Spillover Effects of Medicare Policy on Medicaid: Evidence From the Nursing Home Industry*

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Abstract

Despite rapid growth in the U.S. elderly population, the utilization of nursing facilities in the country has decreased substantially since the 2000s. Previous literature has attributed the decline to the surge in alternative services such as in-home care. This paper explores a different explanation for this phenomenon. Using administrative data and a quasi-random variation in Medicare reimbursement policy, I find that a one percent increase in Medicare fees reduces Medicaid admissions to nursing facilities operating near capacity by two percent. I do not find evidence of increased access for new Medicare residents, but I estimate a one percent increase in Medicare readmissions. Because a significant fraction of long-term residents are enrolled in both Medicaid and Medicare, there is an incentive for facilities to strategically adjust their readmissions to induce a Medicare payment. These findings show how changes in Medicare policy have fueled the shift in focusing on long-term care covered by Medicaid to short-term care covered by Medicare. It also illustrates how the existence of separate payment systems for Medicare and Medicaid have unintended negative consequences by reducing Medicaid beneficiaries' access to long-term care.

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Nursing facilities provide crucial care for the highest-need elderly such as those with dementia and those in need of complex rehabilitative care after a hospital stay. The COVID-19 pandemic showed that residents in these facilities are among the most vulnerable subpopulations in the U.S., not only because of their health status but also because of "cherry-picking" practices in the industry. Anecdotal evidence suggests that increases in government payments for COVID patients induced some nursing facilities to evict less profitable patients (Silver-Greenberg and Harris, 2020). Previous literature has also shown that once capacity is met, nursing facilities engage in selective admissions and discharges (Grabowski et al. 2004, He and Konetzka 2015, Hackmann et al. 2020, and Gandhi 2020).

In this paper, I link two strands of the literature to show how the interplay between Medicare and Medicaid policies fuels "cherry-picking" behavior in the nursing home industry. Previous research on spillover effects in healthcare markets was limited because centralized data on utilization across all payers is scarce in the U.S. I use patient-level administrative data on admissions across all payers to quantify spillover effects. Additionally, and in contrast with most recent literature, I include all U.S states in my analysis. This gives the statistical power needed to estimate the effect of a federal Medicare reimbursement change and to investigate the interaction between Medicare and Medicaid. Quantifying the spillover effects of Medicare policy on Medicaid beneficiaries matters greatly for healthcare policy as nursing facility residents covered by Medicaid are on average poorer and sicker than the general Medicare population.

Medicare and Medicaid are both public health insurance programs that cover stays at nursing facilities. Medicare covers short-term rehabilitative[1] stays for individuals above 65 years of age (hereafter "seniors"), while Medicaid pays for long-term care[2] for eligible low-income seniors. Payment incentives for healthcare providers differ between the programs because the federal government establishes Medicare reimbursement rates, while states do so for Medicaid. The nursing home industry is an interesting setting to study the interaction between these two programs for several reasons. First, around 95% of residents covered by Medicaid receive care in nursing facilities that also offer services covered by Medicare (skilled nursing facilities); thus, a change in reimbursement by one payer, i.e., Medicare, may have first-order consequences for the *other* payer's beneficiaries, i.e., Medicaid residents. Second, nursing-facility residents may be beneficiaries of more than one program. Thus, nursing facilities may bill both Medicare and Medicaid for different

[1] For example, physical or speech therapy or more complex care such as intravenous therapy and specialized feeding. Such care is delivered by therapists, registered nurses, and licensed vocational nurses.

[2] Custodial care involves helping with daily living activities such as toileting, eating, dealing with medication, and bathing. Such care is provided mainly by aides.

services rendered to the same resident. Third, the senior population has grown by 40% since the early 2000s, but the number of nursing facility residents has remained constant. However, this pattern differs by program: the number of Medicaid residents decreased by 12% and the number of Medicare ones increased by 13.6% (Figure 1).

The cause of this shift from Medicaid towards Medicare remains unclear. Previous literature has attributed this decline to the surge in alternative services like in-home care and assisted living facilities (Kaye et al. 2009, Kane et al. 2013 and Guo et al. 2015). However, growth in Home and Community-Based Services (HCBS) is driven in many states by non-elderly individuals who are not eligible for nursing facility care (O'Malley and Musumeci 2018). Further, states with low spending on assisted living facilities have also had a decrease in nursing facility use (Wiener et al. 2009), and not all Medicaid programs cover care at assisted living facilities. To shed light on alternative mechanisms explaining the decline in Medicaid utilization, I use highly detailed administrative data to control for concurrent policy changes, including changes in in-home care supply. Specifically, I investigate Medicare's role in the decline in nursing facility utilization by Medicaid

Estimating the causal effect of a larger profit gap between Medicare and Medicaid on Medicaid beneficiaries is challenging because each facility chooses their patient mix. To address this endogeneity problem, I use quasi-experimental policy variations following an increase in Medicare fees mandated by the *Medicare, Medicaid, and SCHIP Balanced Budget Refinement Act* (BBRA) of 1999, and the *Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act* (BIPA) of 2000. These laws increased Medicare's nursing-facility fees by 20% and 6.7%, respectively. They also increased nursing reimbursements by 16.6%. The former increases were effective from 2000 to 2005, while the latter was effective from 2001 to 2002. Congress authorized the increase in response to concerns regarding severely ill Medicare patients' access to nursing facility services (OIG 1999, OIG 2000, and OIG 2001). However, the new payments were considered overly generous by the Medicare Payment Advisory Commission (MedPAC), which recommended removing the fees increases when the estimated aggregate Medicare profit margin reached 15.3% (MedPAC 2005).

Since Medicare is a federal program with standardized payments, I follow Dafny (2005) and exploit variation in patient composition in a nursing facility's area-of-payment baseline Medicare population to create cross-sectional variation in the form of a simulated price shock. Given the national fee increase, my research design measures if facilities with higher predicted-price shocks experienced a greater decrease/increase in the outcome of interest. I evaluate the validity of the simulated price shock by estimating an event-study model of nursing facility revenues. I find that price shocks are not correlated with pre-existing revenue trends. However, revenues respond strongly to changes in Medicare reimbursement policies; I estimate an elasticity of 1.6 after the enactment of BBRA in 1999. Given the average pre-reform revenue per facility of $8.3 million (converted to 2020 dollars), the estimates suggest that facilities who experience a 6 pp (percentage point) higher price shock (equivalent to the difference between a 90th and 10th percentile facility) have a $816,721 increase in yearly revenue (2020 dollars).

After studying the effect of the Medicare fee increase on revenues, I estimate reduced-form models for admissions by payer type and readmissions by source. The policy variable is the variation in the simulated price shock. I find that nursing facilities do not change admissions of new Medicare residents, but they do increase readmissions. In particular, long-term residents who had been temporarily discharged to the hospital and admitted again to the nursing facility drive the observed increase with an estimated elasticity of 0.69. This finding suggests that nursing facilities can strategically adjust their readmissions to take advantage of the fee bump. A particular feature of the nursing home industry is that residents may be beneficiaries of more than one program. For example, 86.3% of long-term residents in my study period are also Medicare enrollees. Therefore, nursing facilities can be receiving Medicaid payments for long-term services and Medicare payments for short-term services if the resident needs rehabilitation services after a qualifying hospital stay.

The results for Medicaid admissions show that the Medicare fee increase induces nursing facilities to substitute away from Medicaid. I estimate a supply cross-price elasticity of -1.3, implying that the average nursing facility experiencing a 23% price shock reduces their yearly Medicaid admissions by 3.6 individuals (or 29.9%). All of the specifications include facility and state-by-year fixed effects, which control for concurrent changes in state policy such as the expansion in Home and Community-Based Services. In line with previous literature, I find that nursing facilities facing binding capacity constraints are driving the decline in Medicaid admissions with an estimated cross-elasticity of -1.9. The coefficient estimate for nursing facilities operating below capacity is smaller and not statistically significant. This finding points to high opportunity costs for admitting a low-profit resident today (Medicaid patient), as this will prevent facilities from using that given bed in the future for a high-profit resident (Medicare patient). Further heterogeneity analysis shows that facilities with worse health inspection scores substitute more than facilities with good scores. The estimates for readmissions generally do not differ by facility type.

This paper also presents evidence that facilities operating near capacity are more likely to be located in states with a strong regulations regarding the supply of long-term care services. I approximate the stringency of supply regulations using the number of certificate-of-need (CON) and moratorium laws in a state. The laws aim to prevent providers from inducing demand to fill their underused capacity by regulating the number of beds and capital expenditures. In addition, CON states may also regulate the supply of substitute services such as home-based care, residential care, and adult daycare. I show that nursing facilities in heavily CON–restricted states have higher occupancy rates than facilities in states with comparatively lax regulations. Using the total number of rules in place in 1998, I divide facilities and states into two groups: capacity-constrained and unconstrained.

Using the information at the state-year level on the unique number of Medicaid beneficiaries at nursing facilities, I find that heavily CON-restricted states drive the decrease in Medicaid beneficiaries' utilization of nursing facilities. In particular, I find that the increase in Medicare fees induces a reduction in the relative number of residents whose stay is covered by Medicaid in constrained states by 6.1% . This finding provides evidence that the interaction between Medicaid policies restricting the supply of long-term care services and Medicare reimbursement policies is responsible for an essential share of the observed substitution from Medicaid towards Medicare.

This study makes three contributions to the literature. First, to the best of my knowledge, this paper provides the first causal evidence of Medicare's role in the decline in nursing home utilization by Medicaid residents. Due to the concurrent surge in substitutes for nursing home care such as HCBS and assisted living , previous studies provide only anecdotal evidence pertaining to the shift from long-term care covered by Medicaid to short-term care covered by Medicare (Bishop 1999 and Wiener et al. 2009). I use highly detailed administrative data to control for concurrent policy changes, including changes in in-home care supply. Additionally, I create a machine-readable database of Medicare fees using the Federal Register PDFs for my study period. Using this information and the patient-mix for each nursing facility, I construct a simulated price shock to estimate the effect of a federal Medicare reimbursement change.

Second, this paper shows that nursing homes can induce a Medicare payment by sending long-term residents to a hospital and then readmitting them as Medicare residents. This is a crucial finding as many long-term residents are eligible for both programs, and it is a billing practice that has not been documented in the existing literature. Previous studies focus on long-term services rendered at nursing facilities (Gandhi 2020 and Hackmann et al. 2020); however, the findings on readmissions in this paper suggest that we need to consider both long-term and short term services within a stay. Moreover, bundled payment systems for long-term services such as the one proposed in Hackmann et al. 2020 may have unintended consequences as nursing facilities can compensate by inducing readmissions covered by Medicare. Thus, this paper highlights the importance of creating a system that incorporates both long-term and short-term payments.

Third, this paper also contributes to the broader literature on the behavior of healthcare providers working with multiple payers. Empirical studies of spillover effects at the provider level are scarce partly due to the need to carry out separate data-collection processes for each payer. Databases with standardized information at the provider level about the services rendered to each payer and for all U.S. states are not publicly available or the data are hard to collect because there is no centralized source. Thus, studies of hospitals and physicians tend to focus on the direct effects of changes in Medicare reimbursement on services rendered to Medicare beneficiaries (Gillis and Lee 1997, Clemens and Gottlieb 2014, Eliason et al. 2018, Einav et al. 2018) or use national surveys (see Brunt and Jensen 2014)[3]. The nursing home industry, on the other hand, is a suitable setting to study spillover effects as the Centers for Medicare and Medicaid Services (CMS) collect information on all payers. I am also able to use data from all U.S. states to overcome power challenges and estimate the supply cross-price elasticity between Medicaid and Medicare prices.

The paper is organized as follows. Section 1 provides institutional details such as the benefits covered, the method of payment, and trends in nursing home markets that distinguish between Medicaid and Medicare. In Section 2, I describe the data and the research design. Section 3 shows the results and underlying mechanisms, and I discuss my conclusions in Section 4.

1 Bakground on Nursing Home Industry

Nursing facilities provide 24-hour aide assistance and nursing care. Most facilities, 95%, provide two levels of care: long-term and short-term. Long-term care assists with the activities of daily living such as toileting, eating, help taking medication, and bathing. Long-term residents are expected to spend the rest of their lives in the facility. On the other hand, short-term care includes rehabilitation and medical services needed after a hospital visit. Residents receiving short-term care are expected to stay on a temporary basis and return to their homes after their stay. Medicaid and Medicare are the primary payers for nursing facility services, with 80% of the residents being covered by one of the two program. The remaining 20% are paying out-of-pocket, or have private insurance or other programs such as CHAMPVA (Civilian Health and Medical Program of the Department of Veterans' Affairs).

[3]See Barnett et al. (2020) for recent results on spillover effects of Medicare policy on Non-Medicare patients.

1.1 Medicaid Insurance for Long-Term Needs

Medicaid is a state-based program for low-income people. All U.S. states have a Medicaid program however they have a lot of flexibility in how they implement the program. This produces variation across states in terms of payment amounts, people who are eligible for the program, and the services covered. In the case of long-term care, nursing facility care is required to be covered by all states while in-home care is an optional benefit that states may or not cover. In fact, Medicaid programs are not required to cover the large majority of long-term care received at home or in the community. Thus, the availability and coverage generosity of Medicaid Home and Community-Based Services (HCBS) varies widely from state to state. Although HCBS are optional benefits, the Federal government has provided multiple stimuli to encourage states to shift from using nursing facility care toward HCBS care. The 1999 U.S. Supreme Court ruling in Olmstead v. Zimring required states to provide community-based services to persons for whom institutional care is inappropriate. Expansion in HCBS in Medicaid programs also follows cost-containment efforts as HCBS are substantially cheaper than nursing facility care. According to the Genworth 2017 Cost of Care Survey, the median annual cost of a semi-private room in a nursing home is \$85,775, while the median annual cost of a home health aide is \$49,192. Moreover, in 2005 the Centers for Medicare and Medicaid Services (CMS) enacted the Money Follows the Person (MFP) Demonstration Program, which is the largest program designed to transition individuals living in long-term care institutions back into the community.

Despite CMS's efforts and MFP, overall enrollment in home and community-based programs is driven in many states by non-elderly individuals who are not eligible for nursing-facility care (O'Malley and Musumeci (2018)). Likewise, access to these services is often restricted in some states as there are a predetermined numbers of slots for HCBS services, generating long waiting lists. O'Malley and Musumeci (2018) find that in 2016 there were 656,195 individuals on waiting lists who had waited on average 23 months to be assigned a slot. More importantly, recent evidence suggests that aged Medicaid beneficiaries in HCBS have poorer health outcomes than their counterparts in nursing facilities (Konetzka et al., 2020). The authors find that HCBS users are more likely to be admitted to a hospital (by 10 percentage points) and to visit for a potentially avoidable cause (3% percentage points) relative to nursing facility residents.

1.1.1 Certificate of Need Laws

Certificate of Need (CON) laws began in the 1970s as a state regulatory mechanism for controlling health care costs and increasing access in underserved areas. CON regulation limits the growth of providers by requiring them to seek a state health planning agency's approval before expanding their bed capacity, making capital expenditures, acquiring a new medical equipment, or establishing a new services. The underlying assumption is that a 'built bed is a filled bed,' that there is an incentive for providers to induce demand to cover for the costs of underused capacity .

CON laws have primarily targeted the nursing home industry. Although some states repealed the laws and replaced them with market-based means such as managed care and a prospective payment system, other states have had them unchanged for several decades. In 1998, the first year of this study, there were 36 states regulating the nursing home industry. By 2019, all 36 states continue to have a CON program in place. Some states have also regulated substitute sectors like home-health agencies, assisted living facilities, and adult day care.

Previous studies have found that during the 1990s CON laws reduced the growth in the number of nursing home beds, resulting in excess demand in this market (Nyman 1988,1989, 1993; Zinn 1994; Harrington et al. 1997). Since the late 1990s, however, occupancy rates and other measures of excess demand in the nursing home market have been declining (Strahan 1997, Bishop 1999, Grabowski 2001, Wiener et al. 2009). Previous studies point to demographic changes and the surge in substitutes services to nursing facility care as the main forces driving these decline (Bishop 1999, Grabowski 2001, Wiener et al. 2009, and Grabowski et al. (2012)). However, enrollment in home and community-based programs is driven in many states by non-elderly individuals who are not eligible for nursing facility care (O'Malley and Musumeci (2018)). Further, states with low spending on assisted living facilities have also exhibited a decrease in nursing facility use (Wiener et al. (2009)).

1.2 Medicare Insurance for Short-Term Needs

Medicare is a federal program for people aged 65 years or older and for disabled individuals with an end-stage renal disease or with Social Security Disability Insurance (SSDI). Medicare delivers services through public health insurance (Traditional Medicare) and through publicly financed private insurance (Medicare Advantage). The laws and description laid out in this section refer to Traditional Medicare also known as the fee-for-service component. Medicare is a centralized program and thus it covers the same package of services and has one payment system for providers across all states. In the case of nursing facilities services, Medicare pays for only up to 100 days of a stay per year, and beneficiaries must have a doctor referral and a recent three day or longer inpatient hospital stay. Since 1998 and until 2020, Medicare reimbursed nursing facilities under a prospective payment system (PPS). Under PPS, a patient is classified according to the level of care they need in 1 of 44 Resource Utilization Group (RUG), and nursing facilities are paid a fee per each day of care. The fee is set in advance and it also takes the the facility's geographic into account. Thus nursing facilities receive a higher daily payment for patients needing more care, such as those needing physical therapy, or if they are located in areas with high labor costs.

The PPS was implemented in 1998 as a response to the rapid growth in Medicare nursing facility expenditures under the previous cost-based reimbursement system. The change to the new system decreased Medicare payments by $2 billion, which created financial pressures in the nursing home industry (Medicare Payment Advisory Commission, 2003). Congress responded to providers' concerns by authorizing two temporal increases to the daily fee. The first increment was announced in November 1999 with the enactment of the BBRA and increased the nursing component of the fee by 16.66%, and laso provided a 4% increase in the fee all RUGs for fiscal years (hereforth FYs) 2001 and 2002. Additionally, they authorized a 20% fee increase for medium-care RUG groups that went into effect for FYs 2001 through 2005. One year later, in 2000, the BIPA raised the fee for rehabilitation RUG groups by 6.7% for FYs 2002 through 2005.

Figure 2 displays the evolution of the Medicare payments per day for nursing facilities. The charges exhibit accelerated growth after the implementation of BBRA and BIPA. The PPS created incentives for nursing facilities to upcode patients into higher rehabilitation groups. Grabowski et al. (2011) find that the shift to using PPS increased admissions within the rehabilitation RUGs by 3.7 pp and by 8.8 pp for the six highest rehabilitation RUGs. Wodchis (2004) and Bowblis and Brunt (2014) find bunching at the minimum number of therapy minutes required to classify a patient into a higher reimbursed RUG (i.e., 150, 325, 500, and 720), suggesting that nursing facilities over-reported therapy minutes to place patients into higher reimbursed codes. As for the increase in fees implemented with BBRA and BIPA, Grabowski et al. (2011) find that the share of Medicare patients increased 7% after BIPA was enacted suggesting a strong direct supply response to the increase in Medicare's fee.

Congress was alerted of this misalingment in incentives and was advised to completely remove the 6.7% increase payment for rehabilitation RUGs (U.S Government Accountability Office 2002, Medicare Payment Advisory Commission (2003), and Medicare Payment Advisory Commission 2004) but the fee increase remained in place till FY 2006, after Medicare published a refined RUG classification. Medicare fees for nursing facilities are set using payments for previous years which added to the incentive to upcode patients, and created a different trajectory for future Medicare payments. It was not until October 2020 that the PPS was replace with a new system, the Patient-Driven Payment Model (PDMP). Under the new system, nursing facilities use patient's clinical characteristics rather than the number of therapy minutes as the basis for payment classification. The new system aims to correct the current bias towards rehabilitation care.

2 Empirical Strategy

2.1 Data

Data about Medicare payments to nursing facilities comes from the Federal Register. I create a machine-readable database of Medicare fees by Resource Utilization Group (RUG) and geographic region from 1998 to 2005. I obtain information on the number of Medicare days per RUG and total inpatient revenues from the Medicare Cost Reports. Information on admissions by payer type and readmissions come from the Minimum Data Set (MDS). This administrative database is maintained by CMS and contains resident assessments performed at admission and discharge, and quarterly/annual evaluations. The MDS provides a unique identification number for each resident-facility pair, along with the assessment date. To distinguish new-resident admissions from readmissions, I look for discharge assessments in the previous 30 days. If I find a discharge to a hospital or the community in the past 30 days, I classify the new stay as a readmission. To determine the payment source, i.e. Medicare vs Medicaid, I use MDS information payment sources at admission. Unfortunately, the MDS does not collect payer information at the time of discharge. For the state-level analysis, data on the number of individuals served in nursing facilities and expenditures came from the Medicare and Medicaid Statistical Supplemental records.

To compute the occupancy rate by facility I use the Online Survey, Certification and Reporting (OSCAR) database. Information in the OSCAR database is collected through the standard certification survey, which is an unannounced on-site health inspection given to all certified nursing facilities in the U.S. every 12–15 months. OSCAR reports residents by payer type at the time of the survey, the total number of health deficiencies, the number of nurses and, beds, and other facility characteristics such as for-profit status and ownership. For the state-level analysis, I use information collected by Harrington et al. (1998) on CON/Moratorium laws to approximate capacity constraints. Table A1 displays the rules that apply to each long–term care sector by state.

Finally, I use information at the county level to control for economic conditions and supply of substitute services. Specifically, I obtain county covariates from the County Business Pattern (CBP), the Survey of Epidemiology and End Results (SEER), the Area Health Resource File (AHRF), the U.S. Bureau of Economic Analysis (BEA), and the Bureau of Labor Statistics (BLS). From the CBP information, I compute the number of assisted-living facilities by county, adding the number of establishments classified as NAICS 623311 (continuing care retirement communities) and 623312 (assisted living facilities for the elderly). From the SEER I construct demographic variables such as total population, and population by age brackets. From the AHRF I obtain the total number of long-term care providers and personal income per capita by county, and state economic variables such as personal income per capita and unemployment rates from the BEA and the BLS.

2.1.1 Sample

I include nursing facilities that provided services to both programs, Medicare and Medicaid, before the change in Medicare fees. I exclude from my sample facilities that were hospital-based or government-owned as they are reimbursed differently from free-standing facilities (see Section 1).[4] In the main analysis I also exclude New York because the state differs significantly from other states in important dimensions of regulation. On one hand, the majority of facilities in New York participated in the Nursing Home Case-Mix and Quality (NHCMQ) demonstration, a program that transitioned facilities from the Medicare cost–based payment system to the new prospective-payment system (PPS). Facilities in New York had been paid under the new PPS system starting in 1995, while the rest of the country adopted that system in 1998. Thus, it is likely that the increased in Medicare fees affects facilities in New York differently from how it affects them in other states. On the other hand, New York is the only state that did not allow facilities to limit how many of their beds can be used Medicare patients (a practice known as distinct parts). Anecdotal evidence suggests that this limitation was used to ration Medicare access, although OIG (2000a) do not find strong evidence for this claim. Because of these factors I exclude New York from my main analysis.

2.2 Empirical Specification

I examine evidence at the facility-by-half-year level using the information on the number of admissions and readmissions by payer. Since Medicare is a federal program with standardized payments, I exploit variation in a nursing facility's baseline Medicare-days composition to create a simulated price shock for each area-of-payment. My study period runs from 1997 through 2005 whenever the data are available for 1997. Throughout the analysis, I date the introduction of the fee increase in November 1999 that is when it was authorized by Congress. As my study period ends in 2005, I exclude the effects from the MFP program, the largest Medicaid program that transitions nursing facilities residents back into their communities.

To isolate the effect of the generosity of the Medicare fee from direct facility responses to the policy, such as upcoding, I construct a simulated instrument. Specifically, I interact pre-reform

[4] Free-standing facilities are entities that are neither integrated with nor are departments of any hospital.

RUG-specific day shares with the RUG price changes at the area-payment level:

$$\widehat{\%\Delta P_{a(i)}} = \sum_{g=1}^{44} \frac{Days^{g}_{a(i),1998}}{Days_{a(i),1998}} \times (ln\text{Price}^{g}_{a(i),post} - ln\text{Price}^{g}_{a(i),1998}), \tag{1}$$

where $\text{Price}^{g}_{a(i),post}$ denotes the Medicare fee for RUG g in the years following the reform for facility i in area-payment $a(i)$. Table 3 provides descriptive statistics for Medicare fees in the pre-period and the simulated price shock. The average daily Medicare fee in the pre-period was \$228. The composition of Medicare days predicts an average Medicare fee increase of 23%.

To estimate the effect of Medicare reimbursements on admissions I use a Poisson pseudo-maximum likelihood (PPML) to account for the presence of zeros in my outcomes of interest (Table 3, Panel B and C). Specifically, I estimate the following reduced-form event study model:

$$\log \mu_{i,t} = \alpha_i + \theta_{half-year} + \gamma_{state\times year} + \sum_{p=1998}^{2005} \beta_p I(p=t) \times \widehat{\%\Delta P_{a(i)}} + \mathbf{X}_{c,year}\vartheta_2 + \varepsilon_{i,t}, \tag{2}$$

where $\mu_{i,t}$ is the facility-by-half-year mean admission count. $\widehat{\%\Delta P_i}$ is the fixed price shock for each area-of-payment. During the study period there are 365 areas. I interact the price shock with time-to-event dummies $I(p=t)$ and exclude the second semester of 1999 (1999-2) so that each β_p estimates the change relative to the enactment of the Medicare fee increase (BBRA). Estimates of β_p for periods before 1999-2 are testing for pre-exisiting trends related to the price shocks. On the other hand, estimates of β_p following the enactment of the law measure the effect of the fee increase on the outcomes of interest. Since I am modeling the log of the mean admission count and the price shock is expressed in logs, these β_p coefficients can be interpreted as elasticities. The coefficients measure if facilities in areas with higher predicted price increases experienced a greater change in the outcome variables. Equation 2 also includes calendar state-by-year fixed effects $\gamma_{state\times year}$ to account for contemporaneous changes in state policy (e.g. Medicaid HCBSs), half-year fixed effects $\theta_{semester}$, and facility fixed effects α_i. I also control for changes in economic conditions and the supply of alternative services like the number of assisted living facilities in the county ($\mathbf{X}_{c,year}$). Standard errors are clustered by facility.

Then I estimate a continuous difference-in-difference model that pooled the semester-specific effects estimated in Equation 2. The specification is as follows:

$$\log \mu_{i,t} = \alpha_i + \theta_{half-year} + \gamma_{state\times year} + \beta \times Post \times \widehat{\%\Delta P_{a(i)}} + \mathbf{X}_{c,year}\vartheta_2 + \varepsilon_{i,t}, \tag{3}$$

where *Post* takes the value of one in periods after 1999-2 and zero otherwise. The rest of the coefficients are interpreted as in Equation 2. Besides estimating Equation 3 for Medicare and Medicaid, I estimate the effect on residents who are paying for their stay (Self-Pay). As can be seen in Table 3 Panel D, these residents are also expected to be long-term. Note that Self-Pay residents are charged higher fees than their publicly insured counterparts as nursing facilities are legally allowed to charge them higher rates. Therefore, this group of residents is an ideal group on which to perform falsification tests.

Finally, I investigate heterogeneous effects by facility type to shed light on the mechanisms driving the results. I test for differences in responses by capacity-constrained status. This is done by computing the occupancy rate by facility using the most recent resident census before fiscal year 2000. The resident census is collected during health inspections, which are conducted every 12-15 months. I define capacity-constrained facilities as those with an occupancy rate equal or greater than 90%. Figure 4 provides evidence that at 90%, the share of Medicaid residents declines sharply. This 90% threshold is in line with the findings in Hackmann et al. (2020), which shows that facilities increase their efforts to discharge Medicaid residents at this occupancy level.

To address concerns about occupancy-rate endogeneity, I run a state-level analysis as a robustness test. I first group states into constrained and unconstrained states according to the number of CON/ Moratorium laws that were in place in 1998. Column 10 of Table A1 reports the total number of laws regulating the supply of long-term care options, i.e., the growth of nursing homes, home and health agencies, hospital bed conversion, residential care, and adult day care. The state with the highest number of restrictions is Mississippi with eight out of the nine possible laws, and the states with the lowest number of restrictions are Arizona, California, Idaho, Kansas, Nevada, New Mexico and Pennsylvania, which do not have any of them.

The scope and stringency of any given CON/Moratorium law may vary across states and because of this a high number of restrictions does not necessarily translate into a high occupancy rate. Thus, I conduct a graphical and linear regression analysis to examine the relationships between the mentioned variables. Figure 3 shows that there is a positive relationship between the number of restrictions and occupancy rates, and Table 2 indicates that the relationship is statistically significant. Column 2 in Table 2 indicates that adding one CON/Moratorium law is associated with one percentage point statistically significant increase in the occupancy rate. Thus, I construct a binary measure to divide states into constrained or unconstrained in order to avoid relying on the linear relationship between the number of restrictions and the occupancy rate. I identify constrained states as those on the 75th percentile in the number of CON/Moratorium laws. This corresponds to having four or more CON/Moratorium laws. As can be seen in Column 2 of Table 2, the binary measure has greater explanatory power than the count variable as measured by F-statistics.

In this robustness test I use aggregate utilization measures such as the total number of residents whose stay is covered by Medicaid and the total nursing-facility Medicaid expenditures. Specifically:

$$\log \mathrm{Y}_{s,t} = \theta_s + \gamma_t + \sum_{t=1999, t\neq 2000}^{2004} \beta_t \times \mathrm{Constrained}_s + \mathbf{Z}_{s,t}\vartheta + \varepsilon_{s,t}, \tag{4}$$

where $Y_{s,t}$ is an outcome variable for state s in year t; θ_s and γ_t are state and year fixed effects; $\mathbf{Z}_{s,t}$ are time-varying state control variables. I measure the effects relative to 2000, as the CMS data is annual, and a year goes from October to September. Therefore, the 2000 data goes from October 1999, the quarter when the fee increase was authorized, to September 2000. The estimates for β_t for years after 2000 measure the effects of the induced opportunity cost increase on the outcome variables $Y_{s,t}$. I also estimate the DD version of Equation 4.

3 Results

3.1 Summary Statistics and Trends

Table 3 reports the summary statistics for the outcome variables. Panels B and C show the descriptive statistics for admissions and readmissions at the facility-half-year level. As can be seen, nursing facilities admit, on average, six Medicaid residents per half-year. In contrast, they admit 32.5 Medicare residents in the same period. As for readmissions, Panel C shows that at least two-thirds of readmissions are long-term residents who are readmitted from the hospital (18.1 on average). Finally, to illustrate changes in the payer mix during my study period, I plot the evolution of the average number residents by payer type and constrained status. Figure 7a shows that in both constrained and unconstrained states, the average number of Medicare patients served increased between 1999 and 2005. This is not the case for Medicaid patients, they decreased in constrained states. This is suggestive evidence of a Medicare crowd-out effect on Medicaid.

3.2 Findings

The first question I explore is how the simulated price shock translates into actual changes in nursing facilities revenues. Figure 6 reports the β_p coefficients from Equation 2. As can be seen, facilities exhibit parallel trends in inpatient revenues before the Medicare fee increase, which shows that $\widehat{\%\Delta P_i}$ is not correlated with a pre-existing revenue trend. After the fee bump, revenues respond significantly to Medicare prices, building toward an elasticity of 1.63 (Table 4). The estimates suggest that facilities which experience a 6pp higher price shock (equivalent to the difference between a 90th and 10th percentile facility) have a 9.8% in revenues.

To better understand the margins along which nursing facilities respond to a fee change, I evaluate the reduced form for the outcomes of interest. Panel A in Figure 7 shows that facilities that had a higher fee increase do not disproportionally change their admission of new Medicare residents. However, they do increase readmissions. Table 5 reports continuous DD estimates by readmission type. As shown in Column 1, readmissions of long-term residents from the hospital are driving the observed increase with an estimated elasticity of 0.69. This is an important finding as it suggests that Medicare fee generosity increases may induce strategic changes in readmissions. Given that a large fraction of long-term residents are paying via Medicare (86.3% see Table 3), if nursing facilities can induce their hospitalization and thus following readmission, they can take advantage of Medicare's policies on short-term care. Column 2 shows other types of readmissions are not affected by the increased fees.

To evaluate the spillover effects of Medicare on Medicaid beneficiaries' access to nursing facilities, I estimate the impact on the admission of new Medicaid residents. Figure 8 shows a sharp decrease in the number of Medicaid admissions after the Medicare price increase was announced. The continuous DD estimate in Table 6 Column 1, indicates a cross-price elasticity of supply of -1.3. Before the Medicare fee increase, facilities admitted six Medicaid residents on average per half-year. Given the mean price shock of 23%, the elasticity implies that Medicare reimbursement policies induce facilities to reduce Medicaid admissions by 1.79 individuals per half-year. It is important to note that all regressions include state-by-year fixed effects which capture contemporaneous changes in Medicaid policy such as HCBS expansions.

3.3 Heterogeneity Analysis

To shed light on the patterns and underlying mechanisms driving the findings, I examine heterogeneity in the admission effects across facility types. Table 7 presents the estimates by capacity-constrained status. I use the occupancy rate at the health inspection prior to the shock to identify facilities facing capacity constraints (see Subsection 2.1). Column 1 shows that facilities operating near capacity (90% or greater occupancy rate) respond strongly to the Medicare fee increase by substituting away from Medicaid. The estimated cross-price elasticity of supply is -1.97. Moreover, these facilities induce an increase in readmissions by 5.8% when they experience a 6pp higher price shock.

On the other hand, coefficient estimates for facilities operating below capacity are smaller than for constrained facilities and are not statistically significant. This result is consistent with higher opportunity costs for admitting a Medicaid patient when there are limited beds as this will prevent the facility from using the bed for higher-profit patients such as Medicare ones or those paying out-of-pocket. In addition, readmissions figures suggest that, under binding capacity constraints, future Medicaid residents are also competing against current Medicaid residents, as facilities can induce a Medicare payment by inducing readmission from the hospital for an existing resident.

In Table 8 Columns 1, I group facilities into whether the nurse to resident ratio is above or below the facilities median. Column 2, is the same except for using the total number of health deficiencies identified in the annual inspection. As can be seen, facilities with a high nurse to resident ratio and a high number of deficiencies drive the decrease in Medicaid admissions. Column 5 shows a negative and statistically significant coefficient for For-Profit facilities (-1.3), but I can not precisely estimate the effect for Not-For-Profit ones due to lack of power. Finally, Panel B shows that there is not large heterogeneity effects on readmissions across facility types.

3.4 Robustness Checks

I check that my results are robust to changes in the specification, namely, by estimating models in logarithms. Table A3 and Table A4 show that my main findings are similar if I use the logarithm and condition on having at least one admission in the half-year. I further use the group of Self-Pay residents, the highest-profit long-term residents, to further confirm that my research design captures the effect of payment divergence between Medicare and Medicaid without being confounded by contemporaneous changes. Figure 8 Column 3 shows that the Medicare price shock does not change admissions for Self-Pay residents. Thus, a generous Medicare fee combined with capacity constraints only affects Medicaid residents, i.e. low-profit long-term residents.

To overcome concerns on the possible occupancy-rate endogeneity, I use the number of CON laws in 1998, to instrument for capacity-constraints. Figure 9 I show graphically how the number of Medicaid residents and Medicaid expenditures evolved over time between 1999 and 2005 in constrained and unconstrained states. First, note that in the pre–period there is no statistically significant difference between the figures for constrained and unconstrained states which supports the identifying assumption of no pre–existing trends. However, the coefficient estimates for the years after 2000 show that after Medicare increased its fees the number of Medicaid persons served declines in constrained states relative the number served in unconstrained states and the effect becomes stronger during the later years of the study period. The figures support the findins at the facility-level by pointing to an overall decrease in nursing home services rendered to Medicaid beneficiaries in constrained states relative to those served in unconstrained states as a result of the

Medicare policy change.

Finally, I provide additional evidence that my results are not confounded by the increase in Medicaid HBCs by estimating the relationship between the number of Medicaid residents and lags and leads of numbers of HCBS participants.[5] Table A5 shows the coefficients are not statistically significant but more importantly, the negative coefficient on the lead of numbers of HCBS suggests that the current number of Medicaid nursing-facility residents negatively impacts the number of HCBS and not the other way around.

4 Discussion and Conclusion

The utilization rate of nursing facilities has decreased over time, although the elderly population has been growing quickly. This pattern differs by payment source, with the number of Medicare residents increasing and the number of Medicaid ones decreasing. In this paper, I formulate an empirical test of Medicare's crowding-out effect on Medicaid based on a simulated price shock empirical strategy. I find that the interplay between capacity constraints and more generous Medicare fees has produced a decline in the number of Medicaid admissions in capacity-constrained facilities. Specifically, I estimate a cross-price elasticity of supply of -1.9. Instead of evidence of increased access for new Medicare patients, I find strategic responses concerning readmissions covered by Medicare. Because a significant fraction of long-term residents are also enrolled in Medicare, my findings suggest that nursing facilities can and are increasing Medicare volume by inducing hospital stays that qualify the resident for short-term services covered by Medicare when they are readmitted.

Despite the need to account for spillover effects of a change in payer payments on access for other patients, previous empirical studies have found it difficult to quantify this effect. This paper addresses this challenge using a novel multi-sourced database to study unintended consequences of Medicare policy. A back-of-the-envelope calculation of my findings suggests that the Medicare fee increase in 2000 to 2005 prevented 220,771 Medicaid beneficiaries from receiving long-term care at nursing facilities. Moreover, nursing facilities increased their Medicare volume by inducing readmissions for services covered by it. I estimate an increase of nursing facilities' revenues by 37.5% following the average Medicare price shock of 23%.

The analysis in this paper is concerned most directly with the impact of Medicare fee increases on the utilization of nursing facilities. A broader study could also examine the effects of the

[5] I collected information on the number of participants in Medicaid HCBS programs from the following reports: LeBlanc et al. (2001), Kitchener et al. (2007), and O'Malley and Musumeci (2018).

increase in Medicare fees on the use of substitutes for nursing facilities. If Medicaid beneficiaries who are not admitted into nursing faciltiies are receiving alternative care through home and community–based programs, this would imply that the Medicare reimbursement policy induced “cost shifting” from nursing-facility care to in-home care in constrained states. On the other hand, if Medicaid beneficiaries are not receiving in-home care or if in-home care is not appropriate for their health conditions, then the decrease in Medicaid admissions to nursing facilities could translate into a lack of care leading to worse health outcomes. These questions set a natural direction for future research.

Finally, in fiscal year 2020, the Center for Medicare and Medicaid Services launched a new case mix model for nursing facilities that aims to correct the current bias towards rehabilitation care. The new Patient–Driven Payment Model (PDMP) focuses on clinical factors rather than on minutes of therapy in the formula for determining Medicare payments. The change in the case–mix model is a response to concerns regarding the role of Medicare in motivating the provision of services based on a facility’s financial motives rather than the patient’s needs. Since this paper shows that misalignment of Medicare payment schemes also affects the provision of services to Medicaid residents, it raises questions about the consequences of PDMP on Medicaid residents and if the policy change will end up having the effects desired by public policy makers.

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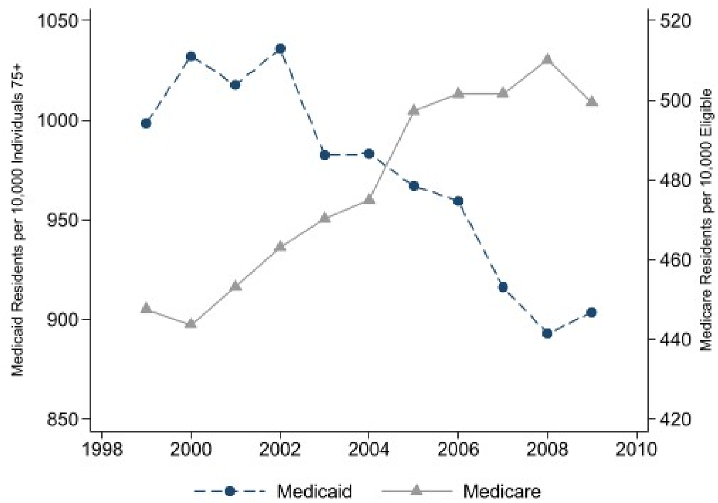
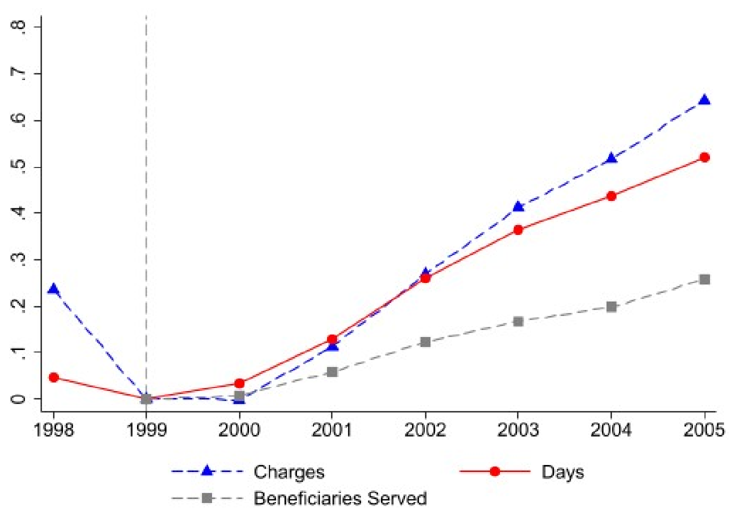
Figures and Tables

Figure 1: Nursing Facility Residents by Payer Type



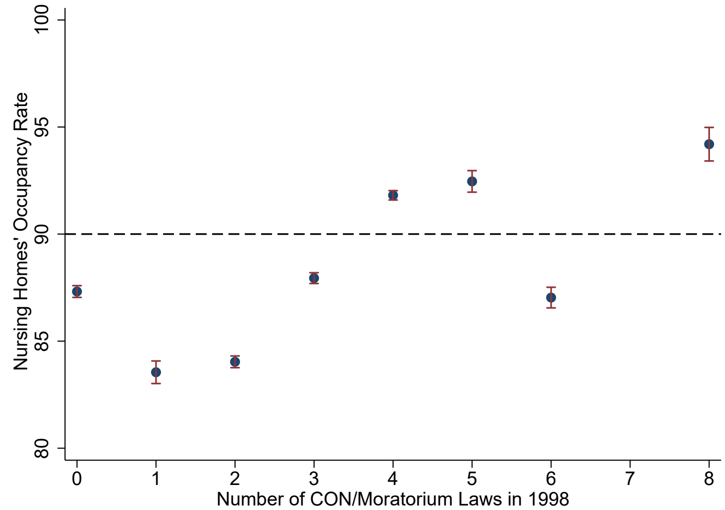
Note: Totals are computed using information from the Online Survey Certification and Reporting, Medicare and Medicaid Statistical Supplement, and Survey of Epidemiology and End Results. Eligible corresponds to fee-for-service enrollees.

Figure 2: Medicare Payments, Days Covered and Beneficiaries Served at Nursing Facilities



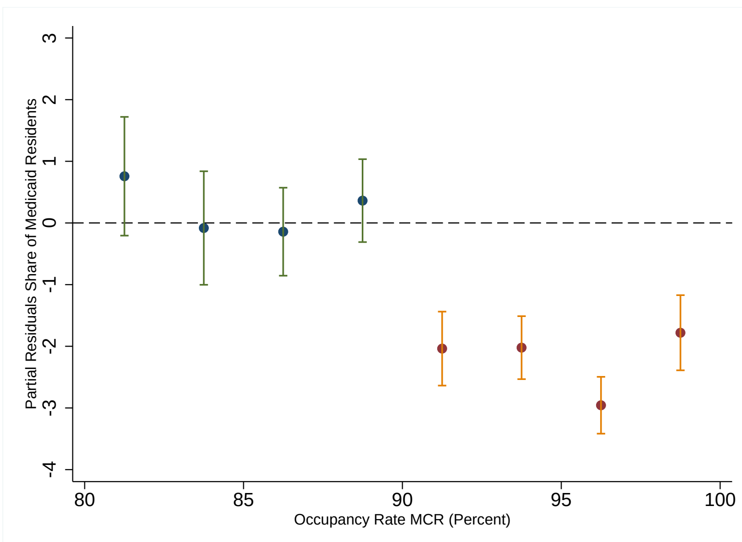
Note: Changes are computed using information from the Medicare and Medicaid Statistical Supplement.

Figure 3: Relationship between Occupancy Rates and Number of CON/Moratorium Laws



Note: Figure plots the mean and confidence interval of nursing homes' occupancy rate by the total number of CON/Moratorium laws. I compute the number of CON/Moratorium laws using information from Harrington et al. (1998).

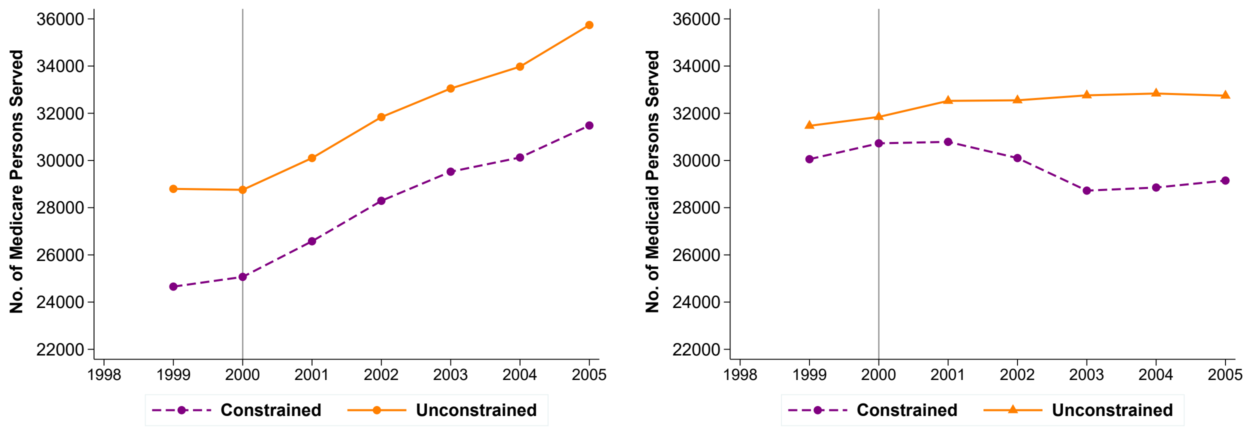
Figure 4: Relationship Between the Share of Medicaid Residents and Occupancy Rates



Note: Figure shows the relationship for facilities that serve Medicare and Medicaid residents in the pre–period. Facilities that serve only Medicare or only Medicaid residents are excluded. The y-axis is the partial residuals from a regression of the share of Medicaid residents on county covariates. The occupancy rate corresponds to the ratio of the total number of days of care to available bed days taken from the Medicare Cost Reports (MCR).

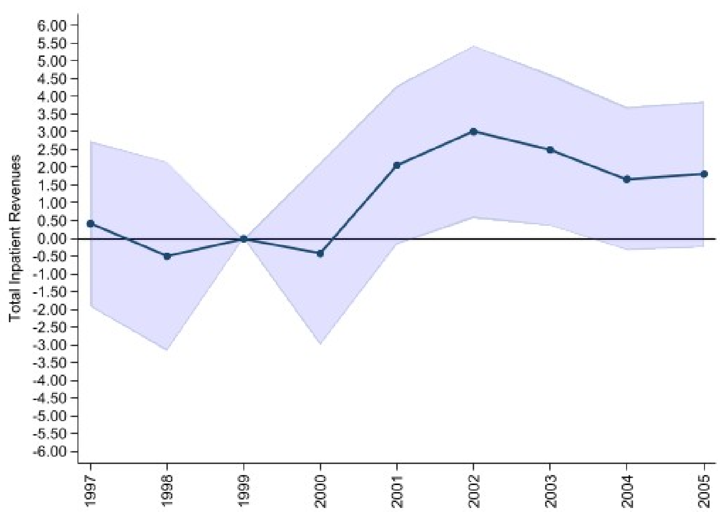
Figure 5: Evolution of Persons Served in Nursing Homes by Payer Type and Constrained Status

(a) Medicare (b) Medicaid



Note: Trends are computed using data from the Medicare and Medicaid Statistical Supplement for the study period.

Figure 6: Effects of Medicare Fee Increase on Nursing Facilities' Revenues

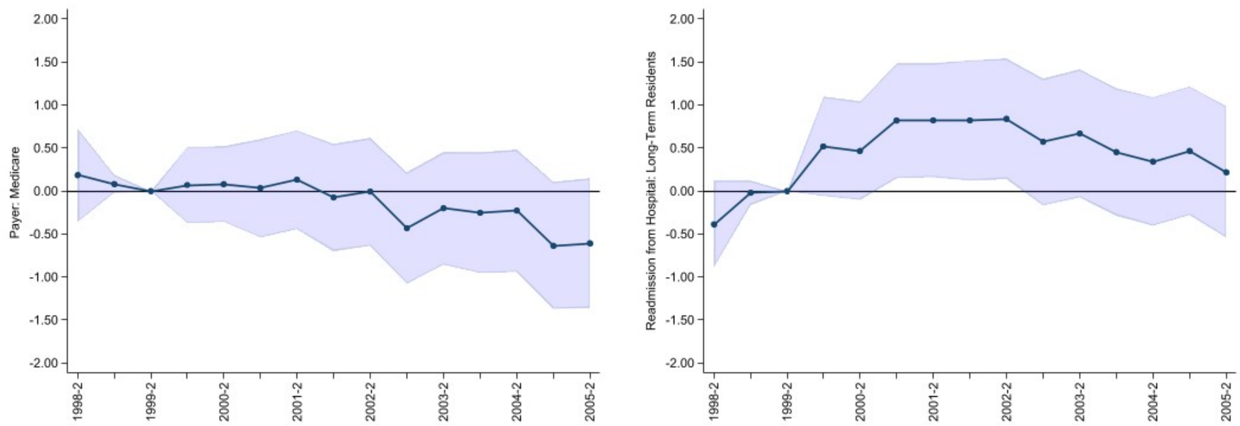


Note: The figure plots the interaction between time-to-event dummies and the price shock using facility-level information. The outcome variable is the logarithm of revenues. The information on gross revenues comes from the annual financial reports in the Medicare Cost Reports. The regression includes facility and state-by-year fixed effects. Standard errors are clustered at the area-payment level.

Figure 7: Effects of Medicare Fee Increase on Medicare Admissions and Readmissions Covered by Medicare

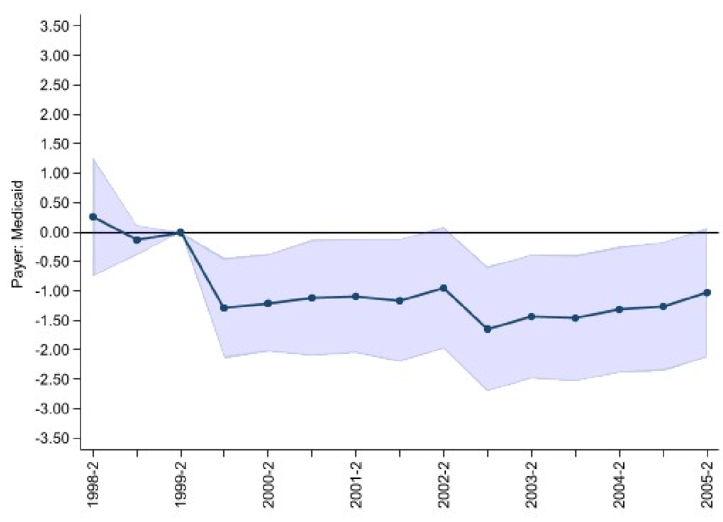
(a) New Residents

(b) Readmissions



Note: The figure plots the interaction between time-to-event dummies and the price simulated shock. The outcome variable is the number of admissions or readmissions at the facility-half year level, which comes from the Minimum Data Set. The regression includes facility and state-by-year fixed effects and county covariates such as the unemployment rate, per-capita income, and the number of assisted living facilities. Standard errors are clustered at the area-payment level.

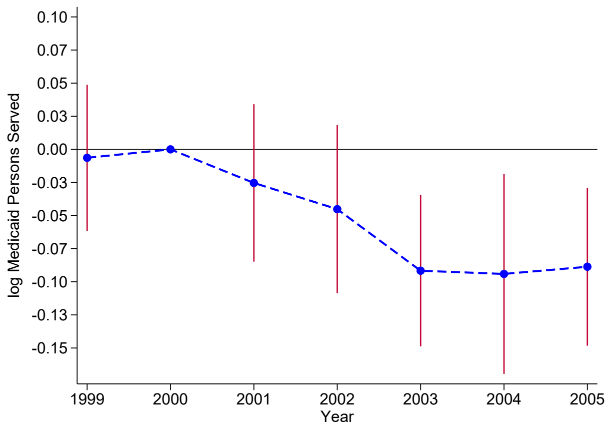
Figure 8: Effects of Medicare Fee Increase on Medicaid Admissions



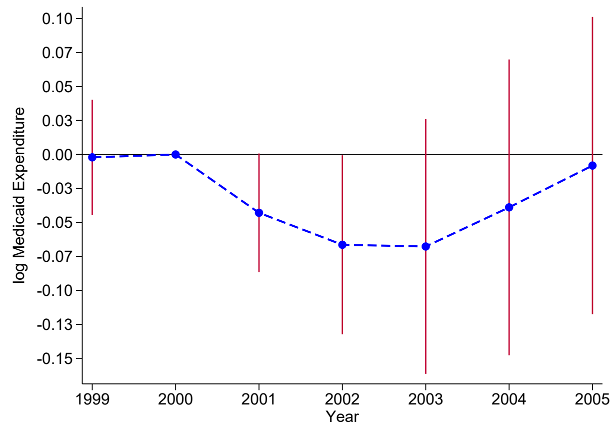
Note: The figure plots the interaction between time-to-event dummies and the price simulated shock. The outcome variable is the number of admissions or readmissions at the facility-half year level, which comes from the Minimum Data Set. The regression includes facility and state-by-year fixed effects and county covariates such as the unemployment rate, per-capita income, and the number of assisted living facilities. Standard errors are clustered at the area-payment level.

Figure 9: Event–Study Plot of the DD Effects of the Increase in Medicare Fees on Medicaid Beneficiaries Served and Medicaid Expenditure in Nursing Facilities (State–Level Analysis)

(a) Beneficiaries



(b) Expenditure



Note: Figure plots the interaction between year dummies and the constrained indicator from Equation 4.The estimates are weighted by state populations of individuals over 75 years of age in the pre–period. Standard errors are clustered at the state level.

Table 1: Medicare Fee Schedule and Increments Implemented in BBRA and BIPA

	(1)	(2)	(3)	(4)	(5)
	Time Weights		Average Fee	Price Increase	
	Nursing	Therapy	FY 1999	BBRA	BIPA
Rehabilitation 14 RUGs	1.04	1.21	$269.56	4%	6.7%
Medium–Care 12 RUGs	1.07	0	$184.39	20%	
Low–Care 18 RUGs	0.61	0	$134.06	4%	

Source: Author's calculations using information obtained from Federal Register issues for FYs 1999 through 2005.

Table 2: Relationship Between Occupancy Rates and the Number of CON/Moratorium Laws

	(1)	(2)
No. Restrictions	0.010**	
	(0.004)	
Constrained		0.049***
		(0.015)
Mean	0.86	
Observations	49	
F statistic	5.52	10.99

Note: The table reports coefficient estimates from linear models. The dependent variable is the occupancy rate in a $state \times year$. The independent variables are the total number of CON/Moratorium laws (Column 2), and the binary indicator for states with 4 or more CON/Moratorium laws (Column 3).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Summary Statistics

	Mean	Standard Deviation	Minimum	Median	Maximum
Panel A: Medicare Fee for Nursing Facilities					
Medicare Price$_{1998}$	228.16	26.88	188.31	223.79	326.72
$\widehat{\Delta\%P}$	0.23	0.02	0.14	0.23	0.33
Yearly Revenue[a]	\$ 6,766,607	\$28,418,934	\$0	\$5,395,627	\$2,441,358,336
Panel B: Admission New Residents (Semester)					
Medicaid[b]	6.08	6.98	0	4	175
Medicare	32.54	32.23	0	23	457
Self-Pay	3.86	4.66	0	2	117
Panel C: Readmissions					
From the Hospital[b]	18.12	15.30	0	14	317
Other	7.78	10.32	0	4	239
Panel D: Fraction of Admissions Projected to Be of Long Duration					
Medicaid[b]	0.66	0.33	0	0.73	1
Medicare	0.36	0.27	0	0.29	1
Self-Pay	0.66	0.34	0	0.74	1
Panel E: Fraction of Long-Term Residents Enrolled in Medicare					
Medicare Enrollees[b]	0.864	0.167	0	0.918	1
Panel F: State Aggregates (Year)					
Medicare Patients Served[c]	29,578	27,332	758	20,836	120,507
Medicare Expenditure	\$429,937	\$461,093	\$14,988	\$277,277	\$2,587,323
Medicaid Patients Served	31,132	29,613	893	23,067	126,159
Medicaid Expenditure	\$662,664	\$654,407	\$15,062	\$445,289	\$3,070,522

Note: The table presents summary statistics for the price shock and other relevant variables.
[a] Figures obtained from Medicare Cost Reports.
[b] Figures obtained from the Minimum Data Set.
[c] Figures obtained from the Medicare and Medicaid Statistical Supplement.

Table 4: Effects of Medicare Fee Increase on Nursing Facilities' Revenues[a]

	(1)
$\Delta P_f \times Post_t$	1.633**
	(0.703)
Mean	$5,673,201
Observations	84,068
Facilities	10189
Clusters	10189

Note: The table reports estimates from a linear model of the logarithm of revenue on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisted living facilities. Standard errors are clustered by area-of-payment.

[a] Information comes from the Medicare Cost Reports, which are collected annually. Not all facilities report their financial statements, so the number of facilities is different from the tables using the Minimum Data Set.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: DD Effects of Medicare Fee Increase on Readmissions by Source

	(1) Long-Term Residents [From Hospital]	(2) Other Readmissions
$\Delta P_f \times Post_t$	0.687**	0.368
	(0.325)	(0.530)
Mean	13.25	4.47
Observations	153187	153187
Facilities	10278	10278
Clusters	10278	10278

Note: The table reports estimates from Poisson models. Each cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisted living facilities. Standard errors are clustered by area-of-payment.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: DD Effects of Medicare Fee Increase on Admissions by Payer Type

	(1) Medicaid	(2) Medicare	(3) Self-Pay
$\Delta P_f \times Post_t$	-1.288***	-0.288	0.374
	(0.411)	(0.283)	(0.414)
Mean	6.00	26.26	4.59
Observations	153187	153187	153187
Facilities	10278	10278	10278
Clusters	10278	10278	10278

Note: The table reports estimates from Poisson models. Each cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisted living facilities. Standard errors are clustered by area-of-payment.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: DD Effects of Medicare Fee Increase on Medicaid Admissions and Readmissions from Hospital by Capacity-Constrained Status

	(1)	(2)	(3)	(4)
	Medicaid Admissions		Readmissions from Hospital of Long-Term Residents	
	Capacity-Constrained	Unconstrained	Capacity-Constrained	Unconstrained
$\Delta P_f \times Post_t$	-1.974***	-0.593	0.972**	0.414
	(0.652)	(0.518)	(0.475)	(0.444)
Mean	5.61	6.34	14.18	12.44
Observations	71876	81311	71876	81311
Facilities	4802	5476	4802	5476
Clusters	4802	5476	4802	5476

Note: The table reports estimates from Poisson models. Each cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisted living facilities. Standard errors are clustered by area-of-payment.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: DD Effects of Medicare Fee Increase on Medicaid Admissions and Readmissions from Hospitals by Facility Type

	(1)	(2)	(3)	(4)	(5)	(6)
	Nurses Per Resident		Deficiencies		Profit Status	
	Low	High	Low	High	Profit	Not-For-Profit
Panel A: New Medicaid Resident Admissions						
$\Delta P_f \times Post_t$	-0.746	-1.804***	-0.524	-1.716***	-1.291***	-1.036
	(0.516)	(0.654)	(0.614)	(0.547)	(0.447)	(1.013)
Mean	6.24	5.76	5.04	6.89	6.55	3.95
Panel B: Readmission from Hospitals of Long-Term Residents						
$\Delta P_f \times Post_t$	0.620	0.728*	0.745	0.695	0.695*	0.844
	(0.496)	(0.433)	(0.456)	(0.450)	(0.373)	(0.630)
Mean	12.27	14.24	12.08	14.35	13.57	12.07
Observations	76525	76662	74178	79008	120736	32451
Facilities	5131	5147	4967	5311	8103	2175
Clusters	5131	5147	4967	5311	8103	2175

Note: The table reports estimates from Poisson models. Each cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisted living facilities. Standard errors are clustered by area-of-payment.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX

Table A1: Certificate-of-Need Laws and Moratorium Rules by State (1998)

State	Nursing Homes		Other Long Term Care Services							
	Moratorium[a]	CON[b]	Moratorium HHA[c]	CON HHA	Moratorium Hospital Bed Conversion	CON Hospital Bed Conversion	Moratorium Residential Care[d]	CON Residential Care	CON Adult Day Care	Total Restrictions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Alabama	0	1	0	1	0	1	0	0	0	3
Alaska	1	1	0	1	0	1	0	0	0	4
Arizona	0	0	0	0	0	0	0	0	0	0
Arkansas	0	1	0	1	0	0	0	1	0	3
California	0	0	0	0	0	0	0	0	0	0
Colorado	1	0	0	0	1	0	0	0	0	2
Connecticut	1	1	0	0	1	1	0	1	0	5
Delaware	0	1	0	0	0	1	0	0	0	2
D.C.	0	1	0	1	0	1	0	1	1	5
Florida	0	1	0	1	0	1	0	0	0	3
Georgia	0	0	0	0	0	1	0	1	1	3
Hawaii	0	1	0	1	0	1	0	1	0	4
Idaho	0	0	0	0	0	0	0	0	0	0
Illinois	0	1	0	0	0	1	0	1	0	3
Indiana	0	1	0	0	0	0	0	0	0	1
Iowa	0	1	0	0	0	1	0	0	0	2
Kansas	0	0	0	0	0	0	0	0	0	0
Kentucky	0	1	0	1	0	1	0	1	1	5
Louisiana	1	1	0	0	0	0	0	0	0	2
Maine	1	1	0	0	1	1	0	0	0	4
Maryland	0	1	0	1	0	1	0	1	0	4
Massachusetts	1	1	0	0	1	1	1	1	0	6
Michigan	1	1	0	0	0	1	0	0	0	3
Minnesota	1	0	0	0	1	0	1	0	0	3
Mississippi	1	1	1	1	1	1	1	1	0	8
Missouri	1	1	0	0	1	1	1	1	0	6
Montana	0	1	0	1	0	1	0	0	0	3
Nebraska	0	1	0	0	0	0	0	0	0	1
Nevada	0	0	0	0	0	0	0	0	0	0

Table A1 continued from previous page

State	Nursing Homes		Other Long Term Care Services							
	Moratorium[a]	CON[b]	Moratorium HHA[c]	CON HHA	Moratorium Hospital Bed Conversion	CON Hospital Bed Conversion	Moratorium Residential Care[d]	CON Residential Care	CON Adult Day Care	Total Restrictions Restrictions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
New Hampshire	1	1	0	0	0	1	0	0	0	3
New Jersey	0	1	0	1	0	1	0	1	0	4
New Mexico	0	0	0	0	0	0	0	0	0	0
New York	0	1	0	1	0	1	0	0	1	4
North Carolina	0	1	0	1	0	1	1	0	0	4
North Dakota	1	0	0	0	1	0	1	0	0	3
Ohio	1	1	0	0	0	0	0	0	0	2
Oklahoma	0	1	0	0	0	1	0	0	0	2
Oregon	0	1	0	0	0	1	0	0	0	2
Pennsylvania	0	0	0	0	0	0	0	0	0	0
Rhode Island	1	1	0	0	1	1	0	0	0	4
South Carolina	0	1	0	1	0	1	0	0	0	3
South Dakota	1	0	0	0	1	0	0	0	0	2
Tennessee	0	1	0	1	0	1	0	1	0	4
Texas	1	0	0	0	1	0	0	0	0	2
Utah	1	0	0	0	0	0	0	0	0	1
Vermont	0	1	0	1	0	1	0	1	0	4
Virginia	0	1	0	0	0	1	0	0	0	2
Washington	0	1	0	1	0	1	0	0	0	3
West Virginia	1	1	0	1	0	1	0	1	1	6
Wisconsin	1	1	0	0	1	1	0	0	0	4
Wyoming	0	1	0	0	0	0	0	0	0	1

Note: The table reports the certificate–of-need laws (CON) and/or Moratorium laws in 1998 for each state. A value of one indicates that the state had a program in place; however, the specific criteria and enforcement may vary by state. Column 10 reports the sum of columns one through nine. [a] Moratorium: prohibits the addition of any new beds.
[b] Certificate of Need Laws (CON): each state may establish its own criteria for entry of new providers, expansion of number of beds, and purchasing of new equipment, among other things related to the supply of services.
[c] Home Health Care Agencies (HHAs): agencies that serve people who need frequent medical treatment along with personal care. The service is provided in the beneficiary's home.
[d] Residential Care: facilities that provide services to individuals who do not not require skilled nursing care. They provide supportive care and supervision services and include foster care, family and group homes among others.
Source: the table summarizes information reported in Harrington et al. (1998).

Table A2: State Characteristics by CON Status (1998-2000)

		Nursing Homes			Hospital Bed Conversion			Home and Health Agencies		
	Units	No CON	CON	P-Value Dif.	No CON	CON	P-Value Dif	No CON	CON	P-Value Dif
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Nursing Home Market										
1. Occupancy Rate	%	0.851	0.865	0.171	0.837	0.876	0	0.85	0.884	0.001
		(0.009)	(0.006)		(0.007)	(0.006)		(0.006)	(0.008)	
2. Nursing Homes	100,000	48.081	48.881	0.822	53.502	45.581	0.015	53.648	38.349	0
	elderly	(2.996)	(1.895)		(2.520)	(2.006)		(1.812)	(2.602)	
3. Hospital-Based Nursing Homes	100,000	10.739	8.498	0.092	11.276	7.785	0.004	8.675	10.095	0.269
	elderly	(1.117)	(0.706)		(0.941)	(0.749)		(0.731)	(1.050)	
4. Nursing Facility Beds	100,000	4586.364	5173.726	0.043	5243.912	4855.172	0.149	5394.307	4204.835	0
	elderly	(242.716)	(153.507)		(209.815)	(166.976)		(150.092)	(215.553)	
5. Hospital-Based Nursing Facility Beds	100,000	588.624	525.916	0.508	713.251	436.534	0.001	536.033	559.919	0.793
	elderly	(79.798)	(50.469)		(66.204)	(52.687)		(52.042)	(74.740)	
6. Total Employment at Nursing Facilities	100,000	4580.923	4733.516	0.62	4806.592	4616.025	0.504	5033.754	3980.755	0
	elderly	(259.594)	(164.181)		(222.679)	(177.213)		(161.681)	(232.197)	
7. For-Profit	%	0.573	0.623	0.115	0.587	0.623	0.221	0.611	0.605	0.829
		0.027	0.017		0.023	0.018		0.018	0.025	
8. Part of a Chain	%	0.622	0.512	0	0.587	0.516	0.001	0.554	0.522	0.147
		0.018	0.011		0.016	0.013		0.013	0.018	
Panel B: Other Healthcare Markets										
9. Home and Health Agencies	100,000	54.492	49.855	0.202	52.683	50.228	0.467	53.253	46.904	0.069
	elderly	(3.060)	(1.935)		(2.637)	(2.098)		(1.982)	(2.846)	
10. Assisted Living Facilities	100,000	54.526	57.373	0.665	50.729	60.252	0.116	54.723	60.348	0.373
	elderly	(5.539)	(3.503)		(4.718)	(3.754)		(3.600)	(5.171)	
11. Adult Day Care Facilities	100,000	42.062	49.734	0.073	46.07	48.474	0.547	45.559	51.631	0.142
	elderly	(3.595)	(2.273)		(3.116)	(2.480)		(2.350)	(3.375)	
12. Short-Term and Acute Care Hospitals	100,000	24.912	21.181	0.122	25.707	20.056	0.011	21.772	23.228	0.532
	elderly	(2.026)	(1.281)		(1.714)	(1.364)		(1.329)	(1.908)	
13. Long-Term and Acute Care Hospitals	100,000	0.942	0.667	0.048	1.105	0.518	0	0.921	0.385	0
	elderly	(0.116)	(0.073)		(0.094)	(0.075)		(0.072)	(0.104)	
14. Number of States		14	37		19	32		33	18	

Table A2 continued from previous page

	Units	Residential Care			Adult Day Care			Restrictions≥4		
		No CON	CON	p–value dif	No CON	CON	p–value dif	Unconstrained	Constrained	p–value dif
		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Panel A: Nursing Home Market										
1. Occupancy Rate	%	0.852	0.886	0.001	0.856	0.921	0	0.854	0.879	0.017
		(0.006)	(0.009)		(0.005)	(0.016)		(0.006)	(0.009)	
2. Nursing Homes	100,000	49.473	46.599	0.418	49.616	37.805	0.042	51.406	41.768	0.006
	elderly	(1.891)	(2.990)		(1.648)	(5.527)		(1.846)	(2.920)	
3. Hospital-Based Nursing Homes	100,000	9.869	7.313	0.054	9.113	9.43	0.886	8.582	10.529	0.144
	elderly	(0.704)	(1.113)		(0.629)	(2.110)		(0.708)	(1.119)	
4. Beds Nursing Homes	100,000	4873.966	5335.763	0.112	5075.379	4224.364	0.076	5137.321	4677.376	0.113
	elderly	(154.350)	(244.049)		(135.827)	(455.577)		(154.361)	(244.067)	
5. Beds Hospital-Based Nursing Homes	100,000	566.485	487.202	0.402	545.117	529.382	0.92	518.705	606.652	0.352
	elderly	(50.423)	(79.726)		(44.575)	(149.511)		(50.395)	(79.681)	
6. Total Employment at Nursing Homes	100,000	4560.782	5012.758	0.141	4753.618	3973.298	0.123	4794.892	4427.484	0.232
	elderly	(163.092)	(257.871)		(143.730)	(482.085)		(163.510)	(258.532)	
7. For-Profit	%	0.592	0.651	0.069	0.611	0.584	0.607	0.619	0.584	0.269
		0.017	0.027		0.015	0.051		0.017	0.027	
8. Chain-Owned	%	0.559	0.505	0.018	0.547	0.507	0.295	0.572	0.473	0
		0.012	0.019		0.011	0.036		0.012	0.018	
Panel B: Other Healthcare Markets										
9. Home and Health Agencies	100,000	52.874	46.942	0.102	51.543	47.086	0.458	53.205	46.117	0.05
	elderly	(1.928)	(3.049)		(1.713)	(5.746)		(1.921)	(3.037)	
10. Assisted Living Facilities	100,000	62.253	42.325	0.002	58.149	38.677	0.071	55.528	59.139	0.582
	elderly	(3.392)	(5.363)		(3.057)	(10.253)		(3.502)	(5.537)	
11. Adult Day Care Facilities	100,000	48.392	45.416	0.489	47.355	49.637	0.748	44.239	55.799	0.007
	elderly	(2.295)	(3.629)		(2.027)	(6.797)		(2.241)	(3.543)	
12. Short-Acute Care Hospitals	100,000	23.817	18.323	0.022	22.205	22.72	0.898	21.467	24.199	0.258
	elderly	(1.269)	(2.006)		(1.139)	(3.821)		(1.286)	(2.033)	
13. Long-Acute Care Hospitals	100,000	0.78	0.661	0.396	0.754	0.652	0.657	0.891	0.382	0
	elderly	(0.074)	(0.117)		(0.066)	(0.220)		(0.071)	(0.112)	
14. Number of states		36	15		46	5		33	18	

Source: I obtain CON laws from Harrington et al. (1998), and compute statistics using information from the county business pattern, the Online Survey, Certification and Reporting (OSCAR), and Medicare Cost Reports.

Table A3: DD Effects of Medicare Fee Increase on Log(Admissions) by Payer

	(1) Medicaid	(2) Medicare	(3) Self-Pay
$\Delta P_f \times Post_t$	-0.906***	-0.336	0.336
	(0.282)	(0.253)	(0.269)
Mean	6.92	26.97	5.57
Observations	133144	150595	120610
Facilities	10222	10277	10181
Clusters	10222	10277	10181

Note: The table reports estimates from linear models. Each cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisting living facilities. Standard errors are clustered by area-of-payment.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4: DD Effects of Medicare Fee Increase on Log(Readmissions) by Source

	(1) Long-Term Residents [From Hospital]	(2) Other Readmissions
$\Delta P_f \times Post_t$	0.510***	0.215
	(0.160)	(0.255)
Mean	13.25	4.47
Observations	153187	153187
Facilities	10278	10278
Clusters	10278	10278

Note: The table reports estimates from linear models. Each table cell corresponds to a separate regression of the dependent variable on the continuous DD estimator, state-by-year fixed effects, and facility fixed effects. I also include time-varying county covariates such as per-capita income, unemployment rate, and the number of assisting living facilities. Standard errors are clustered by area-of-payment.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Effects of Medicaid HCBS Participants on Medicaid Nursing Facilities Residents Using Lags and Leads (State-Level Analysis)

	(1)	(2)	(3)	(4)
Log(HCBS(t-2))	0.091			
	(0.057)			
Log(HCBS(t-1))	-0.005	0.030	0.038	0.029
	(0.036)	(0.031)	(0.027)	(0.032)
Log(HCBS(t))			-0.016	0.003
			(0.029)	(0.027)
Log(HCBS(t+1))				-0.044
				(0.036)
Observations	240	288	288	288
Period	2001-2005			

Note: The dependent variable is the logarithm of Medicaid person served in nursing homes. Each column is a separate regression of the dependent variable on state fixed effects, year fixed effects and the corresponding lags and leads. I use weights in all regression and clustered the standard errors at the state level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$