The Welfare Effects of Single Rooms in German Nursing Homes: A Structural Approach*

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Abstract

Since two big federal states implemented a single room policy recently, we analyze the welfare effects of a single room policy in all German nursing homes. We estimate a one-level nested logit model of demand and show first, that single rooms are indeed preferred. Then, based on a bargaining model for payers and nursing home providers, we recover their marginal costs and markups. We finally analyze a counterfactual market in which only single rooms are offered. Under the scenario of unchanged total capacities, the single room policy increases consumer surplus by 1.8% and providers’ variable profits by 5.1%. Yet, if the capacities are reduced by transforming all double rooms into single rooms, consumer surplus decreases by 6.6% and providers’ variable profits by 16.2%. We also look at an increase to 80% single rooms as implemented in one of the federal states or vary the bargaining power to test for the robustness of the results. We conclude that, for positive welfare effects of a single room policy, the total supply of nursing home places must be secured by investing in new facilities.

JEL classification: I11, I18, L13, L51

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1 Introduction

Nursing homes and other forms of long-term care have been subject to much attention in recent years, from both the public and researchers alike.\(^1\) The main reason behind the increased interest is the rise in demand due to population aging and the limited availability of informal caregivers. For example, the size of the care-dependent population in Germany is projected to increase from 2.6 million in 2013 to 3 million in 2020 and to 3.5 million in 2030 (Augurzky et al., 2013). The same projection for the US foresees an increase from 12 million in 2010 to 27 million in 2050 (Commission on Long-Term Care, 2013). Since nursing homes provide support for chronic care needs, the length of stay is longer than for hospitals and varies from several months to several years. For example, the estimated average length of a nursing home stay in the US between 1992 and 2006 was 13.7 months (Kelly et al., 2010), while the corresponding estimate for the UK between 2008 and 2010 was 26.3 months (Forder and Fernandez, 2011) and 30 months in Germany from 2007 to 2014 (de Vries, 2015). Due to prolonged time spent in nursing homes, the issues of well-being and life quality of nursing home residents take precedence.

The emerging concept of long-term care is a person-centered care (Calkins and Cassella, 2007). It affirms the right to autonomy, privacy, and dignity and reiterates the importance of a self-directed care and flexible forms of living. The relevance of a person-centered care for the well-being of care recipients was acknowledged by the German federal state of Baden-Wuerttemberg, in which a single room policy in nursing homes is to be implemented by 2019.\(^2\) The federal state of North Rhine-Westphalia has followed suit, with the regulation that at least 80% of nursing home places must be provided in single rooms by July 2018.\(^3\) It is possible to share one bathroom, though.

The policy mandating exclusively single rooms is controversial. Although it increases nursing home residents’ well-being, it is likely to entail higher prices. Living in a single room is associated with more privacy, a higher satisfaction, and a range of health benefits. Available studies suggest that single rooms are among the most desired characteristics of a nursing home (Lawton and Bader, 1970; Mosher-Ashley and Lemay, 2001; Calkins and Cassella, 2007). Research into acute care settings reports that residents living in single rooms have undisturbed communication with staff and visitors (Chaud-

\(^1\)Long-term care refers to services aimed at providing assistance to individuals who, owing to a physical, psychological, or mental disease, require a significant amount of support to carry out the recurring activities of everyday life for a minimum of six months (SGB XI §14).


hury et al., 2005), and tend to express high satisfaction with their current living arrangement (Pinquart and Burmedi, 2004). The key clinical benefits of single rooms include a lower prevalence of infections (Drinka et al., 2003; Coleman, 2004), and less negative sleep patterns (Schnelle et al., 1999).

The downside of transforming a double room into single rooms comprise high transformation costs and potential capacity reductions. This might jeopardize the quality and provision of care. German nursing home providers warned of the detriments of this legislation including a deteriorated financial position and, possibly, a market exit. To countervail the negative effects of the reforms, both federal states grant investment subsidies and allow for deadline extensions.

The average share of nursing home places provided in single rooms in the period 2007 to 2009 was 0.58. Figure 1 illustrates the regional distribution of single rooms at county-level over time. Increasing this share to 1 has different welfare effects, which depend on the corresponding total capacity changes. The simulation of the welfare effects of a single room policy is therefore an empirical issue.

In this study, we evaluate welfare outcomes in a counterfactual nursing home market with single rooms only, and compare it with the status quo. We contribute to the sparse literature on the value of privacy in nursing homes and to a broader strand of literature on choice and welfare in the long-term care market. We are the first to estimate a structural model of demand and supply for inpatient long-term care.

Our methodological approach is based on Berry (1994) and builds on recent empirical studies modeling individual behavior in health care markets (Bundorf et al., 2009; Varkevisser et al., 2012; Werner et al., 2012; Gowrisankaran et al., 2015). These studies employ structural econometric models, which are better-suited to capture various market complexities. Yet, in contrast to them, we circumvent the usage of arbitrary quality criteria, such as staff-to-residents ratios or measures defined by the regulatory authorities. Instead, we take a more direct approach by exploring the welfare effects of a change in one crucial dimension of a nursing home. Care-dependency needs are evaluated based on a

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7The extent of subsidies and the exact implementation costs are unknown. Therefore, our analysis is limited to a counterfactual market (where all parameters, with the exception of the share of single rooms, remain unchanged) and focuses on changes in the welfare of consumers, who are the primary target of this policy change.
uniform procedure, which enables the comparison between the care recipients. The potential market comprises the entire care-dependent population in a county. The outside option includes ambulatory and informal long-term care.

We apply a one-level nested logit model of demand and use the nursing home ownership type as the nesting criterion, distinguishing between for-profit and non-profit facilities. This grouping structure reflects the individual heterogeneity of preferences. On the supply side, we recover the marginal costs and markups using a bargaining model between providers and payers, which reflects the real price-setting mechanism in Germany. Furthermore, this approach, unlike the often-used Nash-Bertrand competition model, generates positive marginal costs (Gowrisankaran et al., 2015).

Finally, our methodological approach allows us to directly compare the welfare of the nursing residents in different policy regimes with respect to the single room share. There are two studies which use structural approaches to identify welfare effects in nursing home markets (Lin, 2015; Ching et al., 2015). While Lin (2015) looks at the effects of competition on quality modeling supply-side decisions by endogenizing quality choice in a dynamic setting (demand-side decisions are not explicitly modeled). Ching et al. (2015) are the first to analyze the effects of capacity constraints on the rationing of Medicaid patients. Exploiting the price differences between Medicaid and private payers, they estimate that the benefits of satisfying the demand by Medicaid patients would be nearly offset by the additional costs. In both studies, there is no bargaining between providers and payers and they do not look at differences between single and double rooms.

In addition to analyzing the effects of lodging single rooms in nursing homes, the literature on long-term care explores the effects of assisted living concepts (Shura et al., 2010; Corazzini et al., 2015), and the excessive use of medication (Hughes and Lapane, 2005; Alanen et al., 2006; Stroka, 2016) on the well-being of the nursing home residents. Yet, these studies are descriptive and/or are based on anecdotal evidence. Other questions on the research agenda include the impact of public quality evaluations and staffing standards on the long-term care quality (Mukamel et al., 2008; Park and Stearns, 2009; Grabowski and Town, 2011; Mukamel et al., 2012; Lin, 2014; Herr et al., 2016), demand (Grabowski and Town, 2011; Werner et al., 2012), and the relationship between quality, prices, and competition (Grabowski, 2004; Forder and Allan, 2014; Herr and Hottenrott, 2016; Lin, 2015). However, these studies consider neither the welfare of the nursing home residents, nor the overall welfare implications of regulatory interventions.

Our dataset is a comprehensive sample of all German nursing homes covering two years, which enables us to exploit the time-variation in demand to identify consumer preferences, address the endogeneity of prices and, finally, gain additional insights into the functioning of a large and growing, but relatively unresearched market.
In the first stage, we estimate the mean own-price elasticity of nursing home demand at -0.752. The cross-price elasticities across different nursing homes range between 0.004 and 0.046. In the second stage, we recover the marginal cost and markups. Finally, we simulate the equilibrium prices and market shares in a counterfactual market with single rooms only.

Assuming a symmetric bargaining power between providers and payers, we explore three implementation scenarios: a) constant capacities, which are secured either by expanding the facilities or, if possible, by splitting double rooms into singles; b) reduced capacities, whereby double rooms are transformed into singles without being divided; c) reduced capacities, whereby 50% of double rooms are transformed into singles by being divided and 50% without being divided. In addition, we evaluate scenarios d) and e), which are equivalent to c), but with the payers’ bargaining power of 2/3 and 1/3, respectively. The single room policy increases the attractiveness of nursing homes relative to other forms of long-term care. Yet demand utility increases only under scenario a) with constant total capacities. In this case, the average share of informal and outpatient/ambulatory care (the outside option) declines from 71.1% to 69.2%, whereby consumer surplus increases by 1.8% and providers’ variable profits by 5.1%. The high capacity reductions under the second scenario b) raise the average market share of the outside option to 75%. Consumer surplus decreases by 6.6% and providers’ variable profits by 16.2%, implying that the negative welfare effects of lower capacities outweigh the positive effects of single rooms. Under the most realistic scenario c), the average share of the outside option increases to 72%, which leads to a 2.6% decline in consumer surplus and a 5.5% drop in providers’ variable profits. Under scenario d), a decline in consumer surplus is 2.4% and 35.1% in providers’ variable profits while in scenario e) consumer surplus decreases more while providers gain compared to status quo due to their higher bargaining power. Hence, assuming symmetric bargaining powers, the policy mandating exclusively single rooms is welfare-enhancing for both consumers and providers only if the supply of nursing home places remains unchanged. Welfare effects for providers are pronouncedly negative if their bargaining power is low.

2 The German long-term care market

The German long-term care system is organized around the principle “Prevention and rehabilitation before care, outpatient care before inpatient care, and short-term care before full-time inpatient care” (SGB XI §3), in an effort to enable the care recipients to remain in their familiar environment for as long as possible. Inpatient care comprises short- and long-term nursing home care, whereas short stays are limited to a period of
four weeks per year. Therefore, nursing home entry is supposed to take place only after all other care options have been exhausted. As of 2013, 30.6% of the care-dependent population were receiving full-time inpatient care, while 23.9% used the outpatient care services (Augurzky et al., 2015). Care-dependency needs are externally evaluated by the Medical Review Board of the Statutory Health Insurance based on the assistance necessary to perform the activities of daily living (ADL). An individual is classified as care-dependent if she requires assistance with at least two basic ADL, which include personal hygiene, feeding and mobility, and one instrumental ADL, which is related to household chores.

Long-term care insurance (LTCI) in Germany has been mandatory since 1995 and follows the health insurance. Members of the public health insurance schemes are automatically enrolled into public LTCI, and those privately insured are obliged to purchase private LTCI offering the same set of benefits. In 2013, public LTCI included 86% of the population, while the rest were privately insured. In the event of care-dependency, LTCI beneficiaries are entitled to a lump-sum allowance, which varies depending on the form of care and the level of care-dependency. The LTCI allowance for inpatient care usually covers only a fraction of the total price (45–47%, on average). It is a fixed price for care, not covering accommodation or nutrition or extra quality of care. Based on the total number of hours of assistance needs, care-dependents are sorted into three levels, as shown in Table A1. The table also presents detailed data on public LTCI allowances by care needs. If neither the care recipients nor their families are able to bear the entire amount of the out-of-pocket payments, social insurance funds step in.

Prices for inpatient and outpatient long-term care are negotiated between providers and payers on behalf of LTCI beneficiaries (SGB XI §85). Payers are organized at the federal state-level and include social insurance and LTCI funds. Other parties may include state-level associations of nursing home owners (for example, Red Cross, Caritas, Diakonie), representatives of the local authority districts, and private health insurance funds. Prices are negotiated for a certain period in advance and are valid for at least one year. Negotiations are initiated following the disclosure of the past, current, and

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8 Care recipients are entitled to short-term nursing home stays when the outpatient care becomes insufficient or unavailable for a period of time. This is usually the case during the post-operative recovery, caregivers’ vacation or search for a nursing home place for a long-term stay.


10 Private LTCI funds must provide at least the same set of benefits as the public ones. Supplementary LTCI is voluntary and in our sample period (2007–2009) of minor importance (1.2-1.5 million contracts – one person can have more than one contract and benefits may be small – out of 79m insureds).

11 Since 2017, the system distinguishes between 5 degrees instead of 3 levels. That time period is not covered by our data.

12 Social insurance funds bore 42% of total expenses for inpatient care in 2013 and 50% in 2011 (Augurzky et al., 2015).
projected costs, and are carried out for each provider separately. Social insurance funds have a veto right over the final decision, and the power to restart the negotiations. If the price cannot be agreed upon within six weeks, an independent arbitration board determines it. Prices for inpatient care include expenses for: nursing care, which varies across the levels of care-dependency, and cover assistance with the basic and instrumental Activities of Daily Living (ADL); room and board; and investments, which are based on the room type (single- vs. multiple-bed), and cover the costs of facility maintenance and repair.

The German long-term care market is dominated by non-profit nursing homes, although for-profits are gaining an increasingly important role. The LTCI does not differentiate between the ownership types either when it comes to price negotiations or when it comes to the insurance type (private versus public) of the residents. Non-profit nursing homes are dominant in North Rhine-Westphalia, Thuringia, and in some areas of Bavaria and Baden-Wuerttemberg (Figure 2), although a majority of counties display a relatively balanced mix of for-profits and non-profits. Thus, prospective residents should not face major restrictions in their choice of a particular ownership type.

3 Empirical strategy

To evaluate the welfare effects of a single room policy in German nursing homes, we estimate a structural model of the demand for inpatient care, recover the marginal costs and markup and, finally, simulate the prices and market shares in the given counterfactual scenario. This general approach follows the industrial organization literature on structural modeling. We focus on nursing homes providing full-time inpatient care for the elderly (aged 65+) and exclude specialized facilities for care recipients with psychological and mental disorders and hospices, as well as residential units with outpatient care.

3.1 Demand model

The basic idea behind demand estimation with aggregate, i.e., firm-specific, data lies in the theory of utility maximization: Market shares reflect the aggregated utility maximizing behaviour of single individuals. We assume that nursing homes are differentiated products. Individuals or their relatives pick the best nursing home given several observable characteristics such as ownership, quality, location, capacities, or the share of

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13As of 2013, market shares of for-profit and non-profit nursing homes were 36.4% and 63.6%, respectively, while the corresponding shares in 1999 were 25.4% and 74.6%. During this period, the number of places increased by 105% in for-profit and by 25% in non-profit facilities (Augurzky et al., 2015).
single rooms.\footnote{Rationing would be a problem since we cannot account for it (Ching et al., 2015). We do not observe nursing home-specific waiting lists or switching to other facilities because of capacity constraints. However, we show that, on average, sufficient capacities are available ex-ante (compare Figure 3 in the Appendix).}

Measuring market shares relies on the definition of the relevant market. Care recipients tend to choose nursing homes in the proximity of their residences. Several studies provide empirical evidence on this issue (Varkevisser et al., 2012; Schmitz and Stroka, 2014; Gowrisankaran et al., 2015).\footnote{Yet, a care recipient might enter a nursing home in another county – for example, in order to stay closer to their family or to receive a higher quality care. We give this issue due attention in the construction of price instruments.} Thus, we use the county of the nursing home as the relevant market. We observe $m = 1, \ldots, 429$ geographic markets (counties) in year $t = 2007$ and $m = 1, \ldots, 412$ in $t = 2009$.\footnote{Lower $m$ in 2009 is due to administrative reforms in Saxony (2008) and Aachen (2009).}

Potential market size ($M$) corresponds to the size of the care-dependent population in county $m$. The consumer choice set consists of $j = 1, \ldots, J$ nursing homes located in county $m$ and the outside option, which includes short-term nursing home stays, informal care, and outpatient care. At the beginning of period $t$, each of the $i = 1, \ldots, M$ care recipients chooses one form of care. We model the choice as a utility-maximization problem of a representative consumer and approximate it by a one-level nested logit model (Berry et al., 1995; Verboven, 1996; Slade, 2004). The nesting structure, where we choose the ownership type as the nest as discussed below in subsection 3.2, allows us to account for the correlation of preferences within the nursing home types (e.g., private versus non-profit). Furthermore, this model is suitable for aggregate market data and reflects the two-stage decision structure, i.e., first choosing the ownership type and then the nursing home itself, that we observe in the German long-term care market.

The agent $i$'s indirect utility from choosing a nursing home $j$ in period $t$ is:

$$u_{ijt} = \delta_{jt} + v_{ijt},$$

where $\delta_{jt}$ represents the mean utility of care recipients in nursing home $j$, and $v_{ijt}$ is the individual-specific deviation from the mean. The latter term allows for the correlation of preferences across nursing homes with similar characteristics. We define $\delta_{jt}$ as:

$$\delta_{jt} = \beta x_{jt} - \alpha p_{jt} + \xi_{jt},$$

where the vector $x_{jt}$ includes the observable characteristics: nursing home size, extra facilities (such as neighboring residential units, hospitals) and the share of single rooms. $p_{jt}$ is the price, and $\xi_{jt}$ the unobservable characteristics. We hypothesize that prospective
residents have a preference for single rooms.\footnote{Note that we abstract from residential units with outpatient care, whose residents may prefer double rooms in order to live with their spouses. Within the single room policy, two separate bedroom apartments sharing a bathroom will be available for spouses.} The utility from the outside option is normalized to zero ($u_{0t} = 0$).

Nursing homes are grouped into nests based on the similarity of one structural characteristic, the ownership type, where this specific choice is explained below. This grouping structure is captured by the term $v_{ij,t}$, which is the individual’s $i$ deviation from the mean utility and defined as:

$$v_{ij,t} = \epsilon_{igt} + (1 - \sigma)\epsilon_{ijgt},$$

where $\sigma$ measures the correlation of preferences for nursing homes within the same ownership type $g$, and parameters $\epsilon_{igt}$ and $\epsilon_{igt} + (1 - \sigma)\epsilon_{ijgt}$ are Type-I extreme value distributed. If $\sigma = 1$, preferences for facilities within the same nest are perfectly correlated, while $\sigma = 0$ implies no correlation of preferences. In the latter case, $\epsilon_{igt} + (1 - \sigma)\epsilon_{ijgt}$ is i.i.d. and the nested logit is reduced to a standard logit model. In line with the random utility maximization, we postulate that $0 < \sigma < 1$, which implies a higher degree of substitution within than between the groups. This property of a nested logit model remedies the shortcomings of a standard logit model, where the substitution between the products is assumed to be symmetric. The market share of nursing home $j$ is calculated as the probability of choosing $j$ conditional on choosing the nest $g$:

$$Pr_{jt} = Pr_{j|gt} \cdot Pr_{gt}.$$

This expression is the basis for the final nested logit demand estimation equation, which links market shares to prices, nursing home characteristics, and within-group market shares (Berry, 1994):

$$
\ln(s_{jt}) - \ln(s_{0t}) = \beta x_{jt} - \alpha p_{jt} + \sigma \ln(s_{j|gt}) + \xi_{jt}.
\tag{2}
$$

where $s_{jt}$ is the market share of nursing $j$ in the county, $s_{0t}$ is the market share of the outside option and $s_{j|gt}$ is the nursing home’s market share within the nest $g$.

### 3.2 Nesting structure

Our nesting criterion is the ownership type. We distinguish between for-profit and non-profit facilities, whereby the objectives of the latter are not limited to profit-maximization. For example, the Red Cross defines its mission as to “protect life and health and to en-
sure respect for the human being,” Caritas shares the mission of a “Catholic Church to serve the poor and to promote charity and justice,” while Diakonie strives to “address the wants and needs of others based on the Christian view of a mankind.” Our nesting structure is motivated by the possible quality disparities between for-profit and non-profit facilities. In markets with information asymmetries, product quality is *a priori* uncertain. If the contractual compliance cannot be fully monitored, for-profit organizations might provide suboptimal quality on imperfectly observable product dimensions. Non-profits, on the other hand, are subject to the non-distribution constraint, which prohibits the payment of profits to owners and employers (the Arrow-Hansmann hypothesis). This softens the non-compliance incentive and increases the likelihood of delivering higher quality. Thus, care recipients with a higher information cost might prefer the non-profit facilities due to the implicit quality assurance.

Our choice of the nesting structure is supported when looking at the existing literature on the relationship between ownership type and quality. In a seminal study, Arrow (1963) demonstrates that the dominance of the non-profit sector in health care markets is due to the contradiction between the profit motive and the trustworthiness necessary to provide a high quality. Grabowski et al. (2013) account for the endogeneity of ownership status and find that non-profit facilities deliver better care quality. Chou (2002) documents quality disparities between for-profit and non-profit nursing homes under the information asymmetries, which vanish if the care recipients are well-informed. Grabowski and Hirth (2003) find positive competitive spillovers from non-profit to for-profit nursing homes. If the non-profits dominate the market, for-profits are chosen primarily by the well-informed. This leads to a better care quality in the latter, which is consistent with the hypothesis that non-profit ownership serves as a low-cost signal for quality.

### 3.3 Identification

The structural error term $\xi$ in equation (2) encapsulates a range of unobservable factors, such as care quality, staff attentiveness, location, and reputation, which are systematically correlated with the explanatory variables. For example, nursing homes with an excellent reputation or those located in urban areas are not only likely to face higher demand and higher market shares, but also to negotiate higher prices. Unobservable factors induce omitted variable bias, which affects the consistency of the OLS estimates of the price and the within-group market share coefficients. Unobservable factors are

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18 According to the German tax code, non-profit organizations may use their profits only for the purpose of fostering their primary activity (Abgabenordnung, §52 Gemeinnützige Zwecke). Thus, profit payouts to owners and employers are ruled out.

19 Information asymmetries in this study are proxied by the frequency of family visits. Regular visits are assumed to imply a consistent monitoring of the care quality.
associated with higher cost and, thus, with the price. This positive correlation would lead to a downward bias of the price coefficients. Within-group market shares are likely endogenous, facing positive simultaneity or omitted variable bias (e.g., underlying quality, management, or competition). These two biases both go into the same direction; ignoring them, we would overestimate the true preferences for substitution.\textsuperscript{20} In order to identify the true effects of the endogenous variables, we combine the fixed-effects with the instrumental variable approach. Fixed-effects net out all the correlation between the time-invariant unobserved factors and explanatory variables. The instrumental variable approach eliminates simultaneity bias from the regression through instruments for the endogenous variables, which are uncorrelated with the error term. Our identifying assumption is therefore \( E[p_{jt}, s_{jt} | \xi_{jt}] = 0 \).

We instrument for the price variable by the average prices for comparable nursing homes. Comparability is established if a) the difference in capacity is not more than 20 places and b) staff-to-resident ratios do not deviate by more than 10\%.\textsuperscript{21} We employ the prices for five most similar facilities as instruments. As a robustness check, we lower the number of facilities to two. Our instrument set includes nursing homes located in the same federal state, but outside the county of interest. In order to ensure that the identification conditions are met, we exclude nursing homes located in immediately neighboring counties and in counties whose centroids are less than 60 kilometers distance from a centroid of a county of interest.\textsuperscript{22} Our choice of instruments is based on the following considerations. First, capacity and staff employed are the major cost determinants for a nursing home provider. Facilities similar across these two dimensions are likely to have a comparable cost structure and, therefore, correlated prices (Hausman et al., 1994). Second, prices for similar facilities serve as a reference point in price negotiations (SGB XI §84). Third, all providers within a federal state negotiate with a similar group of payers representing the majority of residents, which implies a uniform price-setting mechanism. Fourth, the prices for nursing homes in neighboring counties could be correlated due to unobserved demand shocks.

As an instrument for the within-group market share, we employ the number of facilities in the same ownership group (Berry et al., 1995; Herr and Suppliet, 2017).\textsuperscript{23} Entry in a nursing home market entails high sunk costs and extensive preparations. Thus, the short-term demand shifts are unlikely to alter the number of providers, and the identification condition is fulfilled.

\textsuperscript{20}Other nursing home characteristics, such as size and ownership, are chosen before the negotiations and are, therefore, likely exogenous.

\textsuperscript{21}Prices are negotiated based on costs for personnel, among others.

\textsuperscript{22}Distances are calculated based on the centroid coordinates provided by the German Office for Cartography and Geodesy (BKG), publicly available at http://www.geodatenzentrum.de/aufrag1/archiv/vektor/vg2500/.

\textsuperscript{23}Within-group market share instruments are inverted and log-linearized in order to ensure a positive correlation with the instrumented variable.
Several institutional characteristics of the long-term care market could confound our empirical estimates. First, the choice set of social assistance beneficiaries may be initially restricted. However, the residents are allowed to move into their preferred facility if the cost is not disproportionate and the choice can be soundly justified, for example, through an offer of a particular religious service or proximity to the family (SGB XII §9). Our model assumption is that the (including social insurance funds) negotiate on behalf of nursing home residents, maximizing their utility (see section 3.5). Second, the nursing home choice may be restricted through capacity constraints. Yet, in emergency cases, prospective residents are entitled to short-term nursing home stays until an adequate facility is found (SGB XI §42). Figure 3 indicates a relatively small share of nursing homes operating at full capacity. Thus, the observed choice might not always be the most preferred, but it should largely reflect consumer preferences. Furthermore, we control for the capacity (size) of the nursing home, which determines the chances to get into the preferred nursing home.

3.4 Elasticities

For a clear interpretation of the estimated price coefficients, we calculate the price elasticities of demand. The own-price elasticity measures the responsiveness of the demand for nursing home \( j \) to changes in its own price and is expressed as (Berry, 1994):

\[
\eta_{jjt} = \alpha_{pj} \left( s_{jt} \frac{1}{1 - \sigma} + \frac{\sigma}{1 - \sigma} s_{j|gt} \right). \tag{3}
\]

This means that the demand for nursing home \( j \) decreases by \( \eta_{jjt} \) percent if the price is decreased by one percent given the nursing home-specific price level. The elasticity depends on the price level and the willingness to substitute to different nursing homes and ownership types.

Cross-price elasticities capture the effect of changes in prices for homes \( k \) on the demand for \( j \). Due to different degrees of substitution, we distinguish between homes within the same ownership group (\( j \in g, k \in g \)) and within different groups (\( j \in g, k \notin g, k \in h \)). Based on this distinction, we calculate within- and between-group cross-price elasticities as:

\[
\eta_{jkt} = \begin{cases} 
\alpha_{pj} \left( \frac{\sigma}{1 - \sigma} s_{j|gt} + s_{jt} \right), & j \in g, k \in g \\
\alpha_{pj} s_{jt}, & j \in g, k \notin g, k \in h.
\end{cases} \tag{4}
\]

\(^{24}\)We divide the total number of residents by the number of available places and assume that \( > 99\% \) defines the full capacity.

\(^{25}\)Due to the above issues, we cannot uncover the extent of rationing. While Ching et al. (2015) identify rationing by comparing private and Medicaid patients, we cannot distinguish between the care recipients based on their entitlement to social assistance.

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3.5 Supply side

We estimate the supply side using a model of oligopolistic competition with differentiated products (Berry et al., 1995; Verboven, 1996; Slade, 2004). Nursing homes are assumed to operate as single-product firms, but their product (long-term care) differs across multiple dimensions. The produced care is a vector of characteristics that reflect distinctive features of a nursing home. Typically, the differentiation stems from physical location, ownership, size, and quality. Hence, we assume that all nursing homes within the relevant market are to some degree substitutable. We recover the extent of substitution based on the estimates of cross-price elasticities from equation (4). Our supply-side model is based on the assumption of bargaining between providers and payers. We build upon a classic bargaining model by Horn and Wolinsky (1988) and two models applying bargaining to health care markets (Grennan, 2013; Gowrisankaran et al., 2015).

Negotiations are carried out between the individual nursing homes and payers, which include the long-term care funds, social insurance funds, and several smaller players.\(^{26}\) We assume that payers negotiate on behalf of nursing home residents and maximize their utility with respect to observable facility characteristics.\(^{27}\) Hence, the objective utility functions of payers and nursing home residents are assumed to be equivalent. This assumption subsumes the main objectives of the negotiating parties. Long-term care insurance funds have initiated a system of public quality reporting and are therefore likely concerned with the welfare of nursing home residents. On the other hand, social insurance funds have an incentive to negotiate lower prices in order to minimize the number of beneficiaries and the overall cost. Price sensitivities of the self-paying nursing home residents and of the social insurance funds, who cover the out-of-pocket payments of social assistance beneficiaries, may nonetheless differ. However, as we have no information on the shares of care recipients entitled to social assistance, the estimation of separate price coefficients is beyond the scope of this paper. The objective utility function of a nursing home is assumed to depend on its profit motive. The for-profits pursue a profit-maximization strategy, while the non-profits maximize a weighted combination of profit and output (Gaynor and Vogt, 2003; Lakdawalla and Philipson, 2006).

The negotiation outcome is a solution to the Nash-bargaining problem, which takes the following form:

\(^{26}\)In the German long-term care market, nursing home chains are relatively common. Hence, one provider might negotiate on behalf of multiple facilities. Yet, the prices are supposed to be independent of each other, irrespective of the chain membership (SGB XI §85).

\(^{27}\)As the long-term care is a credence good, this assumption does not rule out the necessity of a regulatory intervention. For example, staff engagement and attentiveness influence the care quality, but are unobservable by the payers and are, hence, not a subject of negotiations. In this context, the aim of public quality reporting is to provide information on the unobserved aspects of care quality to prospective nursing home residents.
\[ NB_{jt,s} = (U_{jt} - U_{0t})^{\gamma_j} (V_{jt} - V_{0t})^{\gamma_s}, \]  

where \( U_{jt} \) and \( V_{jt} \) are the payoffs from an agreement of nursing home \( j \) and payer \( s \) in period \( t \), respectively, \( U_{0t} \) and \( V_{0t} \) are the payoffs without an agreement, and \( \gamma_j \) and \( \gamma_s \) are the respective bargaining powers. Without loss of generality, we assume that \( \gamma_j + \gamma_s = 1 \), and denote the bargaining powers as \( \gamma_j = \gamma \) and \( \gamma_s = 1 - \gamma \). If the negotiations fail and the nursing home rejects the price offered by an independent arbitration board, it exits the market. Therefore, the payoff from a disagreement is zero, \( U_{0t} = V_{0t} = 0 \). Equation (5) can be rearranged to obtain:

\[ NB_{jt,s} = \left[ (\beta x_{jt} - \alpha p_{jt} + \xi_{jt}) q_{jt} \right]^\gamma [\theta_p (p_{jt} + l_{jt} - c_{jt}) q_{jt} + \theta_q q_{jt}]^{1-\gamma}, \]  

where \( \delta_{jt} \) captures the mean utility derived from a nursing home \( j \) in period \( t \), \( q_{jt} \) is the number of residents, and \( p_{jt}, l_{jt} \) and \( c_{jt} \) denote the out-of-pocket payments, LTIC entitlements of publicly insured nursing home residents, and the estimated marginal costs, respectively. \( \theta_p \) and \( \theta_q \) capture the relative weights placed on the profits and outputs of nursing home providers, whereby \( \theta_p + \theta_q = 1 \). For for-profit providers, we assume that \( \theta_q = 0 \). Optimizing equation (6) with respect to price gives the following marginal cost expression:

\[ MC_{jt} = \frac{c_{jt}}{\frac{\text{MC}}{\theta_p}} - \frac{\theta_q}{\text{MRS}} = \left( p_{jt} + l_{jt} - \frac{\delta_{jt}(1 - \gamma)}{\alpha \gamma - \delta_{jt} q_{jt}} \right), \]  

with \( \eta_{jit} \) the own-price elasticity given in (3). This expression is equal to the difference between the “true” marginal cost \( (c_{jt}) \) and the marginal rate of substitution (MRS) between profit and output. The terms \( c_{jt} \) and MRS cannot be identified separately. We therefore estimate the “behavioral” marginal cost, which is equal to \( c_{jt} - \frac{\eta_{jt}}{\sigma_e} \) for non-profit, and \( c_{jt} \) for for-profit nursing homes (Gaynor and Vogt, 2003).

Marginal cost cannot be estimated analytically because the expression (7) is non-linear. Thus, we assume that the bargaining powers are symmetric \( (\gamma = \frac{1}{2}) \). First, if the bargaining parties fail to agree and the price set by an independent arbitration board is rejected, the nursing home exits the market. The treatment of the current residents therefore needs to be discontinued, which is an outcome with serious negative welfare implications. Hence, the payers are unlikely to exert their bargaining power to a degree that hinders the profitable operations of a nursing home. Second, payers and providers repeatedly interact with each other, which entails similar discount factors (Rubinstein, 1982). Third, symmetric bargaining powers are roughly in line with the estimates from
the empirical literature (Crawford and Yurukoglu, 2012; Gowrisankaran et al., 2015). Finally, if the bargaining power was concentrated at the payers’ side, prices would be set at the level close to marginal cost. Under this scenario, policy changes would have a negligible impact on prices, which is unrealistic. Yet, in order to assess the robustness of our results, we allow for asymmetric bargaining powers and assume $\gamma = \frac{2}{3}$ and $\gamma = \frac{1}{3}$.

In our framework, the bargaining model has two key advantages over the Bertrand-Nash competition, where the price is the equilibrium outcome of the competitive market game. First, it better approximates the price-setting mechanism in the German long-term care market. Second, the out-of-pocket payments are a fraction of the actual price. That is why the estimated elasticities are lower than those under the full co-payment scheme. Third, it generates more reasonable marginal cost estimates. In a Bertrand-Nash framework, providers might exploit lower elasticities and set higher prices. Thus, applying the classical Bertrand-Nash competition model would result in unrealistically low marginal cost estimates (Gowrisankaran et al., 2015). Nevertheless, we apply that framework or assume that consumers need to cover the full price to compare the resulting estimated price elasticities as a robustness check.

### 3.6 Simulation

We evaluate the welfare effects of a policy mandating exclusively single rooms by comparing the status quo with the counterfactual market values. The basis for our welfare analysis are the changes in the utility of consumers and providers induced by a) higher availability of single rooms; b) cost of facility rebuilding; c) potential capacity reductions. Assuming symmetric bargaining powers, we evaluate three implementation scenarios: a) constant capacities, whereby facilities are either expanded or double rooms are split into single rooms in order to retain the same number of places; b) reduced capacities, whereby double rooms are transformed into single rooms without being divided; c) reduced capacities, whereby 50% of shared rooms are transformed into single rooms by being divided and 50% without being divided. In addition, we use c) and vary the payers’ bargaining power to be 2/3 (scenario d) strengthens the payers) and 1/3 (scenario e) strengthens the providers) as opposed to 1/2. In this counterfactual market, we assume that the consumer valuation of observable nursing home characteristics, price sensitivity, and marginal costs ($MC$) remain constant. We only change the ratio of single rooms to total available places, which increases to 1 for all nursing homes, while the nursing home capacities (size) change under each scenario. We define the nested logit demand function as:

$$\ln(s_{jt}(p_t^\text{sim}, \delta_{jt})) - \ln(s_{0t}(p_t^\text{sim}, \delta_{jt})) = \beta x_{jt} - \alpha p_{jt}^\text{sim} + \sigma \ln(s_{jt}(p_t^\text{sim}, \delta_{jt})) + \xi_{jt}, \quad (8)$$
where the coefficients $\hat{\alpha}$, $\hat{\beta}$ and $\hat{\sigma}$ are estimated from equation (2). Based on the expression for marginal cost (7), we specify the first-order condition as:

$$p_{jt}^{sim} + l_{jt} - \bar{MC}_{jt} = \frac{\delta_{jt}(1 - \gamma)}{\hat{\alpha} \gamma - \delta_{jt} \frac{\eta_{jt}(p_{jt}^{sim}, s_{jt}(p_{jt}^{sim}, \delta_{jt}))}{p_{jt}^{sim}}} = 0.$$  \tag{9}$$

We determine the new equilibrium values of prices $p_{jt}^{sim}$, market shares $s_{jt}(p_{jt}^{sim}, \delta_{jt})$ and within-group market shares $s_{j|gt}(p_{j|t}^{sim}, \delta_{jt})$ by applying the Newton-Raphson algorithm on equations (8) and (9). Based on the simulated values of prices and market shares, and estimates $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\sigma}$, we calculate the consumer surplus as follows (Ivaldi and Verboven, 2005):

$$CS(p_{t}^{sim}) = \frac{1}{\hat{\alpha}} M \ln(1 + \sum_{g=1}^{G} D_{gt}^{1-\hat{\sigma}}),$$  \tag{10}$$

where $D_{gt} = \sum_{j \in G} \exp(\frac{\delta_{jt}}{1-\hat{\sigma}})$ and $M$ is the total market size (care-dependent population in the county). Providers’ variable profits are expressed as:

$$\Pi(p_{t}^{sim}) = (p_{jt}^{sim} - \bar{MC}_{jt}) q_{jt}(p_{t}^{sim}),$$  \tag{11}$$

where $\bar{MC}_{jt}$ is the marginal cost estimate, and $q_{jt}$ the demand for nursing home $j$ under the prices $p_{t}^{sim}$. However, the magnitude of the fixed cost associated with the policy implementation is unknown. Our evaluation of the welfare effects is therefore limited to the comparison of the status quo and counterfactual values of consumer surplus and providers’ variable profits.

4 Dataset and descriptive statistics

Our dataset is provided by the statistical offices of the Länder (federal states) and is used on-site at the Research Data Centre Düsseldorf. We observe all nursing homes offering full-time inpatient care for the elderly in 2007 and 2009. The dataset includes information on nursing homes’ capacities, occupancy rates, ownership, extra facilities (hospitals, ambulatory services, residential units), and prices for each care level. The share of for-profit nursing homes in the sample is 40.1%. Non-profit facilities are on average more expensive, have a higher capacity, provide more often extra facilities, and provide

28Data aggregated at the federal state level is publicly available at https://www.destatis.de/DE/Publikationen/Thematisch/Gesundheit/Pflege/LaenderPflegeheime.html.
a higher average share of single rooms. We also observe the care recipients using informal care (either alone or combined with outpatient care), which is our outside option. The total market size \((M)\) is defined as the care-dependent population in a county. They are eligible for payments from the mandatory long-term care insurance funds. Since the individual’s care-dependency needs are evaluated based on a standardized procedure developed by the long-term care insurance funds, market conditions across the counties are homogeneous within the federal states. This ensures a consistent estimate of the market size. Detailed summary statistics of the sample are presented in Table 1.

**Table 1: Summary statistics**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>For-profit</th>
<th>Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d.</td>
<td>mean</td>
</tr>
<tr>
<td>Market shares</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(s_j) [in 10]</td>
<td>0.013</td>
<td>0.013</td>
<td>0.010</td>
</tr>
<tr>
<td>(s_{j</td>
<td>g})</td>
<td>0.093</td>
<td>0.104</td>
</tr>
<tr>
<td>(s_0)</td>
<td>0.711</td>
<td>0.067</td>
<td>0.706</td>
</tr>
<tr>
<td>Size [# of places]</td>
<td>81.19</td>
<td>48.28</td>
<td>71.38</td>
</tr>
<tr>
<td>Extra facilities available</td>
<td>0.30</td>
<td>0.46</td>
<td>0.25</td>
</tr>
<tr>
<td>Single rooms [share]</td>
<td>0.58</td>
<td>0.28</td>
<td>0.48</td>
</tr>
<tr>
<td>Weighted average price(^{∗}) [EUR]</td>
<td>1,477.32</td>
<td>435.23</td>
<td>1,402.13</td>
</tr>
<tr>
<td>Price per care level(^{∗})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care level 1</td>
<td>1,258.15</td>
<td>398.62</td>
<td>1,219.60</td>
</tr>
<tr>
<td>Care level 2</td>
<td>1,416.95</td>
<td>435.73</td>
<td>1,347.32</td>
</tr>
<tr>
<td>Care level 3</td>
<td>1,685.05</td>
<td>477.83</td>
<td>1,579.15</td>
</tr>
<tr>
<td>Instruments for price(^{∗}) [EUR]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price, comparable home 1</td>
<td>1,479.00</td>
<td>435.35</td>
<td>1,449.94</td>
</tr>
<tr>
<td>Price, comparable home 2</td>
<td>1,473.86</td>
<td>440.78</td>
<td>1,447.14</td>
</tr>
<tr>
<td>Price, comparable home 3</td>
<td>1,466.99</td>
<td>429.25</td>
<td>1,437.74</td>
</tr>
<tr>
<td>Price, comparable home 4</td>
<td>1,468.83</td>
<td>436.48</td>
<td>1,436.91</td>
</tr>
<tr>
<td>Price, comparable home 5</td>
<td>1,472.32</td>
<td>434.62</td>
<td>1,441.55</td>
</tr>
<tr>
<td>Instruments for within-group market share</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of homes, same group</td>
<td>18.38</td>
<td>18.31</td>
<td>18.21</td>
</tr>
<tr>
<td>Observations</td>
<td>17,438</td>
<td>6,988</td>
<td>10,450</td>
</tr>
</tbody>
</table>

We report the descriptive statistics for all German nursing homes providing the long-term inpatient care for elderly for 2007 and 2009. \(^{∗}\) Price variables refer to the out-of-pocket payments, i.e., the prices negotiated for each nursing home net of the LTCI allowance. Group \(g\) is defined based on the ownership type of a provider. Market size corresponds to the size of care-dependent population in a county. \(s_j\) is the overall market share of nursing home \(j\) in a county, \(s_{j|g}\) is the within-group market share, and \(s_0\) the share of the outside option. All prices are expressed in EUR (non-deflated). Source: FDZ der Statistischen Ämter des Bundes und der Länder, Pflegestatistik, 2007–2009, own calculations.

We calculate the out-of-pocket payment for nursing home \(j\) as the total price for each care level net of the respective public LTCI allowances. Our price measure is a weighted average of out-of-pocket payments across the three care levels. We employ the ratios of the respective LTCI allowances to the total LTCI allowance as weights:

\[
w_i = \frac{LTCI_i}{\sum_{i=1}^{3} LTCI_i},
\]
where \( i \) denotes the care level.\(^{29}\) We do not observe the out-of-pocket payments of privately insured and social assistance beneficiaries. However, this issue is not of major concern for two reasons. First, the share of privately insured care recipients is low (14\% as of 2013). Second, our price coefficient captures the price sensitivity of both the nursing home residents and social insurance funds, which cover part of the long-term care expenses. Although distinguishing between the two would be helpful, our analysis is concerned with the aggregate welfare effects. Therefore, the average price sensitivities suffice.

5 Results

5.1 Demand- and supply-side estimation

The results of our demand estimation are presented in Table 2. The first two columns display the coefficient estimates from OLS and time and facility fixed effects (FE) specifications, which do not account for the potential endogeneity of prices and within-group market shares. The third column presents the results from our preferred specification (FE.IV), which addresses the endogeneity problem by instrumenting prices and within-group market shares. Both FE and FE.IV specifications include facility and year fixed-effects.

The coefficient \( \sigma \) measures the correlation of preferences for nursing homes with the same ownership type. The estimated value of \( \sigma \) is in line with random utility maximization (\( 0 < \sigma < 1 \)) and is positive and significant across all specifications (.68 and .51, resp.). This confirms the importance of controlling for the heterogeneity of individual preferences with respect to ownership type. As expected, instrumental variable estimation results in higher (absolute) prices and lower within-group market share coefficients across all specifications. The price effect is normal and, as expected, negative and significant. Facility size increases market shares for two reasons: First, market shares are technically driven by the size. Second, residents value bigger nursing homes positively because larger nursing homes can offer a place to prospective residents more quickly. There is no significant association between providing extra facilities and demand. Finally and most importantly, the share of single rooms to total available places has a positive effect on demand, implying a higher valuation of nursing homes that offer more privacy and independence. This estimate is the basis for our simulation of the effects of a single room policy.

To evaluate the robustness of our coefficient estimates, we introduce two additional

\(^{29}\)Public LTCI allowances in 2007 were \( \text{€} \) 1,023 for care level 1, \( \text{€} \) 1,279 for care level 2, and \( \text{€} \) 1,432 for care level 3. In 2009, the allowance for care level 3 increased to \( \text{€} \) 1,470. The respective weights are therefore 0.27, 0.34 and 0.39. Our dataset does not provide information on prices for dementia and hardship cases.
specifications presented in Table A2. First, since the reference point in the price negotiations are the most similar facilities, we restrict the number of price instruments from five to two. Second, we allow for different correlations of individual preferences across the ownership types. This modeling assumption is based on a finding that better informed care recipients tend to choose for-profit nursing homes discussed in section 3.2 (Chou, 2002), which might result in a higher substitutability within this ownership group. The results in Table A2 demonstrate that our baseline coefficient estimates are robust to different specifications. Moreover, regression (3) indicates a significantly higher correlation of preferences within the for-profit group (z-score of -1.96), which is in line with the existing literature.

Table 2: Demand estimation results with \( ls_j = \ln[s_j] - \ln[s_0] \) as dependent variable

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>FE</th>
<th>FE.IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma ) [ownership]</td>
<td>0.68531***</td>
<td>0.58355***</td>
<td>0.50969***</td>
</tr>
<tr>
<td></td>
<td>(0.00498)</td>
<td>(0.00721)</td>
<td>(0.01189)</td>
</tr>
<tr>
<td>Price</td>
<td>-0.00006***</td>
<td>-0.00003***</td>
<td>-0.00026***</td>
</tr>
<tr>
<td></td>
<td>(0.00000)</td>
<td>(0.00000)</td>
<td>(0.00006)</td>
</tr>
<tr>
<td>Size</td>
<td>0.00543***</td>
<td>0.00422***</td>
<td>0.00451***</td>
</tr>
<tr>
<td></td>
<td>(0.00013)</td>
<td>(0.00032)</td>
<td>(0.00035)</td>
</tr>
<tr>
<td>Extra facility</td>
<td>0.05869***</td>
<td>-0.00076</td>
<td>0.00169</td>
</tr>
<tr>
<td></td>
<td>(0.00897)</td>
<td>(0.00558)</td>
<td>(0.00605)</td>
</tr>
<tr>
<td>Single rooms</td>
<td>0.15987***</td>
<td>0.02075</td>
<td>0.07401**</td>
</tr>
<tr>
<td></td>
<td>(0.01487)</td>
<td>(0.02660)</td>
<td>(0.03169)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.78668***</td>
<td>-2.92495***</td>
<td>-2.85108***</td>
</tr>
<tr>
<td></td>
<td>(0.02290)</td>
<td>(0.03799)</td>
<td>(0.06855)</td>
</tr>
</tbody>
</table>

Observations 14,205 14,205 14,205
Facility FE no yes yes
Time FE no yes yes
IV (\( \sigma \)) no no yes
IV (price) no no yes
Adjusted R-squared 0.70 0.70 0.68
Underidentification test 121.59
(0.00)
F value first stage 20.66
Sargan test 3.00
(0.56)

One-level nested logit demand estimation. Nest: non-profit or for-profit ownership. The dependent variable is \( ls_j = \ln[s_j] - \ln[s_0] \), where \( s_j \) = total number of care recipients in facility \( j \)/total market size, \( s_0 \) = market share of outside option/total market size. Coefficients cannot be interpreted as marginal effects but will be used to estimate price elasticities and marginal cost. Source: FDZ der Statistischen Ämter des Bundes und der Länder, Pflegestatistik, 2007–2009, own calculations. *** \( p < .01 \) ** \( p < .05 \) * \( p < .1 \)

For a more precise interpretation of the estimated price coefficient, we calculate the price elasticities of demand. Elasticities are calculated using the equations (3) and (4). The results are presented in Table 3. The mean own-price elasticity is -0.752. This means that, if the price is increased by 1%, demand falls by 0.752% at a mean price of €1,477. It is slightly larger for non-profit nursing homes, which is mostly driven by higher average
prices in this group. The average within- and between-group cross-price elasticities are estimated at 0.041 and 0.005, respectively. This shows that reaction to changes in prices of other nursing homes within the same ownership type are small and almost zero across ownership types.

Table 3: Facility-level price elasticities

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>For-profit</th>
<th>Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d.</td>
<td>mean</td>
</tr>
<tr>
<td>Own, actual</td>
<td>-0.752</td>
<td>0.240</td>
<td>-0.706</td>
</tr>
<tr>
<td>Cross-within</td>
<td>0.041</td>
<td>0.045</td>
<td>0.046</td>
</tr>
<tr>
<td>Cross-between</td>
<td>0.005</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>Own, effective</td>
<td>-2.552</td>
<td>0.483</td>
<td>-2.457</td>
</tr>
<tr>
<td>Own, no LTCI</td>
<td>-1.405</td>
<td>0.255</td>
<td>-1.352</td>
</tr>
</tbody>
</table>

Elasticities are calculated using the equations (3) and (4), while the effective own-price elasticity is expressed as $\epsilon = \left( \frac{p - MC}{p} \right)^{-1}$. Our price measure is the actual out-of-pocket payment. Source: Research data center of the statistical offices of the Länder, long-term care statistics 2007 and 2009, own calculations.

Long-term care allowances decrease the out-of-pocket payments, dampening the responsiveness of care recipients to price changes. Abolishing the price negotiations would allow the nursing homes to exploit diminished price sensitivity and set higher prices. Using our marginal cost estimates, we explore the price effects of the hypothetical Bertrand-Nash competition scenario. We calculate the demand elasticities necessary to produce the current price level using the formula $\epsilon = \left( \frac{p - MC}{p} \right)^{-1}$, which we refer to as effective elasticities (Gowrisankaran et al., 2015). The gap between the actual and the effective elasticities describes the level of price increases that the negotiations hinder. The mean estimate of -2.552 in Table 3 is significantly larger in magnitude than the actual elasticity of -0.752. Therefore, under the current long-term care insurance scheme, Bertrand–Nash competition would result in higher prices. Next, we evaluate the impact of long-term care insurance on the average price level under the price negotiations. Assuming that the long-term care insurance rates drop to zero, the mean own-price elasticity increases in magnitude to -1.405, which results in lower negotiated prices. Under the scenario of zero out-of-pocket payments, the demand becomes price insensitive. Long-term care insurance rates therefore need to be adjusted considering their impact on the negotiated price level.

In the second step, we recover the marginal costs and markups for individual nursing homes based on equation (7). The average values for the two years in our sample are presented in Table 4. The average ratio of marginal costs to prices is 0.593, and is significantly higher for for-profit than for non-profit nursing homes (0.604 vs. 0.576, $p < .001$).
Table 4: Marginal costs and markups with respect to total price

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>For-profit</th>
<th>Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d.</td>
<td>mean</td>
</tr>
<tr>
<td>Marginal cost [EUR]</td>
<td>1,658.52</td>
<td>475.42</td>
<td>1,566.49</td>
</tr>
<tr>
<td>Marginal cost (% of price)</td>
<td>0.593</td>
<td>0.084</td>
<td>0.576</td>
</tr>
</tbody>
</table>

Marginal costs are calculated using the expression (7) with respect to total price (= OOP plus long-term care insurance benefits). Source: Research data center of the statistical offices of the Länder, long-term care statistics 2007 and 2009, own calculations.

5.2 Simulation

In the final step of our analysis, we simulate the equilibrium prices and market shares in a counterfactual market with single rooms only. We then evaluate the welfare effects of a single room policy by comparing the status quo and the counterfactual values of consumer surplus and providers’ variable profits.

Table 5: Mean prices (out-of-pocket cost) and market shares in a counterfactual market with single rooms only compared to status quo

<table>
<thead>
<tr>
<th></th>
<th>Status quo</th>
<th>a)</th>
<th>b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d.</td>
<td>mean</td>
</tr>
<tr>
<td>price</td>
<td>1,477.32</td>
<td>435.23</td>
<td>1,459.29</td>
</tr>
<tr>
<td>(s_j \cdot 10)</td>
<td>0.013</td>
<td>0.013</td>
<td>0.013</td>
</tr>
<tr>
<td>(s_{jg})</td>
<td>0.093</td>
<td>0.104</td>
<td>0.089</td>
</tr>
<tr>
<td>(s_0)</td>
<td>0.711</td>
<td>0.067</td>
<td>0.692</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>c)</th>
<th>d)</th>
<th>e)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d.</td>
<td>mean</td>
</tr>
<tr>
<td>price</td>
<td>1,454.35</td>
<td>468.35</td>
<td>1,449.51</td>
</tr>
<tr>
<td>(s_j \cdot 10)</td>
<td>0.012</td>
<td>0.009</td>
<td>0.012</td>
</tr>
<tr>
<td>(s_{jg})</td>
<td>0.093</td>
<td>0.105</td>
<td>0.093</td>
</tr>
<tr>
<td>(s_0)</td>
<td>0.720</td>
<td>0.060</td>
<td>0.719</td>
</tr>
</tbody>
</table>

Scenarios: Symmetric bargaining power \((\gamma = \frac{1}{2})\) and a) constant capacities; b) reduced capacities, whereby doubles are transformed into single rooms without being divided; c) reduced capacities, whereby 50% of doubles are transformed into single rooms by being divided and 50% without being divided. Scenario d) and e) are equivalent to c), with the payers’ bargaining power of \(\gamma = \frac{2}{3}\) and \(\gamma = \frac{1}{3}\), resp., \(s_j\) = total number of care recipients in facility \(j\)/total market size, \(s_j\cdot g\) = total number of care recipients in facility \(j\)/market size of ownership \(g\), \(s_0\) = market share of outside option/total market size. Source: Research data center of the statistical offices of the Länder, long-term care statistics 2007 and 2009, own calculations.

The new equilibrium values of prices and market shares are presented in Table 5. The average prices moderately decline in each scenario.\(^\text{30}\) Considering that care recipients value the single rooms positively (Table 2), the implementation of this policy raises the

\(^{30}\)Note that our counterfactual scenarios are “static” in a sense that no market entry/exit with potential price effects takes place. Furthermore, we abstract from policy implementation costs that are likely to spill over to the prices.
attractiveness of nursing home care. Yet, due to the resulting capacity changes, the actual number of care recipients in nursing homes increases only under scenario a). In this case, it is likely that prices decline due to a fiercer competition between the providers since they now all provide the preferred single rooms. Under the remaining implementation scenarios, the total supply of nursing home places shrinks. This raises the average market share of the outside option and reduces the total number of care recipients in nursing homes. Payers’ utility declines due to lower capacities, which likely leads to a lower negotiated price. If bargaining power is shifted toward the payers, prices decrease more compared to symmetric bargaining power. In contrast, if bargaining power is shifted toward the providers, prices are higher compared to symmetric bargaining power and almost reach the status quo level despite the decrease in bargaining power due to smaller capacities.

Table 6: Aggregate consumer surplus (CS) and providers’ variable profits (PS) in a counterfactual market with single rooms only (in millions of €)

<table>
<thead>
<tr>
<th></th>
<th>status quo</th>
<th>a)</th>
<th>b)</th>
<th>c)</th>
<th>d)</th>
<th>e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>37,500</td>
<td>38,100</td>
<td>35,000</td>
<td>36,500</td>
<td>36,600</td>
<td>36,200</td>
</tr>
<tr>
<td>PS</td>
<td>6,770</td>
<td>7,120</td>
<td>5,670</td>
<td>6,390</td>
<td>4,390</td>
<td>8,280</td>
</tr>
<tr>
<td>∆CS</td>
<td>0.018</td>
<td>-0.066</td>
<td>-0.026</td>
<td>-0.024</td>
<td>-0.034</td>
<td></td>
</tr>
<tr>
<td>∆PS</td>
<td>0.051</td>
<td>-0.162</td>
<td>-0.055</td>
<td>-0.351</td>
<td>0.223</td>
<td></td>
</tr>
</tbody>
</table>

Consumer surplus and providers’ variable profits are calculated using the expressions (10) and (11) and aggregated at the level of Germany. Source: Research data center of the statistical offices of the Länder, long-term care statistics 2007 and 2009, own calculations.

Table 6 presents the aggregate changes in consumer surplus and providers’ variable profits in a counterfactual market with single rooms only. The welfare changes are largely determined by the capacity changes. Under scenario a), transforming all double rooms into single rooms leads to a 1.8% total increase in consumer surplus and a 5.1% increase in providers’ variable profits. Aggregate consumer welfare improves both because of the higher utility derived from individual nursing homes and a larger share of care recipients in nursing homes. Providers’ variable profits increase despite lower prices, which is due to a higher utilization of nursing home capacities. Under scenario b), the negative welfare effect of reduced capacities clearly outweighs the positive welfare effect of single rooms, which leads to a 6.6% decrease in consumer surplus and 16.2% in providers’ variable profits. Under scenario c), the negative welfare effect of reduced capacities prevail, due to which consumer surplus diminishes by 2.6% and providers’ variable profits by 5.5%. Under scenario d), the assumption of asymmetric bargaining powers produces a decline in consumer surplus by 2.4% and 35.1% in providers’ variable profits. The payers have a higher bargaining power and are thus able to negotiate lower prices; yet consumer surplus declines as a result of the reduced supply of nursing home places. Lower prices have a pronouncedly negative impact on providers who incur substantial losses. In scenario e), providers have more power,
which results in a lower consumer surplus (-3.4%) but in a 22% increase in variable profits. However, additional to our theoretical arguments, anecdotal evidence suggests that this scenario is the least realistic.

In sum, under the assumption of symmetric bargaining powers, the effects of a single room policy are welfare-enhancing only if the nursing home capacities remain unchanged.

6 Conclusion

Maintaining a high quality of life is one of the central objectives of good long-term care, which includes the right to privacy. Living in a single room is therefore important for the well-being of nursing home residents. Yet, the implementation of a single room policy raises the issues of nursing home capacities and the financial position of providers. Our paper evaluates the welfare implications of a single room policy in German nursing homes. In this study, we first estimate a structural model of demand for inpatient long-term care. Then, using the demand-side parameters, we apply a Nash bargaining model between providers and payers to recover marginal costs and markups. Finally, we quantify the welfare effects of a single room policy under various implementation scenarios. We use a panel dataset of all German nursing homes for the elderly for 2007 and 2009, before the adaptation process has started.

In our demand estimation, we apply an instrumental variable approach with fixed-effects and find that the care recipients positively value nursing home size and single rooms, but significantly dislike higher prices. The demand for nursing home care is price inelastic. We are the first to model the supply-side of the nursing home market using a Nash bargaining framework, which reflects the real price-setting mechanism in Germany. For a comparison, we show that the current price level would materialize under Bertrand-Nash competition only if the mean own-price elasticity increased approximately 3.5 times in magnitude. Abolishing the system of price negotiations would therefore result in significant price increases. Similarly, we find that higher long-term care insurance rates dampen the price sensitivity of demand, resulting in higher negotiated prices. Changes in the long-term care allowances thus need to be implemented with regard to their impact on the negotiated prices. Based on the estimated demand and supply parameters, we simulate the welfare changes in a counterfactual market for nursing homes with single rooms only. We evaluate five implementation scenarios, with different assumptions on capacity changes and the distribution of bargaining powers. Although the prices decline under each scenario, the welfare implications are predominantly negative due to a reduced supply of nursing home places. A single room policy is welfare-enhancing for both consumers and providers only under the assumption
of symmetric bargaining powers and unchanged nursing home capacities. In the remaining scenarios, the share of care recipients in inpatient care diminishes due to lower capacities, reducing both consumer surplus and providers’ variable profits. Providers incur particularly high losses if their bargaining power is low.

The single room policy enhances the well-being of individual nursing home residents if pre-reform capacities are retained. That is why regulators in Baden-Wuerttemberg and North Rhine-Westphalia have provided assistance (either financially or by extending the deadline if necessary) for older facilities. Our findings confirm that, if there was no incentive for new investments, restructuring the nursing homes in order to provide exclusively single rooms would almost certainly result in reduced capacities and negative welfare effects. In a more recent period, which is beyond the scope of our analysis, there was a marked increase in the average ratio of single rooms to total nursing home places (Figure 1) across all federal states. This increase can be largely attributed to new entrants, which (need to) provide a larger share of single rooms on average than existing facilities (Figure 4). Therefore, instead of imposing strict regulatory requirements on nursing homes that are already present in the market, it may be more welfare-enhancing to stimulate investment in new facilities that would be obliged to provide exclusively single rooms.

References


Appendix

Figure 1: Shares of nursing home places in single rooms to total available places, county-level averages

Figure 2: Shares of nursing home places in non-profit ownership to total available places, county-level

![Map of Germany showing shares of nursing home places in non-profit ownership to total available places in 2007 and 2009.](image)


Figure 3: Shares of nursing homes operating at a full capacity, county-level

![Map of Germany showing shares of nursing homes operating at a full capacity in 2007 and 2009.](image)

Figure 4: Shares of nursing home places in single rooms to total available places, facility-level averages for nursing homes that entered early (before 2008) and late (in 2012–2013), federal state-level

(a) early entry

(c) late entry

Table A1: Daily caregiving needs (minutes of care) until 2016 and monthly LTCI allowances for stationary care 2007 and 2009.

<table>
<thead>
<tr>
<th>Care level</th>
<th>Basic care, minutes</th>
<th>Total care, minutes</th>
<th>LTCI 2007</th>
<th>LTCI 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care level 0*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Care level I</td>
<td>46</td>
<td>90</td>
<td>€ 1,023</td>
<td>€ 1,023</td>
</tr>
<tr>
<td>Care level II</td>
<td>120&lt;sup&gt;c&lt;/sup&gt;</td>
<td>180</td>
<td>€ 1,279</td>
<td>€ 1,279</td>
</tr>
<tr>
<td>Care level III</td>
<td>240&lt;sup&gt;d&lt;/sup&gt;</td>
<td>300</td>
<td>€ 1,432</td>
<td>€ 1,470</td>
</tr>
</tbody>
</table>

This table shows the minimum daily needs for assistance in performing the activities of daily living (ADL) at different care-dependency levels. Basic care includes all recurring activities related to personal hygiene, feeding, and mobility. Total care encompasses both basic care and assistance with household activities, such as cooking, cleaning, and grocery shopping. The minimum daily needs are expressed in minutes. LTCI: Long-term Care Insurance *

*Individuals with dementia in each care-dependency level are eligible for higher allowances. However, our data do not provide information on this specific condition. From 2017, new rules apply with 5 grades. <sup>c</sup>Care-dependency level 0 applies to individuals whose daily caregiving needs are significant, but below those necessary for level 1. <sup>d</sup>At least 3 times a day at different hours <sup>d</sup>Around the clock.
Table A2: Robustness checks with respect to the preferred demand model presented in Table 2, with \( ls_j = \ln[s_j] - \ln[s_0] \) as dependent variable

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma ) [ownership]</td>
<td>0.50617(***)</td>
<td>0.44954(***)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01574)</td>
<td>(0.01134)</td>
<td></td>
</tr>
<tr>
<td>( \sigma_1 ) [non-profit]</td>
<td></td>
<td>0.49982(***)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.01151)</td>
<td></td>
</tr>
<tr>
<td>( \sigma_2 ) [profit]</td>
<td></td>
<td>0.53498(***)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.01372)</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>-0.00029(***)</td>
<td>-0.00030(***)</td>
<td>-0.00026(***)</td>
</tr>
<tr>
<td></td>
<td>(0.00009)</td>
<td>(0.00006)</td>
<td>(0.00006)</td>
</tr>
<tr>
<td>Size</td>
<td>0.00451(***)</td>
<td>0.00491(***)</td>
<td>0.00449(***)</td>
</tr>
<tr>
<td></td>
<td>(0.00036)</td>
<td>(0.00036)</td>
<td>(0.00035)</td>
</tr>
<tr>
<td>Extra facility</td>
<td>0.00192</td>
<td>0.00247</td>
<td>0.00146</td>
</tr>
<tr>
<td></td>
<td>(0.00618)</td>
<td>(0.00627)</td>
<td>(0.00602)</td>
</tr>
<tr>
<td>Single rooms [%]</td>
<td>0.07985(***)</td>
<td>0.08089(***)</td>
<td>0.08095(***)</td>
</tr>
<tr>
<td></td>
<td>(0.03666)</td>
<td>(0.03279)</td>
<td>(0.03142)</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.82872(***)</td>
<td>-2.99902(***)</td>
<td>-2.84403(***)</td>
</tr>
<tr>
<td></td>
<td>(0.09787)</td>
<td>(0.07244)</td>
<td>(0.06803)</td>
</tr>
</tbody>
</table>

Observations: 14,205
Facility FE: yes
Time FE: yes
IV (\( \sigma \)): yes
IV (price): yes
Adjusted R-squared: 0.68
Underidentification test: 46.16
Weak ID test: 15.49
Sargan test: 0.11

The dependent variable is \( ls_j = \ln[s_j] - \ln[s_0] \), where \( s_j \) = total number of care-dependent in facility \( j \)/total market size, \( s_0 \) = market share of outside option/total market size. Comparison to the baseline scenario: (1) two instead of five price instruments; (2) number of places in nursing homes of the same ownership type as within-group market share instrument; (3) separate dummies for the correlation of preferences for non-profit and for-profit nursing homes. Source: Research data center of the statistical offices of the Länder, long-term care statistics 2007 and 2009, own calculations.