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Higher Prices, Higher Quality? Evidence From German Nursing Homes*

Annika Herr† Hanna Hottenrott‡

January 2016

Abstract

Objectives: This study investigates the relationship between prices and quality of 7,400 German nursing homes controlling for income, nursing home density, demographics, labour market characteristics, and infrastructure at the regional level.

Method: We use a cross section of public quality reports for all German nursing homes, which had been evaluated between 2010 and 2013 by external institutions. Our analysis is based on multivariate regressions in a two stage least squares framework, where we instrument prices to explain their effect on quality.

Results: Descriptive analysis shows that prices and quality do not only vary across nursing homes, but also across counties and federal states and that quality and prices correlate positively. Second, the econometric analysis, which accounts for the endogenous relation between negotiated price and reported quality, shows that quality indeed positively depends on prices. In addition, more places in nursing

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homes per people in need are correlated with both lower prices and higher quality. Finally, unobserved factors at the federal state level explain some of the variation of reported quality across nursing homes.

Conclusion: Our results suggest that higher prices increase quality. Furthermore, since reported quality and prices vary substantially across federal states, we conclude that the quality and prices of long-term care facilities may well be compared within federal states but not across.
JEL-Classification: I11, L11, L15, I18
Keywords: Nursing homes, care quality, price, long-term care, two-stage least squares

1 Introduction

An ageing population poses severe challenges with respect to financing and securing high quality long-term care. Long-term care is among the fastest growing branches of health care markets. For instance, in Germany, it increased from 8.6% of total health care expenditure in 1997 to 11.2% in 2013 (Augurzky et al., 2013). While prices and quality vary substantially across nursing homes (see, e.g., Mennicken, 2013), they may also be interdependent (Forder and Allan, 2014). On the one hand, higher prices may facilitate higher quality. On the other hand, since nursing homes can be classified as experience goods, high prices may be used to signal high quality irrespective of its actual level (Plassmann et al., 2008).

In this study, we exploit transparency reports, i.e., the quality report cards of 7,400 nursing homes in Germany, which were published between 2010 and 2013. Some studies for Germany have already described the relationship between nursing home prices and quality (Mennicken, 2013; Reichert and Stroka, 2014; Augurzky et al., 2010), however, without looking at the variation across federal states and without considering competition between nursing homes. Both Augurzky et al. (2010) and Mennicken (2013) find positive correlations between (some) quality measures and prices. Other find some quality indicators to be positively correlated with prices while others do not show any significant effect (Reichert and Stroka, 2014). Men-

nicken et al. (2014) explain differences in remuneration rates across German federal states, yet without controlling for quality differences. Looking at Medicaid reimbursement rates, Cohen and Spector (1996) and Grabowski (2001a) find an effect of higher reimbursement on staffing ratios but not on outcomes, while Grabowski (2001b) also shows a small increase in an outcome-oriented quality measure. Geraedts et al. (2015) show that quality differs significantly by ownership type. For-profit nursing homes provide lower quality than non-profit nursing homes in Germany independent of prices charged. Unlike these studies, the following analysis looks at quality conditional on prices and differentiates across federal states.

This study draws from Forder and Allan (2014) by using a two-stage least squares approach which instruments nursing home prices in the quality equation. They find that competition reduces prices which pushes down quality in English nursing homes (Forder and Allan, 2014).

We add to previous insights by investigating the relationship between prices and quality controlling for a large set of regional characteristics including income, nursing home density, demographics, and infrastructure. First, we show descriptively that quality and prices vary substantially across nursing homes, counties and federal states. Second, we find that quality indeed causally depends on prices in a two-stage least squares framework, which accounts for the endogenous relation between negotiated price and reported quality. Moreover, a county's higher number of places in nursing homes relative to people in need is associated both with lower prices and higher quality. Thus, more resources spent to build up capacities in those counties may contribute to higher average quality. Additionally, we find that unobserved factors at the federal state level explain a substantial part of the variation of reported quality across nursing homes.

2 Institutional background

Health insurance and long-term care insurance are mandatory in Germany and are offered as one package both in the private and the statutory system. Of all insured, 54% belong to health insurances organised at the federal state

level (BMG, 2015), while the remaining health insurances are organised at a different regional or at the national level.

In principle, there is no regulated upper limit for the price that nursing homes may charge. However, prices cannot be set freely but are negotiated for a certain time (at least one year) between each provider and the affected sickness funds (§85, SGB IX) of the provider's residents. In a second step, contracts between nursing homes and residents are individually agreed on. Formal care is partly financed by the health plan and partly out-of-pocket. If the residents (or their families) cannot afford it, social welfare covers the private share of the price. The part paid by the long-term care insurance is constant across federal states and nursing homes and only depends on the care level of the individual in need.

The care level is set by the regional Medical Review Boards (MRB) of the German Statutory Health Insurance after an examination of the individual's needs. The MRBs are organised at the federal state level with three exceptions: North Rhine-Westphalia is the largest state in terms of population and is thus split into North Rhine and Westphalia-Lippe, while Schleswig-Holstein and Hamburg as well as Berlin and Brandenburg are organised in one MRB, respectively. In our analysis, we split the federal state effect of North Rhine-Westphalia into two regional binary indicators and combine Schleswig-Holstein and Hamburg as well as Berlin and Brandenburg accordingly to control for the impact of the respective MRB together with many other unobserved factors at federal state level (e.g, education or other political decisions).

In 2008, the "care transparency agreement" (CTA) was introduced to increase transparency regarding the services offered and the quality of the nursing homes. The evaluation process is carried out by the regional MRBs. Trained representatives of the independent MRBs evaluate all nursing homes regularly. The same 64 criteria are tested in all nursing homes and the reporting of the results is standardised. The results of each evaluation are published in online report cards (for instance, at `www.pflegelotse.de` or `www.bkk-pflegefinder.de`), where only the latest report is available. For a more detailed discussion of the chances and drawbacks of the German

transparency reports we refer to Herr et al. (2015).

3 Estimation strategy

In the following, we present our econometric approach to study variation in nursing home quality. In particular, we estimate the quality of nursing home i as a function of its average price, its size and regional characteristics at the county level, such as income, supply density, demographics or infrastructure. We apply a two-stage least squares framework (using the ivreg2 STATA-command by Baum et al., 2015). Due to reverse causality problems and possible unobserved factors influencing both, quality and price, we follow Forder and Allan (2014) and instrument the price in the quality regression. That is, we estimate a first stage in which we regress the endogenous price on all control variables as well as three exogenous instruments. Since prices are negotiated with the payors for a specific period (at least one year) and are (at least partly) not dependent on the resident (the same price for housing and investments applies to all residents), prices are less adjustable than quality in the short run. Furthermore, the price serves as an important policy variable and can be adjusted according to the respective goals in the negotiations, while quality is more difficult to regulate and monitor. In the second stage, the predicted price, which is now independent of unobserved correlations between quality and price, is used to explain variations in quality. The baseline 2SLS specification can be written as:

$$Price = \beta_0 + \beta_1 IV_1 + \beta_2 IV_2 + \beta_3 IV_3 + R\gamma + T\delta + FS\lambda + \upsilon \quad (1)$$

$$Care\ quality = \beta_0 + \beta_1 \widehat{Price} + R\mu + T\nu + FS\pi + \varepsilon \quad (2)$$

where price is measured either as the private contribution (overall fee minus the subsidies by the long-term care insurance) and net of investment costs (*Price*) or –in the robustness checks– including investment costs (*total price*). The quality measure *Care quality* is described in Section 4.1. The matrix R comprises county-level characteristics, such as income, supply density, demographics or infrastructure as well as the nursing home specific number

of residents. T refers to the year of evaluation and FS comprises the set of federal state dummies which capture the remaining unobserved influences of the regional sickness funds, their strategies and their negotiation strength as well as unobserved time-independent differences across medical review boards in monitoring nursing home quality. γ, δ, λ, μ, ν and π are vectors of estimated coefficients.

We test the validity of the instrumental variables IV_1, IV_2, and IV_3 by verifying their relevance in equation (1), i.e. whether they cause variation in prices. Second, they should not have a direct effect on the outcome variable in equation (2) given the other exogenous control variables, but only indirectly through the price.

IV_1 refers to a county's physician density which is measured as the number of inhabitants per doctor including general practitioners and specialists (*Inhab. per physician*). A higher density around a nursing home's location could increase the price potential residents are willing to pay for a place in that home in expectation of a better overall provision of medical services. Controlling for hospital beds, population density and nursing home personnel, we argue that the actual quality of care –as measured with the seven risk factors described in Section 4.1– provided within the nursing home in the second stage is not directly affected by the availability of outside medical staff. IV_2 measures the average share of untouched nature per area (*share of untouched nature*). A location within a green environment (controlling for many factors such as population density or touristic attractiveness in the second stage) may increase prices, but does not affect care quality within the individual home. The last instrument, IV_3, captures the average available income at county level and represents a measure of the ability to pay, which does not influence quality directly other than through price or the overall GDP and pensions (second stage).

With regard to the first condition, the F-test of excluded instruments yields a partial F-test statistic of $F(3, 7343) = 20.65$ in the first stage of the main model (Table 2, model 1) and $F(3, 6191) = 30.36$ including inv. costs (Table 2, model 3). Both values are well above the commonly applied criterion of 10 (Stock and Yogo, 2005). Second, the validity of the instruments,

i.e. that they are uncorrelated with the error term and that the excluded instruments are correctly excluded from the estimated equation, cannot be rejected by the Hansen J test with a p-value of the test statistic of 0.11 (0.92).

Besides the linear model specification presented above, we further account for the censoring of the quality scores both at the lower and upper limit (quality $\in [0, 1]$) by estimating two-sided censored IV Tobit models (for more details compare Wooldridge, 2001, ch. 16). The first stage is specified as before and its estimation results are very similar (not presented).

4 Data and descriptive statistics

The data for our analysis stems from two data sources. Information on nursing home prices, location and quality is taken from the report cards of German nursing homes. A large set of regional characteristics and socioeconomic control variables at the county level have been gathered from the Federal Office for Building and Regional Planning (INKAR) for the latest year available (2011).

The report cards are available online for all homes in Germany. We focus on general long-term care, that is, we exclude nursing homes that only provide short-term and out-patient care as well as care for children and (younger) people with health conditions or impairments. In addition, we exclude homes that specialise in certain illnesses such as apallic conditions, multiple sclerosis, stroke, or dementia patients and micro homes with fewer than 10 residents, which leaves us with 10,035 observations. We aggregate nursing home information at the address level to obtain average prices and quality and the total number of residents in cases (17) where there are two reports available for separate buildings with the same address.

We control for the year of evaluation since nursing homes were evaluated at different points in time between 2010 and March 2013. After eliminating incomplete records and the largest percentile of nursing homes in terms of residents, the final data set comprises information on 7,382 nursing homes and the 400 (out of 412) counties they are located in. Most of the records (6,296 homes, 85%) stem from 2012 while the others stem from 2010

(24), 2011 (239) and the beginning of 2013 (823). We observe each nursing home only once.

4.1 Quality measure

The first public reporting of quality information in the U.S. started in 2002 with the well-analysed Nursing Home Compare (NHC) initiative and some studies show that information disclosure improves the nursing homes' quality (Lu, 2012; Mukamel et al., 2008), while others find mixed results (Grabowski and Town, 2011).

Herr et al. (2015) show that the reported quality of nursing homes also increased after the first publication of the report cards in Germany in 2010. While the reported quality may not capture all quality aspects and unreported quality may be harmed due to the concentration of resources on reported measures (Lu, 2012), this does not pose a problem for our analysis since reporting is unified across federal states as should be any distortion. In contrast to other studies, our quality measures are mainly objective and based on evaluations by an external institution, the Medical Review Boards. The inspectors of the MRBs test a subgroup of residents in the nursing home, say 10 people, to substantiate whether a criterion is fulfilled and calculate the percentage of individuals for whom it holds true. Then, until 2013, the percentage value was translated into a grade according to the German system of school grades from 1.0 (= excellent) to 5.0 (= inadequate or failed).

We focus on the following seven "risk factors" among the 64 quality indicators in the report cards following the definition of Hasseler and Wolf-Ostermann (2010).

1. Is the nutritional status appropriate given the possibility of influence by the institution? (Q15)
2. Is the supply of fluids appropriate given the possibility of influence by the institution? (Q18)
3. Are documents regarding the treatment of chronic wounds or bedsores analysed and, if necessary, the measures adjusted? (Q11)

4. Are systematic pain assessments conducted? (Q20)
5. Are individual risks and resources of residents with incontinence or a bladder catheter assessed? (Q22)
6. Is the individual risk of contracture collected? (Q27)
7. Do measures restricting the individual freedom require consent? (Q29)

The remaining ones mainly measure processes and services and are arguably uninformative with regards to care quality. Like Herr et al. (2015), we follow the idea by Hendrik Schmitz and Boris Augurzky and construct an aggregate measure of care quality using these seven indicators. We suppose that for each criterion truly good quality is provided only if the maximum grade of 1.0 (excellent) was achieved. Negligence of even a single resident would indicate severe quality deficiencies, for instance, when considering the supply of fluids. More precisely, we define binary indicators q_j for criterion j to equal one if the criterion is fulfilled for all tested residents and zero otherwise.

$$q_k = \begin{cases} 1 & \text{if grade}_j = 1.0 \\ 0 & \text{if grade}_j > 1.0 \end{cases}$$

The final indicator *Care quality* spanning all seven risk criteria is defined as

$$\text{Care quality} = \frac{1}{7} \sum_{k=1}^{7} q_k \qquad k = 1, \ldots, 7$$

In order to avoid potential selection bias due to missing values, *Care quality* is redefined, as question 11 (3.) and 29 (7.) have a high number of missing values. If one of the two values is missing, the share is reduced to $(\frac{0}{6}; \ldots; \frac{6}{6})$ or, if both are missing, to $(\frac{0}{5}; \ldots; \frac{5}{5})$. These outcomes are then mapped on a $(\frac{0}{6}; \ldots; \frac{6}{6})$ scale to the closest neighbouring value.

Following Dranove and Sfekas (2008), we assume that better report card scores in these selected questions reflect better underlying quality and not better selection of less severely-ill residents (Dranove et al., 2003). Five of the seven quality measures are more related to assessment than actual health

outcomes. Moreover, by dropping nursing homes from the sample that are specialized in diseases like dementia (which may make, for instance, the supply of fluids more difficult), we reduce the likelihood of such a selection bias.

4.2 Price measures

The mandatory long-term care insurance pays a share of the price only depending on the individual's care level, independent of the total price or regional characteristics (see section 2). In 2011, health plans covered between €1,023 (care level I) to €1,550 (care level III) per month. The additional private contribution, which is borne by the individual herself (or family members), is defined as the total monthly price net of health plan coverage. We further deduct investment costs, since these are not available for Hamburg and North Rhine, and use the net price (*price*). Furthermore, we average across the three care levels at each nursing home. We also look at the price including investment costs in our robustness checks. We exclude the lowest and the highest percent of the price distribution to reduce the influence of outliers. The private contribution in our sample varies between €454 and €1,817 per month, paid out-of-pocket. The average price is €1,101 per month. All prices and income variables are deflated, with 2009 as the base year.

4.3 Regional control variables

County-level variables are grouped into a) supply density, which is measured by the number of nursing homes, its squared value and the number of available places per 100 inhabitants at county level. Moreover, we distinguish between b) demographic factors (informal care recipients relative to all people in need as well as the number of people in need, hospital beds, and personnel in nursing homes per 100 inhabitants) and c) income-related variables (GDP per inhabitant, unemployment share, pensions, average hourly wage), which reflect the prosperity of the region. The last group d) consists of infrastructure characteristics (price for land, the ser-

vice sector ratio, share of foreign tourists to all people staying over night, and population density). Table 1 presents the most important descriptive statistics as well as the units of measurement.

[Table 1 about here]

4.4 Regional variation

The maps depicted in Figure 1 illustrate regional variation in the supply and demand of stationary long-term care across counties. An exception is panel d), which shows the average number of places per 10,000 inhabitants at the federal state level. We do not observe 12 of the 412 counties in our final sample. The graphs show that besides variation in quality and prices across different nursing homes, there are regional patterns for both indicators. Whereas we see a strong price differential between the north-east and the south-west with considerably higher prices in western and south-western counties (panel b)), the picture for quality is less clear. Reported care quality is lowest in the south-east (a) and highest in Baden-Württemberg, Saxony and North Rhine. However , quality-price ratios (c) are highest in north, central and eastern Germany.

Maps d) and e) show regional variation in the number of places in nursing homes per county as well as in the number of people in need (both per 10,000 inhabitants). It is noteworthy that the share of people in need is higher in central and particularly eastern counties, while the number of places tends to be higher in north and central states and in Saxony. Finally, map f) shows that the supply density (number of places per people in need) is highest in the northern counties and in Bavaria. The presence of the described regional patterns suggests that much of that variation might be explained by regional differences in income, supply, demographic factors and infrastructure, for which we control in the analysis. However, there may also be unobserved differences in negotiations at the federal state level or in evaluation practices at the MRB level, which affect both prices and the reported quality. We control for such time-invariant effects by introducing federal state indicators.

[Figure 1 about here]

5 Results

5.1 First stage: Price

Results from the first stages (from the main model and the robustness checks in Table 4) are presented in Table 2. The three instrumental variables show the expected signs. While a higher share of untouched nature and a higher available income increase the price, the lower physician density (more inhabitants per physician) decreases the price. Furthermore, supply density measured as the number of nursing homes per county given the number of people in need and population density is negatively correlated with the price if the number of nursing homes is low (below the tenth percentile of the distribution). If a county has more than 15 nursing homes, prices and the number of nursing homes are positively associated. We argue that, with respect to the former result, entry does not necessarily occur in those counties with higher average prices due to two reasons: First, prices are negotiated mainly on the basis of the cost structure and second, other regional regulatory rules regarding the facilities and the personnel structure play also a big role for the entry decision.

[Table 2 about here]

The overall number of places in nursing homes per people in need (both measured at county level) shows that a lower supply density (more available places) is associated with a lower price. Finally, a higher price is associated with a lower share of people in need, higher pensions, a better personnel relation (price negotiations depend on the nursing home's personnel structure), more hospital beds and a higher share of informal care (lower demand for nursing homes) in the region, where the latter may be also due to capacity constraints.

5.2 Second stage: Quality

Table 3 presents the second stage results from the preferred specification (OLS, 2SLS, and IV Tobit models). In all specifications the price enters the quality equation positively and is statistically significant. While the OLS estimates suffer from endogeneity, Model (2) suggests that a 10% price increase is associated with a 3.9 percentage point increase in the care quality index. The Tobit model (3), which accounts for the censored dependent variable, suggests a 5.5 percentage point increase in the predicted care quality index, which lies at 73% on average.

Regional control variables are jointly significant at the 1% level ($chi^2(16) = 34.82$). In particular, the variables subsumed as measures of the supply density show significant coefficients. First, the number of nursing homes per county and quality have an inverse U-shaped relationship, which turns negative when the number of nursing homes is above the median (30) per county. Second, a higher share of places in nursing homes per people in need is associated with a higher quality. This means that more supply per person in need is correlated both with lower prices and higher quality. Importantly, we find that even after controlling for a large set of regional characteristics, the federal state fixed effects are highly significant.

[Table 3 about here]

Figure 2 depicts the federal state coefficients (relative to Schleswig-Holstein/ Hamburg). We find a pattern of higher quality in Lower Saxony and in Saxony while quality is lowest in four western German states (Westphalia-Lippe, Rhineland-Palantine, Bavaria, and Saarland) (panel a)). Looking at prices (panel b)) in the first stage, the difference between eastern and western Germany is even more distinct (all eastern German federal states and Bremen and Lower Saxony have lower prices relative to Schleswig-Holstein/Hamburg and all else equal, while the other western states negotiate higher prices).

The unobserved characteristics at the federal state level, such as price negotiations with regional long-term care insurances or quality evaluations at MRB-level, may have an important effect on the nursing home's reported

quality and initially also on prices (compare right of figure 2). Another reason for the regional-level differences may be the high investment level in the eastern part of Germany after reunification, when modern nursing homes were built offering new equipment at lower prices. Thus, the differences in quality may be due to different evaluation methods or strategies at the federal state level or due to true quality differences, which we cannot disentangle here.

[Figure 2 about here]

5.3 Robustness checks

Table 4 presents several robustness checks. First, we reduced the sample and kept only those nursing homes with information on investment costs. We re-estimated the main model (Table 4, models 2 and 5) as well as the one with the total price (including investment costs) as outcome (models 3 and 6). Reducing the sample (mainly dropping Rhineland and Hamburg) decreases the price coefficients slightly while the choice of the price variable itself does not matter. Second, we dropped 15% of the nursing homes which were evaluated before or after 2012. The price coefficients increase (from 0.39 to 0.51 in the 2SLS case), while signs and significance levels are stable. Thus, our preferred specifications present lower bounds to the price effect.

[Table 4 about here]

6 Discussion and conclusion

This paper shows and partly explains variation in the quality of German nursing homes. First, our descriptive analysis hints at the variation in prices, quality and supply across German counties. Second, accounting for the endogenous relation between quality and price in a two-stage least squares framework and for a detailed set of important predictors (demographics, income, infrastructure and health care), we show that a higher price in-

creases quality significantly. In addition, a higher number of places in nursing homes per people in need is associated with lower prices and higher quality, all else equal. This result adds to the discussion about increasing resources for long-term care, which resulted in the recent reforms in Germany increasing premia to and payments of the mandatory long-term care insurance in 2013, 2015, and 2017. These reforms are meant to improve care for people suffering dementia and introduces additional care levels. This study adds to these means to improve care by showing that at the individual nursing home level more resources are needed especially in those federal states which face a growing demand and low supply.

Third, we show that the federal state indicators additionally capture a considerable part of the unobserved variation in quality (and prices when looking at the first-stage results). There may be several reasons for the substantial variation across federal states. First, quality is measured by representatives of the 15 regional MRBs. Thus, differences in quality may either be due to true quality differences or due to different evaluation methods or strategies of the specific MRB in charge. Second, while the subsidies paid by the long-term care insurance to people in need are constant across Germany for a given year and care level, final prices are negotiated between each individual nursing home and the affected statutory long-term care funds within the federal state. This may lead to different average levels of (measured) quality as well as prices across federal states. Within each federal state, quality and prices also vary substantially but should be more comparable. Thus, the distortion by possible different measurement policies, ownership type structure or different bargaining powers of the partners can be levelled out within a federal state but should be considered when comparing nursing homes across federal states.

Finally, the results also show that a considerable part of the variation in quality cannot be explained. This may, on the one hand, be due to missing information on individual facilities, such as the ownership type (Geraedts et al., 2015) or the management, whether the nursing home is part of a chain, whether it is linked to neighboured hospitals or ambulatory facilities or the case-mix of the residents. Furthermore, we only observe the county-specific

care personnel, but not the number of nurses or other staff in the specific nursing homes. This information could serve as a different quality signal. Another limitation of this study lies in the cross-sectional structure of the data. We can only account for unobserved heterogeneity at the federal state level. Therefore, we suggest further research on factors that support care quality. A better understanding of these will contribute to the effectiveness of reforms aiming at securing supply and cost-efficiency without jeopardising care quality.

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Tables and Figures

Table 1: Descriptives: Regional characteristics

Variable	Unit	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Nursing home level					
Care quality	[0/6-6/6]	0.73	0.22	0	1
Price	[EUR/month]	1,100	317	454	1,817
Price [EUR] incl. Inv. Costs[a]		1,425	338	549	2,531
# of residents	[100]	0.76	0.38	0.1	2.16
County level					
Supply density					
# of NH per county		42.89	50.20	3.00	278
Places per ppl in need		0.36	0.08	0.18	0.67
Demographics					
Informal care[b]/all ppl in need		0.46	0.06	0.28	0.66
People in need	[#/ 100 inhab.]	3.14	0.67	1.55	5.43
Hospital beds	[#/ 100 inhab.]	0.61	0.30	0	2.15
Personnel in NH	[#/ 100 inhab.]	0.85	0.21	0.35	2.01
Income					
GDP/inhab.	[1,000 Euro]	28.61	10.69	13.83	103.96
Unemployment share	2009	0.11	0.06	0.02	0.25
Pensions men	[Euro/month]	1,010	73	823	1307
Pensions women	[Euro/month]	538	95	365	762
Average hourly wage	[Euro/hour]	25.08	3.43	15.93	35.44
Infrastructure					
Population density	[#/100 km^2]	7.18	9.58	0.38	44.36
Price for land	[Euro/m^2]	147.45	146.10	5.70	1,123.54
Share of foreign tourists	%	14.6	9.98	0.80	56
Service sector ratio	2009	0.32	0.13	0.13	0.93
Instruments for price					
Inhab. per physician	[in 100]	6.58	1.66	2.57	12.14
Share of untouched nature	[%, 2009]	0.8	1.7	0	25.34
Annual available income	[1,000 euro]	18.71	2.27	13.61	30.86
# of NH			7,382		
# of counties			400		

Source: Transparency reports (NH-level) and INKAR, base year 2011 if not indicated else.
[a] Total price including investment costs only available for 6,229 obs.
[b] receiving benefits from insurance. NH: Nursing Home.

Table 3: Quality regressions OLS, 2SLS, and Tobit-IV

		(1) OLS	(2) 2SLS	(3) IV-Tobit
NH specific	price / $\widehat{\log(price)}^{a}$	0.085***	0.386**	0.545**
		(0.014)	(0.175)	(0.246)
	Residents	-0.116***	-0.198***	-0.270***
		(0.023)	(0.053)	(0.074)
	Residents^2	0.015	0.050**	0.070**
		(0.012)	(0.023)	(0.032)
Supply density	Log(# of NH)	0.088***	0.134***	0.169***
		(0.028)	(0.039)	(0.050)
	[Log(# of NH)]^2	-0.012***	-0.020***	-0.026***
		(0.004)	(0.006)	(0.008)
	Places in NH/ppl in need	0.062	0.288*	0.372*
		(0.092)	(0.163)	(0.221)
Demographics	Ppl in need	0.011	0.045**	0.061*
		(0.011)	(0.023)	(0.031)
	Hospital beds	0.002	-0.016	-0.019
		(0.014)	(0.017)	(0.022)
	Personnel in NH	-0.030	-0.095*	-0.117*
		(0.035)	(0.052)	(0.070)
Income	Log(GDP/inhab.)	0.010	-0.001	-0.019
		(0.024)	(0.026)	(0.034)
	Unemployment share	-0.045	-0.002	-0.017
		(0.131)	(0.136)	(0.173)
	Log(pensions men)	0.049	0.008	0.009
		(0.058)	(0.064)	(0.082)
	Log(pensions women)	0.082**	0.060	0.085
		(0.041)	(0.044)	(0.056)
	Average hourly wage	-0.004	-0.005*	-0.004
		(0.003)	(0.003)	(0.004)
Infrastructure	Log(price for land)	-0.006	-0.010	-0.013
		(0.008)	(0.009)	(0.012)
	Population density	-0.001**	-0.002**	-0.003***
		(0.001)	(0.001)	(0.001)
	Share of foreign tourists	0.001	0.000	0.000
		(0.000)	(0.000)	(0.001)
	Service sector ratio	0.021	0.043	0.075

To be continued on next page

Table 3: Quality regressions OLS, 2SLS, and Tobit-IV: continued

		(1) OLS	(2) 2SLS	(3) IV-Tobit
		(0.059)	(0.062)	(0.080)
	Share of benefit receivers	0.091	0.036	0.082
		(0.087)	(0.094)	(0.120)
Federal states / MRBs	Schleswig-Holstein/Hamburg (Reference category)			
	Lower Saxony	0.048***	0.083***	0.110***
		(0.015)	(0.026)	(0.035)
	Bremen	-0.004	-0.001	0.003
		(0.032)	(0.031)	(0.038)
	North Rhine	0.064***	-0.033	-0.070
		(0.019)	(0.059)	(0.083)
	Westphalia-Lippe	-0.050***	-0.123***	-0.178***
		(0.018)	(0.045)	(0.063)
	Hesse	0.040*	0.018	0.007
		(0.021)	(0.025)	(0.033)
	Rhineland-Palatinate	-0.078***	-0.157***	-0.213***
		(0.022)	(0.051)	(0.070)
	Baden-Württemberg	0.121***	0.062	0.084
		(0.017)	(0.039)	(0.054)
	Bavaria	-0.082***	-0.124***	-0.160***
		(0.017)	(0.030)	(0.040)
	Saarland	-0.038	-0.121**	-0.171**
		(0.027)	(0.055)	(0.076)
	Brandenburg/Berlin	-0.018	0.001	0.005
		(0.024)	(0.027)	(0.034)
	Mecklenburg-W. Pomerania	-0.017	0.050	0.078
		(0.031)	(0.050)	(0.067)
	Saxony	0.058**	0.164**	0.227**
		(0.025)	(0.067)	(0.092)
	Saxony-Anhalt	-0.010	0.067	0.103
		(0.026)	(0.052)	(0.071)
	Thuringia	-0.111***	-0.046	-0.036
		(0.029)	(0.048)	(0.063)
	Time FE	Yes	Yes	Yes

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Table 3: Quality regressions OLS, 2SLS, and Tobit-IV: continued

	(1) OLS	(2) 2SLS	(3) IV-Tobit
N	7,382	7,382	7,382
adj. R^2	0.15	0.10	
F	41.57	37.00	
Partial F (first stage)		20.65	
Hansen's J		4.48	
Hansen's J p-value		0.11	

Marginal effects; Std. errors in parentheses:* $p < 0.1$, $p < 0.05$,***$p < 0.01$. Constant included. Quality $\in (\frac{0}{6}, \frac{1}{6}, \ldots, \frac{6}{6})$
a: Predicted price in 2SLS-IV and IV-Tobit. Instruments: Share of untouched nature, available income, inhab. per physician
Data: Transparency reports 2010-2013 (NH-level) and INKAR 2011 (county level).

Table 2: 2SLS first stages: Main results and robustness checks

	(1) Log(price) Final	(2) Log(price)	(3) Log(Total Price) Sample with inv. costs	(4) Log(price) only 2012
Instruments				
Share of untouched nature	0.006***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Available income	0.008***	0.007***	0.007***	0.006***
	(0.002)	(0.002)	(0.001)	(0.002)
Inhab. per physician	-0.012***	-0.016***	-0.016***	-0.010***
	(0.002)	(0.003)	(0.002)	(0.003)
Residents	0.278***	0.285***	0.218***	0.284***
	(0.020)	(0.022)	(0.019)	(0.021)
(Residents)^2	-0.116***	-0.119***	-0.095***	-0.120***
	(0.010)	(0.012)	(0.010)	(0.011)
Log(# of NH)	-0.132***	-0.097***	-0.094***	-0.149***
	(0.021)	(0.022)	(0.018)	(0.023)
[Log(# of NH)]^2	0.025***	0.019***	0.018***	0.027***
	(0.003)	(0.003)	(0.003)	(0.003)
Places per ppl in need	-0.768***	-0.694***	-0.376***	-0.747***
	(0.070)	(0.076)	(0.060)	(0.075)
Log price for land	0.000	-0.005	0.000	-0.002
	(0.007)	(0.008)	(0.006)	(0.008)
Log(GDP/inhab.)	0.024	0.053**	0.010	0.038*
	(0.020)	(0.021)	(0.018)	(0.021)
Unemployment share	0.005	0.039	-0.201*	-0.027
	(0.121)	(0.139)	(0.108)	(0.130)
Log pensions men	0.200***	0.172***	0.149***	0.213***
	(0.048)	(0.055)	(0.046)	(0.052)
Log pensions women	-0.025	0.039	0.054	0.009
	(0.038)	(0.041)	(0.033)	(0.041)
Average hourly wage	0.003	-0.001	0.003*	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Share of benefit receivers	0.200***	0.350***	0.444***	0.226***
	(0.070)	(0.078)	(0.063)	(0.074)
Ppl in need	-0.116***	-0.125***	-0.088***	-0.118***
	(0.008)	(0.009)	(0.007)	(0.009)
Hospital beds	0.043***	0.022*	0.008	0.044***
	(0.011)	(0.012)	(0.010)	(0.013)
Personel in NH	0.212***	0.233***	0.161***	0.214***
	(0.027)	(0.029)	(0.024)	(0.029)
Federal state FE	Yes	Yes	Yes	Yes
Infrastructure variables	Yes	Yes	Yes	Yes
N	7,382	6,229	6,229	6,296
adjusted R^2	0.71	0.68	0.69	0.72
Partial F first stage	20.65	22.11	30.36	13.73

Marginal effects; Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Data: Transparency reports 2010-2013 (NH-level) and INKAR 2011 (county level).
Models (2), (3): Total price including investment costs only available for 6,229 obs.
Column (1) relates to Table 3, column (2).
Columns (2)-(4) relate to Table 4, columns (1)-(3), respectively.

Table 4: Robustness checks: 2SLS-IV and Tobit quality regressions with different samples and prices

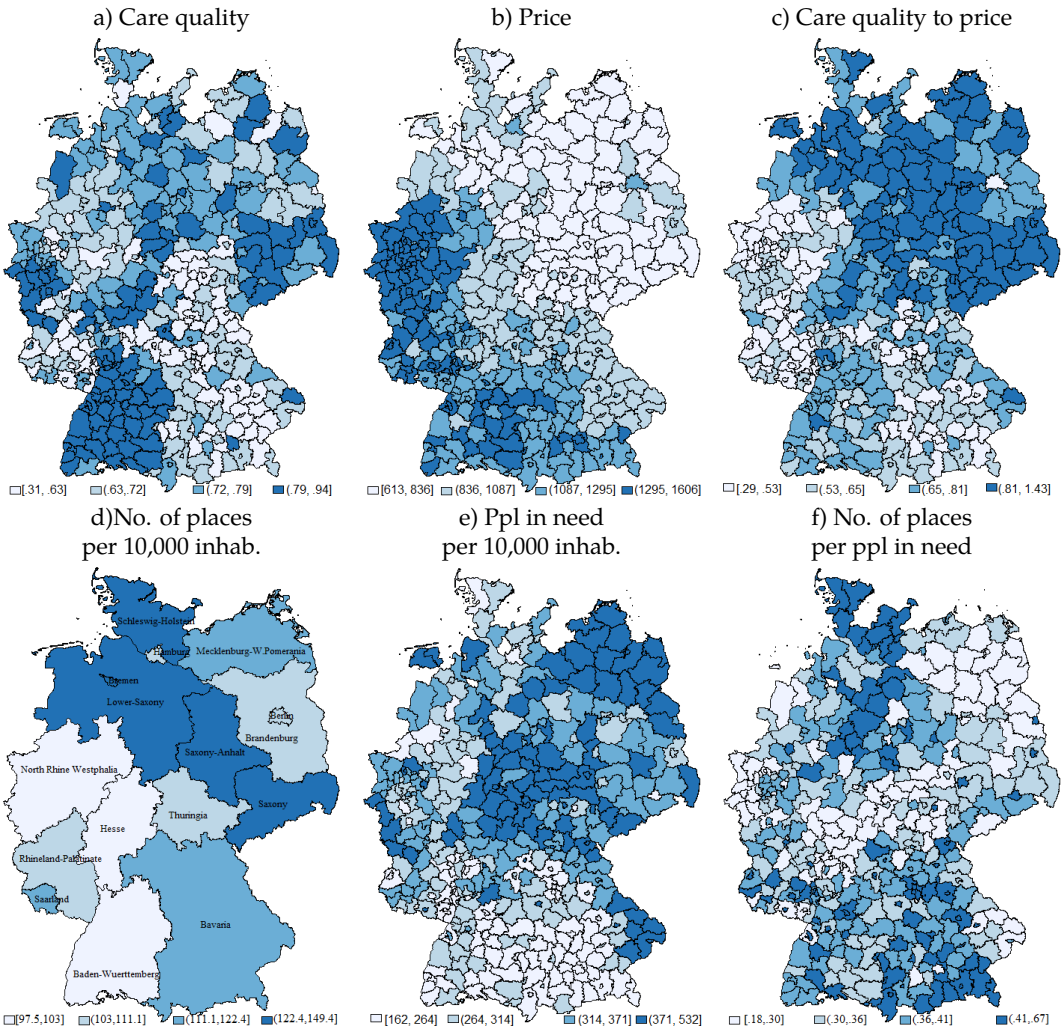
	(1)	(2)	(3)	(4)	(5)	(6)
		2SLS-IV			Tobit	
Care quality	Sample with inv. costs		only 2012	Sample with inv. costs		only 2012
$\widehat{\log(price)}^{a}$	0.341**		0.507**	0.456**		0.723**
	(0.164)		(0.208)	(0.206)		(0.306)
$\widehat{\log(total\ price)}^{a}$		0.363**			0.486**	
		(0.173)			(0.217)	
Year FE	Yes	Yes	No	Yes	Yes	No
Federal state FE	Yes	Yes	Yes	Yes	Yes	Yes
Regional variables	Yes	Yes	Yes	Yes	Yes	Yes
N	6,229	6,229	6,296	6,229	6,229	6,296
adj. R^2	0.12	0.12	0.05			
Partial F (1. stage)	22.11	30.36	13.73			
Hansen's J	0.21	0.16	4.80			
Hansen's J p-value	0.90	0.92	0.09			

Marginal effects; Std. errors in parentheses:* $p < 0.1$, $p < 0.05$,***$p < 0.01$. Constant included.

Quality $\in (\frac{0}{6}, \frac{1}{6}, \ldots, \frac{6}{6})$ a: Predicted price in 2SLS-IV and IV-Tobit.

Instruments used for prices: Share of untouched nature, available income, inhab. per physician.

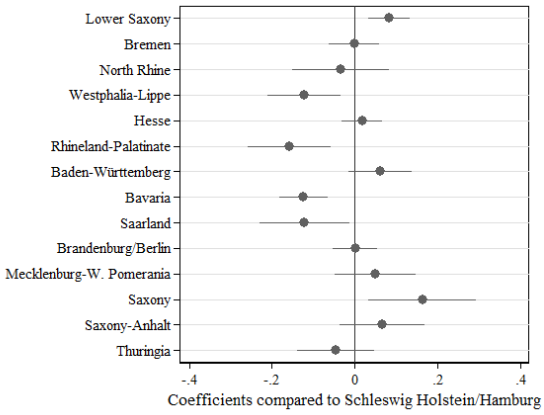
Figure 1: Prices, care quality and supply density at county level



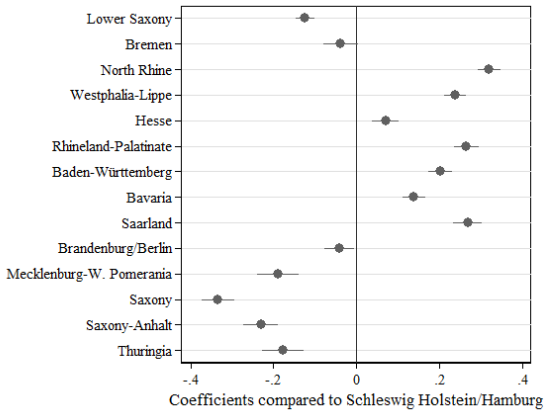
Data: Transparency reports (2010–2013) and INKAR 2011. Averages of the respective variables at county level (panel d) at federal state level), 400 counties, 16 federal states, 15 MRBs (North Rhine Westphalia is split into Westphalia-Lippe and North Rhine, while Hamburg and Schleswig-Holstein as well as Berlin and Brandenburg form one MRB, respectively).

Figure 2: Federal states coefficients

a) Second stage (Table 3): Care quality



b) First stage (Table 2): price



Federal states point estimates (dots) and confidence intervals (lines) from model (2), Table 3 and first-stage estimates from model (1), Table 2 all controlling for the full set of regional characteristics, instrumented price (only in panel a)) and year of evaluation.

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