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Abstract

The German universal long-term care (LTC) insurance program offers beneficiaries the choice between in-kind services and a cash benefit, which can be used for anything, including informal care. The optimal level of the cash benefit de- pends on substitution between formal and informal care options, the cost of public funds, and distributional considerations. To evaluate various policy options, we estimate a random-coefficients demand model for the period 1999-2015 using data on the universe of LTC patients supplemented with micro moments from the German *Mikrozensus*. Results show strong heterogeneity in patient preferences for the three different LTC options: informal, ambulatory and stationary care. A counterfactual analysis predicts that abolishing the cash subsidy leads to a decline in patient sur- plus that far outweighs the savings in public expenditure. It suggests that many countries could benefit from the introduction of a cash subsidy option for LTC.

Keywords: Aging, long-term care, insurance, informal care

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1 Introduction

Population aging has greatly increased the share of elderly and the number of people needing long-term care (LTC). In the United States, the share of the population aged 65 and older is predicted to reach 22% by 2050. In Germany, the corresponding share has already increased by one-third over the last two decades, from 15% in 1995 to 22% in 2021, and it is expected to increase further to 28% by 2050 (Eurostat, 2016; OECD, 2023).

When health deteriorates and the elderly become less self-reliant, there are usually three care options: (i) informal care organized privately, often by family members; (ii) ambulatory care through nurse visits at home; or (iii) stationary care in a nursing home. Due to changes in family structures and rising female labor supply, an ever-larger share of the elderly is receiving stationary care. Public subsidies for long-term care account for a substantial and growing share of government budgets (Gruber et al., 2023). To ensure sufficient supply and sustainable financing, many countries need to reform their LTC system. However, little is known about patients' response to subsidies.

In most countries, long-term care insurance covers only ambulatory and stationary care, even though informal care may be both preferred by the elderly and cheaper to provide (Mommaerts, 2018; Lieber and Lockwood, 2019). In 1994, Germany reformed this market and introduced compulsory insurance. It has been the first country where the majority of beneficiaries and expenditures are in informal and ambulatory care rather than stationary care (Cuellar and Wiener, 2000). The first step to receiving long-term care subsidies is an evaluation of needs by an independent agency. In our observation period, beneficiaries are classified into three care levels, with higher levels reflecting higher long-term care needs. Beneficiaries can opt to receive insurance benefits in the form of an unconditional cash benefit—which can be spent however the beneficiary sees fit, for example, to organize informal care themselves—or receive a subsidy to pay for ambulatory or stationary care services. Importantly, the value of these in-kind benefits, i.e., the subsidy for formal care, exceeds the cash benefit.

We investigate patient choice in this unique setting to study the trade-off between unconditional cash benefits and in-kind subsidies. In particular, we address the following main research question: How do patient choices in the German system compare to those in a system without the cash subsidy option? Importantly, our comparison between the existing German system and a counterfactual without the cash option can be interpreted in reverse to learn how many people would switch out of formal care options if a cash subsidy were introduced, which is the relevant comparison for most other countries.

To address this question, we estimate the extent of substitution between the cash subsidy, ambulatory care, and stationary care in response to price changes and we consider how providers will adjust prices in response to changes in subsidies, given these substitution patterns. We work with the *Pflegestatistik* dataset, a rich administrative source of information on the German long-term care insurance program. It covers the universe of providers and patients in Germany. To allow for flexible substitution patterns, we estimate a random-coefficients, mixed logit demand model with discrete patient types that allows for heterogeneity in tastes for the different long-term care types and their attributes (Berry et al., 1995; Berry and Jia, 2010).[1] To allow for heterogeneous responses to subsidy changes by gender, family status, and income category, we add information from the German *Mikrozensus* dataset, using micro moments to identify the parameters that determine preference heterogeneity (Petrin, 2002; Berry et al., 2004; Berry and Jia, 2010).

Estimated demand coefficients have the expected signs and most are statistically significant. The relative preference for care at home, especially for the informal type, falls markedly with the level of care needs. Within each level, preferences for different types of care are allowed to vary with a few observable characteristics, which show that women and unmarried patients have much stronger preferences for stationary care. We additionally incorporate unobserved heterogeneity in tastes for different care types, and this variation is estimated to be quite large. Prices, and thus subsidies, are an important determinant of patient choice. This is not surprising since the average price of stationary care net of subsidies far exceeds average pension incomes. As expected, patients in the highest income quartiles have the lowest price sensitivity. However, patients in the lowest income quartile also show below-average price sensitivity. This is explained by social insurance covering the patient's share of the price of long-term care homes. Finally, demand also depends on the characteristics of the specific homes, such as the share of full-time employees or single bedrooms. Moreover, nonprofit homes are strongly preferred to for-profit homes, confirming the results in Grant et al. (2022).

We use the estimated demand model to simulate a number of policy counterfactuals. The first exercise is to calculate a new equilibrium without cash benefits. In particular, we measure the fraction of patients currently choosing the informal care option that switches to one of the two formal and more expensive options. The results indicate a reduction in the market share of informal care of 17, 18, and 10 percentage points for the three levels of care needs. In relative terms, this means that 31%, 48%, and 45% of informal

[1] We extend the market share matching approach of BLP to incorporate 798 location by gender specific preference parameters that enter nonlinearly. These are intended to flexibly capture heterogeneous and unobservable opportunity costs of providing informal care.

care users in each level transition to formal care. While ambulatory care is the preferred substitute in care levels 1 and 2, most patients in care level 3 opt for the more expensive stationary care.

Despite increased demand for nursing homes, long-term care homes respond by lowering their prices. This surprising finding is due to a greater propensity of more price-sensitive consumers, primarily from lower income quartiles, which raises the average price elasticity that homes face. This compositional change provides an incentive to reduce the markup that outweighs the opposite effect caused by the increased market share which is still very low for each individual firm.

The policy change leads to notable welfare losses in care levels 1 and 2, as the existing informal care patients incur a direct financial loss. However, in care level 3, the reduction in stationary care prices benefits a larger share of patients, resulting in a small net welfare gain. The impact on public expenditures is mixed, while patients staying in informal care reduce government spending, those switching to ambulatory or stationary care increase costs. Overall, the system sees net savings in care levels 1 and 3 but additional costs in care level 2.

We illustrate how the counterfactual analysis can be reinterpreted to simulate the introduction of a cash option in a country that lacks it. We quantify the magnitude of the newly created informal segment of the LTC market that raises public spending. This expansion of the observed market comes as some patients who already relied on informal care begin claiming subsidies, while others switch from formal care options. However, because the cash allowance is relatively low compared to formal care costs, the overall financial burden remains limited.

Since eliminating the cash option lowers total costs of the LTC system, a welfare evaluation needs to compare lower patient utility with lower public expenditure. Alternatively, we can use the money saved by abolishing the cash option to raise the subsidy going to LTC homes while leaving the ambulatory care option free for patients, leading to a budget-neutral policy adjustment. This now raises the utility of patients in the stationary option and even of some marginal patients switching to this option. Interestingly, we can complete an iso-expenditure curve also considering situations where the cash benefit is raised and the stationary care subsidy lowered. In this case, patients are incentivized to switch to cheaper care options and LTC homes respond by raising their price as the most price sensitive consumers switch to informal care. The results indicate that overall consumer surplus can be raised considerably by raising the cash subsidy above the current level in Germany. It also implies that countries without a cash option would certainly benefit from introducing one.

Our study contributes to two strands of the literature. One investigates the choice between informal, ambulatory, and stationary options in long-term care. These papers primarily use household surveys such as the Survey of Health, Aging and Retirement in Europe (SHARE) (e.g., Bolin et al. (2008), Bonsang (2009), Carrino et al. (2018) and Charles and Sevak (2005)). They have shown that the preferences and opportunity costs that influence patients' choices between care types depend on age, health status, household income, and family situation. Our contribution is to explicitly take the supply side of the market into account, as well as financial determinants, i.e., government-determined subsidies and endogenous prices. Moreover, household datasets often do not include random samples of individuals in nursing homes, while the *Pflegestatistik* contains the universe of all care patients in Germany.

A second literature compares cash and in-kind benefits. In long-term care, many public healthcare systems only offer subsidies for ambulatory or stationary, but not for informal care (Hackmann et al., 2024). If patients are sufficiently price-responsive, it leaves potential for substantial cost savings. However, as the cash subsidy is not as well targeted as in-kind benefits, it could be an inefficient use of public funds if it does not materially change recipients' choices.[2]

Byrne et al. (2009) and Lieber and Lockwood (2019) investigate the benefits of offering either in-kind or cash benefits. In our setting, we can estimate the advantages and disadvantages of allowing patients to choose between the two options which increases the flexibility of how public services are provided. Barczyk and Kredler (2018) consider the German subsidy system as model for a reform of the US system, finding a large reduction in the use of Medicaid. However, as they work with data from the US market where the informal care option does not exist, they cannot pin down the response of US patients to informal care subsidies from observed choices. Other differences are the lack of nursing home characteristics in their data and the absence of a price response by LTC homes. Mommaerts (2025) estimates a dynamic model to show that the availability of informal care by a family member lowers demand for LTC insurance, but also lowers Medicaid spending. In a counterfactual analysis she shows that introducing a cash option would raise insurance demand and lower Medicaid spending further. In a different setting, Collischon et al. (2022) evaluate the introduction of a cash benefit for childcare in Germany using a difference-in-differences approach. They find only a small effect on maternal employment and insignificant effects on public care services. Our structural model allows an evaluation of the effects of various hypothetical changes to the long-term care subsidy

[2]An important characteristic of the German system is the verification of functional limitations and care needs by an independent agency. It limits the need for targeted benefits.

scheme.

We also make a methodological contribution to the literature on demand estimation by allowing for market-specific preference heterogeneity. Starting with the seminal contribution of Berry et al. (1995), a large literature has shown that incorporating preference heterogeneity is crucial for predicting substitution patterns in aggregate, product-level data. As these demand models are estimated based on geographic market-specific or consumer type-specific market shares in different periods, including market-specific (or type-specific) demand shifters or fixed effects would allow for systematic local differences in unobservables. However, as it introduces a large number of parameters that enter the model non-linearly, estimating such fixed effects is practically impossible. Instead, we exploit the discrete choice structure and compute these fixed effects during the inversion of the choice probabilities to reduce the dimensionality of the problem.

The remainder of the paper is organized as follows. In Section 2 we first introduce the different data sources, followed in Section 3 by some background information with descriptive statistics on the German long-term care market and the 1994 reform. In Section 4 we describe the model, and in Section 5 the estimation approach. Estimation results are discussed in Section 6, and in Section 7 they are used to calculate the counterfactual equilibrium following several possible policy changes. Concluding remarks are in Section 8.

2 Data

Pflegestatistik. The primary data source we use is the *Pflegestatistik* dataset provided by the Statistical Offices of the German federal states.[3] It is a census with mandatory participation that contains information on all providers of inpatient and outpatient long-term care in Germany. On the patient side, it contains limited information on all beneficiaries of the long-term care insurance funds: age, gender, and care level (one of three categories, discussed further below). The census is only organized in odd years and we have access to the information from 1999 to 2015. In 2015, it covered 2,899,008 beneficiaries who opt for the cash benefit, received formal care services at their home from one of 13,206 ambulatory care providers, or resided in one of 13,521 nursing homes.[4]

Throughout, we focus only on individuals aged 65 or older and exclude the limited

[3]RDC of the Federal Statistical Office and Statistical Offices of the Federal States, *Pflegestatistik*, survey years [1999–2015], DOI: 10.21242/22411.1999.00.00.1.1.0 to 10.21242/22411.2015.00.00.1.1.0; 10.21242/22412.1999.00.00.1.1.0 to 10.21242/22412.2015.00.00.1.1.0.; and 10.21242/22421.1999.00.00.1.1.0 to 10.21242/22421.2015.00.00.1.1.0.

[4]The data is anonymized and individuals cannot be followed over time.

number of non-elderly patients. Across all nine sample years, there are 19,428,763 observations of long-term care patients and 203,132 observations of long-term care providers. We drop approximately 10% of patients who opt for *Kombinationsleistung*, a combination of reduced cash allowance with limited in-kind ambulatory care benefits. We additionally drop approximately 2% of observations who are patients in a short-term care arrangement or receive only part-time care, i.e., they only receive day or night care services. As some homes specialize in these types of care, this also removes 11,874 provider observations. Markets are defined as a combination of geographic location (*Kreise* or Districts), year, and level of care needs. We drop Kreis-year combinations if one or more homes report prices below the monetary value of the long-term care benefits. Finally, we aggregate ambulatory care providers by ownership type as there are too many providers in some markets without any observable differences to consider them individually. This leaves 15,909,485 patient observations and 88,791 provider observations in the final sample.

Mikrozensus. We additionally use the *Mikrozensus* dataset which is also provided by the Statistical Offices of the German federal states.[5] It is a survey of 1 percent of the German population and contains information on household-level and individual variables. Participation is again mandatory, and participants are followed for four years. It provides useful information on income and family status. We observe whether people receive care at home—combining those in informal or ambulatory care—or in a long-term care home (stationary care), which is used to construct our micro moments. The information in the *Mikrozensus* is aggregated separately for each of the three care levels and also by gender in order to match it to the *Pflegestatistik*.

INKAR. Finally, we also use the INKAR database of the Federal Institute for Research on Building, Urban Affairs and Spatial Development.[6] It provides annual information on average monthly income in each *Kreis*.

3 The long-term care market in Germany

3.1 The 1994 long-term care reform

Germany ranks among the countries with the largest share of elderly worldwide, with more than 20 percent of the population aged 65 or older in 2021 (OECD, 2023). 7.1

[5]RDC of the Federal Statistical Office and Statistical Offices of the Federal States, *Mikrozensus*, survey years [1999–2015], DOI: 10.21242/12211.1999.00.00.1.1.1 to 10.21242/12211.2015.00.00.1.1.1

[6]INKAR (Indicators and maps on spatial and urban development), 2017 edition. The database can be accessed at https://inkar.de.

percent of the population was age 80 or older, and this is predicted to increase further to 11.9 percent by 2050 (OECD, 2023). As a result, an extensive market for long-term care services developed, and long-term care insurance funds (LTCI) were established to finance access to care.

Before 1995, long-term care services provided to elderly patients were reimbursed through municipal and state budgets (Theobald, 2012). The German welfare system only provided means-tested financial support for (formal) inpatient and outpatient long-term care through the *Hilfe zur Pflege* program (Geyer and Korfhage, 2018). As a result, about 80 percent of nursing home patients depended on social services (Geraedts et al., 2000), putting considerable strain on the elderly and their families, as well as local government budgets. There was also no financial support for informal caregivers who were often unable to combine their care tasks with full-time employment.

In 1994, Germany passed a reform introducing a mandatory LTCI program that entered into force in 1995-1996. The objective was to prevent a large share of the elderly from becoming dependent on social services and to lessen the growing financial burden of long-term care on local communities. It is a pay-as-you-go system with mandatory payroll contributions (Cuellar and Wiener, 2000). Everyone enrolled in public health insurance is automatically enrolled in the public LTCI, which covers approximately 90 percent of the population. Members of private health insurance schemes are required to purchase a private LTCI, which offers the same set of benefits (Herr and Saric, 2016).

3.2 Definition of care levels

The LTCI distinguishes three care levels (*Pflegestufen*), which were extended to five categories in 2017. They are based on the extent of impairment and the amount of assistance needed. Each patient's care dependency is assessed independently by staff of the Medical Review Board of the Statutory Health Insurance (Cuellar and Wiener, 2000). It is occasionally reassessed according to the same scale to determine whether their impairment has worsened sufficiently to go up one level.

Before 2017, each patient was assigned to one of the three care levels according to which statement fits best, using for each level the corresponding numbers from the table below:

Care level 1, 2, or 3*: Patients who need help with household chores several times a week and need help with at least X activities from the criteria personal hygiene, feeding or mobility. A family member or caregiver not trained as care worker should spend at least Y minutes to provide the necessary basic care and household chores, of which more than*

Z minutes should be spent on basic care.[7]

	# activities	Total care	Basic care
	X	Y	Z
Care level 1	2	90	45
Care level 2	3	180	120
Care level 3	all (24/7)	300	240

3.3 Long-term care benefits

LTCI benefits are not means-tested, but depend on a patient's care level and the type of services they select: informal care, ambulatory care, or stationary care. The first option, called *Pflegegeld*, is a monthly amount paid out directly by the LTCI. There are no conditions attached on how to spend the money, but in this case, the eligible patient has to organize their own care at home. Most often, benefits are used to compensate relatives for the informal care they provide (Schulz, 2010). The second option, ambulatory care services, entails formal assistance with activities of daily living and/or nursing care provided at the patient's home once or multiple times a day. If no customized add-ons are requested, the public LTCI covers the entire cost, such that for eligible patients the net outlays are zero.

The final option is stationary care in a long-term care (nursing) home. It combines residential accommodation and healthcare services for elderly individuals who do not require hospital care but need assistance with daily living. Some residents may require ongoing medical care from nurses for specific medical conditions but below the level of hospital care. Residents in nursing homes are not typically expected to return to their previous residence but tend to stay until they pass away.[8] Benefits awarded to stationary care patients are intended to cover only the cost of care services provided, but not cover the full price of residence. Out-of-pocket payments are substantial, and amount on average to 1,069 EUR (in 1999 prices) with substantial variation across homes and over time.

Table 1 shows the *Pflegegeld* cash amount and the monetary values of the in-kind benefits for ambulatory and stationary care. The subsidies have increased over time to

[7]The activities included in the four criteria in this statement are (1) Personal hygiene: washing, dental care, combing, shaving or toileting; (2) Feeding: bite-sized preparation or consumption of food; (3) Mobility: getting in and out of bed, dressing, walking, climbing stairs or leaving and returning to the home; (4) Household chores: shopping, cooking, cleaning the house or doing the laundry. (SGB XI §14, §15)

[8]In the US context, they are more like retirement homes, where people permanently move to when they can no longer live independently, than nursing homes, where patients requiring a lot of assistance, often after a medical procedure, stay temporarily.

Table 1: LTCI benefits (€ per month)

		Informal	Ambulatory	Stationary
1995* – 06/2008	Care level 1	205	384	1,023
	Care level 2	410	921	1,279
	Care level 3	665	1,432	1,432
07/2008 – 2009	Care level 1	215	420	1,023
	Care level 2	420	980	1,279
	Care level 3	675	1,470	1,470
2010 – 2011	Care level 1	225	440	1,023
	Care level 2	430	1,040	1,279
	Care level 3	685	1,510	1,510
2012 – 2015	Care level 1	235	450	1,023
	Care level 2	440	1,100	1,279
	Care level 3	700	1,550	1,550

Notes: * 1996 for stationary care
Sources: Bundesrecht website (https://www.buzer.de/gesetz/): Informal care subsidies: SGB 11 §37; Ambulatory: SGB 11 §36; Stationary: SGB 11 §43

keep pace with the increasing cost of services. For informal and ambulatory care, subsidies for care level 1 are approximately one-third as high as those for the highest care level 3, subsidies for care level 2 are approximately two-thirds as high. In contrast, for stationary care subsidies start off much higher in care level 1, already at approximately two-thirds of the value of care level 3 subsidies.

3.4 Long-term care patients

Panels A and B of Table 2 report summary statistics on the individuals qualifying for LCTI benefits. Patient characteristics differ only slightly between the three care levels. The main exception is income which, on average, rises with the level of care needs. Among informal and ambulatory care patients, 60% of those in care level 1 are in the bottom two income quartiles, versus 51% in care level 2, and only 41% in care level 3. In contrast, the share of patients in the top quartile of the income distribution is almost two and a half times higher in care level 3 compared to level 1. Income differences among nursing home patients go in the same direction, but are limited to the top quartile. More remarkable is the much higher share of patients in the top income quartile among nursing home patients than among those receiving care home, with a pronounced difference in each care level.

For gender and age, the differences are also larger between types of care than between care levels. On average, roughly one-third of patients receiving informal or ambulatory

Table 2: Summary statistics for long-term care patients (1999-2015)

	Care level 1	Care level 2	Care level 3
Panel A: Informal and ambulatory care patients in *Mikrozensus* dataset			
Male	0.323	0.382	0.370
	(0.468)	(0.486)	(0.483)
Age	81.20	81.18	80.50
	(7.44)	(7.81)	(8.07)
Married	0.948	0.954	0.954
	(0.222)	(0.210)	(0.210)
Income			
1st quarter	0.261	0.218	0.183
	(0.439)	(0.413)	(0.386)
2nd quarter	0.343	0.290	0.232
	(0.475)	(0.454)	(0.422)
3rd quarter	0.277	0.303	0.298
	(0.448)	(0.459)	(0.457)
4th quarter	0.119	0.190	0.288
	(0.324)	(0.392)	(0.453)
Panel B: Nursing home patients in *Mikrozensus* dataset			
Male	0.239	0.229	0.188
	(0.427)	(0.420)	(0.391)
Age	83.65	84.20	84.22
	(7.51)	(7.45)	(7.67)
Married	0.842	0.872	0.873
	(0.365)	(0.335)	(0.333)
Income			
1st quarter	0.140	0.135	0.138
	(0.347)	(0.342)	(0.345)
2nd quarter	0.122	0.116	0.099
	(0.327)	(0.321)	(0.298)
3rd quarter	0.159	0.123	0.098
	(0.366)	(0.329)	(0.298)
4th quarter	0.579	0.625	0.665
	(0.494)	(0.484)	(0.472)
Panel C: Prices (€/day) paid by stationary care patients in *Pflegestatistik* dataset			
Price of care	42.8	56.55	71.38
	(9.4)	(10.85)	(12.52)
Price of room and board	19.8	19.75	19.78
	(4.9)	(4.88)	(4.87)

Notes: Statistics in panels A and B are averaged using the *Mikrozensus* weights to be representative for the over 65 years population. Panel C shows the daily price paid averaged over all stationary care patients from 1999 to 2015.

care, but only one-fifth of those receiving nursing home care, are male. The mean age of patients receiving informal or ambulatory care is 81 years, while for nursing home patients, it is 84 years. A majority of patients across both care settings are married, though the proportion of married individuals is notably lower among those in nursing home care.

3.5 Long-term care options

The geographical market definition corresponds to districts (*Kreise*) which are the administrative subdivisions of the sixteen German States. In 2015 there were 398 districts. Over the nine odd years between 1999 and 2015 in the sample period, it gives a total of 3,582 markets. From the INKAR data, we observe that the average monthly income across markets is 1,542 EUR for this age group.

Individuals who select a formal care option have on average a choice between 56 ambulatory and 40 stationary care providers in their district. Entry into the nursing home market is largely unrestricted in Germany, subject only to construction and staffing requirements. Capacity constraints were, therefore, much less common than in most other countries, such as the United States during our observation period (Grant et al., 2022). Figure A.1 in the Appendix shows the evolution of the number of nursing homes per 1,000 patients. It remained fairly stable between 1999 and 2015, which implies a significant expansion of supply given population aging (Hackmann et al., 2021). Oversupply of providers is not considered a concern for the insurance system as total LTCI benefits are capped. In fact, entry is encouraged as increased supply is considered beneficial because of the increased competition (Rothgang, 2010). The balanced growth in supply and demand is supported by the fact that state-level occupancy rates consistently fall between 85 and 94 percent (Geyer et al., 2023). After the "Pflegestärkungsgesetz" of 2017, a reform of that strongly extended eligibility for long-term care, demand has risen more than supply. Thus, in recent years, capacity constraints have become more of an issue than in our sample period. In the future, we expect policymakers will have to take into account the shortage of nursing home places when introducing policy shifts, such as making relative changes to formal and informal care subsidies.

Table 3 provides an overview of the product characteristics of the various providers of stationary and ambulatory care. Providers are classified into three ownership types. For-profit and non-profit firms each capture approximately 46% of the ambulatory care market, and public providers serve the remaining 8%. As the ambulatory care firms are relatively small and almost all have a low market share, we aggregate them by ownership type within each district and include at most three ambulatory options in the demand

Table 3: Summary statistics for long-term care providers (1999-2015)

	Ambulatory		Stationary	
	mean	sd	mean	sd
Number of providers	55.7	(86.9)	39.8	(44.5)
Market share within each care type				
For-profit	0.459	(0.498)	0.386	(0.487)
Non-profit	0.465	(0.499)	0.554	(0.497)
Public	0.076	(0.262)	0.061	(0.239)
Number of providers (aggregated)	2.2	(0.4)	39.8	(44.5)
Market share (in district)	0.101	(0.057)	0.018	(0.021)
Share full-time employees	0.258	(0.156)	0.372	(0.212)
Share skilled employees	0.615	(0.125)	0.427	(0.140)
Share male employees	0.103	(0.065)	0.148	(0.075)
Share single bedrooms			0.578	(0.277)

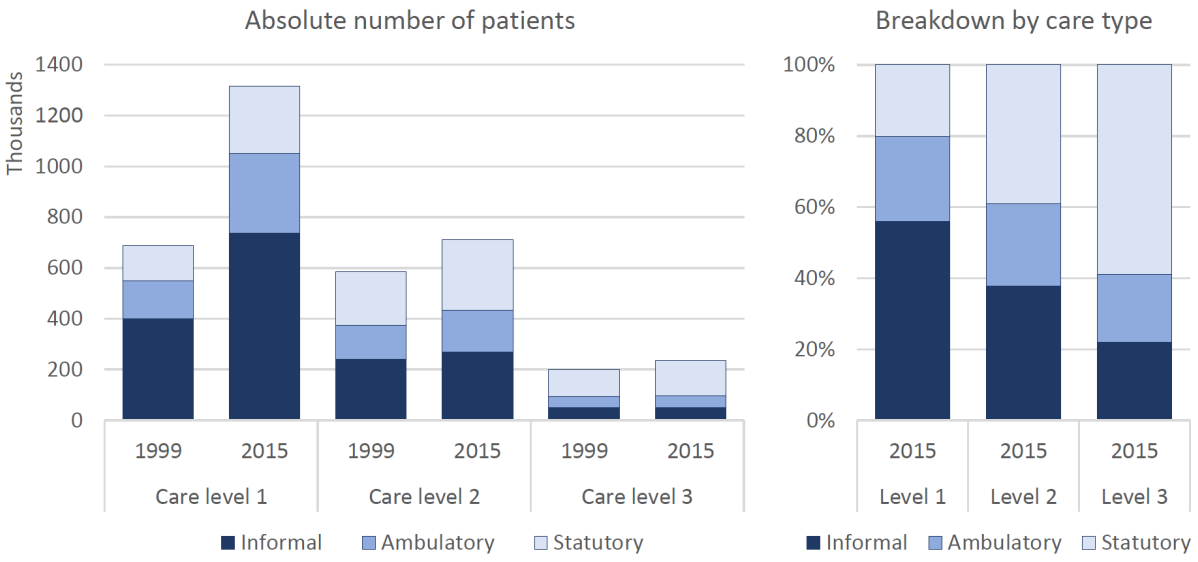
Notes: Characteristics of ambulatory care providers are for the entities created by aggregating within each district all firms with the same ownership type. Market shares in each district are computed by care level and then averaged.

model. On average, each included type has a market share of 10.1%, for a combined market share across all ambulatory care options of 21.7% in the average market (which has 2.22 ambulatory care options). There are no prices associated with ambulatory care as the in-kind services are fully covered by the LTCI. Nursing homes—which are included individually in the demand model—have an average market share of 1.8%, for a combined market share across all stationary care options of 41.6% in the average market.

Comparing provider characteristics between the two care types, the larger presence of non-profit organizations among stationary care providers stands out. Nursing homes also have a higher share of full-time and male employees, but a markedly lower share of skilled (certified) employees. This difference is a natural consequence of the much broader range of services that nursing homes provide for their residents, such as day activities and meal services, which often do not require skilled employees. On average, almost 60 percent of the rooms in a nursing home are single rooms.

The bar charts in Figure 1 illustrate how patients are divided over the three long-term care options, separately for each care level. Almost 60% of LTCI beneficiaries in care level 1 opt for the cash benefit and receive informal care. The remainder spread approximately equally over the two formal care options, ambulatory or stationary. When patients need more care, the share of patients opting for ambulatory care declines ever so slightly. The much bigger difference is a decline in informal care to approximately 40% and 50% of patients, respectively in care levels 2 and 3, with commensurate increases in the share of patients opting for stationary care. This pattern has been remarkably stable

Figure 1: Patient choices over the three care types



Notes: The right panel shows the breakdown of LTC patients by care type for 2015. The left panel shows the same breakdown in terms of the absolute number patients for 1999 (the first year in the sample) and 2015 (the last year in the sample)

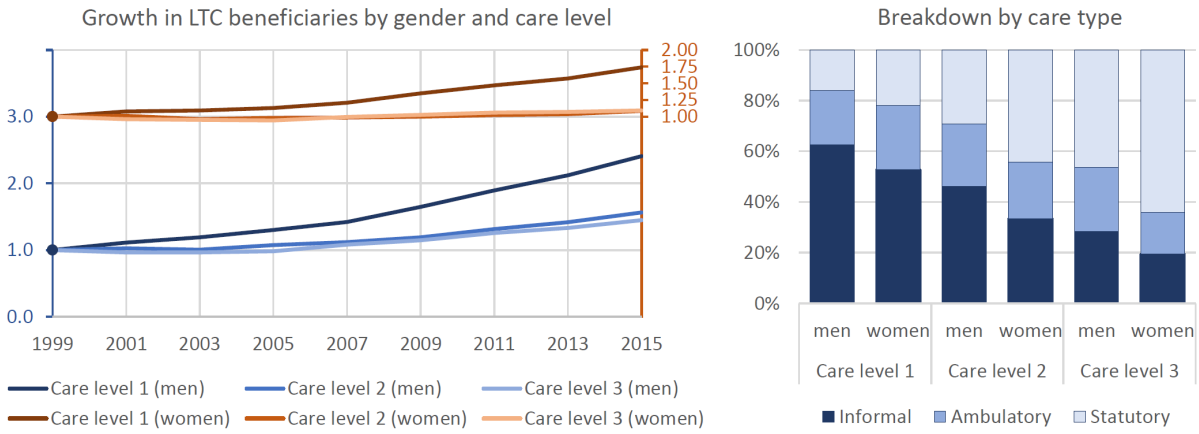
over time, and we only show the breakdown for 2015 in the right panel in Figure 1.

The statistics in the left panel of Figure 1 show the same breakdown based on the absolute number of patients for the first and last years in the sample. This reveals a strong growth in the number of patients that is concentrated in care level 1. The overall increase in LTC beneficiaries was 53%, but the group of care level 1 patients increased by 91%. Even though only a small fraction of patients in level 1 opt for the most expensive option (stationary care), in absolute numbers they almost caught up with level 2 patients in 2015, and they already far outweighed the number in level 3.

Gender plays an important role in determining LTC usage. The higher life expectancy for women and the fact that in most married couples the husband tends to be a few years older leads to very different LTC experiences for women. The panel on the right in Figure 2 shows that in each care level men are at least 10% more likely to choose the cash benefit. Informal care is often provided by their spouse. Even in care level 3, less than half of all male patients are in stationary care versus 63% of women. Access to care is one factor, but having a partner also makes it more expensive and complicated to move into stationary care. Hence, the gender difference is largest in the use of ambulatory care in level 3.

Conditional on care level, there are approximately three times as many women than men in the German LTC system, but this difference has shrunk over the last two decades. The left panel of Figure 2 plots the growth rate of beneficiaries by gender and care needs.

Figure 2: LTCI beneficiaries by gender



Notes: Growth in the number of beneficiaries shown in the left panel is denoted on the left axis for men and on the right axis for women (1999=1). The off-set reflects that in 1999 there were approximately three times as many female than male beneficiaries. The breakdown by chosen care type in the right panel is shown for 2015 (but was virtually identical in 1999).

For both men and women, the number of patients in care level 1 has grown far more rapidly than in the higher care levels. For men, the growth rate of 140% is truly remarkable, and is almost double the 74% growth rate for women. This difference is even starker in higher care levels. In fact, for women, there has barely been any change over the 16-year period we study, while the number of men in care levels 2 and 3 has increased by, respectively, 56% and 45%, far more slowly than the 140% growth rate in level 1. One has to keep in mind that the high growth rate for men started from a much lower base – reflected in the off-set in Figure 2. As result of the differential growth rate, the share of women among beneficiaries declined from 74% in 1999 to 68% in 2015.[9] Differences remained somewhat more pronounced among level 3 beneficiaries (71% women) and among stationary care patients (75% women).

Patients use long-term care services for a relatively short period. Half of all beneficiaries who opt for home care when initially classified into care level 1 pass away within 52 months. For patients initially classified into a higher care level, the usage of long-term care services is even shorter, averaging 26 months (level 2) or 3.5 months (level 3) (Häcker and Hackmann, 2012).[10] For patients who choose nursing home care immediately at the start of their long-term care needs, the remaining life expectancy is even lower. Transitioning between care levels is not uncommon but not very frequent either in light of the

[9]This fraction corresponds approximately to the gender distribution in the relevant population, with on average twice as many women as men in the age bracket of 80 years and older.

[10]There is a substantial gender gap also in the duration of usage of LTC services. The time in the system reached by half of all male patients is only two thirds as high as the time reached by half of all women.

relatively short life expectancy in the system. In any given year, approximately one in six patients transitions to a higher care level.[11] Transitions between care options, e.g., between ambulatory and statutory care, are even less frequent.

3.6 Price setting by nursing homes

As mentioned earlier, an independent agency of the Statutory Health Insurance assesses each patient's care level which determines LTCI benefits. Patients can then choose a predetermined monthly cash allowance and organize informal care themselves. They can also choose ambulatory care at their own home and receive in-kind services without any out-of-pocket costs.

If patients choose the third option, stationary care, they face prices set by the long-term care homes. In fact, prices are negotiated at the state level between individual homes, insurance companies, and the social assistance agency. Insurance companies are fully reimbursed for all long-term care expenses by the national system, leaving them with little incentive to negotiate lower prices (Bakx et al., 2015). Prices are set for at least one year and take into account past, present, and expected costs. The relevant price for patients is the nursing home's price minus the LTCI subsidy. Patients and their families who are unable to pay the full amount can receive financial assistance from social services (Herr and Saric, 2016).

Panel C of Table 2 shows the average daily price across nursing homes distinguishing the price of care and the price of room and board.[12] Nursing homes do not differentiate the price of room and board across care levels, and the variation is solely due to composition by year and market. In contrast, the price of care increases strongly with the care level. For level 1, the average daily price is 43 EUR corresponding to an average monthly price of 1,303 EUR. It rises to 71 EUR in level 3, corresponding to an average monthly price of 2,171 EUR. Comparing these prices with the LTCI benefits in Table 1, it transpires that the average cost in the highest care level exceeds the insurance benefit by 620 to 740 EUR (depending on the year). The relatively high standard deviations, especially on the price of room and board and even within care levels for the price of care, suggest that nursing homes have a lot of flexibility in setting their preferred prices. The price negotiations limit price changes somewhat but do not impose significant constraints. Price differences are potentially correlated with unobserved quality which we take into account in the demand

[11] Transitions, other than death, are most likely for women in care level 1 who reside in a nursing home.

[12] The total cost of residing in a nursing home contains a third component, the investment cost, which we do not observe. It corresponds to a room rental rate and even patients receiving care at home implicitly face such an expense.

estimation.

4 Utility specification

Patients enter markets exogenously when their health status is assessed in a medical exam and they are categorized in one of three care levels. We estimate demand for those three market segments separately as this determination is outside patients' control. We define markets as district-year combinations; there are $3,555$ in our sample.[13] To reduce notation, we omit the market subscript m where possible.

Each patient selects a single alternative among the available options, which we model as a discrete choice problem. The choice menu $\mathcal{J} = \{0, \mathcal{A}, \mathcal{H}\}$ consists of three broad categories: the cash option for informal care, up to three ambulatory care options, and all available LTC homes in the local market. $j = 0$ is the reference option of taking the cash allowance. Because we observe the entire market for long-term care in Germany, we define one of the observed alternatives as the outside option.[14] We differentiate the available ambulatory care services by type of provider: public, not-for-profit and for-profit, such that $\mathcal{A} = \{1, 2, 3\}$. Long-term care homes are gathered in $\mathcal{H} = \{4, \ldots, J\}$.

To allow for heterogeneity with respect to observed demographics, we model patients as discrete types, following Berry and Jia (2010). Interacting gender with marital status and four income quartiles defines a total of sixteen patient types. Preference parameters for each type are further allowed to differ by region (price coefficient) or even by district (care type intercepts) as they might not only capture taste differences, but also opportunity costs. A patient of type τ derives the following indirect utility from choosing long-term care option j.

$$\begin{aligned} u_{\tau,j} &= \delta_j + \mu_{\tau,j} + \epsilon_{\tau,j} \\ \text{with} \qquad \delta_j &= x_j\beta + \alpha p_j + \xi_j, \\ \mu_{\tau,j} &= \alpha_\tau p_j + \gamma_{\tau,\mathcal{A}} + \gamma_{\tau,\mathcal{H}}. \end{aligned} \tag{1}$$

We discuss each component of the utility expression in turn. δ_j is the mean utility, i.e., the systematic part of preferences that are common to all patients. x_j contains the observable characteristics of each care option. For ambulatory providers, these are only

[13] We drop a few markets with long-term care homes that have negative prices after taking into account the insurance subsidy.

[14] We do not observe individuals who choose not to be examined and pay for all their care needs themselves, choosing to remain outside of the LTC market. Given the high cost of long-term care, they are likely to make up only a small part of the patient population.

dummies for non-profit and for-profit status with public services as the base category. For stationary care homes, it includes similar indicators for the two types of private providers, and additionally the share of nursing staff working full time, the share of single bedrooms, and a dummy for homes only offering single bedrooms. The α coefficient captures the baseline price sensitivity, with patients located in the East and in the first income quartile as the reference category. The price entering here is the out-of-pocket price net of LTCI benefits. ξ_j is the option-specific unobservable attribute that can be interpreted as the mean quality of option j. It becomes the model's error term once we aggregate individual demands to the product level.

Preference heterogeneity between patient types is captured by the term $\mu_{\tau,j}$. It incorporates two features. First, to flexibly capture persistent regional differences in terms of incomes and employment opportunities for patients' offspring, we allow the price coefficient to vary over the four regions (R_r) and four income quartiles (Q_q):[15]

$$\alpha_\tau = \begin{cases} 0 & \tau \in Q_1,\ \tau \in R_E, \\ \Delta\alpha_q^y & \tau \in Q_q,\ \tau \in R_E,\quad q = \{2,3,4\}, \\ \Delta\alpha_r & \tau \in Q_1,\ \tau \in R_r,\quad r = \{W,N,S\}, \\ \Delta\alpha_q^y + \Delta\alpha_r & \tau \in Q_q,\ \tau \in R_r,\quad q = \{2,3,4\}, r = \{W,N,S\}, \end{cases}$$

The regional and income-specific deviations from the mean value of α are additive. The income quartiles are defined from the income distribution conditional on requiring long-term care.[16]

Second, the broad categories of ambulatory and stationary care options receive separate intercepts with the cash option being the base category. We allow these intercepts to vary in the population to incorporate heterogeneity in tastes for care types that varies

[15]With a common price coefficient, a large share of observations would select an option that is on the inelastic portion of their demand schedules.

[16]The regions are defined as: East (Sachsen-Anhalt, Thüringen, Sachsen, Brandenburg, Berlin, Mecklenburg-Vorpommern), West (Nordrhein-Westfalen, Rheinland-Pfalz, Saarland, Hessen), North (Bremen, Hamburg, Schleswig-Holstein, Niedersachsen), and South (Baden-Württemberg, Bayern).

systematically with patient characteristics, as follows:

$$\gamma_{\tau,\mathcal{A}} = \begin{cases} 0 & j \notin \mathcal{A}, \\ 0 & \tau \in \text{female}, \\ \sigma_{Ak} & \tau \in \text{male},\ \tau \in D_k,\ \ k = \{1, \ldots, 399\}, \end{cases}$$

$$\gamma_{\tau,\mathcal{H}} = \begin{cases} 0 & j \notin \mathcal{H}, \\ 0 & \tau \in \text{female, not married}, \\ \sigma_w & \tau \in \text{female, married}, \\ \sigma_{Hk} & \tau \in \text{male, not married},\ \tau \in D_k,\ \ k = \{1, \ldots, 399\}, \\ \sigma_{Hk} + \sigma_h & \tau \in \text{male, married},\ \tau \in D_k,\ \ k = \{1, \ldots, 399\}. \end{cases}$$

As preference heterogeneity might also reflect differences in opportunity costs, for example for informal care givers, we also allow intercepts to vary by districts k as economic opportunities tend to be quite different in different parts of the country. For the ambulatory care options, male patients get a district-specific deviation from the average quality valuation.[17] For the stationary care options, there is again a district-specific deviation for male patients with an addition deviation for married patients, σ_h for husbands and σ_w for wives.

With the standard assumption of a type-II extreme value (Gumbel) distribution for the patient-specific taste term $\epsilon_{\tau,j}$ and patients choosing from the available set of options to maximize utility, the choice probabilities for each patient type are given by

$$Prob_{\tau,jm} = \frac{e^{\delta_{jm}+\mu_{\tau,jm}}}{\sum_{\ell=0}^{J_m} e^{\delta_{\ell m}+\mu_{\tau,\ell m}}}. \tag{2}$$

The usual assumption is to normalize the non-stochastic part of the utility of the outside option to zero, i.e. $\delta_0 + \mu_{\tau,0} \equiv 0$, such that $u_{\tau 0} = \epsilon_{\tau,j}$ and $\exp(\delta_{0m} + \mu_{\tau,0m}) = 1$ in the denominator of (2). In our setting, the (out-of-pocket) price of the outside good amounts to the negative of the LTCI cash allowance (p_{0m}), which varies over time and care levels. We can still use the usual choice probability expression, if we normalize the inside options:

$$Prob_{\tau,jm} = \frac{e^{\delta_{jm}+\mu_{\tau,jm}+\tilde{\alpha}_\tau p_{0m}}}{1 + \sum_{\ell=1}^{J_m} e^{\delta_{\ell m}+\mu_{\tau,\ell m}+\tilde{\alpha}_\tau p_{0m}}}, \tag{3}$$

with $\tilde{\alpha}_\tau = \alpha + \alpha_\tau$. The relevant price term in each inside option's utility expression is

[17] As all choice options are district specific, the ξ_j parameters will be estimated to equate the observed and model market share. They will reflect the average valuation by female patients in market m of option j. Note that the ξ_j are market (district-year) specific, while the male deviations are only market specific.

now normalized relative to the outside good and it becomes:

$$\tilde{\alpha}_\tau * \left[\text{price}_{jm} - (\text{benefit}_{jm} - \text{benefit}_{0m})\right]. \tag{4}$$

The market subscript incorporates the variation in prices and subsidies over time. Note that the cash subsidy from the outside option enters as an opportunity cost for the ambulatory and stationary care alternatives. For the ambulatory care option, the benefits exactly cover the cost of care and the opportunity cost is the only price component these patients face.

5 Estimation

Our estimation consists of two sequential steps. In the first step, we base our approach on Petrin (2002) and match as closely as possible the observed patient choices from two sources of information to the model predictions. It produces three outcomes: (1) A vector of mean utility values δ_m that equates the model's market-level shares for all LTC options to the observed shares from the *Pflegestatistik*. (2) Two sets of district-specific preference shifters, for ambulatory and stationary care, that allow for an exact match of the gender-specific choices over the three broad LTC categories in each district. (3) Five non-linear preference parameter estimates that are identified by matching as closely as possible the moments based on the *Mikrozensus*.

In the second step, we regress the observable attributes of the various options, such as prices and LTC home characteristics, on δ_m to obtain the mean values of patient preference parameters. Given that home prices are endogenous, consistent estimation requires instrumental variables.

5.1 Moment matching

The vector $\theta = (\beta, \alpha, \Delta\alpha_r, \Delta\alpha_q^y, \sigma_{Ak}, \sigma_{Hk}, \sigma_w, \sigma_h)_{r=W,N,S;\ q=2,3,4;\ k=1,\ldots,K}$ collects all parameters to be estimated. In the first step, we optimize over the five non-linearly entering preference parameters in $\theta_{2,Mikro} = (\Delta\alpha_2^y, \Delta\alpha_3^y, \Delta\alpha_4^y, \sigma_w, \sigma_h)$ to align the probabilities of choosing the overall stationary care option for sixteen patient types as closely as possible with the directly observed market shares. These moments are defined at the national level. The parameters capture income effects and the impact of marital status, separately for male and female patients, on the likelihood of choosing any of the stationary care options.

Let $\mathcal{S}_{\tau,\mathcal{H}}$ denote the type-specific observed choice frequencies and $s_{\tau,\mathcal{H}}$ denote the model-implied counterparts observed in the *Mikrozensus*. The latter are calculated by aggregating over the choices for all individual LTC homes in a market:

$$s_{\tau,\mathcal{H}}(\delta_{\text{match}};\theta_2) \;=\; \sum_{m=1}^{M} w_m \sum_{j\in\mathcal{H}_m} Prob_{\tau,jm}(\delta_{\text{match},m};\theta_2). \tag{5}$$

The market weights w_m reflect each district's share of the national patient-type population for a given care level.[18] The type-specific probability of choosing one of the available LTC homes naturally depends on all the preference parameters, including the mean utilities δ_{match}, the district-specific preference shifters for ambulatory and stationary care $\theta_{2,k} = (\sigma_{Ak}, \sigma_{Hk})$, and the nonlinear preference parameters $\theta_{2,Mikro}$.

Taking δ_{match} and $\theta_{2,k}$ as given, we can write the nonlinear objective function for the first step as

$$\min_{\theta_{2,Mikro}} ||\mathcal{S}_{\tau,\mathcal{H}} - s_{\tau,\mathcal{H}}(\delta_{\text{match}};\theta_2)||^2_{\tau=1,\ldots,16}. \tag{6}$$

The minimization of (6) is the outer optimization loop of the estimation in step one. In addition, there is a nested inner loop that matches the market-level shares for every available LTC option and recovers the 2×399 district-level preference shifters that measure the preferences of male patients for ambulatory and stationary care, relative to the benchmark for female patients.[19] This matching procedure must be performed for every candidate value of $\theta_{2,Mikro}$. In the standard BLP estimation approach, estimating this many nonlinear parameters through the objective function (6) would be computationally infeasible. We circumvent this problem and instead recover the large number of $\theta_{2,k}$ parameters by extending the demand inversion of Berry (1994) in a nested step.

Specifically, let $\mathcal{S}_{jm}$ denote the market share of option j which we observe directly in the *Pflegestatistik* data and s_{jm} denote the model-implied counterpart defined as

$$s_{jm}(\delta_m;\theta_2) \;=\; \sum_{\tau} w_{\tau,m}\, Prob_{\tau,jm}(\delta_m;\theta_2). \tag{7}$$

Applying the standard inversion procedure of Berry (1994), we obtain the first matching condition:

$$s_{jm}(\delta_{\text{match},m};\theta_2) \;=\; \mathcal{S}_{jm}. \tag{8}$$

The vector implicitly defined, i.e., $\delta_{\text{match},m} = s^{-1}_{jm}(\mathcal{S}_{jm};\theta_2)$, makes the above equality hold,

[18] These micro moments are constructed aggregating over all years in the sample.

[19] Both of these sets of fixed effects measure the gender and district-specific preferences relative to the outside option of informal care at home.

exactly matching the model-implied market shares with their observed counterpart. Moreover, it constitutes an input for the second step of the sequential estimation procedure.

A concern for the consistent identification of patient preference parameters is the presence of district-specific latent factors, which influence the attractiveness of stationary care in a long-term care home relatively to the alternatives. Such latent factors could be systematic differences in the opportunity costs of providing informal care or in the availability of stationary or ambulatory care places. They could also represent preference heterogeneity that is not fully captured by observable patient demographics. We therefore allow for district-specific preference shifters for ambulatory and stationary care that further vary between female and male patients.

Define the model-implied average probability of male patients choosing any of the ambulatory care options in district k as

$$s_{\mathcal{A},k}(\delta_{\text{match},k};\theta_2) = \sum_t \sum_{j\in\mathcal{A}} \sum_{\tau\in male} Prob_{\tau,jk}(\delta_{match,k};\theta_2), \qquad k = 1,...399. \tag{9}$$

$s_{\mathcal{H},k}(\delta_{\text{match},k})$ is defined similarly by summing over all LTC homes in district k. The corresponding market shares from the *Pflegestatistik* data are denoted by $\mathcal{S}_{\mathcal{A},k}$ and $\mathcal{S}_{\mathcal{H},k}$. Each time we average over all years t that district k appears in the sample. We restrict the patient types to males, because female patients are the base category and we only recover gender-specific preference deviations.[20] Matching the shares for male patients will automatically match the corresponding shares for female patients as well.

Rather than estimating the 2×399 district-level parameters, we implement another inversion based on the following system:

$$s_{\mathcal{A},k}(\delta_{\text{match},k};\theta_2) = \mathcal{S}_{\mathcal{A},k}, \;\; k = 1,\ldots,399 \tag{10a}$$

$$s_{\mathcal{H},k}(\delta_{\text{match},k};\theta_2) = \mathcal{S}_{\mathcal{H},k}, \;\; k = 1,\ldots,399. \tag{10b}$$

We solve for the gender-specific preference shifters $\theta_{2,k} = (\sigma_{Ak}, \sigma_{Hk})$, which are part of the full θ_2 vector, that make sure both equalities in system (10) hold for every district. Note that these two equations are solved jointly with the product-level equation (8) as one system.

BLP provide a proof of uniqueness for δ_{match} by establishing that (8) can be solved using a fixed point that is a global contraction. In the Appendix, we provide the analogous proof that the extended system (8) and (10) also can be solved with a fixed point satisfying the global contraction property. The solutions to $\delta_{\text{match},m}$ and $\theta_{2,k}$ for all markets and

[20] These are patient types 9 to 16 in Table A.1.

districts are therefore unique. Note that Arellano and Bonhomme (2023) apply the same idea in the nonparametric estimation of linear models with latent variables.

5.2 Linear preference parameters – Price endogeneity

In the second step we recover the mean values of the preference parameters $\theta_1 = (\beta, \alpha)$ that enter the patients' utility linearly. They are related to the mean utility δ_{jm}, that is recovered in the first step, as follows:

$$\delta_{\text{match},jm} = x_{jm}\beta + \left(\alpha + \sum_{r \in W,N,S} \Delta\alpha_r \mathbf{1}_{m \in r}\right)(p_{jm} - p_{0m}) + \xi_{jm}. \tag{11}$$

Note that the price of the outside good, p_{0m}, the cash allowance, is exogenous. It is determined by the German government and changes only infrequently. Moreover, prices of the ambulatory care options are also assumed to be exogenous. They equal the corresponding subsidy levels, which are also set by the government and completely cover the cost of the baseline bundle of services. As a result, ambulatory care patients do not face any out-of-pocket expenditures.[21] The relevant price of ambulatory care is implicitly set by the government too, as it is the value of the foregone informal care cash subsidy.

For long-term care homes, on the other hand, we observe substantial price dispersion and the stationary care subsidy is not sufficient to cover the full cost. Homes can reasonably be expected to set prices to maximize profits. Here we face the standard price endogeneity problem in differentiated products demand estimation. While patients and care providers are assumed to directly observe all choice-relevant product attributes, the econometrician does not. Some unobservables enter into the error term and care providers take the value of these unobservables into account when setting prices. It leads to a positive correlation between price and the error term. To obtain consistent estimates of θ_1, which includes the baseline price coefficient, we use several instrumental variables.

Our instruments include a so-called Hausman instrument, namely the price variation in neighboring markets, and four cost shifters: the share of male employees, the share of skilled employees, the average number of employees per room in the LTC home, and capacity utilization. Across all three care levels, four of the five instruments exhibit significant and positive effects on nursing home prices, suggesting that higher labor costs and staffing intensity contribute to higher prices. Capacity utilization is the only instrument with a negative effect on prices, and its impact is significant only in care level 2. Table

[21] We do not observe any add-ons that individual patients may book. The cost of these must be borne by the patients.

A.3 presents the results of the first stage regressions of price on the instrumental variables and the other explanatory variables of the model. The relevance of our instruments is supported by the significant effects on nursing home prices across different care levels.

Tables A.4 and A.5 show the results of estimating a standard logit model, i.e., excluding patient preference heterogeneity (random coefficients) from the demand system, using both OLS and 2SLS. A comparison of the point estimates on the price variables highlights the importance of accounting for endogeneity when measuring price elasticities in the long-term care market. The OLS estimates produce relatively inelastic own-price elasticities that range from -0.20 in care level 3 to -0.40 in care level 2. Only about 1% of nursing homes choose prices on the elastic portion of the demand curve, inconsistent with profit maximizing behavior. In contrast, the 2SLS estimates yield significantly more elastic results, with own-price elasticities ranging from -1.69 in care level 1 to -2.81 in care level 3, and fewer than 1% of nursing homes price on the inelastic portion of demand. These differences underscore the critical role of addressing endogeneity, as the 2SLS results reflect more realistic consumer price responsiveness in this market. The pattern is exactly what would be expected if a positive correlation between prices and the error term biases the estimate of the price coefficient upward (towards zero) in the OLS estimation.

For the full demand model, we estimate θ_1 separately for each care level using the mean values δ that are obtained in the first estimation step. This includes region-specific deviations from the average price coefficients that also enter the estimation linearly. To account for this, we supplement the same set of instruments with interactions between the existing instruments and region dummies.

6 Results

Coefficient estimates for the demand system, which is estimated separately for the three care levels, are reported in Table 4. The first important pattern to note is the declining price sensitivity over the three care levels. The baseline estimate on the price variable α is more than three times higher (in absolute value) in level 1 versus level 3, and twice as high compared to level 2. When people become more care dependent, their options shrink and high prices of LTC homes become less of a deterrent. Receiving care at home also becomes less practical for many people. Patients in higher care levels also tend to be somewhat older, which might further reduce their price sensitivity.

The region-specific deviations indicate that patients are most price sensitive in the East, then the North, West, and least in the South. This pattern is exactly in line with average income differences over the four German regions. Differences in price sensitivity

Table 4: Demand model estimates

	Care level 1	Care level 2	Care level 3
Constant	-0.335	0.107	0.097
	(.208)	(.255)	(.204)
Stationary care ($\mathcal{H}$)	1.206***	2.022***	0.495***
	(.248)	(.182)	(.160)
σ_w ($\mathcal{H}$, married female)	-1.853***	-2.441***	-0.619***
	(.122)	(.193)	(.142)
σ_h ($\mathcal{H}$, married male)	-2.258***	-1.251***	-1.876***
	(.073)	(.080)	(.022)
α	-1.814***	-0.921***	-0.545***
	(.156)	(.120)	(.100)
$\Delta\alpha^y_{q2}$	-0.888***	-1.248***	-0.664***
	(.079)	(.096)	(.015)
$\Delta\alpha^y_{q3}$	-0.368***	-0.977***	-0.649***
	(.028)	(.075)	(.015)
$\Delta\alpha^y_{q4}$	0.525***	0.151***	-0.022***
	(.043)	(.013)	(.006)
$\Delta\alpha_{North}$	0.586***	0.299***	0.225***
	(.084)	(.063)	(.041)
$\Delta\alpha_{West}$	0.818***	0.411***	0.323***
	(.074)	(.064)	(.052)
$\Delta\alpha_{South}$	1.057***	0.571***	0.373***
	(.072)	(.062)	(.045)
Non-profit	0.059	0.108***	0.114***
	(.045)	(.022)	(.025)
For-profit	-0.583***	-0.467***	-0.504***
	(.063)	(.049)	(.050)
Share full-time employees	0.218***	0.195***	-0.019
	(.080)	(.048)	(.040)
Share single bedrooms	0.652***	0.265***	-0.010
	(.052)	(.031)	(.029)
Only single bedrooms	-0.467***	-0.470***	-0.422***
	(.038)	(.027)	(.022)
Trend	0.021***	0.020***	0.008***
	(.004)	(.005)	(.004)
Bundesland FE	Yes	Yes	Yes
Kreis-male FE (σ_{Ak} & σ_{Hk})	Yes	Yes	Yes
Observations	87,147	88,187	86,056

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors are reported in parentheses and are clustered at the Bundesland × year level.

by income level are inverse-U shaped. Patients in the second income quartile are far more price sensitive, followed by those in the third income quartile. The much lower price sensitivity of patients in the highest income quartile is as expected, but not for the lowest

income quartile. The reason is the presence of additional government support for people who cannot afford the co-pay through a program that pre-dates the establishment of the current LTC insurance regime. The low price sensitivity of the poorest group of patients is particularly pronounced for those in care level 3, which is also the segment with the highest share of stationary care, where government support for low-income patients is most common. Intuitively, both of the regional and income-related differences in price sensitivity are less pronounced in the higher care levels.

As the subsidy difference between stationary and informal care remains relatively constant over the care levels, at approximately 800 EUR, the lower price sensitivity in level 3 requires a lower preference for stationary care to rationalize its market share. As a result, the stationary care intercept is estimated much lower for level 3, even though its market share is highest there. One of the most pronounced patterns is the highly negative coefficients for stationary care for married patients, who prefer to receive care at home. The aversion to care homes is estimated the strongest for married male patients. Recall that the specification also includes gender-specific taste differences for ambulatory and stationary care that vary by district.

Patients have a preference for non-profits, but a distaste for for-profit providers and this pattern is relatively constant over the care levels. It mitigates the lower prices of for-profit homes. Patients prefer homes that have a large share of full-time employees and more single bedrooms, but like the price sensitivity these preferences strongly diminish with care needs. The negative coefficient for homes with only single bedrooms is likely to reflect an unobservable type effect, e.g., such homes might be more expensive on average and reflect some nonlinearity in the price sensitivity.

The estimates in Table 4 include a mix of linear and nonlinear coefficients. In particular, the micro-moments from the *Mikrozensus* identify the income-specific price sensitivities and the stationary care preferences for married patients. Figure A.2 in the Appendix illustrates that the model matches the micro-moments quite well, with only a few exceptions. This is important because the average probability of choosing any of the stationary care options differs widely over the 16 patient types, ranging from merely 10% to almost 90%. Patient types are grouped first by gender, then by marital status and finally income level. In each of the three care levels that are depicted in separate graphs, we can see a clear U-shaped probability of selecting stationary care over the four income levels, that repeats every four types. The much higher probability for unmarried individuals is also clearly visible, comparing types 1-4 (unmarried women) to types 5-8 (married women) and similarly for men, comparing types 9-12 to 13-16.

6.1 Firm behavior

To conduct counterfactual analyses, we need to recover the marginal cost for all of the options where prices are determined endogenously. Patients choosing informal care receive a cash benefit that is regulated and determined exogenously. Patients choosing ambulatory do not face any out-of-pocket cost, since we are only interested in the in-kind services offered through the LTCI.

For stationary care, the subsidy offered by the LTCI covers only part of the full price of nursing home care. It is likely that homes will adjust their prices in response to adjustments in subsidies as changes in out-of-pocket expenses influence patients' choices. We supplement the demand model with a specific behavioral assumption for nursing homes and solve for the product-specific marginal costs by inverting the full set of first order conditions. We assume that the observed market equilibrium is the outcome of a differentiated products Nash equilibrium in prices. Nursing homes choose their prices to maximize profits, taking prices and characteristics of competitors as given, but responding optimally to them.

We assume that each nursing home is a single product firm with the following profit function in each care level:[22]

$$\Pi_j \quad = \quad \max_{p_j} \left(p_j - mc_j\right) I_m \, s_j(p, X; \theta). \tag{12}$$

I_m is the number of LTCI beneficiaries in the firm's district and s_j is the predicted market share. Because patients cannot switch between care levels and demand in each segment is entirely independent, optimal price setting is also independent across the three care level segments. We only need to pay attention to potential capacity constraints when we consider counterfactual policy changes that (substantially) raise the demand for stationary care.

We recover the vector of marginal costs that rationalizes the observed price vector assuming that patients' price sensitivity is determined by the demand model and that firm's first order conditions are given by the Bertrand-Nash best response curves. This implies the distribution of price-cost markups $(p-mc)/p$ for nursing homes in the different care segments shown in Table 5.

Markups exhibit a clear upward trend across care levels, reflecting differences in price sensitivity. The median markup in care level 3 is more than twice as high as in care level 1. The highest markups in care level 1 align closely with the median markup in care level

[22]While coverage of long term care homes is complete in the *Pflegestatistik*, it is not possible by construction to observe the ownership patterns for firms that operate multiple homes in a market.

Table 5: Distribution of price-cost markups (in percent)

	percentile				
	2.5^{th}	25^{th}	50^{th}	75^{th}	97.5^{th}
Care level 1	13.2	19.7	24.6	31.4	38.3
Care level 2	21.7	31.2	37.3	48.9	62.6
Care level 3	31.4	48.1	57.6	70.3	84.8

2, while the highest markups in care level 2 approximate the median markup in care level 3. These results support the broader characterization of the long-term care market where price responsiveness diminishes with increased care needs, as individuals requiring more intensive care face greater constraints in their ability to substitute between care types. As a result, providers are able to set higher markups for higher care levels. The median markups imply that the median price elasticity over the three care levels equals -4.06, -2.68, and -1.74.

7 Counterfactuals

7.1 Eliminating the cash option

After estimating the demand system and recovering the marginal costs that rationalize the observed market equilibrium, we can conduct counterfactual policy simulations. We use the most recent year in our sample, which is 2015, and hold the observed and unobserved attributes of all existing long term care options fixed. We only adjust subsidies, but allow LTC homes to adjust their prices according to their best response functions.

To evaluate how changes in subsidies affect outcomes in the German market for long term care, we conduct two sets of calculations. In the first, we remove the option of a cash allowance for informal care, mimicking what is the existing situation in most other countries. By removing the cash option, the opportunity cost of the ambulatory and stationary care options falls, which makes them relatively more attractive.

We determine new equilibrium prices and market shares. In addition, we calculate the compensating variation for each type of patient that makes them indifferent between the initial and the new subsidy regimes. In this particular counterfactual, it measures a

patient's willingness to pay for the cash option. Patient surplus for type τ is

$$\begin{aligned} CS_\tau &= \frac{1}{-\tilde{\alpha}_\tau}\left[\log\left(e^{-\tilde{\alpha}_\tau p_0}\right) + \log\left(1+\sum_{k=1}^{J} e^{\delta_k+\mu_{\tau,k}+\tilde{\alpha}_\tau p_0}\right)\right] + C \\ &= subs_0 - \frac{1}{\tilde{\alpha}_\tau}\log\left(s_{\tau,0}(p, subs)\right) + C, \end{aligned} \tag{13}$$

where p is the vector of prices excluding subsidies, $subs$ is the vector of subsidies for all available options, and C is an unknown constant of integration. With $\widetilde{subs}$ and $\tilde{p}$ the counterfactual subsidies and equilibrium prices, the compensating variation is given by

$$CV_\tau = \left(\widetilde{subs}_0 - subs_0\right) + \frac{1}{\tilde{\alpha}_\tau}\log\left(\frac{s_{\tau,0}(p, subs)}{\tilde{s}_{\tau,0}(\tilde{p}, \widetilde{subs})}\right). \tag{14}$$

Aggregating CV_τ over types using appropriate weights, gives the change in aggregate patient surplus from eliminating the cash option.

The first term in (14) indicates that any reduction in the cash subsidy reduces the compensating variation one-for-one. The second term measures a compensating effect as some patients will adjust their behavior, which reduces the market share for the informal care option. An increase in long-term care home prices—as these providers react to the new market environment that makes their offering relatively more attractive—would limit this adjustment.

The results of the counterfactual policy simulation of eliminating the cash option are in Table 6. Panel A contains the initial market shares for the three types of care and average nursing home prices in 2015 as a baseline. Results in Panel B show the decline in market share of the informal care option in each care segment. In absolute terms, the decline is largest in care level 2, at -18 percentage points. This is also the largest decline in relative terms with almost half of all patients changing their preferred care option. When patients switch, ambulatory care is the preferred alternative in care levels 1 and 2, attracting approximately 67% and 53% of switchers, respectively. In care level 3, only one quarter of patients that switch out of stationary care choose ambulatory care, while three quarters choose the much more expensive stationary care alternative.

While an increase in demand for nursing homes would typically be expected to drive up prices, we observe a decline in prices across all three care levels. This counterintuitive outcome arises because the additional demand comes from individuals who are systematically more price sensitive than current nursing home residents. Panels A and B of Table 2 show that, initially, approximately 60% of nursing home residents in each care level belong to the highest income quartile, a group that, according to our estimation results, exhibits

the lowest price sensitivity. In contrast, the new demand comes disproportionately from the second and third income quartiles, where individuals are more price responsive, and chose informal care in the first place. As a result, the composition of demand shifts toward more price-sensitive consumers, prompting nursing homes to lower prices despite an overall demand increase. We return to this finding in Section 7.4 below.

Table 6: Results for counterfactual policy of eliminating the cash allowance

	Care level 1	Care level 2	Care level 3
Panel A: Observed equilibrium in 2015			
Number of patients (thousands)	1,316	711	236
Share informal care	55.9%	37.7%	22.0%
Share ambulatory care	23.9%	23.1%	19.2%
Share stationary care	20.1%	39.1%	58.8%
Nursing home price (€)	2,202	2,677	3,048
Panel B: New equilibrium without the cash option (changes in %p or €)			
Δ Share informal care	-17.6%	-18.0%	-9.8%
Δ Share ambulatory care	11.8%	9.5%	2.4%
Δ Share stationary care	5.8%	8.5%	7.4%
Δ Nursing home price	-2.06%	-5.89%	-6.22%
Δ CV in total (mio. €)	-129	-40	0.89
Δ CV per capita (€)	-98	-56	4
Δ Public expenditure (mio. €)	-24	32	-0.05

Notes: Changes in market shares are in percentage points; changes in prices are in percentages; changes in public expenditure and patient compensating variations are measured in euros at a monthly frequency.

The compensating variation from the policy change varies significantly across care levels, with substantial welfare losses in care levels 1 and 2 but a small positive effect in care level 3. Per capita, the welfare loss in care level 1 is nearly twice as high as in care level 2, primarily due to the high prevalence of informal care users in care level 1. Among these patients, 38 percent of patients are in informal care and do not adjust their behavior, simply incurring an income loss equal to the lost subsidy of €235 on their preferred option. Approximately 24% of patients are initially in ambulatory care and are unaffected by this policy change. 20% of patients are in stationary care and also do not adjust, but they enjoy a welfare gain equal to €45 because equilibrium long-term care home prices decrease. Finally, 17.6% of patients switch from informal to one of the two formal care options. By re-optimizing, they limit the welfare loss from losing the informal care subsidy to only €97. Averaging over these four groups, the average welfare loss of the policy change is €98 per patient, but as our discussion showed, it hides very heterogeneous impacts.

The distribution of welfare changes is quite different in level 3. In that case, informal patients who do not switch lose €700 in subsidies, this group counts 12% of the patient population. However, a larger fraction of the directly affected patients re-optimize their care choices, mitigating much of the welfare loss. Moreover, the average price decrease of €190 in stationary care now affects almost three times as many patients as in level 1. As a result, when averaging across all groups, the compensating variation in care level 3 is small but positive, driven by the high share of individuals in nursing home care who benefit from lower prices. These findings highlight the uneven distributional effects of the policy, with some patients incurring significant losses while others experience welfare gains.

The impact on public expenditure is the net effect of two opposing changes. Patients in informal care who stick with that option in spite of losing their subsidy are a net gain for the LTC budget. In contrast, patients who switch to either of the two formal types of care, which are much more costly, lead to an additional cost on the system. The first change dominates in care levels 1 and 3 and also in the aggregate because of two reasons. First, in care level 1, the absolute level of the cash benefit for informal care is higher than the difference between the cost of informal and ambulatory care, which is the most popular alternative. Second, two thirds of patients who lose their cash benefit do not change their type of care and only a minority upgrade to formal care, which is the most expensive option. In care level 2, the balance goes the other way because the cash subsidy is only two thirds of the benefit difference with ambulatory care, while at the same time more patients switch into formal care (approximately half), and many of them pick the most expensive stationary care option.

7.2 Introducing the cash option

We discussed the counterfactual policy change of eliminating the cash option for informal care in the Germany LTC system. However, we can present the same two equilibrium situations in reverse. This alternative interpretation considers the impact of introducing the informal cash option in a country where it does not yet exists. The counterfactual outcome without the cash option in Germany then represents the initial situation in other countries, and the actual German system with the cash allowance then reflects the policy counterfactual for the other countries. We use the same estimated adjustment propensities, but normalize the observed LTC market differently.

In Table 7 we show the two ways to present the policy experiment. The first two columns follow the original interpretation, appropriate for Germany. Column (1) shows

Table 7: Two ways of presenting the counterfactual

	Eliminating the cash option		Introducing the cash option		
	Cash	No cash	No cash	Cash	
				abs. change	% change
	(1)	(2)	(3)	(4)	(5)
Care level 1:					
Informal	56	38	?	61+29	
Ambulatory	24	36	58	39	-33%
Stationary	20	26	42	32	-23%
Total	100	100	100	161	+61%
Care level 3:					
Informal	22	12	?	14+11	
Ambulatory	19	22	25	22	-14%
Stationary	59	66	75	67	-11%
Total	100	100	100	114	+14%

Notes: (1) Distribution of patients across LTC options in Germany, normalizing the total market to 100. (2) New equilibrium under the counterfactual policy of eliminating the cash option for informal care. (3) Initial situation without the cash option, normalizing the total market size to 100 counting only the (observable) ambulatory and statutory care options. (4) Counterfactual equilibrium introducing a cash option for informal care. In addition to attracting patients from the two formal options (the second number), it reveals patients who were already in the informal care option and remain there (the first number). (5) Percentage change from (3) to (4).

the initial market shares of the three LTC types, normalizing the total market for long-term care to 100 patients. If the cash allowance is removed, the number of patients choosing informal care declines (by 18 percentage points in care level 1 and by 10 percentage points in level 3). Patients switch to either of the two formal options.

Column (3) represents the initial situation in other countries that currently do not offer the informal cash option. The total market size is again normalized to 100, but this now only counts patients in the ambulatory and stationary care options, which are the only visible parts of the market in these countries. The breakdown over ambulatory and stationary care follows that in column (2). In this case, patients who are eligible for LTCI benefits, but prefer informal care over the two formal care options, cannot be identified as indicated by "?".

Columns (4) and (5) then represents a counterfactual simulation that introduces a cash option for informal care. This induces some patients to switch out of the two formal care options into informal care and receive a cash subsidy (29 percentage points of the total initial market for care level 1 and 11 percentage points for level 3). In addition, it also leads to the identification of patients who already chose the informal care option even without the cash benefit and remain there, but who now claim subsidies. It expands the

observed market for long-term care, even though the actual population of patients in need is unchanged. It raises public expenditures, but as we saw before, the total additional cost is limited because the absolute cash allowance is relatively low and a sizeable group of patients switch out of the formal and more costly care options.

7.3 Iso-expenditure curves

Eliminating the cash option has two opposite effects on public expenditures. It saves money as some informal care patients do not change their behavior, but costs money for patients who switch to the more expensive formal care options. The overall welfare effect is the sum of a negative effect on consumer surplus, a positive effects on producer profits and an ambiguous effect on public expenditure.[23]

To avoid taking a stance on the cost of public funds, we now consider a second set of budget-neutral counterfactual policy simulations. In particular, the money saved by lowering the cash allowance is allocated to increased subsidies on stationary care.[24] As we estimated an increased cost for the LTC system in care level 2 after abolishing the cash allowance, in that case we lower stationary care subsidies. We thus keep overall public expenditure on long-term care constant in all situations, lowering or raising stationary care subsidies as necessary. Knock-on effects of changes in stationary subsidies on price setting and further consumer switching are taken into account until convergence.

The left graph in Figure 3 shows the iso-spending curves for the three care levels. It represents combinations of the cash allowance and stationary care subsidies that leave total public expenditure on long-term care unchanged. The cash allowance is scaled by a factor ψ_0 that is shown on the horizontal axis and the factor ψ_H that scales stationary care subsidies is shown on the vertical axis. The initial situation corresponds to $\psi_0 = 1$ and $\psi_H = 1$, which naturally lies on each of the three iso-spending curves.

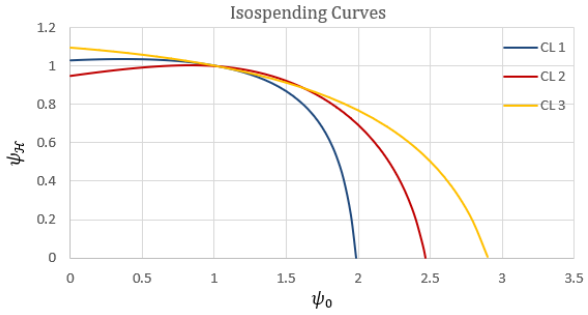
The full elimination we studied earlier corresponds to $\psi_0 = 0$. We already learned that eliminating the cash option reduces public expenditure in care levels 1 and 3. This can also be seen in Figure 3, because the blue and yellow lines hit the vertical axis above one. Subsidies on stationary care can be raised when the cash allowance is abolished. We now learn that only a small increase is possible if overall public expenditures are to remain unchanged: stationary care subsidies can rise by approximately 3% in care level 1 and by 9% in level 3. The reverse is true in care level 2. Because the elimination

[23] As LTC homes lower their prices, they surrender some profits on existing patients. They only do this because the profits they gain from inducing additional patients to switch outweighs that effect.

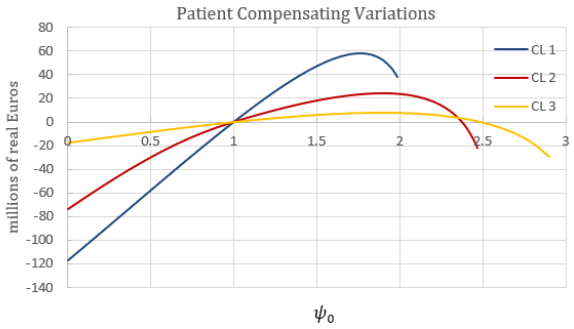
[24] As patients do not face any out-of-pocket expenditures on ambulatory care, we leave that option unchanged.

Figure 3: Changes in LTC home subsidies and average compensating variation under various levels of the cash option with unchanged public expenditures

(a) LTC home subsidies



(b) Compensating variation



Notes: The horizontal axis indicates the factor ψ_0 applied to the cash allowance: $\psi_0 = 0$ is full elimination, $\psi_0 = 1$ is the actual subsidy level, $\psi_0 = 2$ doubles the cash allowance. The factor ψ_H on the vertical axis of the left graph indicates the corresponding factor applied to LTC home subsidies to keep total public expenditures constant. The vertical axis on the right graph shows the average impact on the compensating variation across all patients.

of the cash option raises public expenditures (due to strong substitution), subsidies on stationary care need to fall to finance this and keep total expenditures unchanged.

Because some informal care patients switch into more expensive formal care options, reducing the cash allowance does not save much money and the curves are fairly flat to the left of the $\psi_0 = 1$ point. This dynamic operates in reverse to the right of the $\psi_0 = 1$ point and it makes the iso-spending curves steeper. As the cash allowance is raised, some patients will switch out of the two formal care options. This switching is reinforced by the budget neutrality requirement, as higher cash allowances are accompanied by lower stationary care subsidies. However, in care level 3 where few patients initially receive the cash allowance, the cash allowance can be raised quite substantially without requiring much of a reduction in stationary care subsidies. For example, even doubling the cash allowance only requires a reduction in stationary subsidies by 23% to keep total public expenditure unchanged. For care level 1 the curve is a lot steeper when the cash allowance is raised, because the vast amount of patients are already in the informal care option. Raising the cash benefit raises public expenditure without inducing much change in behavior.

In the graph on the right we show the impact of these budget-neutral policy changes on average patient surplus. In all three care levels, total welfare would increase substantially if the cash allowance were raised and stationary care benefits lowered to pay for it. At some point, the compensating variation (CV) reaches an interior maximum which is the optimal cash allowance from an aggregate welfare perspective. The maximum CV is reached well before the curves in the left graph intersect the horizontal axis, i.e., the full

elimination of stationary care subsidies, which is where we truncated the curves in the right graph. In care levels 1 and 2, the optimal cash subsidy is even reached before its level has caught up with the subsidies awarded to stationary care. However, in care level 3 the maximum CV is reached only after that point. It would be more reasonable to cap ψ_0 at approximately 1.9 which would generate the same benefit level for the informal and stationary care options.

We already learned from the first counterfactual that introducing the cash benefit raises consumer surplus in a long-term care system that lacks it. Now we learn that raising the cash subsidy above the current level for Germany and financing it by reallocating subsidies across care types could raise aggregate welfare quite a bit more without any additional public cost. Note, however, that there are important distributional implications as such a policy has opposite effects on patients in informal and stationary care. Given that stationary care patients tend to be higher-income, such a policy is still worth considering.

Finally, the producer surplus is increased to the left of $\psi_0 = 1$, as the policy raises demand in the segment of stationary care where LTC homes are active. In contrast, producer surplus falls to the right of $\psi_0 = 1$. Stationary care subsidies decline and higher informal care subsidies entice patients to switch out of LTC homes. One reason why the yellow CV line for care level 3 is relatively flat, is that homes raise their prices. As shown in the first counterfactual, the standard response of lowering markups in response to a negative demand shock is dominated by a tendency to raise prices as the most price sensitive consumers switch first towards informal care.

7.4 Price adjustments by LTC homes

We now return to the finding of higher counterfactual LTC home prices if the cash allowance is eliminated. To understand better the mechanism behind the price increases, we perform two alternative calculations. First, we do not allow a competitive response and hold LTC home prices unchanged at their initial levels. These results are reported in panel B of Table 8; in panel A we report a subset of the baseline results for comparison.

Without LTC home price adjustments, fewer patients switch out of informal care and those that switch are relatively more likely to opt for ambulatory care. The difference is largest in care level 3 where 1.1 percentage points (11%) fewer patients switch and the share of stationary care in those switches is approximately one half rather than three quarters in panel A. Both patterns are entirely as expected as the original counterfactual shows price reductions. In all three care levels, but especially in level 2 and 3, consumer welfare declines far more without the helpful price reductions. Note that the price changes

Table 8: Eliminating the cash allowance: Alternative counterfactuals

	Care level 1	Care level 2	Care level 3
Panel A: Original counterfactual			
Δ Share informal care	-17.6%	-18.0%	-9.8%
Δ Share ambulatory care	11.8%	9.5%	2.4%
Δ Share stationary care	5.8%	8.5%	7.4%
Δ Nursing home price	-2.06%	-5.89%	-6.22%
Δ CV per capita (€)	-98	-56	4
Panel B: No price adjustments			
Δ Share informal care	-16.9%	-16.3%	-8.7%
Δ Share ambulatory care	12.3%	11.8%	4.1%
Δ Share stationary care	4.6%	4.5%	4.6%
Δ Nursing home price	0%	0%	0%
Δ CV per capita (€)	-109	-126	-119
Panel C: No heterogeneity in price sensitivity			
Δ Nursing home price	0.04%	0.07%	0.10%

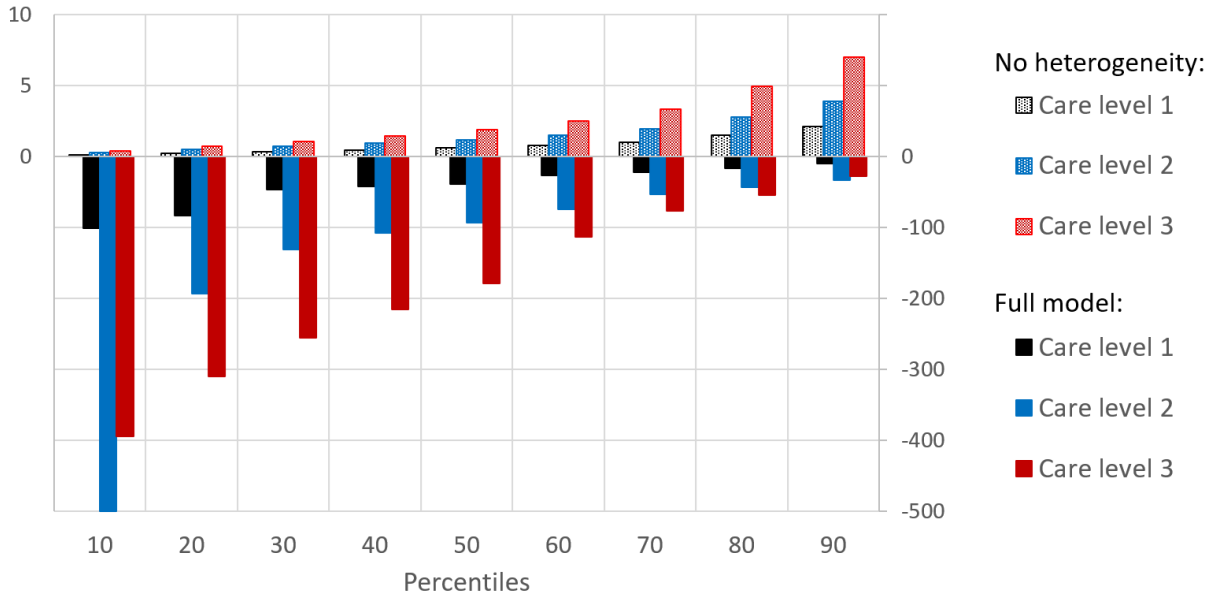
Notes: Changes in market shares are in percentage points; changes in prices are in percentages; changes in public expenditure and patient compensating variations are measured in euros at a monthly frequency.

also work in the opposite direction if we follow the reverse interpretation, i.e., when considering the introduction of the cash option. The ability of LTC homes to raise prices when their most price elastic patients opt for the cash option eliminates all of the welfare gains for patients in care level 3 and it cuts the welfare gains in care level 2 in half. With price adjustments, the introduction or elimination of the cash option leads to welfare gains for some, but losses for others.

In a second alternative exercise, we still allow for price adjustments, but eliminate the heterogeneity in price sensitivity from the model. Imposing the same baseline price coefficient α on all patient types—although still varying by care level—eliminates the incentive to change prices in response to a change in patient composition. Results in panel C show only the resulting price changes as the comparison with the baseline market shares is flawed when the average price elasticity in the model is changed.

Without price heterogeneity across consumer types, the elimination of the cash allowance for informal care straightforwardly raises demand for LTC homes. Without an effect on the average price elasticity, homes respond by raising their prices, but changes are extremely small. Even in care level 3 which counts most patients in the stationary care segment, the average price increase is only 0.1%. Compared with the changes in panel B, fewer patients will switch out of the informal care option and the average gain

Figure 4: Range of counterfactual price adjustments by LTC homes based on two alternative demand models (€/month)



Notes: Price changes for each decile in the distribution of price changes. Solid columns are for the counterfactuals based on the full model (right scale); dotted columns are for counterfactuals based on a demand model without price heterogeneity across consumer types (left scale).

in consumer welfare will be lower, but differences will be minor.

Finally, in Figure 4 we show the range of price changes that underlie the averages shown in panels A and C. The direct response to the demand shock is represented by the price increases in the model without heterogeneity in price sensitivity. The median price changes range between €1-2 and the maximum reaches €7 for the 90th percentile in care level 3. This is a small change, but not unreasonable given the low market share of almost all LTC homes. The share of the stationary care option in each district is split over, on average, 40 different homes that set prices independently. The market share increase in the counterfactual, which never exceeds 10 percentage points in the aggregate, has only a marginal impact on each individual home's market power.

The adjustment to the change in composition in a home's client base directly follows the Lerner's index and should be directly proportional to the increase in average (absolute) price elasticity. The point estimates on the differential price sensitivity for patients from the 2nd and 3rd income-quartiles, reported in Table 4, are quite large and indicate a price elasticity that is approximately twice as high in the East. In the more price sensitive regions, patients from the middle income groups even have a price elasticity that is 3 to 4 times as high. The 7.4 percentage point increase in the share of the stationary care option in the baseline model for care level 3 represents an average of 12.5% more patients.

If the average price elasticity of this group of new patients were twice as high as that of the existing client base, it would raise the price elasticity by more than one tenth.

Taking 10% of the original (median) markups gives a back-of-the-envelope estimate on the predicted price declines.[25] The values for the three care levels that we obtain (all expressed in € per month) of €54, €100, and €175, are close to the observed values of €38, €93, €179 for the 50th percentile in Figure 4. Moreover, if homes are more expensive, have higher than average markups, or if the income-related differences in price elasticity are much higher (as in the Southern region), the price adjustment would also be proportionately higher.

8 Conclusions

As populations age and long-term care needs rise, governments must carefully design subsidy systems to balance patient welfare and public expenditure. Our study examines Germany's unique LTC insurance system, which allows beneficiaries to choose between in-kind subsidies for formal care and an unconditional cash benefit that can be used for informal care. We investigate how patient choices respond to these subsidies and assess the implications of eliminating the cash option in Germany or introducing a cash option in other countries.

We base our analysis on a flexible model of demand that incorporates several dimensions of taste heterogeneity. Micro-moments that are introduced through the *Mikrozensus* data make it possible to incorporate relevant household characteristics, such as marital status and income quartile, that are not observed in the *Pflegestatistik* data, which has the advantage of covering the universe of patients. The price sensitivity in particular is estimated to vary strongly by gender, income, and region. As a result, the response of firms to policy changes depends not only on the direct impact on their market share, but also on the composition of patients they attract.

Our counterfactual simulations demonstrate that allowing patients to choose between in-kind benefits and a cash subsidy leads to beneficial self-selection, ultimately increasing patient welfare while holding public LTC insurance expenditures constant or even reducing them. Given these findings, an expansion of the cash option appears optimal for Germany, where this option has been in place for some time. For countries that do not yet provide subsidies for informal care, introducing a cash option would encourage a shift toward

[25]The median price-cost markup in the three care levels are estimated at €542, €999, and €1751 obtained by multiplying the percent markups from Table 5 with the average monthly prices reported in Table 3.

informal care. While this policy change would expand the observed LTC market—since existing informal care users would begin claiming benefits and some patients would switch from formal to informal care—the resulting increase in public spending would be limited, as the cash benefit can be relatively low compared to formal care costs.

Moreover, the counterfactual scenarios assume that LTC homes can seamlessly adjust to demand. In the original exercise of abolishing the German cash benefit option, the number of patients that we predict to transition into formal care might be an overestimate. In practice, the adjustment will be constrained, especially in the short run, by factors such as a limited supply of skilled nursing staff and capacity constraints in LTC facilities. As such, the increase in public expenditures could also be lower. In contrast, if an informal option were newly introduced in a country, it would divert patients away from LTC homes and mitigate existing capacity constraints. The possibility of adjusting gradually to population aging seems to be an additional advantage of the system with a cash benefit as capacity constraints in Germany are less pressing than in most countries.

Given these insights, policymakers in countries without a cash option should consider introducing one to enhance patient welfare and optimize public spending. Likewise, countries like Germany which already offer a cash subsidy, should quantitatively assess whether increasing the subsidy could further improve patient welfare while maintaining the current cost of LTC provision. The evidence from our study strongly suggests that a well-calibrated cash benefit can lead to a more efficient and patient-centered system.

There are two caveats to this conclusion. First, we focused on total patient welfare, but already mentioned that there are important distributional implications. Some patients gain, while others lose. Moreover, it would also be important to incorporate the welfare effects on informal caregivers, but our model is not well suited for this (see Hackmann et al. (2021) for a general equilibrium evaluation of the German LTC system). Second, attention should be given to LTC homes' price responses. We find in our counterfactual that abolishing the cash option would markedly increase the price sensitivity of the average patient choosing stationary care. As a result, homes optimally respond by lowering prices, in spite of the demand increase. Given this trade-off, it is possible that the introduction of a cash option (or an increase in the level) could induce firms to raise prices. Such a policy would be expected to temp away the most price-elastic patients first and the effect on the homes' patient composition in terms of price responsiveness might outweigh the negative demand shock. Given that these two opposing forces are present, it would be straightforward for the regulator to monitor competition when deciding to approve price increases or not. Moreover, such price responses depend on prevailing market structure and price regulations and those are bound to vary across countries.

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Cash or care? Insights from the German long-term care system

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Supplemental Appendix

List of Figures

List of Tables

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A Appendix

A.1 Proof of uniqueness for the augmented market share inversion

Here, we prove that the solution to the inversion of the market share system that is nested in the first step of our estimation is unique. The system consists of equations (8), the standard Berry (1994) inversion, and equation (10), the additionally appended matching conditions at the patient-gender level. The latter are based on a partition of the set of available inside options into mutually exclusive subsets. We define a total of $g = 1, \ldots, G$ nonoverlapping sets of alternatives;[1] and we assume that there are $i = 1, \ldots, I$ discrete types of patients.[2] The inversion problem therefore has $J + I \cdot G$ nonlinear equations to be solved.

We follow BLP and proof uniqueness by using a fixed point iteration to solve the inversion problem. Throughout, we suppress the market index and thereby obtain patient-gender preference shifters for the G groups of alternatives at the market level.

$$\begin{aligned} G_j(\xi;\theta,w) &= \xi_j + \mathcal{S}_j - s_j(\xi;\theta,w),\ j = 1,\ldots,J \\ G_{J+m} &= \xi_{ig} + \mathcal{S}_{ig} - s_{ig}(\xi;\theta),\ m = 1,\ldots,I\cdot G \\ \xi^{\text{iter}+1} &= G(\xi^{\text{iter}};\theta,w) \end{aligned} \tag{A.1}$$

Where $\xi = (\xi_1, \ldots, \xi_j, \ldots, \xi_J, \xi_{1,1} \ldots, \xi_{i,g} \ldots, \xi_{IG})$ and $G(\xi;\theta,w)$ is the stacked system of equations. If a norm of the Jacobian of $G(\xi;\theta,w)$ is bounded between zero and one, the fixed point iteration satisfies the contraction mapping property. This is the case if the sum of the derivatives of each row of $G(\xi;\theta,w)$ with respect to ξ lies in the unit interval. We verify that this is indeed the case for the two representative rows of $G(\xi;\theta,w)$.

$$\begin{aligned} \sum_{n=1}^{J+I\cdot G} \frac{\partial G_j(\xi;\theta,w)}{\partial \xi_n} &= 1 - \left(\sum_i w_i s_{ij}(1-s_{ij}) - \sum_i \sum_{k\neq j} w_i s_{ij} s_{ik} \right. \\ &\quad \left. + \sum_i w_i s_{ij}(1-p_{ig}) - \sum_{h\neq g} \sum_i w_i s_{ij} s_{ih} \right), j = 1,\ldots,J \\ &= 1 - 2\sum_i w_i s_{ij} s_{i0} \in \left(\frac{1}{2}, 1\right) \end{aligned} \tag{A.2}$$

[1] In the main text, these are the sets of ambulatory care options, $\mathcal{A}$, and stationary care options $\mathcal{H}$. The cash option is the outside option, indexed by $j = 0$.

[2] In the main text, these are female and male patients, which are aggregates of the 16 distinct patient types that we allow for.

We use the fact that the product $s_{ij}s_{i0}$ is guaranteed to lie in the interval $(0, 1/4)$.

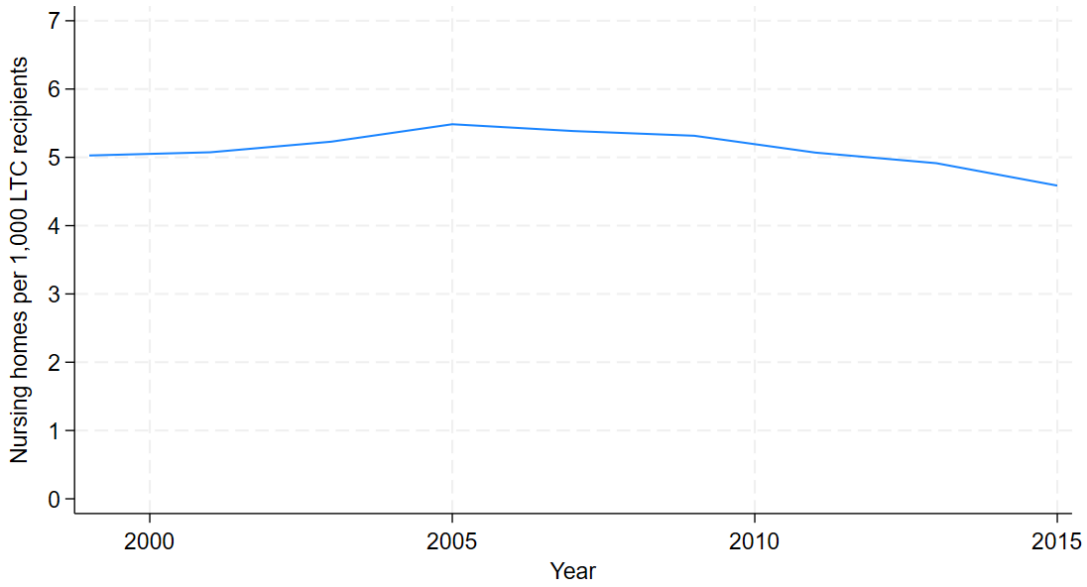
$$\begin{aligned}
\sum_{n=1}^{J+I\cdot G} \frac{\partial G_{J+m}(\xi;\theta,w)}{\partial \xi_n} =& 1 - \sum_{j\in g} s_{ij}(1-s_{ij}) - \sum_{j\in g} s_{ij} \sum_{h\neq g} \sum_{k\in h} (-s_{ik}),\ j = 1,\ldots,J, m = 1,\ldots,I\cdot G \\
& - \sum_{j\in g} s_{ij}(1-s_{ij}) + \sum_{j\in g} \sum_{\ell\neq j} s_{ij}(-s_{i\ell}) \\
&= 1 - 2\sum_{j\in g} s_{ij} \left(1 - s_{ij} - \sum_{k\neq j} s_{ik}\right) \\
&= 1 - 2s_{i0} \sum_{j\in g} s_{ij} \\
&= 1 - 2s_{ig}s_{i0} \in \left(\frac{1}{2}, 1\right)
\end{aligned} \tag{A.3}$$

We again use the fact that the product of two shares is bounded from above and below by $1/4$ and 0, respectively. It follows that the sum of every row of the Jacobian of $G(\xi;\theta,w)$ is bounded on the unit interval and the extended share inversion thereby satisfies the global contraction property. The solution to ξ is therefore unique.

In the main text, we perform the inversion to arrive at patient-gender level shifters at the district level. The derivatives of the gender-specific preference shifters for that variant are averaged over all years (markets) for a given district. For each year observed for a given district, the above bounds hold. An average of these year-specific bounds remains within the bounds. Therefore, the proof of uniqueness also applies to the variant of the extended inversion in the main text. For the estimation, we do not use the fixed point iteration to solve the system, because of its slow convergence rate. Instead, we reformulate the system as a nonlinear minimization problem, which can be solved quickly for each market.

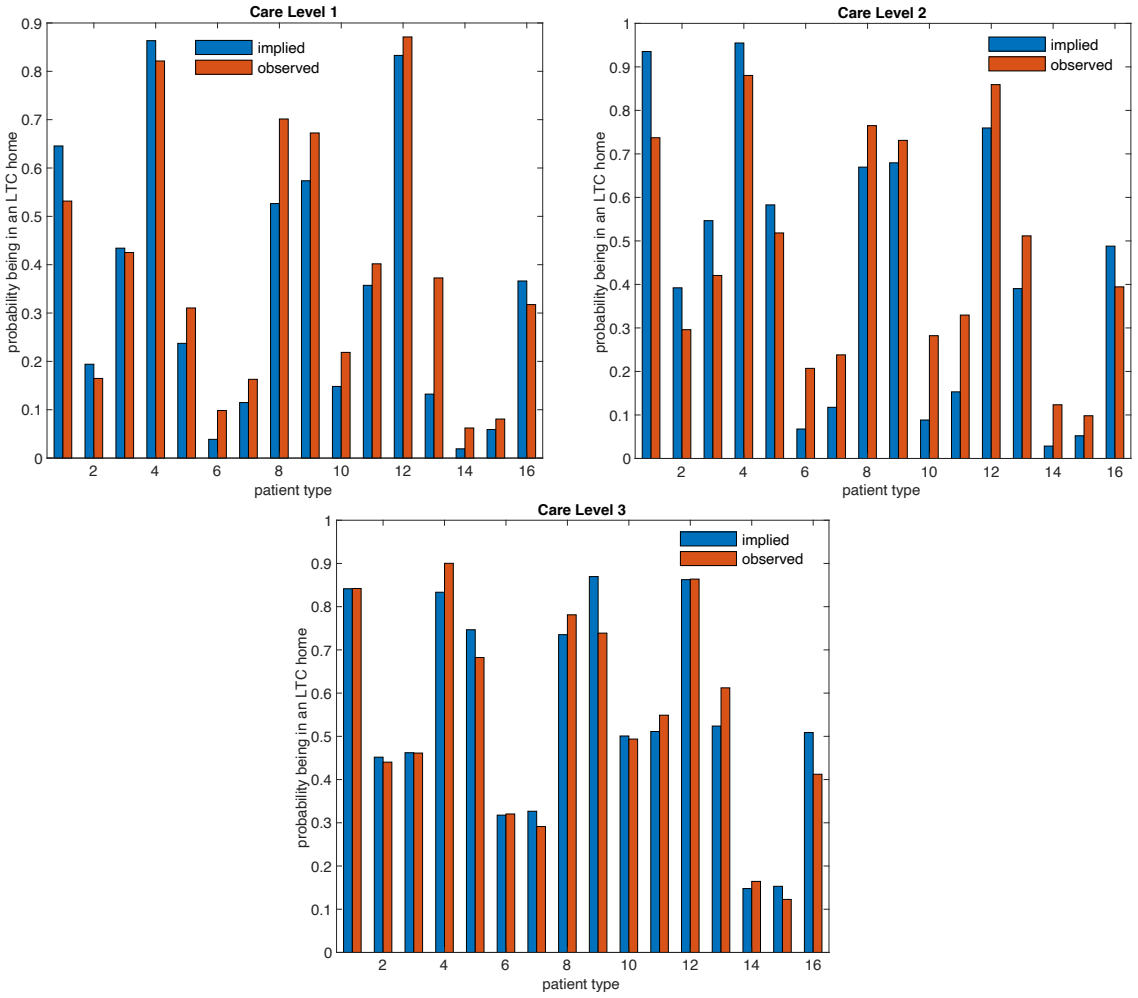
A.2 Additional figures and tables

Figure A.1: Evolution of the number of active nursing homes per 1,000 LTCI beneficiaries



Notes: Average across all markets between 1999 and 2015.
Source: Own computations based on the *Pflegestatistik*.

Figure A.2: Observed and model-implied (micro) moments



Notes: Results for the three care levels are depicted in separate graphs. The 16 patient types are ordered first by gender, then by marital status, and finally income. I.e., types 1-4 are the four income levels for unmarried women, types 5-8 are the four income levels for married women, and types 9-12 and 13-16 are unmarried and married men. The vertical axis shows the observed (orange) and estimated (blue) probabilities of selecting any of the stationary care options in a patient's local market.

Table A.1: Patient Types

patient type	τ
female, not married, income quartile 1	1
female, not married, income quartile 2	2
female, not married, income quartile 3	3
female, not married, income quartile 4	4
female, married, income quartile 1	5
female, married, income quartile 2	6
female, married, income quartile 3	7
female, married, income quartile 4	8
male, not married, income quartile 1	9
male, not married, income quartile 2	10
male, not married, income quartile 3	11
male, not married, income quartile 4	12
male, married, income quartile 1	13
male, married, income quartile 2	14
male, married, income quartile 3	15
male, married, income quartile 4	16

Note: Income quartiles are based on the observable income distribution pooled over genders and conditional on requiring long-term care.

Table A.2: Probability of receiving nursing home care

		Care level 1		Care level 2		Care level 3	
		mean	sd	mean	sd	mean	sd
Panel A: Conditional on being married							
1st income quarter	Male	0.373	(0.377)	0.512	(0.518)	0.612	(0.618)
	Female	0.310	(0.316)	0.518	(0.531)	0.682	(0.689)
2nd income quarter	Male	0.062	(0.060)	0.123	(0.126)	0.164	(0.173)
	Female	0.098	(0.099)	0.207	(0.211)	0.320	(0.329)
3rd income quarter	Male	0.081	(0.081)	0.098	(0.097)	0.123	(0.118)
	Female	0.163	(0.166)	0.238	(0.241)	0.291	(0.289)
4th income quarter	Male	0.317	(0.321)	0.394	(0.395)	0.412	(0.415)
	Female	0.701	(0.707)	0.765	(0.768)	0.781	(0.786)
Panel B: Conditional on not being married							
1st income quarter	Male	0.672	(0.678)	0.731	(0.728)	0.739	(0.744)
	Female	0.532	(0.545)	0.737	(0.743)	0.842	(0.846)
2nd income quarter	Male	0.219	(0.214)	0.282	(0.287)	0.494	(0.444)
	Female	0.165	(0.168)	0.296	(0.298)	0.440	(0.412)
3rd income quarter	Male	0.402	(0.388)	0.330	(0.329)	0.549	(0.522)
	Female	0.425	(0.422)	0.421	(0.429)	0.461	(0.459)
4th income quarter	Male	0.871	(0.872)	0.859	(0.858)	0.864	(0.857)
	Female	0.821	(0.831)	0.880	(0.885)	0.900	(0.902)

Notes: Weighted means and standard deviations computed using the *Mikrozensus* dataset.

Table A.3: First stage regression of LTC home prices on the explanatory variables and instruments

	Care level 1	Care level 2	Care level 3
Constant	-170.79***	26.68	475.32***
	(22.312)	(23.618)	(25.336)
Share full-time employees	19.00***	19.58**	2.69
	(5.404)	(5.716)	(6.291)
Share single bedrooms	27.56***	45.01***	55.77***
	(4.140)	(4.412)	(4.796)
Only single bedrooms	11.26**	1.87	-7.19
	(3.505)	(3.741)	(4.094)
Not-for-profit	-15.84***	-23.31***	-30.52***
	(3.964)	(4.226)	(4.571)
For-profit	-151.43***	-204.42***	-257.62***
	(4.113)	(4.379)	(4.746)
Instruments			
Share male employees	148.69***	156.70***	167.50***
	(12.654)	(13.413)	(14.774)
Share skilled employees	132.33***	150.48***	153.57***
	(7.019)	(7.383)	(8.153)
Employees per room	96.15***	113.08***	111.78***
	(4.388)	(4.420)	(5.033)
Price in neighboring markets	0.56***	0.51***	0.47***
	(0.010)	(0.009)	(0.008)
Capacity utilization	-8.56	-15.81*	-12.31
	(7.351)	(7.777)	(8.780)
Year FE	YES	YES	YES
Bundesland FE	YES	YES	YES

Notes: First stage regressions for real net nursing home prices by care level computed using the *Pflegestatistik* dataset.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4: Logit demand specification, estimated with OLS

	Care level 1	Care level 2	Care level 3
Constant	14.203***	2.723*	-3.696**
	(1.403)	(1.278)	(1.332)
α	-0.0001***	-0.00002	0.00003**
	(0.00001)	(0.00001)	(0.00001)
$\Delta\alpha_N$	-0.0006***	-0.0005***	-0.0002***
	(0.00004)	(0.00003)	(0.00003)
$\Delta\alpha_W$	-0.0003***	-0.0004***	-0.0002***
	(0.00003)	(0.00002)	(0.00002)
$\Delta\alpha_S$	-0.0001**	-0.0001***	-0.00005*
	(0.00003)	(0.00002)	(0.00002)
Stationary care	-2.361***	-1.826***	-1.638***
	(0.025)	(0.023)	(0.026)
Share full-time employees	0.238***	0.114***	-0.022
	(0.017)	(0.016)	(0.018)
Share single bedrooms	0.554***	0.207***	-0.041**
	(0.015)	(0.014)	(0.015)
Only single bedrooms	-0.488***	-0.468***	-0.421***
	(0.012)	(0.011)	(0.013)
Not-for-profit	0.089***	0.124***	0.127***
	(0.013)	(0.012)	(0.014)
For-profit	-0.291***	-0.262***	-0.335***
	(0.014)	(0.013)	(0.014)
Year FE	YES	YES	YES
Bundesland FE	YES	YES	YES
Own-price elasticity	-0.320	-0.397	-0.196

Notes: Logit regressions for $\ln(s_j/s_0)$ computed using the *Pflegestatistik* dataset.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.5: Logit demand specification, estimated with 2SLS (second-stage regressions)

	Care level 1	Care level 2	Care level 3
Constant	-37.915***	28.434***	-3.026*
	(1.647)	(1.471)	(1.328)
α	-0.0041***	-0.0023***	-0.0013***
	(0.00007)	(0.00006)	(0.00005)
$\Delta\alpha_N$	0.0012***	0.0006***	0.0003***
	(0.00005)	(0.00004)	(0.00004)
$\Delta\alpha_W$	0.0018***	0.0009***	0.0005***
	(0.00005)	(0.00004)	(0.00003)
$\Delta\alpha_S$	0.0023***	0.0012***	0.0006***
	(0.00005)	(0.00004)	(0.00003)
Stationary care	-0.388***	-0.560***	-0.679***
	(0.042)	(0.038)	(0.047)
Share full-time employees	0.188***	0.068***	-0.069***
	(0.017)	(0.016)	(0.018)
Share single bedrooms	0.639***	0.280***	0.012
	(0.014)	(0.014)	(0.015)
Only single bedrooms	-0.445***	-0.455***	-0.421***
	(0.012)	(0.011)	(0.013)
Not-for-profit	0.057***	0.097***	0.107***
	(0.013)	(0.012)	(0.014)
For-profit	-0.605***	-0.495***	-0.515***
	(0.015)	(0.014)	(0.016)
Year FE	YES	YES	YES
Bundesland FE	YES	YES	YES
Own-price elasticity	-2.812	-2.232	-1.688

Notes: Second-stage regressions for $\ln(s_j/s_0)$ computed using the *Pflegestatistik* dataset.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.6: Full demand model estimates: Robustness

	Care level 1		Care level 2		Care level 3	
Specification	(A)	(B)	(A)	(B)	(A)	(B)
Constant	-0.464**	-0.335*	-0.269*	0.107	0.145	0.097
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Stationary care ($\mathcal{H}$)	1.194***	1.194***	0.710***	2.022***	0.662***	0.495***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
σ_w ($\mathcal{H}$, married female)	-1.673***	-1.853***	-0.992***	-2.441***	-0.728***	-0.619***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
σ_h ($\mathcal{H}$, married male)	-2.381***	-2.258***	-1.690***	-1.251***	-1.745***	-1.876***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
α	-1.823***	-1.814***	-0.986***	-0.921***	-0.554***	-0.545***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha^y_{q2}$	-0.852***	-0.888***	-0.751***	-1.248***	-0.654***	-0.664***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha^y_{q3}$	-0.357***	-0.368***	-0.621***	-0.977***	-0.640***	-0.649***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha^y_{q4}$	0.524***	0.525***	0.170***	0.151***	-0.017***	-0.022***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha_{North}$	0.560***	0.586***	0.281***	0.299***	0.197***	0.225***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha_{West}$	0.781***	0.818***	0.415***	0.412***	0.290***	0.323***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
$\Delta\alpha_{South}$	1.020***	1.057***	0.557***	0.571***	0.340***	0.373***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Non-profit	0.058	0.059	0.102***	0.108***	0.109***	0.114***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
For-profit	-0.586***	-0.583***	-0.470***	-0.467***	-0.502***	-0.504***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Share full-time employees	0.204***	0.218***	0.093*	0.195***	-0.063	-0.019
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Share single bedrooms	0.645***	0.652***	0.270***	0.265***	-0.002	-0.010
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Only single bedrooms	-0.466***	-0.467***	-0.465***	-0.470***	-0.423***	-0.422***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Trend	0.021***	0.021***	0.018***	0.020***	0.008***	0.008***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Bundesland FE	Yes	Yes	Yes	Yes	Yes	Yes
Kreis-male FE (σ_{Ak} & σ_{Hk})	No	Yes	No	Yes	No	Yes
Observations						

Notes: Demand model estimates without district-level taste shifters for ambulatory and stationary care for male (and female) patients. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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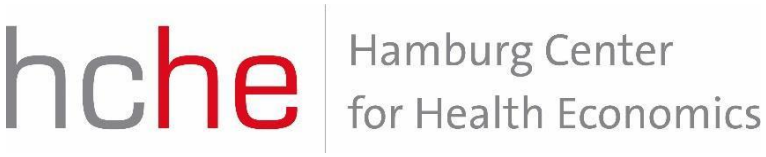

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