UNDERSTANDING NONPROFIT AND GOVERNMENT OWNERSHIP: EVIDENCE FROM NURSING HOMES IN THE COVID-19 PANDEMIC*

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Abstract

This paper explores the differences in incentives and thus behavior between for-profit and not-for-profit firms. I investigate a terrible choice nursing homes faced during the pandemic: isolating residents prevents deaths from COVID-19, but increases non-COVID deaths by aggravating mental illnesses such as dementia. I explore how ownership structure led to differences in isolation measures taken and consequently health outcomes. I model decisions regarding isolation measures as a trade-off between profits and satisfying the demands of staff, with not-for-profit managers more constrained in how they consume profits. The model predicts that not-for-profit facilities will have more restrictive isolation measures and consequently lower COVID-19 cases. Using cell phone location data, I find that not-for-profit facilities implemented more restrictive isolation measures during the pandemic and thus had fewer COVID-19 cases and deaths. However, not-for-profit ownership is predictive of substantially more non-COVID deaths, such that they had more total deaths than for-profit facilities.

JEL codes: L33, L31, D23, I11

Keywords: firm behavior, nonprofit organizations, nursing homes, ownership structure

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1 Introduction

Nursing home residents were disproportionately affected by COVID-19. About 20% of those who died of COVID-19 resided in nursing homes, even though only 0.46% of the population live in nursing homes.[1] The impact of COVID-19 on nursing homes was severe and widely covered by the media to the extent that nursing home aversion increased substantially after the pandemic (Achou et al., 2022). An important decision nursing homes faced during the pandemic was regarding preventive measures. More restrictive isolation measures were expected to reduce the spread of COVID-19 but also to have harmful mental health effects on residents, which could result in more non-COVID deaths. This paper explores the decisions made by nonprofit and government firms (hereinafter referred to as not-for-profit firms[2]), and how differences in nursing home ownership structure are predictive of differences in isolation measures and consequently rates of COVID-19 cases and deaths, non-COVID deaths, and total deaths during the pandemic.

I extend the model of not-for-profit decision-making from Glaeser and Shleifer (2001) and Dalton and Warren (2016) to the context of nursing homes in the COVID-19 pandemic. I argue that managers are subject to production biases particular to the context of the pandemic. The concept of production bias represents any aspect of production that managers have preferences for besides profits. Sources of production bias include more control over resources, lower effort, a desire to offer products of better quality than profit-maximizing levels, gaining favor with internal or external interest groups, among others. In the presence of production biases, managers face a trade-off between the benefits of production bias and the cost of reducing net revenue (or simply profits)[3].

Various sources of production bias may have affected nursing home managers during the pandemic. In this paper, I consider two potential sources of production bias. First, the demands from

[1] Data on COVID-19 deaths come from the Centers for Medicare and Medicaid Services and are further described in the data section of this paper. The percentage of the nursing home population relative to the US population comes from Harris-Kojetin et al. (2019).

[2] I use the term *not-for-profit* to refer to all firms that are legally not allowed to keep profits, which includes both nonprofit private firms and government-owned firms.

[3] I use the term net revenue to refer to profits because not-for-profit firms cannot legally keep profits and thus do not call it profit. So for clarity, I refer to it as net revenue but the concepts are identical.

nurses and staff, who faced high risks of contracting COVID-19, were likely a source of production bias during the pandemic. There was a clear trade-off associated with determining isolation measures for residents. Restrictive isolation measures benefited residents by decreasing their chances of contracting and dying from COVID-19. These measures, however, imposed high costs on residents by preventing them from being with their loved ones for many months, negatively affecting their mental health and potentially expediting death from other causes. Montgomery et al. (2020) surveyed nursing home residents during the pandemic. When asked about their experience, nearly all residents mentioned loneliness, depression, missing their family, and feeling as if they were in prison. One resident said, "Not allowing visits with my family for five months is inhumane." Another asked, "It's like prison. Caregivers come and go. Why can't my one family member come and go?" Thus, the costs of isolation were likely substantial on residents and their families. By contrast, restrictive isolation measures imposed a relatively lower cost on nurses and staff, since they were not isolated and could still be with their loved ones on a daily basis, and decreased the chances that they would contract COVID-19 and spread it to their family members.

Nurses and staff publicly demanded stricter isolation measures during the pandemic. Thousands of nurses went on strike several times during the pandemic demanding more protections against COVID-19 for workers. When the Centers for Disease Control (CDC) relaxed isolation guidelines in Decemeber 2021, many nurses and nurses' unions responded with protests and strikes (cite axios). Zenei Triunfo-Cortez, a registered nurse and president of National Nurses United - a labor union with more than 175,000 members - claims that nurses have fought since the beginning of the pandemic for stricter isolation measures and stronger protections against COVID-19. According to Zenei, "Our demands include optimal isolation times to prevent further COVID spread and an enforceable OSHA COVID health care industry standard to mandate our profit-driven employers, who would never do it on their own, give us optimal protections at work." She concludes by saying that "Nurses have fought every single day of this pandemic for strong protections, and we are not going to stand by while the federal government and our employers weaken those protections by the day. We are not going backward now" (cite NNU). These examples, as well as the distinct

incentives faced by nurses and residents, suggest not only that nurses preferred stricter isolation measures than residents but that many of them fought for stricter measures to be implemented.

Firm decisions over isolation measures were expected to impact profits by affecting the likelihood of residents choosing a facility. Thus, I assume that there was a profit-maximizing level of isolation. Since isolation measures imposed a relatively lower cost on nurses and staff, I assume that they preferred more isolation than the profit-maximizing level of isolation. When preferences of nurses and staff over managerial decisions differ from the profit-maximizing allocation of resources in nursing homes, managers face a trade-off between net revenue and satisfying the demands of these interest groups.

The second potential source of production bias considered in this paper is an intrinsic motivation to offer higher quality or to better comply with recommendations and regulations from government agencies (e.g., the CDC) or the scientific community[4]. Cronin and Evans (2022) suggest that nursing home managers may have an innate desire to provide better quality and to comply with mandates and medical recommendations. This compliance motivation implies that an increase in isolation measures above profit-maximizing levels could have a positive effect on the utility of managers by satisfying their desires of higher quality and compliance. In the same way that managers may face a trade off between more net revenue and satisfying interest groups, an intrinsic compliance motivation would lead managers to face a trade off between net revenue to satisfying their compliance motivation. This potential source of production bias would lead to the same predictions as an internal interest groups bias. Other production biases may have affected nursing home managers. My model requires the presence of at least one, and not necessarily more, sources of production biases. If, for example, both interest group and compliance motivation biases were present at nursing homes, these biases would reinforce each other's predicted effects.

How much net revenue are managers willing to give up to satisfy interest groups or their compliance motivation? In my model, I follow previous models of not-for-profit behavior and assume that managers at not-for-profit healthcare providers face more rapidly diminishing marginal value

[4]I hereinafter refer to this source of production bias as a compliance motivation.

from net revenue than managers at for-profit providers, because they are more constrained in how they can use the net revenue. Agency problems exist in any type of ownership structure, and both for-profit and nonprofit nursing homes are subject to production bias. Yet, my model predicts that managers in not-for-profit nursing homes are willing to trade off more net revenue to satisfy interest groups or their compliance motivation than their for-profit counterparts. Thus, not-for-profit nursing homes are expected to have more restrictive COVID-19 isolation measures than for-profit nursing homes.

More strict isolation measures were expected to decrease COVID-19 cases and thereby reduce COVID-19 deaths. However, if the mental health deterioration caused by higher levels of isolation expedites deaths from other causes, as suggested by Andrew and Rockwood (2010), Aronson (2020), Montgomery et al. (2020), Dyer et al. (2021), and Melo (2022), not-for-profit nursing homes are also expected to have higher non-COVID deaths. Furthermore, not-for-profit nursing homes are expected to have more non-COVID deaths even after these measures end. Andrew and Rockwood (2010) show that the cognitive damage caused by isolation can last for many years. Cognitive deterioration, especially among residents with Alzheimer's disease or other forms of dementia, which are over half of all residents in nursing homes (Harris-Kojetin et al., 2019), is likely to impact residents' physical health. Thus, an empirical implication from my model is that for-profit facilities will have higher COVID-19 cases and deaths but fewer non-COVID deaths.

I first examine if not-for-profit ownership is associated with more restrictive isolation measures. I use the changes in monthly visitors and visits at facilities relative to their 2019 average as an estimate of isolation measures implemented during the pandemic. These data come from SafeGraph's Patterns series, which contains cell phone tracking data for nursing homes in the United States. I find that, while nearly all facilities reduced visitors and visits in the first months of the pandemic, not-for-profit facilities reduced both substantially more than for-profit facilities. This evidence shows that not-for-profit nursing homes implemented more restrictive isolation measures during the pandemic.

I then use a negative binomial model to estimate the relationship between nursing home own-

ership and COVID-19 cases, COVID-19 deaths, non-COVID deaths, and total deaths among residents. I use the weekly data of COVID-19 outcomes at nursing homes from May 24, 2020, to March 25, 2022. I find that not-for-profit ownership is predictive of fewer COVID-19 cases and lower COVID-19 mortality rates. Not-for-profit ownership is, however, also predictive of much higher non-COVID mortality rates, such that not-for-profit nursing homes had more total deaths than for-profit nursing homes. In the first months of the pandemic, the effects of ownership structure on non-COVID deaths is small and insignificant. But after September 2020, the effects are large and significant. This pattern is consistent with the prediction that differences in non-COVID deaths are caused by the health deterioration associated with more restrictive isolation measures, because the mental health effects of isolation are likely to be delayed and long-lasting (Andrew & Rockwood, 2010).

Not-for-profit ownership is widely prevalent in many industries, especially in healthcare. Thus, it is important to understand how incentives differ among firms with distinct ownership structures. My findings and conceptual framework are important for at least two reasons. First, they offer insights into how managerial decisions at for-profit firms differ from managerial decisions at not-for-profit firms. When preferences of interest groups within firms differ substantially from the profit-maximizing managerial decisions or other forms of production bias are present, managers at not-for-profit firms are likely to deviate more from the profit-maximizing allocation of resources than managers at for-profit firms, all else being equal. Second, my findings show that decisions over isolation measures were determined, at least partially, by factors unrelated to the health of residents, such as ownership structure.

This paper contributes to a vast literature on how ownership structure affects the behavior of firms, in particular healthcare providers. Deneffe and Masson (2002), Horwitz (2007), Brickley et al. (2010), and Horwitz and Nichols (2009) offer alternative frameworks to the question of what drives the decisions of not-for-profit firms. McClellan et al. (2000), Sloan et al. (2001), Picone et al. (2002), Frank and Salkever (1994), and Eggleston et al. (2008) analyze the effects of ownership on service quality and medical costs in hospitals. Spector et al. (1998), Amirkhanyan et

al. (2008), Chou (2002), Grabowski et al. (2013), and O'Neill et al. (2003) analyze the effects of ownership on nursing home outcomes. Hirth (1999) and Duggan (2002) explore how ownership affects competition in nursing homes and hospitals, respectively. Other papers have examined how hospital ownership structure affects managerial compensation (Ballou & Weisbrod, 2003), access to care for the uninsured (Norton & Staiger, 1994), outsourcing choices (Dalton & Warren, 2016), and reactions to negative financial shocks (Dranove et al., 2017). I contribute to this literature by offering the first analysis of how ownership structure affected nursing home outcomes and by building a framework of the mechanisms for the outcomes.

I also contribute to a growing literature exploring nursing home outcomes during the COVID-19 pandemic by showing that ownership and consequent differences in isolation measures played a major role in determining COVID-19 cases and deaths, as well as non-COVID deaths. Other works have revealed other important insights about how nursing homes performed during the pandemic. Brown et al. (2021) analyze nursing homes in Ontario, Canada, and find that crowding is associated with larger and deadlier COVID-19 outbreaks. Panagiotou et al. (2021) find that increased age and impaired cognitive and physical function are independently associated with mortality among nursing home residents in the United States who contracted COVID-19. McGarry et al. (2020) show that, in the early stages of the pandemic, as many as 20% of US nursing homes reported severe shortages of personal protective equipment and staff. The effects of staff shortages are ambiguous. While the importance of adequate staffing in ensuring satisfactory health outcomes for nursing home residents is well-established (Harrington et al., 2000; Schnelle et al., 2004), more staff may facilitate transmission of an infectious disease. Indeed, McGarry et al. (2021) suggest that a higher number of unique staff was associated with more COVID-19 cases in US nursing homes, independent of the size of the facility. The paper closest to mine, in terms of the empirical analysis, is Cronin and Evans (2022). The authors show that higher-quality nursing homes are associated with fewer COVID-19 deaths, but higher non-COVID deaths during the pandemic.

Finally, I expand on a large body of work on the effects of measures — initiated by both public authorities and private entities — intended to mitigate the health impact of COVID-19.

Many governments responded to the pandemic by imposing stay-at-home orders, mask mandates, vaccine mandates, and temporarily closing certain businesses. Alfano and Ercolano (2020), Fang et al. (2020), and Herby et al. (2022) examine the effects of lockdown measures on COVID-19 outcomes. Joo et al. (2021), Karaivanov et al. (2021), and Krishnamachari et al. (2021) estimate the impact of mask mandates on COVID-19 cases and hospitalizations. Karaivanov et al. (2022), Mills and Rüttenauer (2022), and Melo (2023) examine the effect of mandatory immunization policies and vaccine uptake in several countries. Barrios et al. (2021), Cherry et al. (2021), Wright et al. (2020), and Painter and Qiu (2021) explore the determinants of pandemic rule compliance. Bullinger et al. (2021), Di Novi et al. (2022), Serrano-Alarcón et al. (2022), and Melo (2022) investigate the unintended health consequences of COVID-19 policies.

2 Model

I model managerial decision-making within not-for-profit and for-profit firms based on the framework of Glaeser and Shleifer (2001) and Dalton and Warren (2016). Managers value net revenue and production bias associated with isolation measures. I consider two sources of production bias. First, pressure from nurses and staff may be a source of bias such that managers gain utility by increasing isolation towards the isolation levels preferred by nurses and staff. Second, managers may have an intrinsic compliance or quality motivation such that they gain utility by increasing isolation measures.

Let i represent production bias associated with isolation measures. I normalize i such that $i = 0$ represents the net revenue–maximizing level of isolation. i is increasing in isolation levels. Thus, $i > 0$ implies that some net revenue was given up for production bias. In other words, i is the difference between isolation level chosen by a given nursing home and the net revenue-maximizing level of isolation. Let net revenue be a function of isolation measures and be defined as $R(i)$ such that an increase in i above zero decreases net revenue. I assume there is a net revenue-maximizing level of isolation because isolation measures would affect the likelihood of residents

and their families choosing a given facility. Let $R(i)$ be concave and single-peaked at $i = 0$. ρ is a parameter representing the manager's utility gain from the production bias associated with isolation. I assume that at least one of the production biases discussed in this paper are present, which implies that $\rho > 0$.

The objective function for a manager in a for-profit firm is

$$\max_i u(i|\rho) = f(R(i)) + \rho * i, \tag{1}$$

while the obejective function for a manager in a not-for-profit firm is

$$\max_i u(i|\rho) = v(R(i)) + \rho * i. \tag{2}$$

Managers choose the level of isolation, and thereby determine net revenue. The key distinction between for-profit and not-for-profit firms is that not-for-profit managers are not legally allowed to keep profits or distribute them to shareholders and thus are more constrained in how they can use net revenue than for-profit managers. I incorporate this ownership difference into the model by assuming that not-for-profit managers have faster diminishing returns to net revenue relative to for-profit managers. In other words, I assume that an additional dollar of net revenue is valued more by a manager at a for-profit facility than by a manager at a not-for-profit facility. Thus, let $v'(R(i)) < f'(R(i))$ for all positive values of net revenue, and let $v'(I-F)$ and $f'(I-F)$ be strictly positive.

Interest groups within a firm can influence the manager to change production in a way that benefits their members but reduces net revenue, such as offering more open workspaces, longer breaks, better equipment and furniture, or additional social events. Some of these benefits are part of workers' total compensation and thus are consistent with net revenue maximization. But other benefits can be associated with a rent-seeking process within the organization where interest groups influence the manager to shift production away from profit maximization. In the context of nursing homes during the pandemic, nurses and staff may pressure managers to implement

isolation policies that benefit them but are more strict than the net revenue-maximizing isolation measures. Alternatively, managers may have a preference for proving a higher quality service or being more compliant with medical recommendations such that they gained satisfaction from increasing isolation measures.

Note that for my model, it is not necessary for the residents' preferences to be the profit-maximizing level of isolation. Higher levels of isolation during the pandemic may have been a compensating differential for nurses and staff. This implies that the profit-maximizing isolation policy may have been more restrictive than consumers would prefer. The only assumption necessary for the model is for nurses and staff to prefer more restrictive isolation measures than the profit-maximizing measures, which allows the profit-maximizing measures to be anywhere between the preferences of residents and the preferences of staff.

Since the marginal value of a dollar is lower for a manager at a not-for-profit facility than for a manager at a for-profit facility, my model predicts that not-for-profit managers will be willing to trade off more net revenue for production bias than for-profit managers. This implies that not-for-profit managers will choose to trade-off more net revenue in order to implement isolation measures above the profit maximizing levels. More formally, I show this result by considering the return to a not-for-profit manager of a marginal increase in isolation measures from the level of isolation imposed by the for-profit manager. The return to that change is given by

$$v'(R(i^F)) * R'(i^F) + \rho = 0, \tag{3}$$

where i^F is the level of isolation chosen by managers at for-profit facilities. We know from the optimization of the for-profit manager that $R'(i^F) = \frac{-\rho}{f'(R(i^F))}$, so we can make that substitution and rewrite equation 3 as

$$v'(R(i^F)) * (\frac{-\rho}{f'(R(i^F))}) + \rho = 0. \tag{4}$$

But since $0 < v'(R(i^F)) < f'(R(i^F))$, this expression is positive, which means that the not-for-profit manager would benefit from imposing isolation measures above the level preferred by the

for-profit manager. Thus, the not-for-profit manager will choose more strict isolation measures than the for-profit manager. This result leads to proposition 1.

Proposition 1. *Managers at not-for-profit nursing homes will implement more restrictive isolation measures than managers at for-profit nursing homes.*

Since marginal returns from net revenue are lower in not-for-profit than for-profit nursing homes, not-for-profit nursing homes would give up more net revenue to gain more production bias. Production bias, in this case, may come from the utility gain associated with satisfying the demands from nurses and staff. It may also come from more strictly complying with recommendations from the medical community or providing a product perceived to be of better quality. All else equal, more restrictive isolation measures would reduce the spread of COVID-19. Thus, not-for-profit facilities are expected to have fewer COVID-19 cases and deaths than for-profit facilities, which leads to empirical implication 1.

Empirical Implication 1. *Not-for-profit nursing homes will have fewer COVID-19 cases and deaths for both residents and staff during the pandemic than for-profit nursing homes.*

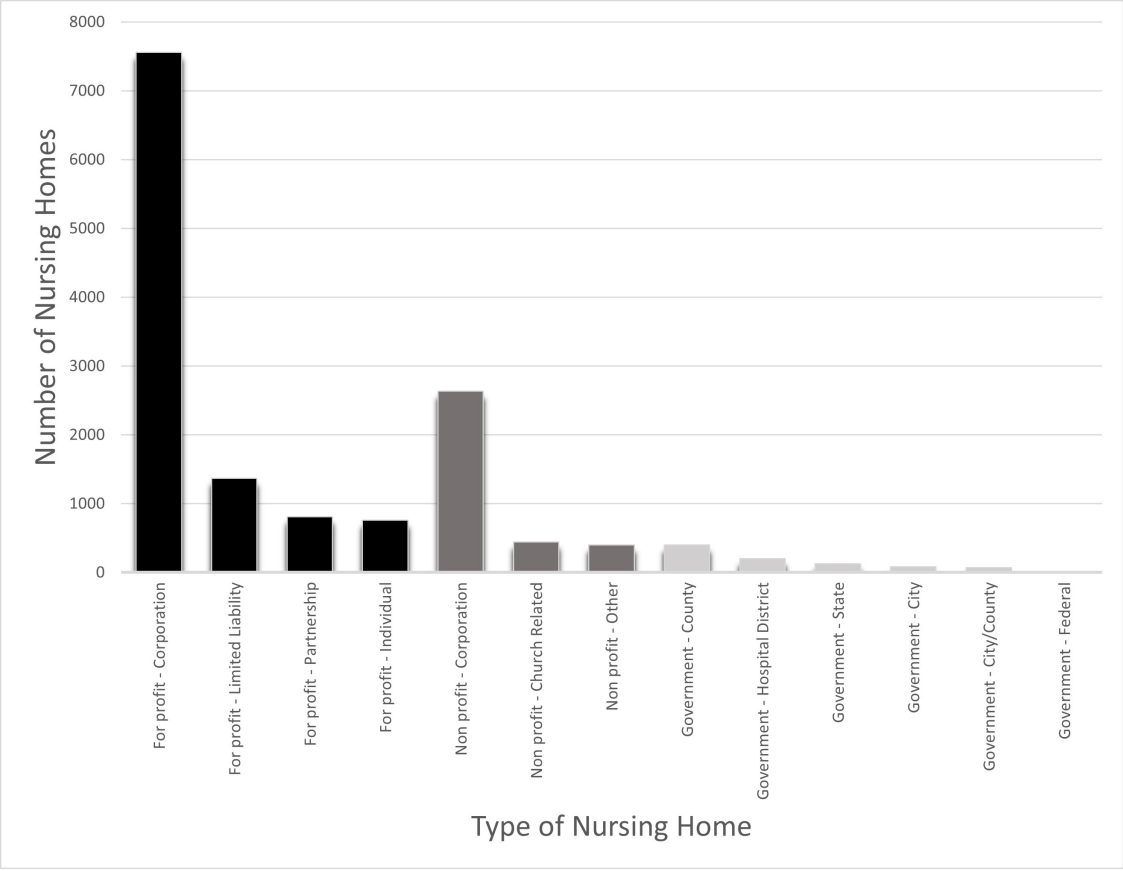
Andrew and Rockwood (2010), Aronson (2020), Montgomery et al. (2020), Dyer et al. (2021), and Melo (2022) also show that isolation measures negatively impact the mental health of residents and increased their likelihood of dying from non-COVID causes. Given that about half of the residents in nursing homes suffer from some type of dementia, the effects of isolation on residents' physical health may be substantial. This large literature on the effects of isolation on nursing homes and those with dementia along with proposition 1 imply that not-for-profit nursing homes will have more non-COVID deaths than for-profit facilities, which is empirical implication 2. The difference in non-Covid deaths is also likely to be present during and after the pandemic since the mental health deterioration caused by isolation is often long-lasting (Andrew & Rockwood, 2010).

Empirical Implication 2. *Not-for-profit nursing homes will have more non-COVID deaths during and after the pandemic than for-profit nursing homes.*

3 Data

There are many forms of nursing home ownership structure. Most nursing homes are for-profit organizations, but 23% are nonprofit and 6% are government owned. About three quarters of for-profit facilities are managed by corporations and only about 9% are managed by individuals. About 60% of nonprofit facilities are managed by nonprofit corporations. Most government-owned nursing homes are managed at the county level and are often located in rural areas. Figure 1 breaks down the number of nursing homes by type of ownership. I explore this variation in nursing home ownership and compare outcomes during the pandemic across facilities with different ownership structure to test the predictions of my model.

Figure 1: Number of Nursing Homes by Ownership Type



Notes: Black bars represent types of for-profit ownership. Dark gray bars represent types of nonprofit ownership. Light gray bars represent types of government ownership.

I use the weekly data from the Centers for Medicare and Medicaid Services (CMS) to estimate the relationship between ownership and COVID-19 outcomes. These data include COVID-19 surveillance information for nursing homes in the United States from May 24, 2020, to March 25, 2022. The primary variables of interest in this study are cumulative COVID-19 cases per 100 residents, cumulative COVID-19 deaths per 100 residents, cumulative non-COVID deaths per 100 residents, and cumulative total deaths per 100 residents.

Data on the weekly COVID-19 cases for US counties come from the Centers for Disease Control and Prevention (CDC). Data on nursing home star ratings, which represent the quality of nursing homes, come from CMS. These ratings account for an inspection rating, a service quality rating, and a staffing rating, and are aggregated by CMS into an overall quality rating. The ratings range from one star to five stars, with five stars being the highest possible rating a nursing home can receive and one star being the lowest.

All specifications in this paper control for several demographic characteristics. I include two estimates of education: percentage of adult population with a bachelor's degree and percentage of adult population without a high school diploma. The data come from the American Community Survey. The unemployment data come from the US Bureau of Labor Statistics. The county-level median household income, population, and poverty rates come from the US Department of Commerce, Bureau of the Census. The data on the percentage of residents with dementia in a given facility in 2020 and a dummy indicating whether a given nursing home had a staff shortage in 2020 come from the LTCFocus project at Brown University. Table 1 reports the descriptive statistics of all variables used in this paper for for-profit facilities, nonprofit facilities, and government facilities from May 24, 2020, to September 13, 2020.

Table 1: Descriptive Statistics of Nursing Home Facilities, Health Outcomes from 5/24/2020 to 9/13/2020

	For-Profit		Nonprofit		Government	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
COVID-19 Cases per 100 Residents	9.672	16.485	5.734	11.876	6.699	14.632
COVID-19 Deaths per 100 Residents	1.911	4.135	1.308	3.222	1.339	3.382
Non-COVID Deaths per 100 Residents	6.363	27.534	8.145	15.166	5.526	5.123
Total Deaths per 100 Residents	8.274	27.908	9.453	15.529	6.864	6.026
Five Star Dummy	.179	0.384	.378	0.485	.294	0.456
Four Star Dummy	.204	0.403	.262	0.440	.243	0.429
Three Star Dummy	.191	0.393	.161	0.367	.184	0.388
Two Star Dummy	.223	0.417	.143	0.350	.176	0.382
Local COVID-19 Cases (at County)	13.999	9.870	11.944	8.544	12.676	9.966
Urban Dummy	.741	0.438	.69	0.462	.498	0.5
Unemployment Rate	7.938	2.253	7.3	2.247	7.001	2.309
Median Income	65909.31	18175.741	66802.08	16512.21	61661.28	14563.788
Population	922064.4	1913951.443	604187.3	1254532.875	306552.4	727475.19
Poverty Rate	12.646	4.612	11.416	4.207	12.331	4.606
% of Adult Pop. without High School Diploma	11.76	5.073	9.97	4.345	11.397	5.507
% of Adult Pop. with Bachelor's Degree	29.49	11.317	30.561	11.073	25.5	10.399
% of Residents with Dementia	49.199	14.452	53.785	14.113	55.877	14.033
Staff Shortage Dummy	.164	0.370	.161	0.368	.215	0.411
Number of Facilities	8,695		2,694		629	

Table 1 reports the descriptive statistics of all variables used in this study for for-profit facilities, nonprofit facilities, and government facilities for the period from May 24, 2020 to September 13, 2020. I follow Cronin and Evans (2022) in dividing the analysis into four time periods: period 5/24/20–9/13/20 represents the summer 2020 COVID-19 wave; period 9/13/20–12/6/20 represents after the summer wave but before vaccines were distributed; period 12/6/20–4/25/21 represents when nearly all nursing home residents and staff were being vaccinated; and period 4/25/21–3/25/22 represents when all nursing home residents and staff already had the chance to be vaccinated.

I explore the data on the number of visitors and visits at nursing home facilities to test the mechanism described in empirical implication 1. The data come from SafeGraph's Patterns series and are based on cell phone tracking data drawn from anonymous mobile applications. The data range from January 2019 to August 2021. I use the data to calculate the percentage change in visitors and visits at each nursing home facility relative to their 2019 average. Figures 2 and 3 show how much for-profit and not-for-profit nursing homes reduced their numbers of visitors and visits in the first 18 months of the pandemic.

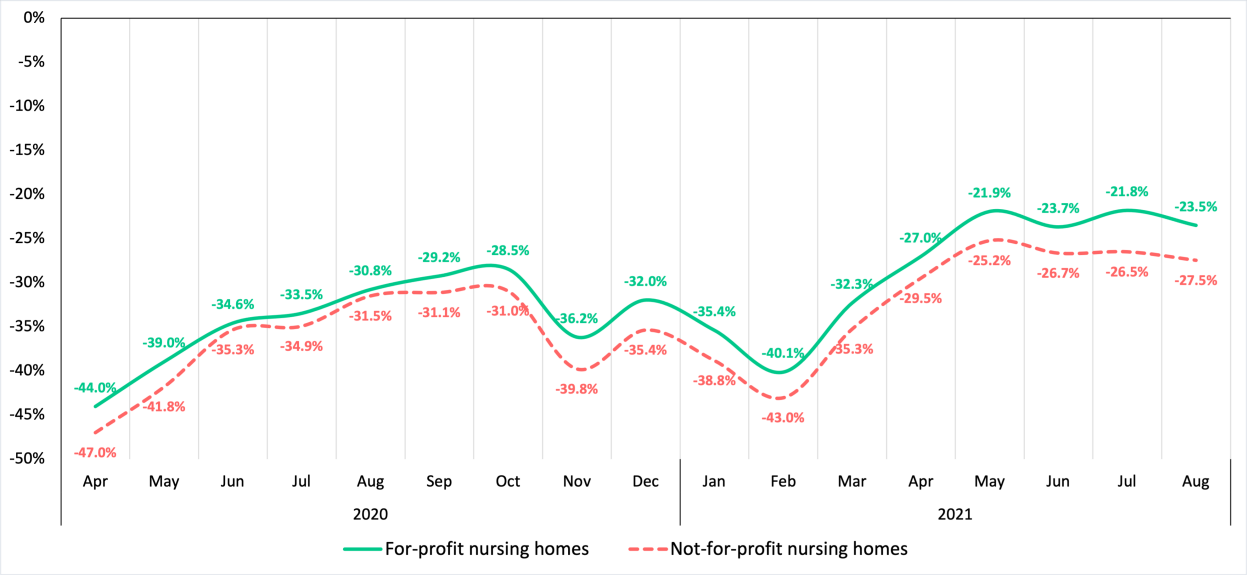
4 Empirical Strategy and Results

This section is divided into three parts. First, I test empirical implication 1 by estimating the relationship between ownership structure and isolation measures. Second, I test empirical implication 1 by estimating the relationship between ownership structure and COVID-19 cases and deaths. Third, I test empirical implication 2 by estimating the relationship between ownership structure and non-COVID and total deaths during and after the pandemic.

4.1 Ownership and Isolation Measures

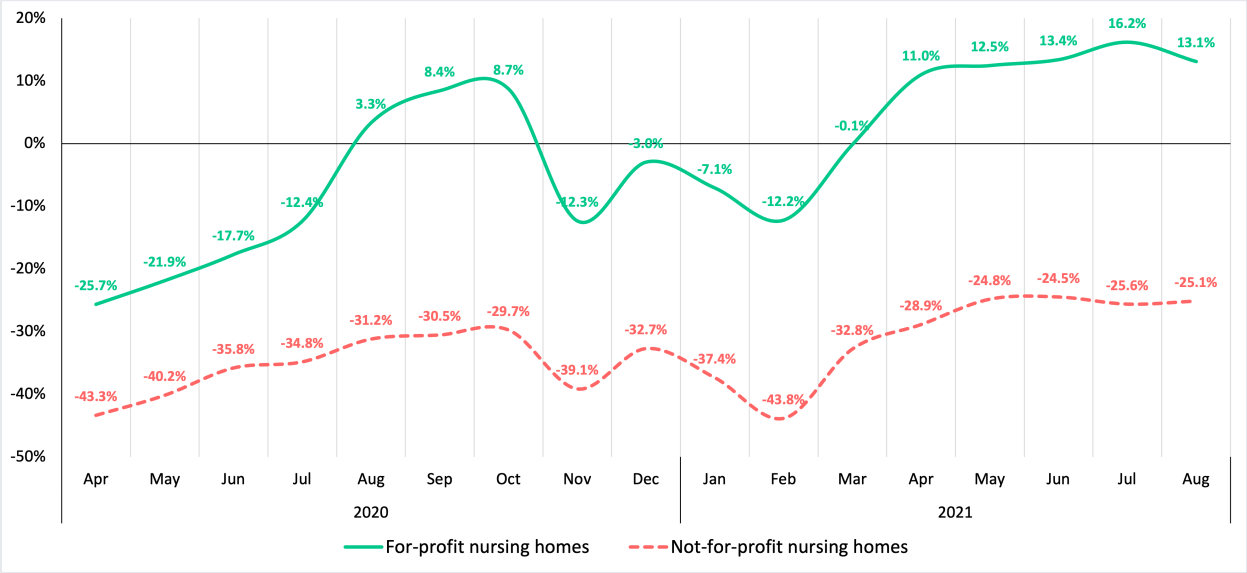
Empirical implication 1 proposes that not-for-profit facilities implemented more restrictive isolation measures than for-profit facilities during the pandemic. Figure 2 shows the average percentage change in the number of visitors at a given nursing home facility relative to each facility's 2019 average for for-profit and not-for-profit nursing homes. Figure 3 shows the same breakdown for visits, which is defined as the number of people who visited a facility for more than 10 minutes but less than 4 hours. Nearly all facilities reduced visitors and visits in the first several months of the pandemic, but these figures show that not-for-profit facilities reduced both substantially more than for-profit facilities.

Figure 2: Average % Change in Visitors Relative to 2019



Notes: The y-axis represents the average percentage change in the number of visitors at a given facility relative to the facility's 2019 average. Not-for-profit nursing homes reduced their number of visitors by an average of 47% in April 2020 relative to their respective 2019 average. Visitors are defined as a unique person who spent any time at a given nursing home. The data come from SafeGraph's Patterns series.

Figure 3: Average % Change in Visits Relative to 2019



Notes: The y-axis represents the average percentage change in the number of visits at a given facility relative to the facility's 2019 average. Not-for-profit nursing homes reduced their number of visits by an average of 42% in April 2020 relative to their respective 2019 average. Visits are defined as the number of people who visited a facility for more than 10 minutes but less than 4 hours. The data come from SafeGraph's Patterns series.

I estimate the relationship between ownership and isolation measures using the following specification:

$$Visitors_{it} = \sigma_t + \gamma_s + \beta_1 * 1[For - Profit]_{it} + X_{it}\lambda + e_{it} \quad (5)$$

In this equation, i indexes the nursing home facility, t indexes the month of the year, and s indexes the state the facility is located. $1[For - Profit]$ indicates whether a given nursing home is for-profit. σ_t represents a vector of monthly fixed effects and γ_s represents a vector of state-level fixed effects. The dependent variable, $Visitors$, represents the percentage change in visitors at a given nursing home relative to the facility's 2019 average. I apply the same specification for visits, where the dependent variable represents the percentage change in visits relative to the facility's 2019 average. X_{it} represents the matrix of nursing home quality, county-level monthly COVID-19 cases, and a series of county-level demographic characteristics—percentage of adult population with a bachelor's degree, percentage of adult population without a high school diploma, unemployment rate, median household income, population, and poverty rate. The error term is represented by e_{it}.

The results of the specifications described in equation 5 are reported in table 2. I find that for-profit facilities had a smaller decrease in visitors than not-for-profit facilities, which shows that residents in for-profit facilities were less isolated. Not-for-profit facilities decreased their visitors by 4.1 percentage points more than for-profit facilities, and this relationship is statistically significant. Not-for-profit facilities also decreased their number of visits by 11 percentage points more than for-profit facilities, although this relationship is not statistically significant. Note that the data on visits from SafeGraph contain missing data for nearly half of the facilities in 2019 and 2020, which greatly increases the standard errors and may be a potential source of measurement error. Thus, the results for visitors are much more reliable than for visits. I report both results for transparency. Overall, these numbers show that not-for-profit nursing homes implemented more restrictive isolation measures during the pandemic, which is consistent with empirical implication 1.

Table 2: Isolation Measures

	% Change in Visitors Relative to 2019 Average	% Change in Visits Relative to 2019 Average
For-Profit	4.114***	10.94
	(1.298)	(12.94)
County-Level COVID-19 Cases	-3.33e-06	0.000170
	(9.57e-06)	(0.000205)
County-Level Demographic Controls	YES	YES
Quality Dummies	YES	YES
Monthly and State Fixed Effects	YES	YES
Observations	229,058	127,271

Notes: County-level demographic controls include unemployment rates, median household income, population, poverty levels, a dummy for whether a county is urban, percentage of adult population with a bachelor's degree, and percentage of adult population without a high school diploma. A dummy variable indicating if a given nursing home is rated as five star, four star, three star, or two star is based on the Nursing Home Compare ratings from CMS. Standard errors clustered at the county level are shown in parenthesis. *** p<0.01, ** p<0.05, and * p<0.1.

4.2 Ownership and COVID-19 Outcomes

The results from table 2 show that not-for-profit nursing homes implemented more restrictive isolation measures than for-profit facilities. In Melo (2022), I argue that more restrictive isolation measures are associated with fewer COVID-19 cases and deaths but also more non-COVID deaths, particularly in the second year of the pandemic. Thus, all else being equal, not-for-profit facilities are expected to have fewer COVID-19 cases and deaths but higher non-COVID deaths.

I estimate the relationship between nursing home ownership and COVID-19 cases, COVID-19 deaths, non-COVID deaths, and total deaths using a negative binomial model. Cronin and Evans (2022), using data similar to the data used here, argue that a negative binomial model is appropriate in this context due to over-dispersion. I follow their empirical approach for the same reason. I estimate the probability of nursing home i having outcome Y_i as follows:

$$Prob(Y_i) = \frac{\Gamma(Y_i + \gamma_i)}{\Gamma(Y_i + 1) * \Gamma(\gamma_i)} * (\frac{\theta}{1+\theta})^{\gamma_i} * (\frac{1}{1+\theta})^{\gamma_i} \tag{6}$$

In this equation, $\Gamma(.)$ represents a gamma function. γ_i represents the shape parameter and θ represents the scale parameter of the gamma distribution. Let γ_i vary with X_i which is a matrix

that includes dummies representing the quality rating of nursing homes, county COVID-19 cases, fixed effects for states, the percentage of residents in a facility with dementia, a dummy indicating if a facility reported a staff shortage in 2020, the percentage of adult population with a bachelor's degree, percentage of adult population without a high school diploma, unemployment rate, median household income, population, and poverty rate. Thus, $ln(\gamma_i) = X_i\beta$. Both β and θ are estimated via maximum likelihood. All standard errors are clustered at the county level.

Table 3 reports the estimated average marginal effects of for-profit ownership on COVID-19 cases based on the specification from equation 6. The columns (1) through (4) show the results of the negative binomial model for the periods 5/24/20–9/13/20, 9/13/20–12/6/20, 12/6/20–4/25/21, and 4/25/21–3/25/22, respectively. Column (1) shows that for-profit ownership is predictive of 2.38 more COVID-19 cases per 100 residents in the first period of analysis. Note that the dependent variable is COVID-19 cases per 100 residents, and there are about 1.7 million nursing home residents in the United States. Thus, the magnitude of this relationship is economically meaningful and remains large in each time period of analysis.

Table 3: Marginal Effects of For-Profit Ownership on COVID-19 cases and Deaths per 100 Beds

Dependent Variable	(1) 5/24/20 - 9/13/20	(2) 9/13/20 - 12/6/20	(3) 12/6/20 - 4/25/21	(4) 4/25/21 - 3/25/22
COVID-19 Cases per 100 Residents	2.38***	2.89***	2.04***	4.87***
	(0.52)	(0.52)	(0.44)	(0.43)
COVID-19 Deaths per 100 Residents	0.33***	0.22**	-0.07	0.1*
	(0.11)	(0.1)	(0.12)	(0.05)

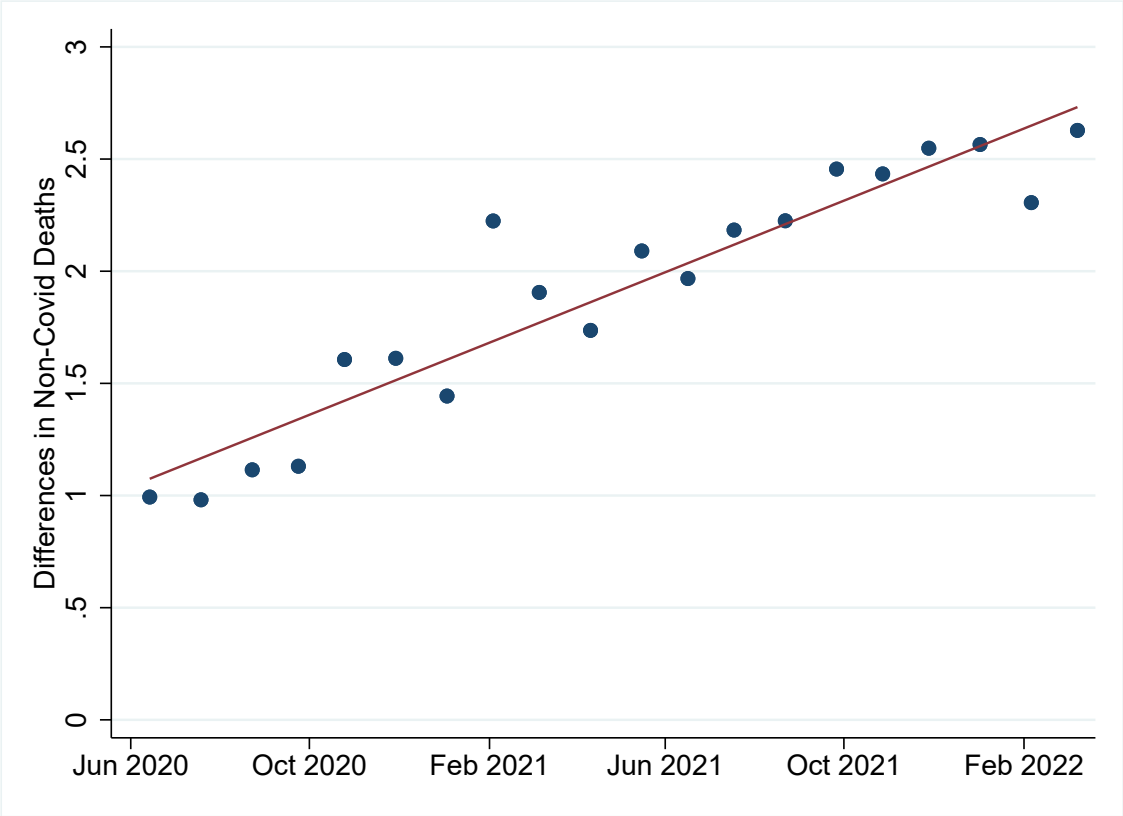
Notes: All specifications include unemployment rates, median household income, population, poverty levels, a dummy for whether a county is urban, percentage of adult population with a bachelor's degree, percentage of adult population without a high school diploma, dummies indicating if a given nursing home is rated as five star, four star, three star, or two star based on the Nursing Home Compare ratings, percentage of residents in a facility with dementia, and a dummy indicating if a facility had a staff shortage in 2020. Standard errors clustered at the county level are shown in parenthesis. *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

Table 3 also reports the estimated average marginal effects of for-profit ownership on COVID-19 deaths. Column (1) shows that for-profit ownership is predictive of an additional 0.33 more COVID-19 deaths from May 24, 2020 to September 13, 2020. Thus, for-profit facilities were expected to have one more COVID-19 death per 300 residents in the summer of 2020. The predicted difference in COVID-19 deaths between for-profit and not-for-profit facilities remains large in the second period. But both the magnitude and significance of this result become much smaller in the periods after December 6, 2020, which is when most residents already had been vaccinated. This suggests the association between ownership and COVID-19 deaths is stronger in the periods before residents had access to the COVID vaccine. These results support empirical implication 1 and show that for-profit facilities had less stringent isolation measures and consequently higher COVID-19 cases and deaths.

4.3 Ownership Structure, Non-COVID Deaths, and Total Deaths

Empirical implication 2 proposes that for-profit nursing homes had fewer non-COVID deaths than for-profit nursing homes, all else being equal. A vast literature shows that isolation negatively impacts the mental health of residents and consequently increases the likelihood of dying from non-COVID causes (Andrew & Rockwood, 2010; Aronson, 2020; Dyer et al., 2021; Melo, 2022; Montgomery et al., 2020). Furthermore, the effects of isolation are long-lasting, especially for residents with dementia (Andrew & Rockwood, 2010). Thus, if differences in non-COVID deaths between for-profit and not-for-profit facilities are caused by isolation measures, these differences are expected to be smaller in early phases of the pandemic than in later phases when residents have been isolated for many months.

Figure 4: Difference in Non-COVID Deaths per 100 Beds Between Not-for-Profit and For-Profit Nursing Homes



Notes: The y-axis represents the average number of non-COVID deaths per 100 residents in not-for-profit nursing homes minus the average number of non-COVID deaths per 100 residents in for-profit nursing homes. Each dot represents the biweekly average difference. The solid red line shows the trend in differences. The consistent positive numbers show that not-for-profit nursing homes had more non-COVID deaths from June 2020 to March 2022. The solid red line shows the trend in differences. This figure shows that not-for-profit facilities had substantially more non-COVID deaths than for-profit in early 2022 relative to 2020.

Figure 4 shows the differences in the average number of non-COVID deaths between not-for-profit nursing homes and for-profit nursing homes from June 2020 to March 2022. Not-for-profit facilities had more non-COVID deaths on average than for-profit facilities. There is also a clear upward trend in these differences, which shows that not-for-profit facilities had a much higher number of non-COVID deaths per resident in early 2022 than in 2020 and early 2021. This trend is to be expected if some of the differences are caused by differences in isolation measures.

Table 4 reports the estimated relationship between ownership and non-COVID deaths. I find no evidence of differences in non-COVID deaths between for-profit and nonprofit nursing homes from May 24, 2020, to September 9, 2020. The magnitude of the relationship between ownership and

non-COVID deaths in this period is also smaller than in all other periods of analysis. However, for-profit ownership is a significant predictor of non-COVID deaths in the later three periods of analysis. For-profit ownership is predictive of 0.51, 0.91, and 3.55 fewer non-COVID deaths per 100 residents in the second, third, and fourth period of analysis, respectively.

Table 4: Marginal Effects of For-Profit Ownership on Non-COVID and Total Deaths per 100 Beds

Dependent Variable	(1) 5/24/20 - 9/13/20	(2) 9/13/20 - 12/6/20	(3) 12/6/20 - 4/25/21	(4) 4/25/21 - 3/25/22
Non-COVID Deaths per 100 Residents	-0.26	-0.51***	-0.98***	-3.55***
	(0.25)	(0.15)	(0.19)	(0.41)
Total Deaths per 100 Residents	-0.01	-0.38*	-1.11***	-3.49***
	(0.3)	(0.2)	(0.25)	(0.43)

Notes: All specifications include unemployment rates, median household income, population, poverty levels, a dummy for whether a county is urban, percentage of adult population with a bachelor's degree, percentage of adult population without a high school diploma, dummies indicating if a given nursing home is rated as five star, four star, three star, or two star based on the Nursing Home Compare ratings, percentage of residents in a facility with dementia, and a dummy indicating if a facility had a staff shortage in 2020. Standard errors clustered at the county level are shown in parenthesis. *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

The results from table 4 are consistent with the pattern in figure 4 and the pattern expected from the mechanism described in empirical implication 2. If not-for-profit nursing homes implemented more restrictive isolation measures, these polices are likely to increase rates of depression and mental illnesses, as well as the rate of health deterioration of residents with brain-related diseases such as dementia. Thus, nursing homes with more restrictive isolation measures are expected to have more non-COVID deaths even after these measures end.

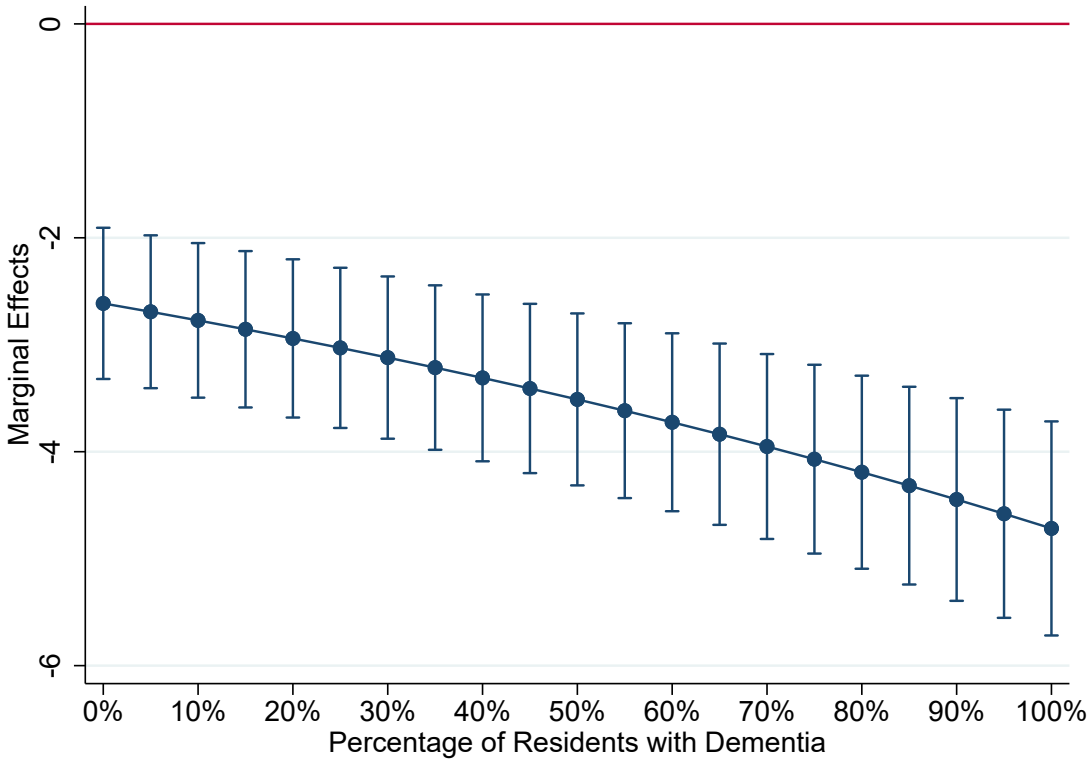
I estimate the relationship between ownership structure and total deaths during and after the pandemic. Table 4 shows that there is no evidence of differences in total deaths in the first period of the pandemic since the results are insignificant and the magnitude of the relationship is relatively small. However, I find that for-profit ownership is predictive of fewer total deaths in all periods of analysis after September 9, 2020. Moreover, the magnitude of these differences becomes substan-

tially larger in later periods. For-profit ownership is predictive of 0.38, 1.11, and 3.49 fewer total deaths per 100 residents in the second, third, and fourth periods of analysis, respectively. Not only is for-profit ownership predictive of substantially fewer non-COVID deaths, but the pattern of differences is consistent with the mechanism described in my model. The mental health deterioration associated with isolation policies in the first part of the pandemic is expected to have long-term effects on death rates.

I also test if the predicted marginal effects of ownership structure on non-COVID deaths depends on the proportion of residents with dementia. About half of nursing home residents have Alzheimer's disease or other forms of dementia (Harris-Kojetin et al., 2019). Andrew and Rockwood (2010), Bennett et al. (2006), and Kuiper et al. (2015) show that social interactions and frequent contact with family members can substantially slow the progression of symptoms. Thus, isolation is likely to disproportionately affect the physical health of residents with dementia. If differences in non-COVID deaths between for-profit and not-for-profit facilities are caused by differences in isolation, these differences are expected to be greater among facilities with a high proportion of residents with dementia.

Figure 5 shows the average marginal effects of for-profit ownership on non-COVID deaths for different percentages of residents with dementia. The results show that the difference in non-COVID deaths between for-profit and nonprofit facilities is much greater among facilities with a high percentage of residents with dementia. This further supports empirical implication 2 and the isolation measures mechanism from empirical implication 1. If differences in non-COVID deaths between for-profit and not-for-profit facilities are caused by differences in isolation measures and isolation has a larger health impact on residents with dementia, the marginal effect of for-profit ownership on non-COVID deaths is expected to be larger when the percentage of residents with dementia is higher. This is precisely the pattern I find in figure 5.

Figure 5: Average Marginal Effects of For-Profit Ownership on Non-COVID Deaths per 100 Beds



Note: This figure shows the average marginal effects of for-profit ownership on non-COVID deaths per 100 residents and their respective 95% confidence intervals by the percentage of residents with dementia.

5 Conclusion

The decision nursing home managers faced during the pandemic regarding what prevention measures to implement offers a unique scenario where demands from interest groups differ from the profit-maximizing allocation of resources. I explore these differences in my model and conclude that not-for-profit nursing homes are expected to implement more restrictive isolation measures and consequently have fewer COVID-19 cases and COVID-19 deaths. But the mental health deterioration associated with isolation is expected to cause long-term harm to the health of residents, which is likely to increase non-COVID deaths.

The results from my estimation support the propositions described in my model as well as the

patterns expected from such mechanisms. My findings show that for-profit nursing homes had less restrictive isolation measures during the pandemic than did not-for-profit nursing homes and that the increase in non-COVID deaths caused by more restrictive isolation measures outweighed the decrease in COVID-19 deaths associated with these measures. Thus, I find that for-profit nursing homes had fewer total deaths than not-for-profit nursing homes during the pandemic. Furthermore, decisions over isolation measures were affected by factors unrelated to the health of residents, such as incentives associated with different ownership structures.

A large share of healthcare services is provided by not-for-profit organizations. The conceptual framework and empirical findings in this paper provide important insights into how these firms differ from for-profit healthcare providers. Managerial decisions in for-profit firms will differ from managerial decisions at not-for-profit firms when preferences of interest groups within firms diverge substantially from the profit-maximizing managerial decision. In these situations, managers at not-for-profit organizations are likely to deviate more from the profit-maximizing allocation of resources than managers at for-profit firms, all else being equal. The framework in this paper can be applied to understand how ownership structures affect managerial decisions in other industries. Thus, this paper is an important contribution to the broader literature on the effects of ownership structure. Future research may explore how ownership differences affect decisions of firms in other industries by focusing on the impact of internal interest groups and exploring situations where the preferences of interest groups are likely to differ from the profit-maximizing allocation of resources.

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