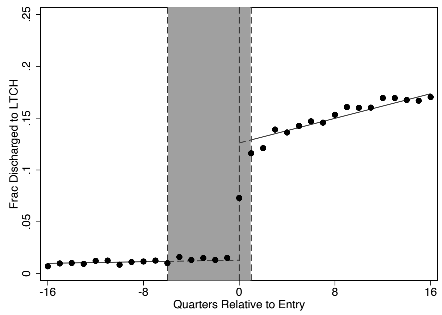
Figure A6: First Stage: Heterogeneity by ICU /CCU and Mechanical Ventilator



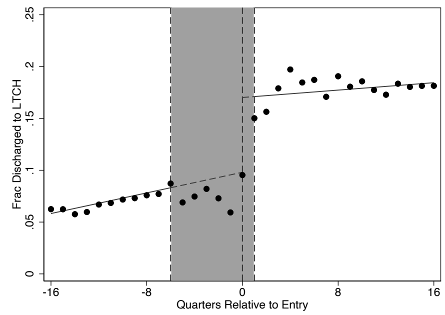
Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of various robustness event study samples. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the discharge to LTCH indicator. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. Panels A and B show plots separately by whether the patient spent 3 or more days in an intensive care unit (ICU) or coronary care unit (CCU) prior to LTCH discharge. Panels C and D show plots separately by whether the patient spent 8 or more days in a ICU / CCU. Panels E and F split the analysis by whether was placed on a mechanical ventilator at the initiating ACH. The y-axis reports the share discharged to LTCH and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among the geographies in the sample.

Figure A7: First Stage: Heterogeneity by Pre-Entry Discharge and For-Profit Status

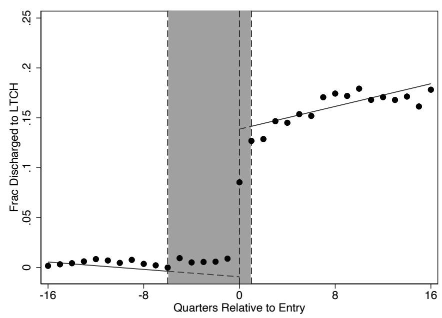
(A) Below Median Pre-Entry Discharge Rate



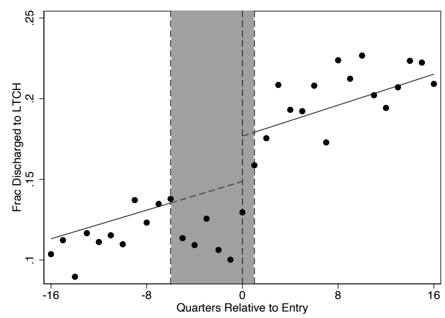
(B) Above Median Pre-Entry Discharge Rate



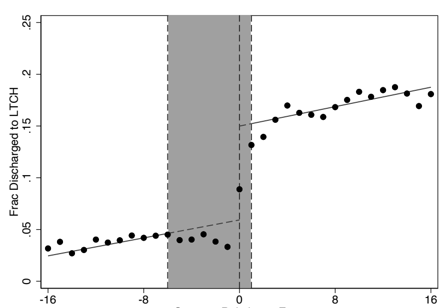
(C) Bottom Quartile Pre-Entry Discharge Rate



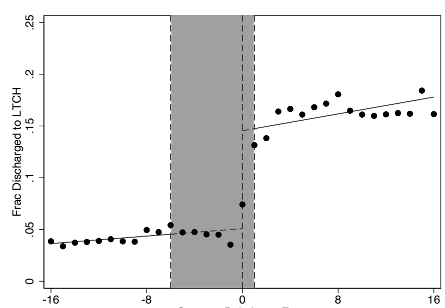
(D) Top Quartile Pre-Entry Discharge Rate



(E) For Profit

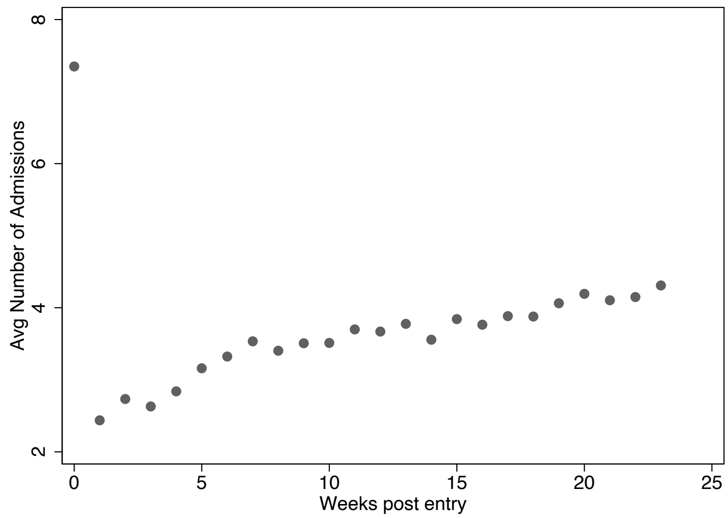


(F) Not For Profit



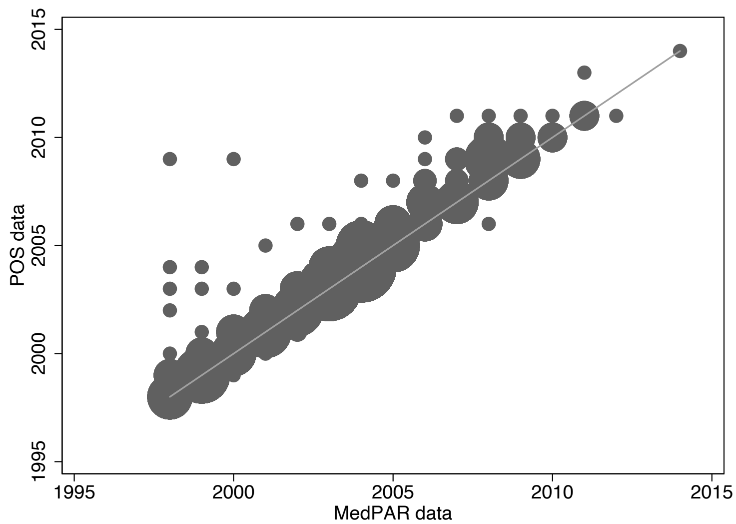
Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of various robustness event study samples. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the discharge to LTCH indicator. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. Panels A and B split the sample by whether the HSA had below or above the median LTCH discharge share. Panels C and D show results for the bottom and top quartiles of LTCH discharge share. Panels E and F split the analysis by whether the LTCH is a for-profit or non-for-profit organization. In Panels A-D, the pre-entry discharge rate is based on the rate in period $r = -6$. For these panels, we exclude 30 of the 186 HSAs where we do not observe outcomes in period $r = -6$. The y-axis reports the share discharged to LTCH and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among the geographies in the sample.

Figure A8: Average Weekly Admissions Following LTCH Entry



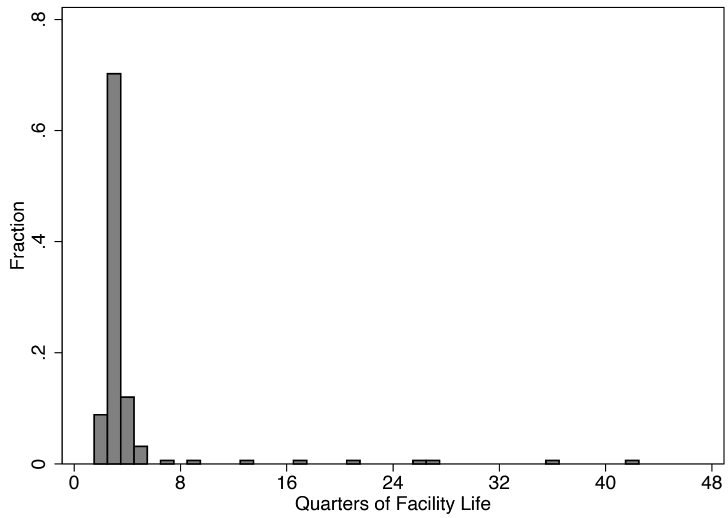
Note: Figure shows the average number of LTCH admissions per week relative to LTCH entry for all LTCH entries from 1998-2014. Admission frequencies were calculated by taking the average number of admissions across all active LTCHs for a given week relative to LTCH entry.

Figure A9: Dates of LTCH Entry Into HSA, As Coded in Different Data Sets



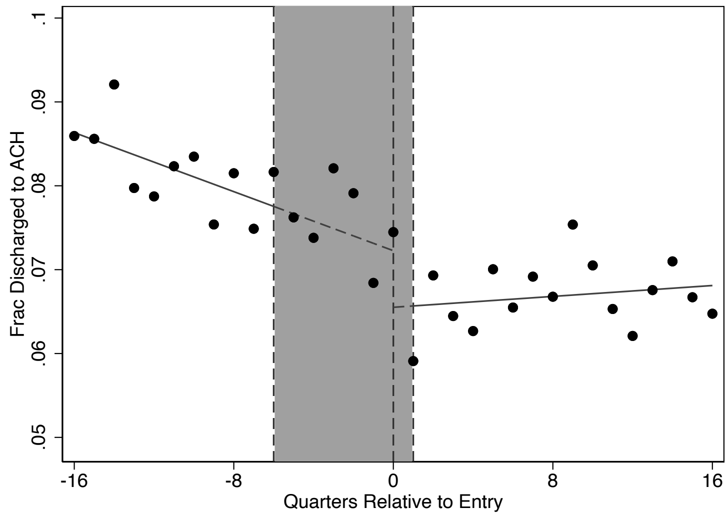
Note: Figure plots entry years using the Provider of Service (POS) file against entry years using MedPAR data from 1998-2014. The size of each point on the scatter plot is determined by the number of observations for each unique (MedPAR data entry year, POS data entry year) point in order to view the density of matched observations. A 45 degree line is included for reference.

Figure A10: LTCHs-in-Training: Facility Life



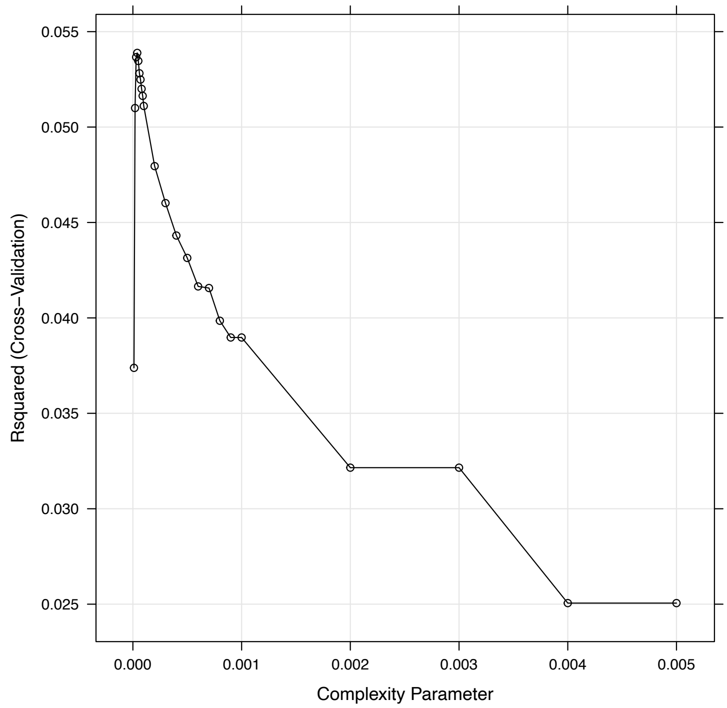
Note: Figure plots a histogram of the number of quarters the LTCHs-in-Training admit patients. Quarters of Facility Life denotes the number of quarters from the first observed admission date to the last observed admission date.

Figure A11: Discharged to Acute Care Hospital



Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of the baseline event study sample restricted to the 112 HSAs where we believe we were able to identify an associated LTCH-in-training. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of Discharge to ACH . Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the share discharged to an ACH and is scaled so that the mean at $r = -1$ is equal to the mean at $r = -1$ among the 112 HSAs.

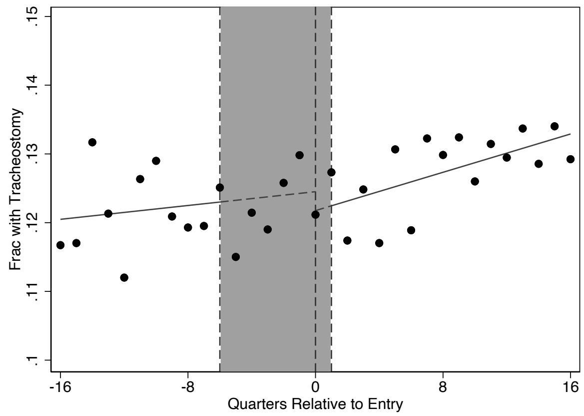
Figure A12: Complexity Parameter vs. R-squared



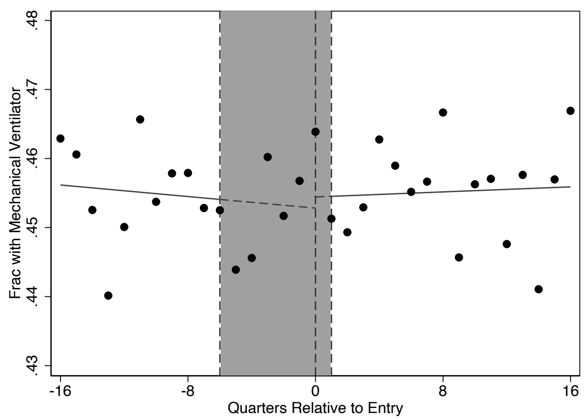
Note: This figure shows a plot of the variation explained (R^2) versus the complexity parameter.

Figure A13: Responsiveness of Procedures to LTCH Entry

(A) Tracheostomy



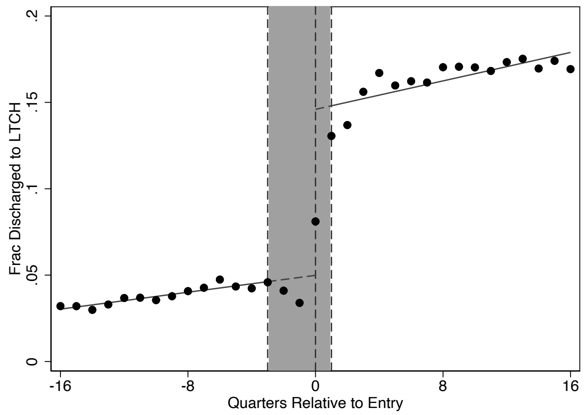
(B) Mechanical Ventilation



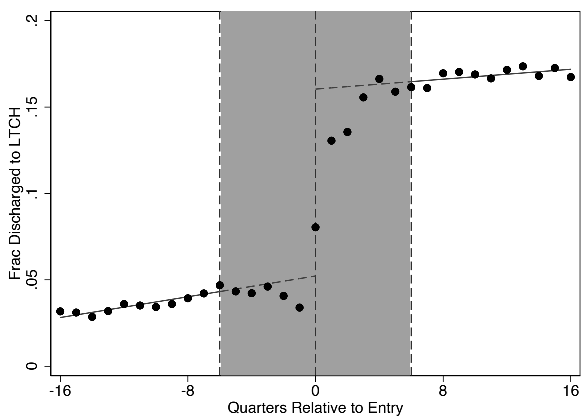
Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of the baseline event study sample. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of tracheostomy, and mechanical ventilation. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. The y-axis reports the frequency of the procedure indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

Figure A14: Alternative Transition Periods: First Stage

(A) Narrow Transition Period

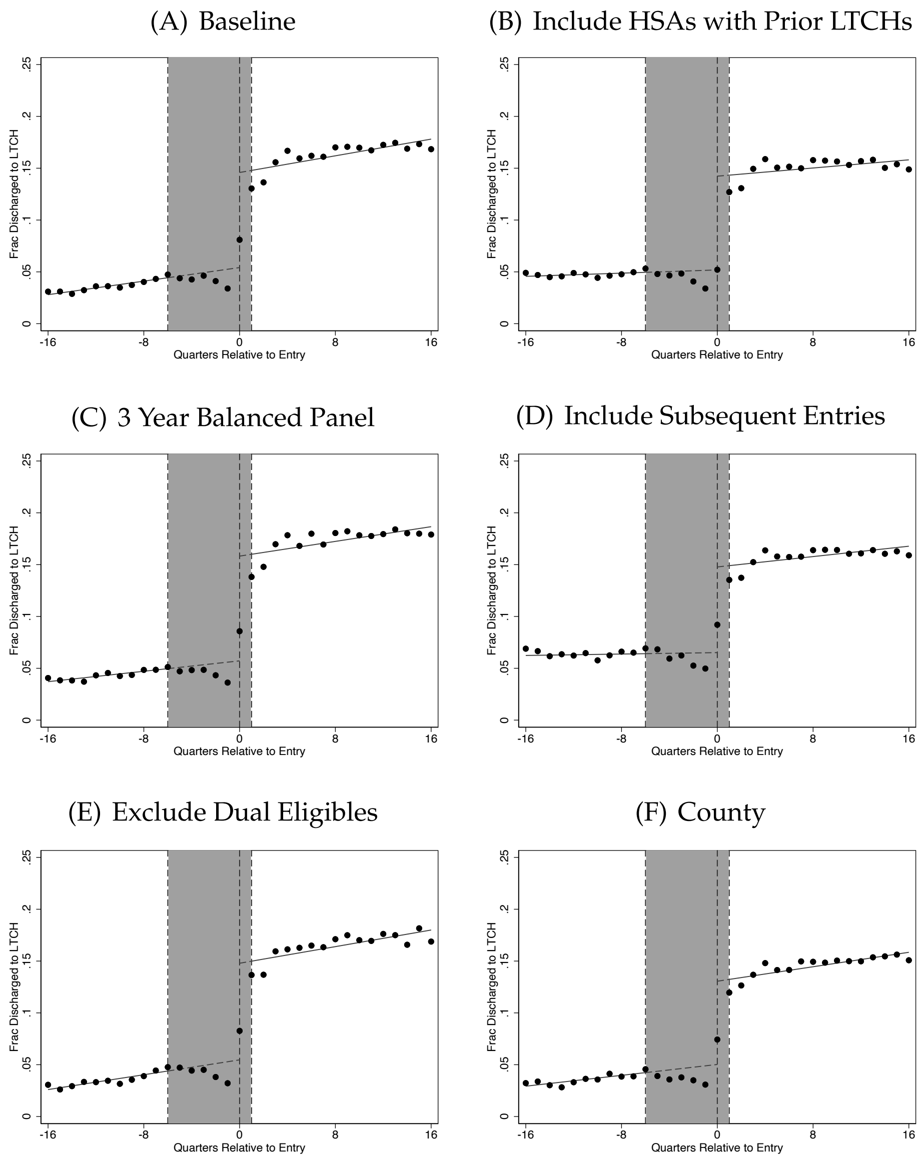


(B) Wide Transition Period



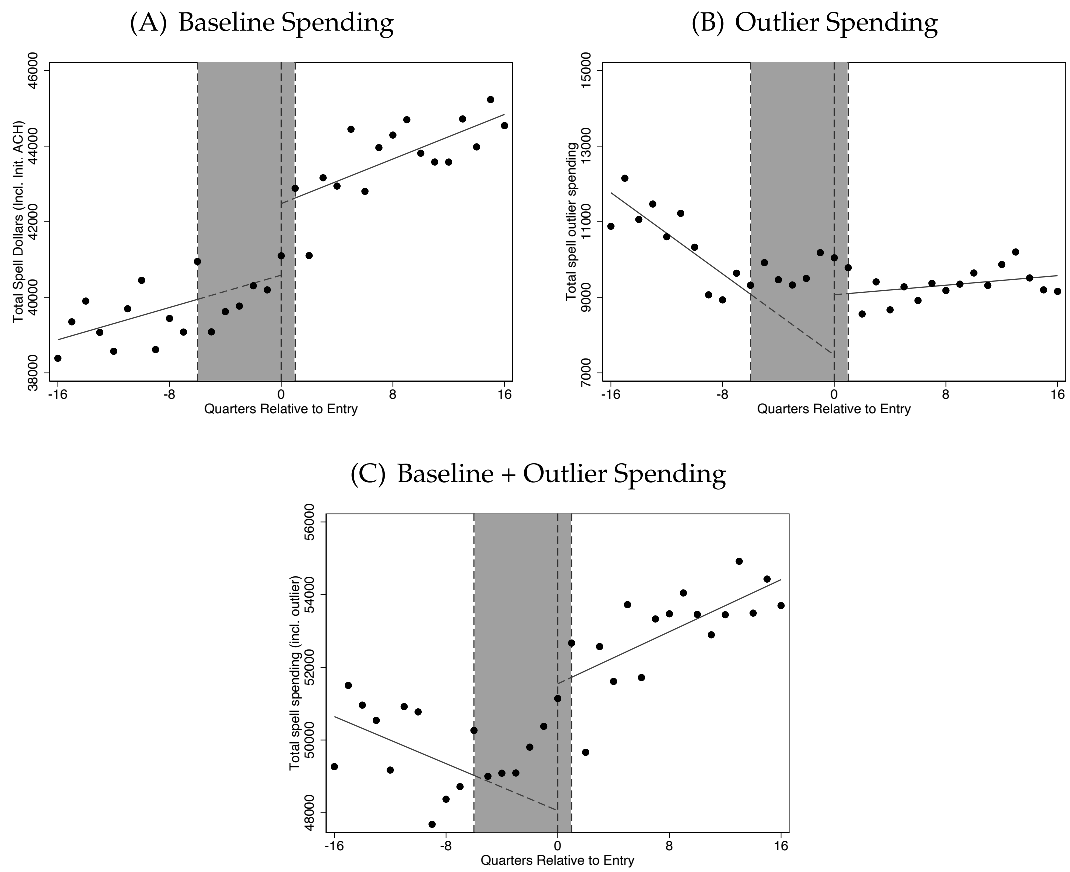
Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of the baseline event study sample. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the discharge to LTCH indicator. The greyed out quarters are the alternative dropped transition periods, with the narrow transition period defined as $r \in [-2, 0]$ and the wide transition period defined as $r = [-5, 5]$. The y-axis reports the share discharged to LTCH and is scaled so that the mean at $r = -1$ is equal to the mean at $r = -1$ among HSAs.

Figure A15: First Stage: Robustness



Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of various robustness event study samples. Figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the discharge to LTCH indicator. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. In panel (A) we present the result from our baseline event study sample. In panel (B) we include all HSAs that already had at least one LTCH as of 1998 as controls. In panel (C) we restrict to all observations with a balanced 3-year panel around entry (i.e. first entries that occurred between 2001 and 2011 and was not followed by an entry or exit within three years). In panel (D) we do not drop subsequent entries or exits, and in panel (E) we restrict to all beneficiary-years in which beneficiaries are not dually eligible for Medicaid. In panel (F) we use county as the geographic unit. The y-axis reports the share discharged to LTCH and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among the geographies in each robustness sample.

Figure A16: Outlier Payments



Note: Figure reports estimates of equation (1), estimated on the high $\hat{p}$ sub-sample of the baseline event study sample. The figure displays our estimated function of relative quarter, r, and a scatter plot of the average residualized values of the spell utilization by destination. Quarters $-6 < r < 1$ are greyed out because we drop all observations in these quarters. Panel (A) shows effects on the baseline spending measures, which is the sum of Medicare reimbursements excluding outlier payments, panel (B) shows effects on outlier payments, and panel (C) shows effects on combined baseline and outlier payments. The y-axis reports the spell utilization indicated and is scaled so that the mean at $r = -1$ is equal to the outcome mean at $r = -1$ among HSAs.

Table A1: Summary Statistics by $\hat{p}$ Bin

	Bin 1 (1)		Bin 2 (2)		Bin 3 (3)		Bin 4 (4)		Bin 5 (5)	
Discharge destination										
LTCH	0.003	(0.056)	0.006	(0.080)	0.013	(0.115)	0.044	(0.205)	0.126	(0.332)
Skilled Nursing Facility	0.163	(0.370)	0.242	(0.428)	0.234	(0.424)	0.257	(0.437)	0.252	(0.434)
Home/Other	0.771	(0.420)	0.656	(0.475)	0.631	(0.483)	0.513	(0.500)	0.334	(0.472)
LTCH-in-training	0.000	(0.006)	0.000	(0.009)	0.000	(0.013)	0.001	(0.022)	0.001	(0.036)
(Other) Acute Care Hospital	0.042	(0.201)	0.069	(0.254)	0.063	(0.242)	0.053	(0.223)	0.063	(0.243)
Death	0.021	(0.142)	0.027	(0.162)	0.059	(0.235)	0.134	(0.340)	0.224	(0.417)
Spell days										
LTCH	0.2	(2.5)	0.3	(3.2)	0.5	(4.3)	1.5	(7.6)	4.3	(13.1)
Skilled Nursing Facility	6.4	(18.0)	9.8	(22.1)	9.6	(22.5)	10.4	(23.3)	12.4	(25.9)
Initiating Acute Care Hospital	5.0	(4.1)	5.9	(4.7)	6.5	(5.6)	9.8	(8.9)	16.2	(14.0)
Total	12.6	(21.0)	17.6	(25.2)	18.3	(26.8)	23.7	(30.3)	35.8	(38.3)
Spell spending ($)										
LTCH	217	(3,160)	342	(3,922)	619	(5,425)	1,932	(10,104)	5,869	(18,115)
Skilled Nursing Facility	2,388	(6,579)	3,852	(8,476)	3,669	(8,504)	3,853	(8,568)	4,782	(10,189)
Initiating Acute Care Hospital	8,770	(8,613)	10,221	(8,645)	10,027	(9,503)	15,113	(16,273)	27,583	(30,116)
Total	12,809	(14,272)	16,435	(16,107)	16,541	(18,109)	23,514	(26,609)	42,202	(44,769)
Patient outcomes										
Out-of-pocket spending ($)	1,338	(2,210)	1,691	(2,627)	1,730	(2,974)	2,059	(3,988)	3,334	(6,431)
Home within 90 days	0.83	(0.38)	0.79	(0.41)	0.71	(0.45)	0.59	(0.49)	0.42	(0.49)
Died within 90 days	0.14	(0.34)	0.13	(0.33)	0.22	(0.41)	0.32	(0.47)	0.44	(0.50)
Mean p-hat	0.009	(0.000)	0.016	(0.003)	0.028	(0.004)	0.077	(0.026)	0.189	(0.034)
Number of Obs. (1000s)	3,841		3,078		3,236		2,565		373	
Number of LTCH Discharges	12,204		19,574		43,186		113,211		47,020	

Note: Table shows summary statistics by $\hat{p}$ bin. Each observation is a unique Acute Care Hospital stay. Bins are divided among the baseline event study sample, which drops all observations with $\hat{p} \leq 0.004$, restricts to all HSAs that experience a first entry from 1998-2014, and drops observations at and after the quarter of subsequent entry or LTCH exit. Bins 1 to 3 are quartiles of the $\hat{p}$ distribution, and groups 4 and 5 are based on splitting the top quartile into two groups ($\hat{p} < 0.15$ and $\hat{p} > 0.15$).

Table A2: First Stage and IV by $\hat{p}$ Bin

	Bin 1 (1)		Bin 2 (2)		Bin 3 (3)		Bin 4 (4)		Bin 5 (5)	
Discharge destination										
LTCH	0.005	(0.001)	0.009	(0.001)	0.017	(0.002)	0.044	(0.004)	0.092	(0.009)
Skilled Nursing Facility	-1.343	(0.613)	-1.677	(0.499)	-0.997	(0.244)	-0.748	(0.108)	-0.674	(0.103)
Home/Other	0.262	(0.689)	0.432	(0.475)	-0.204	(0.259)	-0.288	(0.103)	-0.244	(0.105)
LTCH-in-training	0.008	(0.005)	0.001	(0.003)	0.003	(0.002)	0.008	(0.004)	0.007	(0.006)
(Other) Acute Care Hospital	0.217	(0.355)	0.456	(0.314)	0.180	(0.130)	0.030	(0.053)	-0.035	(0.064)
Death	-0.144	(0.171)	-0.211	(0.119)	0.018	(0.104)	-0.002	(0.072)	-0.054	(0.101)
Spell days										
LTCH	28.4	(3.1)	25.0	(2.1)	28.1	(1.6)	28.7	(1.4)	30.0	(1.9)
Skilled Nursing Facility	-23.9	(27.6)	-3.7	(21.1)	-19.9	(11.6)	-12.6	(5.5)	-16.2	(6.3)
Initiating Acute Care Hospital	-5.8	(7.7)	-7.7	(4.8)	-4.8	(4.0)	-5.7	(2.6)	-15.5	(4.8)
Total	-5.7	(34.6)	17.3	(24.0)	4.0	(13.9)	9.6	(7.0)	1.5	(9.4)
Spell spending ($)										
LTCH	34,141	(4,160)	28,373	(2,592)	33,445	(2,164)	35,367	(2,170)	34,210	(4,079)
Skilled Nursing Facility	2,855	(11,166)	9,179	(9,640)	-2,374	(4,368)	-2,621	(2,230)	-5,593	(2,714)
Initiating Acute Care Hospital	-8,730	(19,212)	-6,010	(12,670)	-6,139	(5,476)	4,738	(4,504)	-12,256	(9,340)
Total	25,426	(24,402)	35,264	(16,728)	26,120	(8,062)	34,874	(6,147)	20,649	(11,065)
Patient outcomes										
Out-of-pocket spending ($)	499	(3,221)	1,786	(2,229)	576	(1,321)	2,071	(828)	3,928	(1,381)
Home within 90 days	0.19	(0.65)	0.24	(0.52)	-0.21	(0.29)	-0.27	(0.13)	-0.04	(0.11)
Died within 90 days	-0.62	(0.45)	-0.33	(0.30)	0.02	(0.17)	0.13	(0.10)	0.15	(0.11)
Number of Obs. (1000s)	3,449		2,765		2,931		2,336		343	

Note: Table displays first stage (top row) and IV estimates (all other rows) for each $\hat{p}$ bin. Standard errors are clustered at the HSA level (186 clusters). Bins 1 to 3 are quartiles of the $\hat{p}$ distribution, and bins 4 and 5 are based on splitting the top quartile into two groups ($\hat{p} < 0.15$ and $\hat{p} > 0.15$).

Table A3: Mortality Horizons

	Baseline Sample			
	Estimate	S.E.	Mean	Proportional Change
Died within				
30 days	0.056	(0.058)	0.12	0.47
60 days	0.065	(0.065)	0.17	0.39
90 days	0.101	(0.065)	0.20	0.51
180 days	0.091	(0.067)	0.26	0.35
365 days	0.003	(0.072)	0.35	0.01
Number of Obs. (000s)		11,824		

Note: Table displays IV estimates from equations (4) and (5), estimated on the baseline sample, along with the mean and the implied proportional change in the mortality rate. Mortality is measured from the day of admission to the initiating Acute Care Hospital. Standard errors are clustered at the HSA-bin level.

Table A4: Heterogeneity by ICU/CCU and Mechanical Ventilator

	3 or More Days in ICU/CCU (1)		Fewer Than 3 Days in ICU/CCU (2)		8 or More Days in ICU/CCU (3)		Fewer than 8 Days in ICU/CCU (4)		Patient on Mechanical Ventilator (5)		Patient Not on Mechanical Ventilator (6)	
Discharge destination												
Skilled Nursing Facility	-0.689	(0.069)	-1.015	(0.137)	-0.700	(0.069)	-0.901	(0.115)	-0.673	(0.074)	-0.851	(0.098)
Home/Other	-0.302	(0.067)	-0.134	(0.141)	-0.218	(0.066)	-0.257	(0.113)	-0.314	(0.082)	-0.162	(0.094)
LTCH-in-training	0.006	(0.004)	0.008	(0.002)	0.006	(0.004)	0.008	(0.002)	0.007	(0.004)	0.007	(0.003)
(Other) Acute Care Hospital	-0.009	(0.043)	0.155	(0.064)	-0.030	(0.043)	0.132	(0.057)	-0.080	(0.049)	0.097	(0.048)
Death	-0.007	(0.060)	-0.015	(0.079)	-0.059	(0.057)	0.018	(0.072)	0.060	(0.094)	-0.092	(0.054)
Spell days												
LTCH	28.6	(1.1)	28.8	(1.3)	30.0	(1.2)	27.2	(1.1)	31.5	(1.5)	27.5	(1.0)
Skilled Nursing Facility	-12.8	(3.5)	-19.2	(7.2)	-15.8	(3.8)	-14.5	(5.9)	-19.4	(4.4)	-11.1	(4.9)
Initiating Acute Care Hospital	-8.0	(2.4)	-4.8	(2.7)	-8.8	(2.6)	-3.9	(2.2)	-9.9	(2.8)	-7.7	(2.2)
Total	9.1	(4.9)	4.0	(8.8)	6.4	(5.2)	8.8	(7.4)	3.0	(6.9)	9.4	(6.1)
Spell spending ($)												
LTCH	34,798	(1,955)	32,886	(1,754)	36,450	(2,155)	31,674	(1,593)	40,788	(2,593)	31,624	(1,531)
Skilled Nursing Facility	-4,090	(1,470)	-2,019	(2,718)	-5,285	(1,507)	-1,419	(2,338)	-6,820	(1,763)	-988	(1,914)
Initiating Acute Care Hospital	-235	(5,580)	-2,745	(2,923)	-570	(6,255)	229	(2,664)	-4,563	(7,131)	-556	(3,560)
Total	31,935	(6,472)	25,818	(5,345)	31,108	(7,189)	29,780	(4,572)	29,033	(8,852)	30,695	(5,047)
Patient outcomes												
Out-of-pocket spending ($)	3,166	(706)	639	(960)	3,361	(795)	1,151	(802)	3,172	(977)	2,124	(738)
Home within 90 days	-0.157	(0.074)	-0.176	(0.157)	-0.108	(0.075)	-0.218	(0.131)	-0.125	(0.095)	-0.159	(0.106)
Died within 90 days	0.176	(0.070)	-0.015	(0.120)	0.165	(0.070)	0.041	(0.101)	0.221	(0.097)	-0.003	(0.077)
Number of Obs. (000s)	3,297		8,527		1,825		10,000		924		10,900	

Note: Table displays IV estimates for different splits of the data. Columns 1 and 2 show plots separately by whether the patient spent 3 or more days in an intensive care unit (ICU) or coronary care unit (CCU) prior to LTCH discharge. Columns 3 and 4 show plots separately by whether the patient spent 8 or more days in a ICU / CCU. Columns 5 and 6 split the analysis by whether was placed on a mechanical ventilator at the initiating ACH. Standard errors are clustered at the HSA-bin level.

Table A5: Heterogeneity by Pre-Entry Discharge and For-Profit Status

	Below Median LTCH Discharges		Above Median LTCH Discharges		For Profit		Not for Profit	
	(1)		(2)		(3)		(4)	
Discharge destination								
Skill Nursing Facility	-0.713	(0.085)	-0.765	(0.121)	-0.745	(0.101)	-0.824	(0.113)
Home/Other	-0.272	(0.088)	-0.292	(0.115)	-0.409	(0.100)	0.040	(0.107)
LTCH-in-training	0.003	(0.003)	0.014	(0.006)	0.004	(0.003)	0.010	(0.005)
(Other) Acute Care Hospital	0.048	(0.041)	-0.036	(0.070)	0.105	(0.054)	-0.097	(0.059)
Death	-0.067	(0.061)	0.080	(0.080)	0.045	(0.067)	-0.129	(0.074)
Spell days								
LTCH	29.9	(0.9)	27.4	(1.8)	29.1	(1.3)	28.5	(1.6)
Skilled Nursing Facility	-16.7	(5.1)	-9.7	(5.6)	-10.4	(5.0)	-19.8	(6.4)
Initiating Acute Care Hospital	-11.4	(2.5)	-4.6	(3.1)	-10.2	(2.9)	-7.2	(2.6)
Total	2.3	(6.7)	11.6	(7.1)	11.6	(6.6)	-3.1	(7.8)
Spell spending ($)								
LTCH	36,363	(1,582)	30,983	(3,167)	34,447	(2,118)	35,546	(3,383)
Skilled Nursing Facility	-3,007	(1,716)	-2,846	(2,917)	60	(2,063)	-6,841	(2,651)
Initiating Acute Care Hospital	-1,925	(4,806)	-1,053	(5,553)	-6,250	(5,134)	6,501	(5,989)
Total	31,769	(5,791)	24,867	(7,797)	33,970	(6,287)	25,185	(7,997)
Patient outcomes								
Out-of-pocket spending ($)	2,347	(824)	2,260	(977)	3,459	(796)	400	(1,161)
Home within 90 days	0.103	(0.090)	-0.563	(0.164)	-0.223	(0.111)	-0.060	(0.148)
Died within 90 days	0.014	(0.077)	0.276	(0.111)	0.192	(0.080)	-0.062	(0.109)
Number of Obs. (1000s)	5,551		4,590		7,599		4,225	

Note: Table displays IV estimates for different splits of the data. Columns 1 and 2 split the sample by whether the HSA had below or above the median LTCH discharge share. Columns 3 and 4 split the analysis by whether the LTCH is a for-profit or non-for-profit organization. In columns 1 and 2, the pre-entry discharge rate is based on the rate in period $r = -6$. For these columns, we exclude 30 of the 186 HSAs where we do not observe outcomes in period $r = -6$. Standard errors are clustered at the HSA-bin level level.

Table A6: Selected Features

Clinical Classification Software (CCS) Categories		Other
Respiratory failure; insufficiency; arrest	Mycoses	Age
Septicemia	Intestinal obstruction without hernia	
Other aftercare	Complication of device; implant or graft	
Nutritional deficiencies	Upper respiratory disease	
Complications of surgical procedures of medical care	Acute and unspecified renal failure	
Pleurisy; pneumothroax; pulmonary collapse	Other fractures	
Secondary malignancies	Urinary tract infections	
Acute cerebrovascular disease	Essential hypertension	
Pneumonia	Congestive heart failure; nonhypertensive	
Intracranial injury	Disorders of lipid metabolism	
Chronic ulcer of skin	Bacterial infection	
Aspiration pneumonitis; food/vomitus	Peri; endo-; and myocarditis; cardiomyopathy	
Infective arthritis and osteomyelitis	Skin and subcutaneous tissue infections	
Paralysis	Gangrene	
Neck of femur (hip) fracture	Peritonitis and intestinal abscess	
Spinal cord injury	Chronic obstructive pulmonary disease and bronchiectasis	

Note: Table lists potential predictors for the LTCH discharge regression tree model which were actually selected.

Table A7: Distribution of $\hat{p}$

	All ACH admissions (1)	High p-hat sample (2)	All close ACH admissions (3)
Mean	0.020	0.189	0.022
S.D.	0.031	0.034	0.035
Median	0.009	0.179	0.009
Percentile			
10th	0.004	0.159	0.004
25th	0.004	0.164	0.004
75th	0.024	0.206	0.025
90th	0.053	0.218	0.062
95th	0.085	0.272	0.092
99th	0.173	0.291	0.181
Discharged to LTCH	0.009	0.110	0.022
Number of Obs. (1000s)	163,649	2,338	32,708

Note: Table presents the distribution of $\hat{p}$ for all Acute Care Hospital (ACH) admissions, ACH admissions with a high predicted probability of LTCH discharge ($\hat{p}$>0.15), and all ACH admissions with an LTCH within 5 kilometers.

Table A8: Alternative Transition Periods

	Baseline (1)		Narrow transition period (2)		Wide transition period (3)	
Discharge destination						
Skill Nursing Facility	-0.791	(0.075)	-0.676	(0.049)	-0.716	(0.070)
Home/Other	-0.236	(0.073)	-0.245	(0.052)	-0.318	(0.073)
LTCH-in-training	0.007	(0.003)	-0.006	(0.003)	0.001	(0.002)
(Other) Acute Care Hospital	0.044	(0.040)	-0.016	(0.027)	0.067	(0.038)
Death	-0.024	(0.051)	-0.057	(0.034)	-0.034	(0.053)
Spell days						
LTCH	28.9	(1.0)	29.2	(0.8)	29.0	(1.1)
Skill Nursing Facility	-14.3	(3.9)	-10.5	(2.4)	-13.2	(3.6)
Initiating Acute Care Hospital	-8.6	(2.1)	-7.7	(1.4)	-9.2	(2.2)
Total	6.6	(5.1)	10.2	(3.3)	7.2	(4.9)
Spell spending ($)						
LTCH	34,569	(1,708)	35,585	(1,307)	35,100	(1,691)
Skill Nursing Facility	-3,024	(1,572)	-2,709	(1,121)	-2,852	(1,578)
Initiating Acute Care Hospital	-2,016	(3,800)	-914	(2,319)	-2,653	(3,928)
Total	29,583	(4,810)	31,295	(3,240)	29,880	(4,657)
Patient outcomes						
Out-of-pocket spending ($)	2,420	(640)	3,074	(469)	2,486	(677)
Home within 90 days	-0.17	(0.09)	-0.08	(0.06)	-0.05	(0.09)
Died within 90 days	0.10	(0.07)	0.02	(0.04)	0.08	(0.07)
Number of Obs. (1000s)	11,824		12,438		10,737	

Note: Table displays IV estimates from equations 4 and 5, estimated for the baseline sample, dropping alternative transition period observations. The narrow transition period is defined as $r \in [-2, 0]$ and the wide transition period is defined as $r = -5, 5]$. Standard errors are clustered at the HSA-bin level (930 clusters).

Table A9: Robustness

	Baseline		Include HSAs with prior LTCHs		3 year balanced panel		Include subsequent entries		Exclude dual eligibles		County	
	(1)		(2)		(3)		(4)		(5)		(6)	
Discharge destination												
Skill Nursing Facility	-0.791	(0.075)	-0.795	(0.075)	-0.765	(0.081)	-0.760	(0.074)	-0.837	(0.082)	-0.770	(0.090)
Home/Other	-0.236	(0.073)	-0.225	(0.073)	-0.182	(0.079)	-0.225	(0.075)	-0.201	(0.086)	-0.170	(0.085)
LTCH-in-training	0.007	(0.003)	0.008	(0.003)	0.006	(0.002)	-0.009	(0.008)	0.007	(0.003)	0.007	(0.003)
(Other) Acute Care Hospital	0.044	(0.040)	0.054	(0.041)	-0.011	(0.041)	0.002	(0.034)	0.062	(0.052)	-0.020	(0.042)
Death	-0.024	(0.051)	-0.042	(0.052)	-0.048	(0.052)	-0.009	(0.048)	-0.031	(0.061)	-0.047	(0.058)
Spell days												
LTCH	28.9	(1.0)	28.2	(1.1)	27.9	(1.0)	28.3	(1.0)	28.6	(1.1)	26.6	(1.2)
Skill Nursing Facility	-14.3	(3.9)	-14.3	(3.9)	-10.0	(4.1)	-14.0	(3.6)	-16.0	(4.2)	-12.6	(4.4)
Initiating Acute Care Hospital	-8.6	(2.1)	-8.7	(2.1)	-7.2	(2.0)	-8.0	(1.8)	-10.1	(2.3)	-13.1	(2.5)
Total	6.6	(5.1)	5.6	(5.1)	10.9	(5.3)	5.6	(4.9)	4.0	(5.7)	2.2	(5.7)
Spell spending ($)												
LTCH	34,569	(1,708)	33,645	(1,903)	34,646	(1,866)	33,903	(1,892)	33,440	(1,811)	34,420	(1,828)
Skill Nursing Facility	-3,024	(1,572)	-3,391	(1,610)	-2,201	(1,423)	-2,965	(1,432)	-2,760	(1,710)	-1,182	(1,762)
Initiating Acute Care Hospital	-2,016	(3,800)	-1,806	(3,783)	1,829	(3,699)	-4,343	(3,331)	-2,355	(4,530)	-7,557	(4,308)
Total	29,583	(4,810)	28,740	(5,001)	34,143	(4,973)	24,960	(4,582)	29,606	(5,925)	26,656	(5,493)
Patient outcomes												
Out-of-pocket spending ($)	2,420	(640)	2,245	(656)	2,559	(647)	2,008	(610)	2,167	(718)	2,122	(749)
Home within 90 days	-0.172	(0.088)	-0.169	(0.091)	0.014	(0.080)	-0.217	(0.084)	-0.058	(0.100)	0.089	(0.090)
Died within 90 days	0.101	(0.065)	0.084	(0.065)	0.032	(0.065)	0.128	(0.063)	0.118	(0.076)	0.042	(0.076)
Number of Obs. (1000s)	11,824		38,027		7,993		15,346		8,719		12,307	

Note: Table displays IV estimates from equations 4 and 5, estimated on the baseline sample. Standard errors are clustered at the geography-bin level. Column 1 presents our baseline results. In column 2 we include all HSAs that already had at least one LTCH as of 1998 as controls. In column 3 we restrict to all observations with a balanced 3-year panel around entry (restricting to entries that occurred between 2001 and 2011). In column 4 we do not drop subsequent entries, and in column 5 we restrict to non-dually eligible beneficiary years. In column 6 we use counties as the geographic unit; 148 counties experienced a first LTCH entry.

Table A10: Pooled versus Interacted First Stage

	Baseline (1)		Non-interacted first stage (2)	
Discharge destination				
Skill Nursing Facility	-0.791	(0.075)	-0.926	(0.165)
Home/Other	-0.236	(0.073)	-0.209	(0.170)
LTCH-in-training	0.007	(0.003)	0.006	(0.003)
(Other) Acute Care Hospital	0.044	(0.040)	0.130	(0.095)
Death	-0.024	(0.051)	-0.001	(0.061)
Spell days				
LTCH	28.9	(1.0)	28.1	(1.2)
Skill Nursing Facility	-14.3	(3.9)	-13.5	(7.3)
Initiating Acute Care Hospital	-8.6	(2.1)	-4.5	(2.9)
Total	6.6	(5.1)	10.5	(9.1)
Spell spending ($)				
LTCH	34,569	(1,708)	33,607	(1,966)
Skill Nursing Facility	-3,024	(1,572)	-603	(3,462)
Initiating Acute Care Hospital	-2,016	(3,800)	1,196	(5,674)
Total	29,583	(4,810)	34,356	(7,821)
Patient outcomes				
Out-of-pocket spending ($)	2,420	(640)	1,981	(925)
Home within 90 days	-0.17	(0.09)	-0.21	(0.21)
Died within 90 days	0.10	(0.07)	0.04	(0.10)
Number of Obs. (1000s)	11,824		11,824	

Note: Table displays IV estimates from 4 and 5 (interacted first stage) and equations 2 and 3 (non-interacted first stage) estimated on the baseline sample. Standard errors are clustered at the HSA level for the non-interacted specification (186 clusters) and at the HSA-bin level for the interacted first stage specification (930 clusters).

Table A11: Summary Statistics: Alternative Spell Definition

	1998-2014				2002-2014	
	Continuous spells		365-day spells		365-day spells	
	(1)		(2)		(3)	
Spell days						
LTCH	0.7	(5.1)	1.2	(7.2)	1.4	(7.8)
Skill Nursing Facility	9.0	(21.5)	14.5	(29.2)	15.3	(30.2)
Initiating Acute Care Hospital	6.9	(6.7)	6.9	(6.7)	6.7	(6.4)
Total	18.0	(26.5)	32.2	(39.1)	33.0	(40.3)
Home health care					41.5	(79.9)
Hospice					7.1	(34.1)
Total (incl. home health and hospice)					81.6	(99.9)
Spell spending						
LTCH	843	(6,657)	1,500	(9,161)	1,821	(10,078)
Skill Nursing Facility	3,404	(8,078)	5,404	(10,813)	5,805	(11,337)
Initiating Acute Care Hospital	11,201	(12,342)	11,201	(12,342)	11,382	(12,397)
Total	17,519	(20,713)	32,448	(33,488)	33,955	(35,026)
Home health care					2,698	(5,058)
Hospice					1,303	(5,676)
Total (incl. home health and hospice)					37,956	(36,627)
Number of Obs. (1000s)	13,093		12,700		9,557	

Note: Each observation is a unique Acute Care Hospital stay. Includes all HSAs that experience a first entry from 1998-2014, dropping observations at and after the quarter of subsequent entry or LTCH exit and excluding all observations with the minimum $\hat{p}$ value (the Baseline Sample). Column 1 summarizes outcomes using the continuous spell definitions for utilization used in our baseline utilization analysis; column 1 is the same as the baseline column in Table 3 of the main exhibits. All subsequent columns represent a single deviation from the baseline, as indicated. Column 2 summarizes utilization using a 365-days post admission spell, summing all days and spending at an ACH, LTCHs, SNFs, IRFs, or LTCHs-in-Training with admission dates within 365 days of the admission date at the index acute care stay. Column 3 restricts to 2002-2014 (the years when we have hospice and home health claims data). For these years, we incorporate utilization at home health and hospice into the 365-day post admission spell definition.

Table A12: Event Study Estimates: Alternative Spell Definition

	1998-2014				2002-2014	
	Continuous spells		365-day spells		365-day spells	
	(1)		(2)		(3)	
Discharged to Home/Other					-0.327	(0.100)
Home health care					0.015	(0.063)
Hospice					-0.070	(0.039)
Home (no care)					-0.114	(0.071)
Other					-0.158	(0.059)
Spell days						
LTCH	28.9	(1.0)	47.7	(1.2)	49.5	(1.6)
Skill Nursing Facility	-14.3	(3.9)	-26.8	(4.9)	-21.7	(6.0)
Initiating Acute Care Hospital	-8.6	(2.1)	-8.6	(2.1)	-5.8	(2.6)
Total	6.6	(5.1)	2.7	(6.6)	7.8	(7.9)
Home health care					19.6	(18.0)
Hospice					-1.2	(5.5)
Total (incl. home health and hospice)					26.2	(21.2)
Spell spending						
LTCH	34,569	(1,708)	56,499	(1,868)	60,876	(2,106)
Skill Nursing Facility	-3,024	(1,572)	-7,128	(2,102)	-8,085	(2,310)
Initiating Acute Care Hospital	-2,016	(3,800)	-2,016	(3,800)	9,841	(4,470)
Total	29,583	(4,810)	40,507	(7,022)	55,873	(8,065)
Home health care					916	(1,191)
Hospice					-313	(917)
Total (incl.home health and hospice)					56,477	(8,305)
Number of Obs. (000s)	11,824		11,431		5,997	

Note: Table displays IV estimates from equations 4 and 5, estimated on the baseline sample. Standard errors are clustered at the HSA-bin level.

Table A13: Event Study Estimates: Outlier Payments

	Baseline (1)		Outlier (2)		Baseline + Outlier (3)	
Spell spending ($)						
LTCH	34,569	(1,708)	5,155	(791)	39,724	(1,922)
Skill Nursing Facility	-3,024	(1,572)	178	(57)	-2,846	(1,575)
Initiating Acute Care Hospital	-2,016	(3,800)	4,429	(8,184)	2,413	(9,836)
Total	29,583	(4,810)	10,884	(8,489)	40,466	(10,245)

Note: Table displays IV estimates from equations 4 and 5, estimated on the baseline sample. Column 1 shows effects on the baseline spending measures, which is the sum of Medicare reimbursements excluding outlier payments. Column 2 shows effects on outlier payments. Column 3 shows effects on combined baseline and outlier payments. Standard errors are clustered at the HSA-bin level.