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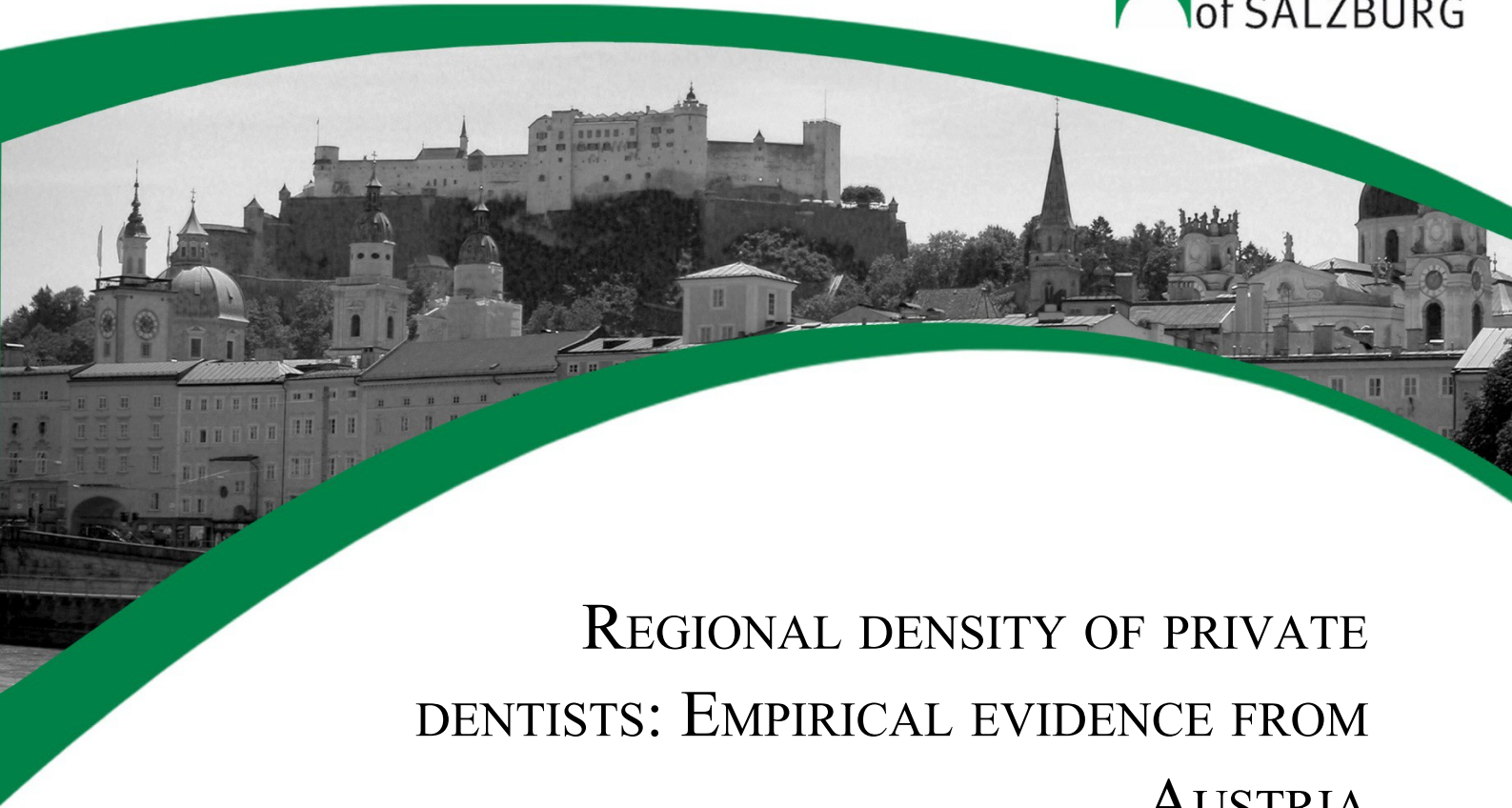
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REGIONAL DENSITY OF PRIVATE
DENTISTS: EMPIRICAL EVIDENCE FROM
AUSTRIA

MARTIN GÄCHTER, PETER SCHWAZER, ENGELBERT THEURL AND HANNES WINNER

WORKING PAPER No. 2012-08

WORKING PAPERS IN
ECONOMICS AND FINANCE

Regional density of private dentists: Empirical evidence from Austria*

Martin Gächter,[§] Peter Schwazer,[§] Engelbert Theurl,[§] Hannes Winner^{§§}

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Abstract

Objectives: We investigated the determinants of disparities in the regional density of private dentists in Austria. Specifically, we focused on the relationship between the density of private dentists and their public counterparts, thereby controlling for other possible covariates of dentist density. *Methods:* Dentist density was measured at the district level. We used panel data of dentist density from 121 Austrian districts over the years 2001 to 2008. We applied a Hausman-Taylor framework to cope with possible endogeneity and to control for cross-district effects in the dentist density. *Results:* A significant negative relationship was found between the density of private and public dentists, indicating a substitution effect between the two dentist groups. A significant positive spatial relationship also existed for private and public dentists in the neighboring regions. Dental capacities in public and private hospitals and dental laboratories run by the public health insurance system did not have a significant effect on private dentist density. *Conclusions:* Although a strong negative relationship existed between private and public dentists within the districts, one should not draw the conclusion that private dentists in Austria are close substitutes for public dentists. Such a conclusion would require further empirical analysis on the utilization patterns of dental services and their relationships with financing mechanisms.

Keywords: Competition in health care markets, dentist location and density, models with panel data

JEL classification: I11, I18, I23

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Introduction

Equity in the provision of health care services is an important performance indicator of health care systems. Equity includes both a horizontal (i.e., equal provision of medical services for equal need) and a vertical perspective (i.e., unequal provision of medical services for unequal need) (1). One important concern within equity considerations are spatial disparities in the provision of health care services. However, before making normative judgments on the spatial patterns of health care services, it is necessary to describe these patterns and to identify possible mechanisms and determinants behind the observed disparities.

A remarkable empirical expertise (2-13) exists on the location decisions of physicians and the resulting density for physicians in general, but the analysis of differences in the geographical distribution of dentists plays only a minor role within this literature. Several studies have mentioned dentists only as one type of specialist (7, 8, 9), and few studies have been dedicated exclusively to the spatial patterns of dentists (14-17).

However, there are some convincing arguments to deal exclusively with the geographical distribution of dentists and not within an overall physician density study. Most importantly, dental care services are different from other physician services (18), and these differences might influence the mechanisms (e.g., the role of service provision by markets or by the state (1, 12)) and the determinants of the location decisions of dentists. Consequently, the assessment of the observed differences in the spatial distribution of dentists might be different from that of other physician groups (1, 12). The important economic characteristics of dental services should first be defined. A limited number of dental diseases exist, and, to some extent, their occurrence is predictable and/or influenced by preventive actions. Dental diseases are comparably easy to diagnose, and emergency cases are normally not life threatening. Learning from experience is possible for the patient. Thus, dental services from the demand side are mainly examples of "experience goods." Substantial economies of scale or economies of scope in the production of dental services do not exist, and the specialization of service provision is relatively low compared to other medical specialties. These characteristics have manifold economic implications: Individuals have the possibility to choose between a broad range of providers and the price elasticity of demand is high (19) compared to other physician services; therefore, insurance against dental expenditure offers lower space for welfare improvement and higher rates of copayment seem to be optimal. On the supply side, the interaction between dentists is dominated by competition and referrals to other dentists, which might result in complementary relationships, are comparably scarce. Although dental services

have common features, substantial variety is present in the institutional design of this sector in reality (for international comparisons see 20, 21). Because of this variety, it is promising to study the determinants of dentist spatial patterns in different institutional settings.

As mentioned above, only limited empirical evidence is available regarding the determinants of the geographic patterns of dentists. Several studies have analyzed the role of personal characteristics of dentists, such as the dentist's place of training, on the location decision (22, 23). Groenewegen/Postma (14) offer a very broad socio-economic framework to study supply and demand for dental services in the Netherlands. Beazoglou et al. (15) studied the determinants of the geographic distribution of dentists in the US, and Toyokawa/Kobayashi (16) recently analyzed the effect of an increase in dentist density on the inequality of the distribution of dentists in Japan. Grytten/Skau/Stevnik studied the distribution of orthodontic services in Norway with respect to access to care (17). In addition to these studies, which focused on the location decisions and the density of dentists, research has been conducted on selected aspects of supply and demand for dental services, which are useful for the explanation of dentist density. Some authors present evidence regarding the determinants of the demand of patients for dental services (24-27). Other authors (see especially 28-30) have analyzed the relationship between pricing behavior, competition, and the structure of supply of dentists.

This paper adds empirical evidence on the determinants of the spatial disparities of dentist density using data from Austria. Following an ecological approach, our main focus was dentist density and not the location decision of the individual dentist. Rather than treat the dentist workforce as a homogeneous group, as has been done in the overwhelming majority of previous papers, we focused on the location decisions of private dentists (PDs), i.e., dentists without a service contract with the public health insurance system. These dentists act as a second tier within the two-tiered Austrian health care system. While market entry for public dentists (CDs) is strongly regulated and based on agreed-upon dentist capacity plans, PDs are free to choose their location. They are also less restricted in their pricing strategies and service provisions. Therefore, and to extend previous studies, we especially focused on the effect of the public dentist workforce on the spatial patterns of PDs. This enabled us to identify whether competitive or cooperative relationships exist between different groups of dentists. To determine how the corresponding dentist densities are related to each other, we used information from 121 Austrian districts between 2002 and 2008. We controlled for factors that might influence demand for PDs such as income, education, and the existing capacities of

dentistry offered by the public health insurance system (dental laboratories) directly or by private or public hospitals. We also controlled for "neighborhood effects," allowing for spatial interdependence of dentist density between the districts. From a health policy perspective, the empirical results of our study are highly relevant in different ways. The effects of policy interventions (e.g., capacity stops in the public dental sector, which is a strategy to manage overall dental capacities) on access, efficiency, and quality depend on the direction and intensity of the relationship between the public and the private sectors.

The remainder of this paper is organized in the following way. In the next section, we describe the institutional setting of supply and demand of dental services in Austria. Based on this characterization, we elaborate two testable hypotheses regarding the determinants of private dentist density. We subsequently provide a brief description of the data, discuss the econometric framework, and present the empirical findings. Finally, we provide a summary and draw some conclusions.

Institutional Setting of Dentistry in Austria

With minor variations, the general institutional design of demand and supply of outpatient health services in Austria is relevant to dental services. Therefore, we start with a short description of this design and point to the peculiarities of the dentist sector. From the demand and financing perspective, the public health insurance system represents the first tier of coverage against the risks of illness. Membership in this system is obligatory for wage earners both in the public and the private sector, but also for self-employed persons. Individuals with family ties to obligatorily insured persons and those without their own coverage obtain free health coverage. Overall, the public health insurance system covers around 98.5% of the population, excluding only small groups. Approximately 80% of the population is covered by public insurance schemes at the provincial level. These schemes are strongly regulated and coordinated at the federal level. Their benefit catalogues are therefore relatively homogenous. Public health insurance is financed mainly by income-related contributions. Private health insurance and out-of-pocket payments constitute the second tier of the Austrian health care system.

Dental services in Austria are supplied by (i) PDs, (ii) CDs, (iii) directly by the public health insurance system (dental laboratories), and (iv) by departments of stomatology of public and private hospitals (the latter include private departments of public hospitals). Following the

governance tradition of a Bismarck type of health care system, important institutional characteristics of these types of provision are regulated by different public agents, resulting in a highly fractionalized system. Market entry for all dentists is based on a dentist license, which qualifies the dentist for the entire range of dental services. Every dentist with a license is free to locate as a self-employed PD. In contrast, the market entry for service types (ii) to (iv) is highly regulated. Service modes (ii) and (iii) are of highly importance for the coverage with publicly financed dental services. CDs have a contract with the public health insurance system. They are self-employed, mainly working in single practices. The spatial distribution of CDs is based on a location plan agreed upon the public health insurance system and the Chamber of Dentists. Every dentist has to be a member of the Chamber of Dentists. The Chamber of Dentists acts as a bargaining partner for the public and private financing institutions of dental services, and it represents the interests of dentists in the political process and acts as an institution of self-regulation of the dental profession. The location plan specifies the regional distribution of the CD-workforce based on crude need-related criteria. Thereby, possibilities of choice between different CDs should be guaranteed at reasonable costs (e.g., travel costs). The location plan does not take into account private dental capacities. Dental services offered by the public health insurance system (dental laboratories) are directly part of this location plan. They offer services comparable to the services of CDs. To some extent, they were established to improve the public provision with dental services. Dental services offered by hospitals are part of the hospital capacity plan implemented by the provinces. This plan is not closely connected with the location plan of dental services mentioned above. Hospitals – mainly hospitals with a comprehensive range of services (f. e. university hospitals) - offer specialized dental services, but also act as an important “first-contact provider” during overnights and weekends, especially in urban areas

As mentioned above, the contract of a CD relies on a bilateral agreement negotiated between the public health insurance system and the Chamber of Dentists. The agreement itself includes substantial dimensions of the work of dentists including working hours, working standards, and fees for dental services. CDs generate income from fee-for-service and lump sum payments. The fee-for-service component of remuneration includes earning caps, resulting in decreased marginal revenues per patient and treatment. Dentists working in institutions of category (iii) are paid on a salary basis (in dental laboratories). In contrast to CDs, their private counterparts (PDs) are free to choose their practice location without restrictions. Their remuneration is based mainly on a fee-for-services system and the corresponding fees are

agreed upon the dentist and the patient. A recommendation for physician pricing policy is available from the Chamber of Dentists. This recommendation is especially important in the case of disputes between the dentist and the patient regarding service prices.

Patients with public health insurance coverage are free to consult providers of categories (i) to (iii). However, the associated costs of utilization are considerably different. The consumption of services (ii) is based on a benefit-in-kind scheme. Basic dental services are offered with negligible cost-sharing elements, but patients are confronted with substantial amounts of cost sharing when they undergo specialized treatments such as endodontic services, crowns and bridges, and prosthodontic and orthodontic services. A similar regulation of service prices exists for dental services offered directly by the public health insurance system. Dental costs in the private sector are paid (i) out of individual pocket, (ii) by private health insurance, and/or (iii) by the public health insurance system. The latter only reimburses a portion of a private dentist's invoice. For basic services, the maximum refundable amount is fixed at 80% of the amount a public dentist is allowed to charge for the same service. For specialized treatments, the utilization schedules of CDs are applied to services consumed in the private sector. Since the prices of PDs for basic and specialized treatments are far above the ones for CDs (rough estimates show that the recommended prices for PDs are 2–3 times higher than the fees agreed upon for CDs), the financial burden for the utilization of PDs is substantial and amounts to about 60 to 80% of the total bill of PDs.

Table 1 gives an overview of the overall financing structure of dentist offices between 2004 and 2008. To better assess the financing structure of dental services in Austria, we compared it with the general financing structure of physicians working in the outpatient sector of the Austrian health care system. There, approximately 80% of total physician expenditures are paid by public institutions, predominantly by the Public Health Insurance System (SHI). Private financing, which accounts for 20% of the total physician bill, is dominated by out-of-pocket payments (OOP). Private Health Insurance (PHI) plays a very limited role. The financing structure for dental services differs substantially: 60% of the total bill is paid publicly and SHI is the dominant payer. More than 40% of dental services are paid privately, mainly by OOP, indicating that private dental services are an essential part of the service provision for oral health. From this finding, we also can conclude that the degree of substitution (competition) between public and PDs is high as compared to general physician services.

Table 1. Expenditures for physicians' and dentists' offices, separated by the source of financing

	2004	2006	2008
Physicians' offices			
Total Expenditures (in Mio. Euro)	2,365	2,422	2,817
Financed by (percentage of total expenditures)			
<i>Public Financing</i>	81	84	79
• General government (without SHI)	6	6	6
• SHI	75	78	73
<i>Private Financing</i>	19	16	21
• PHI	2	2	2
• OOP	17	14	19
Dentists' offices			
Total Expenditures (in Mio. Euro)	1,184	1,215	1,317
Financed by (percentage of total expenditures)			
<i>Public Financing</i>	59	58	57
• General government (without SHI)	3	2	2
• SHI	56	56	55
<i>Private Financing</i>	41	42	43
• PHI	4	4	3
• OOP	37	38	40

Notes: The definition of expenditures for provider industries follows the "System of National Accounts" and includes only current expenditures. Not all providers of outpatient care are included in the category "offices of physicians" (excluded are: laboratories, out-patient care centers, home care services).

Abbreviations:

SHI: Social Health Insurance

PHI: Private Health Insurance

OOP: Out-of-Pocket Expenditures

Source: Statistik Austria, Volkswirtschaftliche Gesamtrechnungen, several recent years.

2930 dentists worked as CDs or PDs in Austria in 2008, roughly 20 % of them as PDs. The number of dentists (CDs and PDs) increased by 10 % in the time period 2002 – 2008 (Increase of CDs: 8 %, increase of PDs: 18 %). So the share of PDs increased slightly over the observed time period. There exist 72 dental laboratories, 4 private and 5 public dental departments operated by hospitals. The number of dental laboratories, private and public dental departments did not change in the time period 2002 – 2008. Approximately 10 % of the total public dental services outside of hospitals are offered by dental laboratories.

Hypotheses, Data, and Econometric Specification

Our empirical approach to studying the determinants of private dentist density was motivated by the following considerations. PDs entering or staying in a regional market expect a profit, which satisfies their economic goals (for models of market entry in the health care sector, see 31). Demand for dental services is influenced by the socio-economic characteristics of the population such as age, income, family structure, and sex (for details, see 14, 23-27). CDs satisfy a portion of this demand. The same is true for dental services offered by the Public Health Insurance System directly (dental laboratories) and, to some extent, the dental services of private and public hospitals. Thus, the demand for private dentist services is a "residual demand". Taking account for the above mentioned specific institutional setting of dentistry provision in Austria, we expect that private dentist services are demanded only if the additional costs are covered by the expected benefits, as compared to the ones of consuming services offered by categories (ii) and (iii). Thereby, the expected benefits might include different dimensions, such as shorter waiting times, lower transportation costs, higher treatment quality, or treatments not offered by the public dentistry system (for a general approach to deriving the demand for private health care, see 32). This means that PDs and CDs are to some extent competing for the same population of patients. In other words, the services of PDs and CDs can be viewed as substitutes, suggesting a negative relationship between the corresponding dentist densities. This, in turn, let us derive hypothesis 1:

Hypothesis 1: The density of PDs is negatively related to the density of CDs.

In addition to the within district effects, there are some reasons to take spatial variables into consideration when analyzing dentist location decisions and ones of planning dental capacities. First, dentists try to compare the attractiveness of regions based on factors like income, population, and age structure. If they anticipate a tight market in a preferred region, they will likely locate in a neighboring market. Accordingly, we assume spatial spillovers across regions. Second, patient mobility might induce demand spillovers and may, therefore, attract physicians to neighborhood regions. Based on these arguments, we presumed a positive relationship between the density of PDs and the ones of PDs as well as CDs in neighborhood regions.

Hypothesis 2: As a cause of the expected spillovers, we expect a positive relationship between the density of PD and the neighboring density of PDs and CDs.

Data and Econometric Specification

Districts are a major public administrative unit in Austria, acting between the local communities and the states. Although they do not have legal competences, they are of crucial importance in health care provision, representing a central planning region for public outpatient specialists. Therefore, our sample relied on 121 districts (including 23 districts of Vienna), for which we had observations for the years between 2002 and 2008. Our dataset was balanced and included 847 observations on dentist densities, which were calculated as the number of dentists per 1,000 inhabitants. The number of dentists per district was inferred from the dentists' locations (33). We did not have additional information on the personal characteristics of dentists such as age, medical school, costs and revenues of the practice, and patient structure. Further, our sample included demographic data per district, which were taken from the Austrian Population Census 2001 (published by Statistics Austria), each district's income (reported in the Austrian Wage Tax Statistics 2004–06, published by Statistics Austria), and information on the number of stomatology departments in public and private hospitals (available from the *Krankenanstaltenverzeichnis* 2008, published by the Austrian Ministry of Health). Information on the dental services offered by the public health insurance system (dental laboratories) was collected from the homepages of these institutions. Figures 1 and 2 (Appendix) plot the densities of PDs and CDs at the district level (i.e., dentists per 1,000 inhabitants).

Figure 1 shows that some districts do not host any PDs within their borders. The majority of districts are in the density range of 0.00–0.10, and the density of PDs was found to be especially high in the urban regions. The mean density of PDs is 0.10, with a minimum of 0.00 and a maximum of 1.93. Figure 2 summarizes the density of CDs. Here, the majority of the districts are in the density range of 0.15–0.30. The mean over all of the districts is 0.37, with a minimum of 0.13 and a maximum of 2.99. The density of CDs between the districts was found to be quite homogenous and, as with PDs, the density is highest in urban regions. Overall, the distribution of PDs is more unequal than that of CDs. Table 2 shows the summary statistics of PDs and CDs as well as additional variables that were controlled for in our estimation.

Table 2 shows several descriptive statistics on variables that were used in the empirical analysis described below. Accordingly, the average annual income (net of income taxes and social insurance contributions), measured by a district's total income to population size, amounts to about 17,400 Euro (the minimum is about 14,700 Euro and the maximum amounts to 28,500 Euro).

Table 2. Descriptive statistics of the variables used in the regression^{a)}

Variable	Mean	SD ^{a)}	Minimum ^{a)}	Maximum ^{a)}
Number of PDs	6.19	9.11	0.00	61.00
Number of CDs	22.92	16.89	1.00	135.00
Density of PDs ^{b)}	0.10	0.18	0.00	1.93
Density of CDs ^{b)}	0.37	0.28	0.13	2.99
Public stomatology departments ^{c)} [CS]	0.03	0.18	0.00	1
Private stomatology departments ^{c)} [CS]	0.04	0.20	0.00	1.00
Dental Laboratories ^{c)} [CS]	0.60	0.87	0.00	7.00
Income ^{d)} [CS]	17.41	2.23	14.70	28.51
Education ^{e)} [CS]	1.69	0.25	1.43	2.65
Living Area (100 km ²) ^{f)} [CS]	2.69	2.37	0.01	11.08

Notes: a) All data are at the level of districts, the dentist density entries (PD, CD) are time variant and represent averages over the years 2002 and 2008; "[CS]" indicates time-invariant variables; SD...Standard Deviation, Minimum...Minimum value of all districts; Maximum...Maximum value of all districts b) Calculated as the number of dentists in a district over 1,000 inhabitants. c) Number of (public/private) stomatology departments (Dental Laboratories) in a district (2008). d) Income in 1.000 Euros per person (2004 – 2006) e) Average education level (2001) f) Size of the district

Education was measured by the weighted average education level. To calculate an average education level, we consider five groups of educational levels and order them ((1) compulsory school, (2) apprenticeship or secondary education, (3) higher school certificate (general

qualification for university entrance), (4) addition education excluding university education (polytechnic degree or college), (5) university degree or equivalent. We multiplied the numbers of persons in each group with the corresponding level of education 1 – 5, and divided the sum of the subgroups by the population above 15 years. Thus we get an index measuring the average educational level, (theoretically) ranging from 1 to 5 within regions where increasing values indicate a higher level of education (for details, see 34). The largest district in our sample is around 1,100 km², with an average value of 270 km². Furthermore, almost every second district hosts a dental laboratory, which acts as a substitute for PDs and CDs. We used the number of dental laboratories as an indicator for this capacity. Stomatology departments at private and public hospitals to some extent are also substitutes for PD and CD capacities. On the other hand, it may be attractive for a dentist to work in geographical adjacency of such departments and this might lead to a complementary relationship (35). Entries labeled with "[CS]" indicate that only one cross section is available for these variables, so that they are time-invariant. This specific feature of our dataset has to be taken into account in our estimation approach.

Previous research on the differences in the regional densities of dentists only included a region's own characteristics as explanatory variables. As described above, however, the location decisions of dentists would be spatially interrelated to each other if patients and/or health care providers are mobile (36). This, in turn, might induce severely biased estimation results. Therefore, we assumed that a district's density of PDs is not only affected by its own CD density (and other district-specific covariates), but also by the densities of PDs and CDs in other, neighboring districts. For this purpose, we included the densities of PDs and CDs as explanatory variables. More specifically, we assumed that the impact of a neighboring district's (PD and CD) density is larger the more adjacent two districts are located to each other. Adjacency is captured by a spatial weighting matrix W (37), where we use the driving distance between two districts as the spatial weight. The typical off-diagonal element of W is given by $w_{ij} = 1 - d_{ij}^2/50^2$, $i \neq j$, while $w_{ii}=0$ (d represents the distance between districts i and j). This weighting scheme implies (i) a non-linear decay in a neighboring district's impact on district i 's dentist density, and (ii) a zero impact if the driving distance between two districts is more than 50 kilometers. Further, we assumed that the weighting matrix is non-stochastic and exogenous. Based on these considerations, we estimated the following equation

$$PD_{it} = \alpha_1 W \cdot PD_{it} + \alpha_2 CD_{it} + \alpha_3 W \cdot CD_{it} + \delta X_i + \lambda_i + v_{it}$$

where i indicates the i^{th} district, $i = 1, \dots, n$. t is a time index, $t = 1, \dots, T$. PD and CD represent time-variant densities of PDs and CDs. X_i represents a matrix of independent variables including the district's availability of private and public departments of stomatology, dental laboratories, average income, the educational level, and living area.

To estimate our empirical model, we have to tackle two issues: First, and as described above, all variables of matrix X are time invariant, and second, it might be the case that the physician densities ($W \cdot PD$ and privately held departments of stomatologists) on the right hand side of the estimation equation are endogenous. To obtain an estimator for δ and also unbiased ones for α_1 we apply an estimation approach as developed by Hausman and Taylor (38), which is specifically well suited to address both issues. Hausman and Taylor (henceforth HT) propose to estimate the time-invariant covariates of a panel regression by generalized least squares (GLS) using an instrumental variable estimator to deal with a possible endogeneity bias. First, the dataset is divided into four groups of variables: (i) time-variant exogenous variables (in our case the density of CDs and the one of neighboring districts), (ii) time-invariant exogenous variables (publicly held departments of stomatologists, dental laboratories and a district's income, living area and educational level), (iii) time-variant endogenous variables ($W \cdot PD$), and (iv) time-invariant endogenous variables (privately held departments of stomatologists). Then, a fixed effects model has to be estimated, which provides consistent estimates of the α 's, but removes the time-invariant X -variables. The residuals of this regression are regressed on the time-invariant exogenous variables using the time-variant variables as instruments. From this, one obtains an estimate of δ , which, along with the consistent estimates of the α 's can be used to estimate the variance components of unit-specific effects (λ) and of the error term. These, in turn are needed to apply the above mentioned GLS estimation.

Results and Discussion

Table 3 summarizes our estimation results. With regard to the time-invariant covariates for the overall demand for dental services, we observed insignificant effects for income, education, and living area. The same holds true for the variables that might act as substitutes to private dental services. The coefficients of the public departments of stomatologists and of the dental laboratories had the expected signs, indicating substitutive relationships, but they were not significant. Although the coefficient of private departments of stomatologists

indicated a complementary relationship, the coefficients were not significant. Regarding our relationship of interest (Hypothesis 1), we were able to confirm a significant substitutive relationship as a consequence of a competitive effect between PDs and CDs within a district. The neighborhood effect of dentist density was significantly positive for both PDs and CDs. This again points to the dominance of the substitution effect between dentists. If dentist density in a district is high, dentists decide to locate in other districts and, therefore, their density there increases.

Table 3: Regression results for the determinants of the density of private dentists (PD) at the district level

Independent Variables	Private Dentists (PD)
Density of CDs	-0.645*** (0.0063)
Spatially weighted density of CDs	1.084*** (0.253)
Spatially weighted density of PDs	0.826*** (0.161)
Public Departments of Stomatologists	-0.067 (1.417)
Private Departments of Stomatologists	1.070 (3.662)
Dental Laboratories	-0.048 (0.545)
Income	-0.372 (3.393)
Education	0.348 (4.108)
Living Area	-0.076 (0.166)
Observations	847
Over identification: $\chi^2(13)$	0.950

Notes: PD...private dentists; CD...public dentists. Bootstrapped standard errors in parenthesis (50 replications). ***, **, * denote statistical significance at 1, 5, and 10 percent levels, respectively

From a health policy perspective, the substitutive relationship between PDs and CDs within the same district is of high interest in several respects. One implication might be that an increase in overall dentist supply need not be a threat to efforts to stabilize the total expenditures for dental services. Overall, the finding of a substitutive relationship between PDs and CDs should not lead us to the conclusion that PD services are generally an

alternative to CD services from a health policy point of view. The treatment capacities offered by PDs are currently not included in the public dental capacity plans in Austria. The strengthening of PDs in the provision of dental service (e.g., by accounting for their capacity in the public dental capacity plans) might lead to higher inequality in the access/utilization of dental services, because the patient's bill is much higher when a PD is utilized compared to a CD. Overall, we should be cautious of drawing too far-reaching policy conclusions from our findings.

We focused on the density of PDs. This indicator mirrors location decisions that were made in the past and, therefore, reflects expected utilization but not actual utilization. In order to draw policy conclusions on the future role of the private and public sector in dental care, empirical work based on enriched characteristics of PDs and/or on the actual utilization patterns is necessary. Data regarding the actual utilization patterns of private and public dental services are necessary in order to draw conclusions on the exact shape/direction of the substitution (e.g., the characteristics of the services and patients where the substitution takes place). Currently, it is not possible to obtain information for an adequate sample of PDs in Austria. The missing of utilization data for PD services also hinders us to test for the role of supplier induced demand in the PD-market. Some authors provide evidence for its existence in the market for dental services (39, 40, 41). Our results – the coefficients for CD in the same district, as well as the ones for CDs and PDs in other, neighboring districts – point to the existence of substitutive relationships. In our opinion this does not exclude supplier induced demand. By analyzing the determinants of dentist density, which is the result of market entry and exit, we take a long term perspective of the dentist market. But rather, we expect that supplier induced demand is mainly a problem of excess supply in the short term (e.g., in periods of a changing demand and supply). Of course, some forms of “long term supplier induced demand” might exist in the observed regions. But to test this systematically, we would need information on utilization of dental services at the level of districts, which is not available so far.

We evaluated dentist density at the district level. To rely on administrative boundaries of observation units might cause biased results, but the necessary information to derive relevant market areas for dental services is presently missing. Furthermore, we assume that dentists are homogenous in their provision of services. Although a rather low degree of specialization exists among dentists in Austria, especially in the private sector, the offered services differ

between dentists. Finally, a much more enriched data set on actual utilization is necessary. This might be part of future research.

Conclusions

This paper analyzed the location decisions of dentists measured by the dentist density at the regional level (district level) in Austria. We have expanded previous research on dentist density in two directions. First, we account for the institutional framework of the Austrian health care system, which regulates the “market entry” for CDs and PDs differently. Thus, because taking the dentists as a whole as a homogenous group would result in biased estimates, we focus on the determinants of the density of PDs. This approach allowed us to study possible interaction effects between PDs and CDs. To identify this relationship, we controlled for covariates that might influence dental service demand such as income and education. We also controlled for public dental services offered by hospitals and the health insurance system. Second, we allowed for spatial interactions of dentist densities between the districts. We found a significant negative relationship between the density of PDs and CDs, indicating a substitution effect between the two dentist groups. Furthermore, a significant positive spatial relationship was found for both PDs and CDs in the neighboring regions. Dental capacities in public and private hospitals and dental laboratories owned by the public health insurance system do not have a significant effect on private dentist density.

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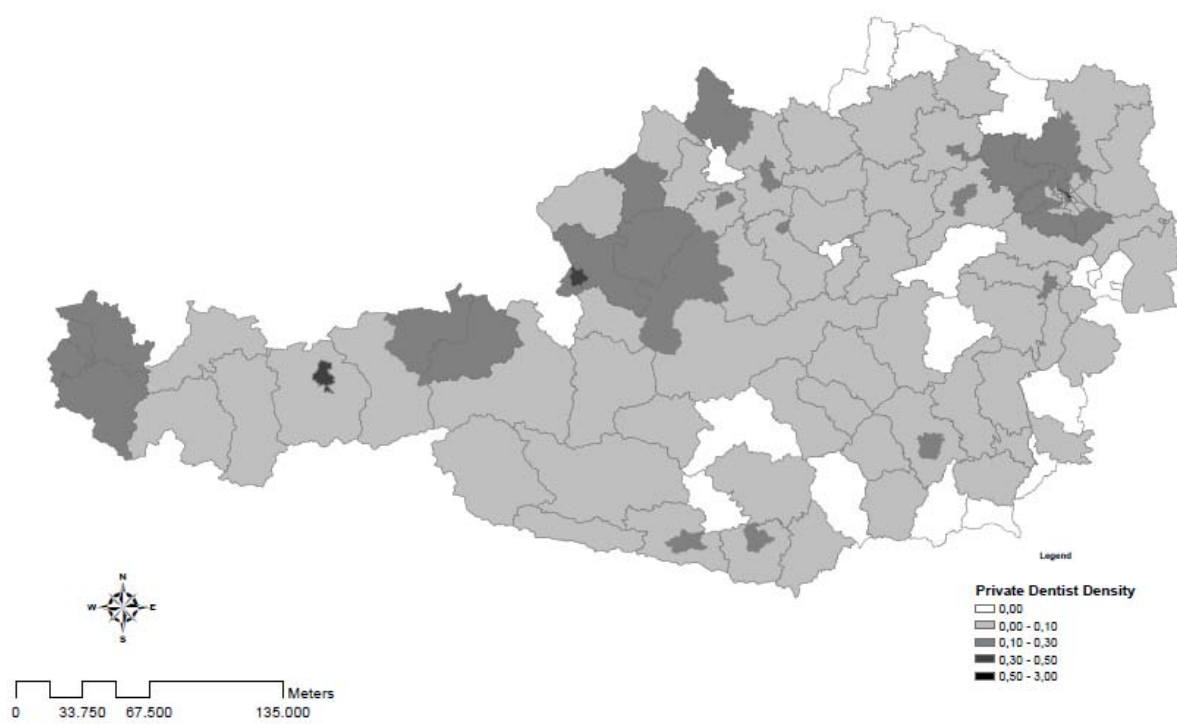


Figure 1: Density of Private Dentists (dentists per 1,000 inhabitants, average of the years 2002–2008), district level.

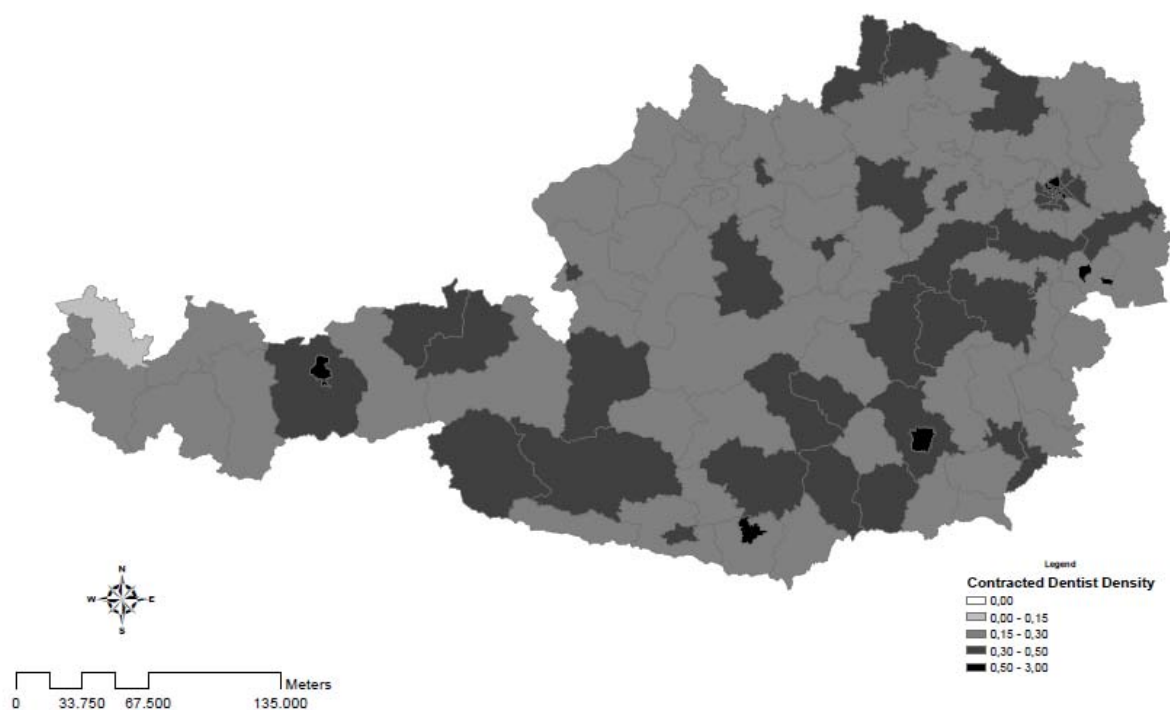


Figure 2: Density of Public Dentists (CD) (dentists per 1,000 inhabitants, average of the years 2002–2008), district level.

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