# Healthcare Reforms and Competition in Private Hospital Markets in Türkiye

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## Abstract

This article investigates the hospital market in Türkiye during a period in which a surge happened in the number of private hospitals nationwide following the inception of the reforms under the Health Transformation Program 2003-2013 (HTP). Bresnahan and Reiss's (1991) static model of firm entry is employed to estimate the market size thresholds for hospital entry in a cross-section of local districts of Türkiye for the years 2002 and 2010 which represent pre- and post-reforms periods. The multi-period analyses clarify the change in the hospital competition over the years, along with providing a measure to assess the overall role of the health reforms and regulations in shaping the hospital industry.

*Keywords: Hospital competition, Regulation, Health reforms, Turkish hospital industry*

*JEL Classification: D43, I11, I18, L11, L13, L51*

# Türkiye'de Sağlık Reformları ve Özel Hastane Piyasasında Rekabet

## Özet

Bu makale, Sağlıkta Dönüşüm Programı 2003-2013 (SDP) çerçevesinde gerçekleştirilen reformların ardından, ülke genelinde özel hastane sayısında artış yaşanan bir dönemde, Türkiye'deki hastane piyasasını incelemektedir. 2002 ve 2010 yıllarında Türkiye'nin yerel ilçelerinde hastanelerin girişi için piyasa büyüklüğü eşiklerini tahmin etmek amacıyla Bresnahan ve Reiss'ın (1991) statik firma girişi modeli kullanılmıştır. Makaledeki çok dönemli analizler, yıllar içerisinde hastane piyasasındaki rekabetin değişimini açıklığa kavuşturmanın yanı sıra, gerçekleşen sağlık reformlarının ve düzenlemelerin hastane endüstrisinin şekillenmesindeki genel rolünün değerlendirilmesine yönelik ölçüm de sağlamaktadır.

*Anahtar Kelimeler: Hastane rekabeti, Regülasyon, Sağlık reformları, Türkiye hastane endüstrisi*

*JEL Sınıflandırması: D43, I11, I18, L11, L13, L51*

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Boğaziçi Journal Review of Social, Economic and Administrative Studies, Vol. 37, no. 2 (2023), pp. 118-146, doi: 10.21773/boun.37.2.4
Research Article | Received: 29.05.2023- Accepted: 25.12.2023

## 1. Introduction

The hospital care industry in Türkiye has experienced major changes since the 2000s, particularly as a result of the health reforms and regulations under the Health Transformation Program 2003-13 (HTP). The rise in the demand for healthcare as a consequence of the progress toward universal health coverage, together with the increased involvement of privately-owned hospitals in the delivery of healthcare, has dramatically changed the competitive environment of the hospital market. Along with the advance in the overall capacity of the health system during the HTP, the reforms resulted in the proliferation of private hospitals nationwide throughout the late 2000s. The growth of the private sector was followed by the introduction of new regulations on pricing and entry of private hospitals. Yet, within the framework of the new empirical industrial organization methods, there appears no investigation of the hospital market in Türkiye and the impact of the most recent health reforms and regulations that have dramatically transformed the industry environment.[1]

Building on the models of empirical industrial organization, the paper investigates the nature of competition among hospitals in Türkiye and its change during the reform period. Despite the absence of price and cost data for hospital care, structural approaches proposed by the firm entry and market structure literature (Bresnahan and Reiss 1991, Mazzeo 2002, Abraham et al. 2007, Schaumans and Verboven 2008, Balmer 2013) can still be employed to model firm entry into local markets as a function of some observable market characteristics.

The econometric model of the paper relies on Bresnahan and Reiss's (1987, 1990, 1991; hereafter BR) *entry threshold method* in a static cross-section oligopoly framework. In the absence of price and cost data, BR framework enables us to analyze the market structure and the nature of competition among hospitals through observations on the number of hospitals in local markets and some market demand and supply indicators.

The empirical analyses rely on the yearly countrywide data about hospitals and local markets in Türkiye. The dataset combines data on hospitals and market characteristics of local districts of Türkiye from 2001 to 2014. The unit of analysis is a geographically local market. The scope of the product market is general hospital care.[2] In a two-period static equilibrium framework, ordered probit models of the number of hospitals in the local districts of Türkiye for the years 2002 and 2010 were estimated. The sample used in the estimations consists of 205 of all 927 districts as local markets across 72 of the provinces of Türkiye in 2010.

With this empirical research, it becomes possible to tell the structure of competition in local districts. This also makes it possible to conduct simulations for later periods when regulations restricted new hospital entry into the markets. The multi-period analysis helps to explore the change in the hospital competition over the years and to measure the overall role of the recent health reforms and regulations under the HTP in shaping the hospital care market.

Although the article is rooted in the health system reform experience of Türkiye, the methodology and policy implications of the study go beyond the national boundaries of Türkiye

[1] It appears that the recent empirical studies on the hospital market in Türkiye has been focused on the competition and hospital efficiency; see Sahin, Ozcan and Ozgen (2011), Erus and Hatipoglu (2013), Torun, Celik and Younis (2013), Ozgen Narcı et. al. (2015), Yıldız, Heboyan and Khan (2018).

[2] The whole range of general hospital care is considered as a composite good since they admit all types of medical cases and provide a wide range of health services. Also, it is assumed that patients are less likely to travel outside of their residential area to receive general hospital services at the secondary care level while patients travel further for specialized or more complex tertiary hospital care after being diagnosed by local general hospitals. For these reasons, special diligence was taken in selecting sample districts as geographically local hospital care markets.

to provide a ground for international health policy issues and debates on competition between private providers that can improve the design and implementation of health policies and their assessments in other national healthcare systems around the world.

The article proceeds as follows. The next section briefly describes the hospital market environment with a focus on the related health reforms and regulatory climate. A subsequent section presents the empirical strategy, followed by Section 4 on the model of hospital entry and equilibrium market structure. Section 5 contains the econometric framework. Section 6 is on the dataset with the description of hospitals, relevant market definition, market selection rules, and variables used in the estimations. Then, Section 7 presents the estimation results, along with some prediction exercises and policy simulations. The final two sections are discussion and conclusion.

## 2. An Overview of the Hospital Market Environment and Health Reforms

The hospital market environment in Türkiye has substantially changed during the Health Transformation Program 2003-13 (HTP). Here, a selective overview of the market environment in which hospitals operate is provided, and only particular health reforms and regulations during the HTP that have direct influences on the hospitals are described.[3]

With the inception of the HTP reforms in 2003, private hospitals began to be included in the public health insurance system and thus citizens began to receive private healthcare services within the scope of their public insurance. On the finance side, the Social Security Institution (SSI - *Sosyal Güvenlik Kurumu, SGK*) and the Social Insurance and General Health Insurance (*Sosyal Sigortalar ve Genel Sağlık Sigortası*) laws were enacted in 2006. Under the SSI, the consolidation of formerly fragmented public health insurance schemes has been completed under a unified General Health Insurance scheme (GHI - *Genel Sağlık Sigortası, GSS*) as of 2011, and so the GHI coverage has improved towards publicly-financed universal health coverage nationwide. Thus, with the HTP reforms, people began receiving both public and private hospital services through their public insurance.

In 2007, the SSI introduced a new payment method, SUT (Communique on Healthcare Practices - *Sağlık Uygulamaları Tebliği*), which regulates the private healthcare prices for hospitals. The SUT payment scheme sets base prices as the common reimbursement rate, in which payment to the contracted private hospitals is made by the single national public purchaser SSI based on a predetermined price for each itemized service. Thus, as a result of the progress towards countrywide universal health insurance coverage, the inclusion of private hospitals into the public insurance system, and the price regulation on hospital care, there has been a more robust patient demand for hospital care.

Such reforms at the early stages of the HTP promoted the private sector to enter the hospital care markets countrywide and triggered more private hospital entry. Then, the rapid proliferation of private hospitals in the following years led to further regulation. In 2008, to control the distribution of hospitals for a better match with the healthcare needs on a demographical and geographical basis, the government introduced a restrictive regulation on market entry of hospitals - a Certificate of Needs (CoN)-like requirement concerning the establishment and capacity expansion of private hospitals. This curbed the rapid expansion of private hospitals. Thus, after a growth phase of the hospital industry from 2005 to 2009, the surge in the number of private hospitals began diminishing following the introduction of the

[3] For the full description of the HTP reforms, the interested readers are referred to the Ministry of Health (2003, 2009, 2011), OECD and Worldbank (2008), Tatar et al. (2011), and Atun et al. (2013).

restrictive CoN regulation in 2008. On the other hand, as a new practice that came into force in 2009 but was abolished at the end of 2013, Private Medical Centers (*özel tıp merkezleri*) were allowed to transform into a private hospital if they met certain conditions. Rather than new hospital openings, this short-term practice contributed to a further considerable rise in the number of private hospitals from 2011 to 2012 although new hospital entry was restricted after 2008. With the finalization of the HTP in 2013, the market structure of the hospital industry remained almost stable in the subsequent years (Figure 1).

Among others, the year 2010 was a critical year during the implementation of the HTP. A new nationwide planning approach regarding all the country's healthcare resources has been put into practice. The dual practice of physicians in public hospitals was completely forbidden with the introduction of the *full-day law* in 2010. The Family Medicine Program at the primary care level was expanded nationwide by the end of 2010. The Ministry of Health (MoH) located 30 Health Service Areas (HSAs) in 2010 and started a region-based healthcare service planning era in the public sector (see Supplementary Materials Appendix A for more description of HSAs).[4] Thus, there has happened a transition from a competitive market setting at the early phase of the HTP (particularly between the years 2003 and 2008) to a mix of competitive, regulated and planned market environment after 2010.

## 3. Empirical Strategy to Measure the Effect of Health Reforms

The underlying assumption of the static firm entry model of the paper is that the industry is at long-run equilibrium in estimation years. It is supposed that the industry was at the long-run market equilibrium in 2002 before the Ministry of Health (MoH) commenced various health reforms under the HTP in 2003. Considering the transformation of the industry environment that is summarized above, it is then assumed that the HTP reforms distorted the equilibrium and the industry reached a new long-run equilibrium in 2010 after the key reforms and regulations on hospital entry and pricing. Hence, two periods were considered in the analysis. The entire sample years, 2001-14, were divided into two periods: before 2003 and after 2003 as pre-reforms and post-reforms periods. Also, due to greater regulations on price and entry into the market after 2008, the post-reforms period was considered into two sub-periods: 2003-2008 and 2008-2014, as relatively free entry and restrictive highly regulated entry periods, respectively.

Given the introduction of restrictive CoN-type entry regulation in February 2008 and the proliferation of private hospitals continued until 2010 during the early stages of the reform program, it is justifiable to suppose that the industry reached another long-run equilibrium in 2010. The completion of a new hospital entry process typically takes two-three years after the MoH grants a pre-approval (*Ön İzin*) for establishing a new hospital. Therefore, the hospital projects that had started just before the introduction of the new restrictive entry regulation in 2008 can be supposed to become apparent in the market competition as of 2010, more or less. From this aspect, even if the key regulation about new hospital entry was introduced in February 2008, the year 2010 was assessed to be a more suitable sample year for representing the post-reforms period than the year 2008 for the empirical analysis. Therefore, a static hospital entry

[4] On the public hospitals side, another important reform at the later stage of the reform program was about the reorganized structure of all public hospitals under the Public Hospitals Association (*Kamu Hastaneleri Birliği*) in every province of the country after 2012. The implementation of the Hospital Associations was ended in 2017, and then public hospitals continue to serve under the General Directorate of Public Hospitals. Since the reforms and regulations briefly summarized here are the ones especially related to private hospital markets and the estimations cover the years 2002 and 2010, further descriptions and discussions on Hospital Associations practice were not considered in the paper.

model with the dataset for the years 2002 and 2010, representing the pre- and post-reforms periods, was estimated. In the remaining period, the year 2014 in the dataset served to conduct some supplemental counterfactual policy analysis.[5]

This two-period estimation allows us to comparatively examine the change in the extent of hospital competition in local healthcare markets after the inception of the HTP reforms. They help to discriminate the impacts of the population changes over the years and the overall impact of the health reforms on the number of hospitals in local districts of Türkiye.

## 4. Model

The model relies on Bresnahan and Reiss's (1987, 1990, 1991; hereafter BR) static firm entry threshold method in an oligopoly framework, which allows the estimation of the minimum demand size necessary for the presence of a specific number of firms in local markets. BR's method first focuses on the relationship between the number of firms at isolated markets in a given year and the corresponding minimum market size, defined as *entry thresholds* needed to accommodate one, two, or three firms, and so on in geographically local markets. Then, the estimates of consecutive *per firm entry threshold ratios* enable inferring changes in the degree of competition in a geographic market as the number of firms rises.

The model focuses on a single market outcome, the number of firms in local markets. This allows using an ordered probit model, in which the dependent variable is the number of firms in each geographic market, to estimate the parameters of the profit function that are used in the calculations of entry thresholds.

Here, BR's (1991) model framework is reiterated, which proposes the concept of demand entry threshold to predict how the number of firms, $N$, in a geographic market varies with the market size, $S$.

The equilibrium condition of the model is that a market has $N$ entrants if firms that entered make nonnegative profits and any additional firm would make negative profits: $\Pi_N \geq 0$ and $\Pi_{N+1} < 0$. Thus, the *entry threshold* is defined as the minimal market size $S_N$ that can accommodate $N$ identical firms. It is derived from the following zero-profit long-run equilibrium level of demand conditions: at $S_N$, $\Pi_N(S_N) = 0$ ; at $S_{N+1}$, $\Pi_{N+1}(S_{N+1}) = 0$ and so on. Then, the equilibrium profit functions become

$$\Pi_N(S_N) = V_N(.)S_N(.) - F_N(.) = 0$$

Next, solving for the entry threshold gives $S_N = \frac{F_N(W)}{V_N(.)}$ which is the ratio of fixed costs $F(.)$ to variable profits $V_N(.)$. Then, *per firm entry thresholds* are defined as the minimal market size needed for each one of the $N$ identical firms as: $s_N = \frac{S_N}{N} = \frac{F_N(W)}{N\,V_N(.)}$ . Lastly, *the per firm entry threshold ratio* is defined as

$$\frac{s_{N+1}}{s_N} = \frac{V^N}{V^{N+1}} \frac{F^{N+1}}{F^N} \frac{N}{N+1}$$

[5] If the dataset of the paper had also covered more recent years after 2014, the longer-term effects of the HTP reforms on hospital market structure could have been investigated further. However, the hospital data for more recent periods after 2014 is not available for the research. Also, regarding the key health reforms under the transformation program, there is no sharp difference between the years 2013 and 2014; however, 2013 is the year that the program formally aimed to be completed and the Ministry of Health leadership has changed. Thus, 2014 represents the period immediately after the health system transformation program was officially completed.

The sequence of these ratios gives a measure for the fall in variable profits markup as the number of firms increases under the assumption that fixed costs do not change with entry. If the ratio is higher than one, this is interpreted as a fall in variable profits with a new firm entry, that is, later entrants need more per-firm demand to breakeven compared to earlier entrants. Moreover, as the sequence of the ratios of successive per firm entry thresholds converges to one, the model infers that the market becomes more competitive. Thus, the ratios provide inference on how the competitive conduct changes as the number of firms increases.[6]

The intuition behind the entry threshold method can be summarized as follows: if the per-firm market size required to support a given number of firms increases as the number of firms increases, the entry of new firms must intensify the competition. That is because the profit margin shrinks as competition becomes more intense, and successive entrants need larger populations to make enough revenue.

## 5. Econometric Specification

The long-run total profit functions in a market with $N$ firms are parameterized as

$$\Pi_N(S^N) = V_N\left(\vec{Z}, \overrightarrow{W}, \alpha, \beta\right) S\left(\vec{Y}, \lambda\right) - F_N\left(\overrightarrow{W}, \gamma\right) + \varepsilon$$

$$S\left(\vec{Y}, \lambda\right) = \lambda_0 Y_0 + \lambda_1 Y_1 + \cdots + \lambda_k Y_k$$

$$V_N\left(\vec{Z}, \overrightarrow{W}, \alpha, \beta\right) = \alpha_1 + X\left(\vec{Z}, \overrightarrow{W}\right)\beta - \sum_{n=2}^{N} \alpha_N$$

$$F_N\left(\overrightarrow{W}, \gamma\right) = \gamma_1 + \gamma_L \overrightarrow{W_L} + \sum_{n=2}^{N} \gamma_N$$

where $\vec{Y}$ represents market size variables; $\vec{Z}$ and $\overrightarrow{W}$ represent exogenous demand and cost shifters; $\lambda, \alpha, \beta, \gamma$ are profit parameters to be estimated; $\varepsilon$ captures the unobserved profits and market-level shocks.

Market size, $S\left(\vec{Y}, \lambda\right)$, is assumed to be a linear function of population variables. Firms' per capita variable profits, $V_N\left(\vec{Z}, \overrightarrow{W}, \alpha, \beta\right)$, are assumed to be a linear function of some cost and demand shifters, $W \; and \; Z$, and include an additional $\alpha_N$ component to capture the decrease in variable profits with the number of firms in the market. Likewise, fixed costs, $F_N\left(\overrightarrow{W}, \gamma\right)$, are assumed to be a linear function of some cost variables, $W$, and include an additional $\gamma_N$ component. The model imposes that later entrants have smaller variable profits and higher fixed costs, $\alpha_N \geq 0$ and $\gamma_N \geq 0$.

Each component of the profit function, $S(.), V(.)$, and $F(.)$, has indeed linear forms itself, but it becomes a nonlinear function of the parameters after replacing them into the log-

[6] It should be remarked that the ratio does not give the level of competition. It might be helpful here to reiterate the hypothetical example in Bresnahan and Reiss (1991) to have better understanding of how to interpret entry thresholds. Let's suppose it takes 2,000 customers to support a monopolist, and the market becomes perfectly competitive when each firm has 4,000 customers. It is expected to observe per firm entry thresholds between 2,000 and 4,000. For example, if the third entrant expects to compete in a perfectly competitive market, then it should be observed 3x4,000=12,000 customers in this market.

likelihood function. Hence, the parameters of the three equations are simultaneously estimated with ordered probit estimations via the maximum likelihood estimation procedure.[7]

## 6. Data

The dataset includes information on all hospitals in districts (*ilçe*) of Türkiye during the 2001-2014 period. The district-level data on market characteristics were gathered from various sources and the data on hospitals comes from the MoH. Then, the data on all individual hospitals in Türkiye were combined with the information on the local market characteristics in which hospitals are located. While the whole dataset was used for descriptive statistics of the hospital industry environment and for sample selection purposes, the econometric model makes use of the hospital data for the years 2002 and 2010 representing pre- and post-reforms periods, and the data for the year 2014 served for the policy analysis exercises.

### 6.1. Hospitals

In 2010, there were a total of 1,439 hospitals in Türkiye. Of these, 842 are public hospitals owned by the Ministry of Health; 62 are publicly- and privately-owned university hospitals; 489 are privately-owned hospitals; and the remaining 45 hospitals are owned by the Ministry of National Defense, municipalities, and other public institutions. Further disaggregation indicates that 149 public hospitals provide specialty health services at the secondary level of care or tertiary care as teaching institutions, as are 57 private hospitals. After excluding these specialized healthcare and tertiary-level hospitals, the empirical analysis begins with employing the data on the remaining publicly-owned 694 and privately-owned 432 general hospitals.[8]

### 6.2. Delineation of Relevant Markets

The model supposes that the relevant product market is general hospital care, and patients prefer to receive general hospital care from the healthcare providers closest to their homes.[9] The whole range of general hospital care is considered a composite good since general hospitals admit all types of medical cases and provide a wide range of health services. It is also presumed that people seldom travel outside of their residential districts (or, more broadly, from their provinces) in search of general hospital services at the secondary care level while patients travel further for specialized or more complex tertiary hospital care after being diagnosed by local general hospitals, so the relevant geographic markets are local districts of Türkiye. Hence, as in similar studies in the literature, some presupposed market selection rules were applied assuring that markets are geographically isolated enough, so that competition from hospitals in nearby areas is minimal.

A critical issue that arises in attempts to empirically study the market structure and competition is the delineation of a *relevant market*. In the selection of geographic markets,

[7] The derivation of the likelihood function is provided in Supplementary Materials Appendix B.

[8] Throughout the paper, private hospitals are simply referred to as privately-owned hospitals and publicly-owned MoH hospitals as public hospitals. The healthcare services are typically classified in three levels as primary, secondary and tertiary level of care. The main primary care providers are Family Medicine Centers; general hospitals are at the secondary care; and university hospitals and hospitals for teaching and research offer higher level tertiary care.

[9] In such models, the delineation of the relevant product and geographic markets is a prerequisite for the identification of the providers and potential customers within each local market. For a detailed discussion on the relevant geographic market definition in hospital care for analyses conducted in different countries, see OECD (2006, 2012). Since there is no one-size-fits-all procedure, at the early stage of the research, abundant time to experiment with alternative market definitions was allocated and after that, the market selection procedures of the analysis were developed in line with the similar studies in the literature.

similar studies in the literature have their own idiosyncratic approaches to defining geographic market areas, and, as it is done in this paper as well, use a mix of criteria which are based on distance, urban and rural distinction, population density, and travel time. Studies in the literature identify local healthcare market areas by (i) adhering to geopolitical boundaries such as towns, counties, districts, and metropolitan statistical areas (e.g., Bresnahan & Reiss, 1991; Abraham, Gaynor, & Vogt, 2007), (ii) using a fixed (or variable) radius around each particular hospital (e.g., Gresenz, Rogowski, & Escarce, 2004; Cooper, Gibbons, Jones, & McGuire, 2011), (iii) utilizing patient inflows and outflows data to derive geographic market boundaries (e.g., Morrisey, Sloan, & Volvana, 1989; Tay, 2003; Kessler and McClellan, 2000; Bowblis and North, 2011; Kleiner, Lyons and White, 2012).[10]

The lack of data precludes us from applying the fixed (variable)-radius or patient-flow approaches. Hence, a priori, it was assumed that the markets coincide with geographic boundaries. Accordingly, all the districts of Türkiye were defined as geographically local markets. Then, intense market selection procedures and robustness investigations were engaged in that resulted in a sample of districts of Türkiye in which the possibility of market overlap is minimal.[11] The market selection restrictions made the sample somewhat smaller, but they enabled the minimization of possible errors in relevant market definition and interrelations across markets.

At the outset, all the 927 districts in 81 provinces of Türkiye listed on the Address-based Population Recording System of Türkiye (*Adrese Dayalı Nüfus Kayıt Sistemi*, ADNKS) in 2010 were assumed as potential geographical markets.[12] Then, as detailed below, some market selection rules that eliminated 'unqualified' districts for the empirical analysis were applied to define local hospital care markets. Next, amongst the 'qualified' districts, the actual highway distance between the neighboring districts to check for market overlaps was examined, which led to further eliminations and adjustments.

Right at the beginning, certain prominent provinces were omitted from the study. First, the three largest metropolitan provinces - İstanbul, Ankara, and İzmir - are particularly outliers. İstanbul is not only the most densely populated metropolitan city in Türkiye but also historically

[10] See the seminal article on the geographic market delineation of Elzinga and Hogarty (1973). In the literature, there appear methods to arrive at a precise relevant geographic market size definition like the Shipment test (Elzinga-Hogarty test) and the Hypothetical Monopolist test (Small but Significant Non-transitory Increase in Prices SSNIP test). However, the former requires patient-level information and the latter relies on the price data, which are not available for research.

[11] Frankly speaking, one of the most valuable aspects of this research is the exhaustive works that was done by the researcher in the delineation of relevant markets despite the limitations imposed by data unavailability. In such analysis, local markets are assumed to be independent from one another in terms of competition and demand such that the equilibrium in one local market does not depend on the equilibrium in the others. Although it is impossible to guarantee completely isolated local geographic markets, tedious efforts have been made to ensure the minimal market overlap and leakage in this empirical work. Unfortunately, publications (like case studies and policy reports) were not helpful for the statistics on the average distance traveled by patients for hospital care. Also, due to the lack of data on the actual pattern of patient flows, we could not address the question of whether hospitals in different areas indeed constitute a real alternative source of supply for patients. To mitigate potential problems with overlapping markets, the actual highway distances between the neighboring districts in the sample were checked one by one. The exclusion of districts with denser populations and contiguous boundaries in metropolitan provinces from the sample also helped to isolate competition from hospitals located in neighboring districts. Furthermore, to capture potential patient flows from nearby districts, a variable representing the surrounding population of a local district was included in the estimations. The full description of these efforts is as given in Section 6.2.

[12] The geopolitical divisions are based on 2010 definitions, and held constant throughout the sample periods. See Appendix C for the description of Türkiye's administrative structure and further discussion on the definition of relevant geographic markets.

and economically at the central position. Ankara is the capital province of the country. İzmir, a commercial port city throughout history, is the third-most populous metropolitan city after İstanbul and Ankara. The districts of these three provinces are mostly contiguous to each other; they likely form integrated local markets. This renders the delineation of market boundaries in these provinces insurmountable. In addition, Antalya and Muğla, on the Mediterranean and Aegean coasts of Türkiye, are among the most popular international tourism destinations, so their economic activities and populations vary dramatically from season to season and year to year.

Firstly, the districts in Ankara, İstanbul, İzmir, Antalya, and Muğla were excluded from the empirical analysis for the reasons described above. Since similar difficulties are likely to arise, the districts with populations greater than 600,000 in 2010 were omitted.[13] These are markets, mostly, with a large number of hospitals that can typically be considered to be attracting patients from other markets. These eliminations help to ensure homogeneity across markets, so the focus can remain on the competitive interactions among hospitals in relatively isolated independent local markets.

An additional issue is that some districts have very low populations and have no general hospital. After several experimentations, it was decided to eliminate districts with a population of less than 50,000, which have no private hospitals, since this population size appeared to be insufficient to sustain a hospital.[14] Finally, in case a province has multiple central districts that are in close proximity to each other, or if a district has at some point in time been partitioned to separate close districts, the geographical union of such contiguous districts was taken as single markets.[15]All these eliminations and arrangements leave a sample of 205 of all 927 districts as local markets across 72 of the 81 provinces of Türkiye with 157 private general hospitals for the empirical analysis. [16] The market selection restrictions made the sample somewhat smaller, but they enabled the minimization of possible errors in the relevant market definition and interrelations across markets. Thus, the sample districts are geographically isolated enough as guaranteed by the market selection procedures. Also, there do not appear considerable variations among sample hospitals in terms of hospital size or being owned by a multi-market

[13] The districts, which have a population over 600,000 in 2010, are all Central districts of Adana (1,614,072 - 6), Antalya (983,827 - 10), Bursa (1,695,136 - 7), Diyarbakır (895,362 - 6), Eskişehir (643,640 - 5), Gaziantep (1,370,598 - 9), Kayseri (843,903 - 11), Konya (1,085,594 - 10), Mersin (891,495 - 5), Şanlıurfa (732,722 - 2). Their populations and the corresponding number of private hospitals are in parenthesis, respectively.

[14] There appear no universally applied criteria in the selection of minimum and maximum population limits, which has been followed in empirical applications of firm entry literature. They depend on the industry setting in the analysis. For example, a population upper bound in Bresnahan and Reiss (1991) and a population lower bound in Abraham, Gaynor, and Vogt (2007) are imposed. These are then supported and cross-checked with a mix of other criteria, which are based on distance to nearby markets, urban/rural distinction, and population density, as it is done in this paper as much as the dataset allowed. The population lower bound was selected to be 50,000 since historically there have been no private hospitals in such small districts (as additional information, 7 of 97 districts with a population between 50,000 and 100,000 have only one private hospital). The population upper bound was determined to be 600,000 in order not to jeopardize the homogeneity of the local market category with '4 or more hospitals' in the ordered probit estimations. In addition, as they are listed in Footnote 16, they are metropolitan regionally central districts that serve not only the provinces they belonged to but the provinces in their regions as well. Their inclusion would have compromised the prerequisite of minimizing interrelations between geographically isolated markets in such local market analyses.

[15] The provinces with more than one central district are Adana, Antalya, Bursa, Diyarbakır, Erzurum, Eskişehir, Gaziantep, Kayseri, Konya, Mersin, Sakarya, Samsun. Kocaeli has several newer districts that are too close to the districts they were part of. Çayırova, Darıca, Dilovası belonged to Gebze district; Başiskele, Kartepe belonged to Kocaeli Central district; likewise, Aksu district of Antalya belonged to Central district previously. Then, they have become separate districts.

[16] The provinces, which do not appear in the sample, are İstanbul, Ankara, İzmir, Muğla, Antalya, Ardahan, Artvin, Gümüşhane, Tunceli.

chain hospital group.[17] Thus, the sample hospitals are suitable to be treated as identical firms in the econometric model.

Table 1 presents the count of local markets for each number of hospitals in the market and population statistics. During the study period, there happened a noticeable rise in the number of private hospitals in local markets between 2002 and 2010. In both years, the case of districts with three or more private hospitals seems to be relatively rare. Also, there appear to be noticeable decreases between 2002 and 2010 in the population mean of sample districts for each category of *N*. The sample in 2010 have enough observation for each category of *N* and enough variation in market size to estimate the population required to support one, two, three, and four or more firms. However, the data for the year 2002 allows estimating entry thresholds only for one and two or more firms.

### 6.3. Market Size Variables

The population of districts, *DPOP*, is the primary indicator of the local market size, *S(.)*, in the model. Also, hospitals in neighboring districts may constitute an alternative healthcare supply source for patients, and hospitals in a district may compete for patients from nearby districts. In addition, since firm entry is a long-run decision, the anticipation of potential entrants about population growth in an area may affect new hospital entry. Therefore, besides *DPOP*, some other predictors of the market size in the estimations were included.

First, the surrounding population variable, *NEARPOP*, to measure the demand that may come from the residents of nearby districts was included. In deriving a measure of the nearby population surrounding a district, the Health Service Areas (HSAs) classification of the MoH is useful.[18] The MoH identifies relatively major districts in an area as *pivotal district areas* consisting of one or more adjacent and relatively integrated districts. Thus, the nearby population variable for each district was computed as the population of the *pivotal district* where each particular district is located minus the district's population. Also, the neighborhood effect on competition among districts may be positive or negative depending on a district's regional centrality. Therefore, to capture this, an interaction variable for *NEARPOP* with the dummy variable for being a pivotal district, *PDISTRICT*, or not was added.

Besides, the ten-year change of district population variable between 2000 and 2010 was included in the analysis, which indicates the expectations about future market growth, *GRW00*. In the estimations, its decompositions as negative and positive population growth variables, *NGRW* and *PGRW*, were used to be able to capture potential asymmetry in expectations about market growth.

Hence, the market size equation was modeled in the following linear form:[19]

$$\hat{S}(\vec{Y}, \lambda) = DPOP + \lambda_1 NEARPOP + \lambda_2 NEARPOPxPDIST + \lambda_3 NGRW + \lambda_4 PGRW$$

[17] Despite the presence of multi-market chain hospitals operating nationwide or in several markets, there appear to be no clear asymmetric patterns in terms of bed numbers between multi-market chain hospitals and single-market hospitals (see Appendix D), and most of the multi-market chain hospitals are located at the larger metropolitan provinces that are not included in the sample of local districts.

[18] See Appendix A for the description of HSA classification of the Ministry of Health of Türkiye.

[19] Following the literature, the coefficient of district population is set to one, $\lambda_0 = 1$; therefore, S(Y) is scaled to the number of people living in the district. This normalization translates unit of market demand into the unit of district population.

### 6.4. Demand and Cost Shifters

The model includes a set of variables, $Z$ and $W$, for cross-section variations in local market demand and cost conditions of the districts, so in variable profits $V(,)$. These are the fractions of the elderly and children, the urbanization rate, a socio-economic development index, and the number of public MoH hospitals. Table 2 summarizes the definition of the variables used in the estimations and their data sources (see Appendix F for the sample descriptive statistics).

As an overall indicator of the wealth level of the districts, a Socio-Economic Development Index ranking at the district level (*Sosyo-Ekonomik Gelişmişlik Sıralaması Araştırması*, SEGE) was used. The index ranks the districts, provinces, and regions based on a wide range of economic, social, and cultural variables. It was published by the Ministry of Development (formerly State Planning Organization) at the province level in 1996, 2003, and 2011, but only in 2004 at the district level. Hence, the SEGE-2004 variable at the district level in the estimations was used.[20]

Public and private providers cannot be considered to belong exactly in the same relevant product market. But still, the presence of public hospitals generates somewhat competitive constraints in the private hospitals market. Thus, the number of public hospitals, MOHHOSP, was included as another demand shifter.[21]

Fixed costs incurred by a hospital include medical labors, equipments, buildings, and some overhead expenses. To proxy such cost differences in local markets, data on the cost index of the Turkish Medical Association, TBBCOST, was gathered, which is officially a measure of the difference in factor prices, i.e. labor and rent, among provinces of Türkiye. Hence, the TTBCOST variable was used as a fixed cost shifter.

## 7. Results

Table 3 shows the cross-section ordered profit estimations for the years 2002 and 2010. These estimation results primarily explain the number of private hospitals that operate in the local districts of Türkiye. Then, the coefficients from these estimations are used to calculate entry thresholds, per firm entry thresholds, and their ratios. These threshold calculations in Table 4 give market sizes required to support a given number of firms and they provide insights into how additional market concentration affects the extent of hospital competition in local markets.

The estimation results in Table 3 indicate that the nearby population variable NEARPOP has a statistically significant positive coefficient if the market is a pivotal district; and a negative

[20] See Appendix E for more description of the SEGE-index.

[21] It is also conceivable that the Family Medicine Centers (FMC) may have an impact on demand for hospital services in 2010 compared to 2002, especially in more local non-pivotal districts. However, even if there are, their effect is limited to only 'primary level of healthcare' services provided at general hospitals, and despite the lack of data on this issue, it can arguably be stated that a large portion of general private hospital services are at the 'secondary care' level. Beyond the difference of the FMCs from general hospitals in terms of their 'level of care' and unavailiblity of data on FMCs for the research, it is also impractical to include the number of FMCs in a local district as a control variable since they have to be located at the neighborhood (*mahalle*) level and citizens can register with only one primary care physician in one family medicine center, so they are not serving to every citizen in the boundary of a local district. For these reasons, the number of public hospital variable, MOHHOSP, does not include the number of FMCs in local districts.

coefficient otherwise.[22] Thus, it suggests that residents of smaller districts travel to more central *pivotal districts* to receive healthcare. It can also be interpreted that those hospitals in more central districts compete for patients from surrounding smaller districts. Population growth variable PGRW on the long-run market size equation has a positive coefficient and the NGRW variable on decreases in population over the years has a statistically significant positive effect on the predicted market size. Based on these results, which are robust to alternative specifications and sample years, the market size of a given district can be predicted, for example, using the following equation whose coefficients are obtained from specification (2) of Table 3:

$$\hat{S}(\vec{Y}, \lambda) = 1DPOP - 0.10NEARPOP + 0.58NEARPOPxPDIST + 2.78NGRW + 1.43PGRW$$

This predicted market size equation suggests that about two people from neighboring districts of a pivotal district correspond to one resident of the pivotal district itself. For example, according to specification (2) for the year 2010, the central district of Çanakkale province with a population of 136,484, which represents the sample average in terms of residential population, has a predicted market size of 273,575:

$$\hat{S}_{Çanakkale} = 1 * 136{,}484 - 0.1 * 186{,}466 + 0.58 * 186{,}466x1 + 2.78 * 0 + 1.43 * 33{,}278$$

As for market characteristics other than population variables in the estimation results, the socio-economic development index, urbanization rate, and elderly and child population in local districts have positive coefficients, while the presence of public hospitals has a negative coefficient. These results suggest that the residents of more urbanized and developed districts and those with higher proportions of elderly and children populations are more likely to visit private hospitals. The estimation results contain insignificant variable coefficients. As pointed out in Bresnahan and Reiss (1991), the statistical insignificance of some coefficients can be interpreted as evidence of a homogeneous sample that resulted from the market selection procedures applied at the outset.

In the estimations for the sample year 2002, the coefficients of WAGE and FCHILD variables are contrary to expectations; they turn out to be negative. The sign change in the coefficient of WAGE may be a consequence of the reforms on the working conditions of physicians and payment methods to them. Because, in 2010, the dual practice of physicians in both public and private hospitals was not allowed anymore and the performance-based payment method for physician salaries in public hospitals was in practice. The inclusion of private hospitals into the public insurance system, together with the improvement in universal health coverage from 2002 to 2010, may be the reason that the coefficient of FCHILD has a positive sign in estimations for 2010 but not for 2002.[23]

Table 4 reports calculations for the entry thresholds $S_N$, entry thresholds per firm $s_N$, and successive entry threshold ratios $s_{N+1,N}$, which are predicted using these three formulas:

[22] Remember that, in the estimations, the coefficient of the district population, $\lambda_0$, is set equal to one so that the unit of market size is normalized to the unit of the district population, so the coefficient of DPOP was not interpreted.

[23] Also, in such structural econometric models of firm entry literature, the estimates of some coefficients may appear with unexpected signs (for example, see Vogt, 2007).

$S_N = \frac{\hat{F}}{\hat{V}} = \frac{\hat{\gamma}_1 + \hat{\gamma}_L \bar{\vec{W}} + \sum_{n=2}^{N} \hat{\gamma}_n}{\hat{\alpha}_1 + \bar{\vec{Z}}\hat{\beta} + \sum_{n=2}^{N} \hat{\alpha}_n}$, $s_N = \frac{S_N}{N}$ , $s_{N+1,N} = \frac{s_{N+1}}{s_N}$ ; where $\vec{Z}$ and $\overrightarrow{W}$ are evaluated at their sample means, and the estimated parameters are from Table 3.[24]

The estimates in the first horizontal panel of Table 4 show the breakeven market size in terms of population. They refer to the population of potential patients including the district population, the residents of nearby districts and market growth expectations.[25]

In the middle panel of Table 4, the per firm entry threshold for the first hospital in 2010 appears to be higher than the thresholds for later entrants. Similarly, the entry threshold estimates for the year 2002 do not suggest that per firm entry thresholds for the later entrants are higher than the first entrant. The year 2002 consists only of three categories for $N$, so one should be particularly careful when comparing the threshold estimates for 2002 with the estimates from 2010. In the estimations for the year 2002, $S_2$ represents the category of two or more hospitals in the market. Therefore, the per firm entry threshold for only two firms would likely be even less than the reported one.

The third panel of Table 4 presents the predicted ratios of successive per firm entry thresholds. The ratios do not follow a monotonic pattern and this does not differ across model specifications. Thus, the threshold ratios for two or more hospitals do not indicate evidence for lower profit margins with an additional private hospital. That is, the competitive conduct remains almost unchanged as the number of hospitals rises except for the first hospital entry. Thus, based on these estimates, it is difficult to argue that the hospital competition intensifies with the entry of second and later hospitals.[26]

Furthermore, Table 4 demonstrates that the market size required to support the first hospital in 2010 shrunk compared with the year 2002. Therefore, it can be argued that the hospital profitability has increased, the fixed costs have decreased, or both have occurred between these two sample years. The changes in the industry environment as a result of the health reforms might explain the noticeable decrease between 2002 and 2010 in the predicted market sizes required for the presence of private hospitals. An interpretation may be through the achievement of universal insurance coverage with the completion of health reforms under the HTP. During the pre-reform period, in 2002, the public insurance system was fragmented and very far from providing universal health coverage, and citizens could not receive healthcare from private hospitals through their public insurance. With the improvement towards universal health insurance coverage during the HTP, all citizens have begun to have access to private healthcare services through their public insurance at relatively low costs. Therefore, the resident

[24]Since the main focus of the analysis is on the entry threshold market size estimates, as in the BR and similar studies with structural models, there was no need to calculate the marginal effects.

[25] For example, according to the specification (2) for the year 2010, the central district of Sivas province with a population of 354,913 has a predicted market size of 469,701:
$S_{sivas}(Y)$ =1*DPOP-0.10*NEARPOP+0.58*NEARPOP*PDISTRICT+2.78*NGRW00+1.43*PGRW00
=1*354,913 - 0.10*74,145 + 0.58*75,145*1 + 2.78*0 + 1.43*54,978 = 469,701.
Based on this calculation, the model predicts that the entry of almost three hospitals is economically sustainable in the Central district of Sivas. In Sivas Merkez, there was only one private hospital in 2010. However, in line with the prediction of the model, the number of private hospitals has risen from one in 2010 to three in 2018 while the population has slightly increased from 354,913 in 2010 to 377,561 in 2018.

[26] Remember that the economic model suggests that the threshold ratio starts from somewhere close to two and eventually converges to one. Departures of successive entry threshold ratios from the value of one measure whether competitive conduct changes as the number of firms increases. When the ratio of successive per firm entry thresholds converges to one, it is inferred that the market becomes competitive. See Appendix G for further discussion of the threshold estimates in comparison with the similar studies in the literature.

population of a district in 2002 can be translated into market demand for a private hospital at a rate lower than the one in 2010.

### 7.1. Further Counterfactual Analysis for Policy Implications

In this section, using the estimated parameters, some prediction exercises to explore further the consequences of restrictive regulations were conducted. Table 5 contains the predicted market sizes for the year 2014 of all central districts in the sample provinces. It presents the predicted carrying capacities (that is, the predicted number of private hospitals that a local market environment can economically sustain) of the sixty-six central districts of the provinces in the sample.

According to Table 5, some districts have a higher number of private hospitals than the number of hospitals predicted by the estimated entry threshold levels, while others have fewer. Table 6 compares the actual observed number of private hospitals in 2014 with the model's predictions based on the estimates for 2010 in the central districts of the sample. The table cells show the number of districts for each possible actual versus predicted pair of the private hospital counts. The deviations of the predicted number of hospitals from the actually observed ones may indicate the level of distortions due to the restrictive government regulations.

From this aspect, this prediction exercise serves as a counterfactual policy analysis that reveals the difference between the market structures observed in 2014 and what might be expected to be seen if there were less restrictive entry regulations. Even though it is not definitive, this analysis provides some policy guidance to address whether reduction or increase, as a result of acquisition and mergers of existing hospitals or new hospital entry, in the number of private hospitals to a particular level reduces or enhances competition at a local hospital care market.

## 8. Discussion

As policy implications, the paper proposes a way of answering the question of how many hospitals a local district of Türkiye can carry. It reveals the discrepancy if there is one, between the actual number of hospitals in a local market and the predicted carrying capacity of this market estimated by the model. Thus, as the policy exercise shows in the previous section, the paper enables us to ascertain local districts in such a ‘disequilibrium’ status in hospital care provision.

Concerning the availability of hospital services for the achievement of universal access to healthcare and other similar health-for-all goals, the government may see it necessary to raise the number of public hospitals in certain districts. However, there may be districts in which the private sector already has sufficient economic motives to enter and compete in the market if private healthcare continues to be financed by public insurance. Therefore, in a situation where a local hospital market already has competitive conduct, government interventions by establishing public hospitals may not be needed. On the other hand, in districts where no private hospital entry seems economically feasible, such a government intervention may be needed to ensure healthcare delivery for all citizens of the country.

Hence, from the welfare aspect, the analyses in the paper appear to be instrumental in identifying markets in which the private sector has necessary profit motives to serve the public purpose and the markets in which more public resources need to be devoted to delivering healthcare on an equal basis across the nation. However, the analyses account for the nature of competition in the local districts, but not for the denser contiguous markets in metropolitan provinces of Türkiye. The type and nature of competition among hospitals in ‘bigger’ provinces

that have continuous boundaries across their districts (such as Ankara, Gaziantep, İstanbul, İzmir, Kayseri, and Konya) may be different from that in 'smaller' less dense provinces.

## 9. Conclusion

In explaining hospital entry in the local districts of Türkiye over the sample period, 2001-2014, the empirical analysis focuses on threshold market sizes estimated by population and other market characteristics. In a multi-period static framework, the overall role of the health reforms and regulations under the HTP in shaping the hospital market structure was explored with the help of a comparison of the estimation results for two different sample years, 2002 and 2010, as the pre- and post-reforms periods.

The estimates robustly reveal that per-hospital demand thresholds to achieve long-run profitability do not display an increasing path. Thus, there appears to be no evidence that more private hospitals after the first entry lead to a rise in competitive conduct. The nonmonotonic nature of the estimated entry thresholds is particularly striking. From this aspect, the paper provides an example of a mixed public-private industry setting in which 'one is enough' to ensure competitive conduct.

The comparison of the two-period entry threshold estimates demonstrates that local market sizes required to support hospital entry remarkably lessened in 2010. The divergence between the estimated market size thresholds in 2002 and 2010 for the pre-reforms and post-reforms periods suggests that the predicted firm-carrying capacities of the local hospital care markets have increased during the HTP. This provides an indicator of the overall effects of the healthcare reforms under the HTP, which encourage the private provision of healthcare along with an improved public health insurance coverage climate.

**Acknowledgements**

I am deeply grateful to Bekir Burçay Erus (Boğaziçi U.), Ayşe Mumcu (Boğaziçi U.), and Esra Durceylan Kaygusuz (Sabancı U.) for their valuable guidance, critical revisions and encouragements throughout the research. I would like to thank the Editorial team for their efforts and the anonymous referees for their helpful comments. I would like to acknowledge Boğaziçi University, İstanbul Ticaret University, and the Yale University MacMillan Center's Fox Fellowship Program.

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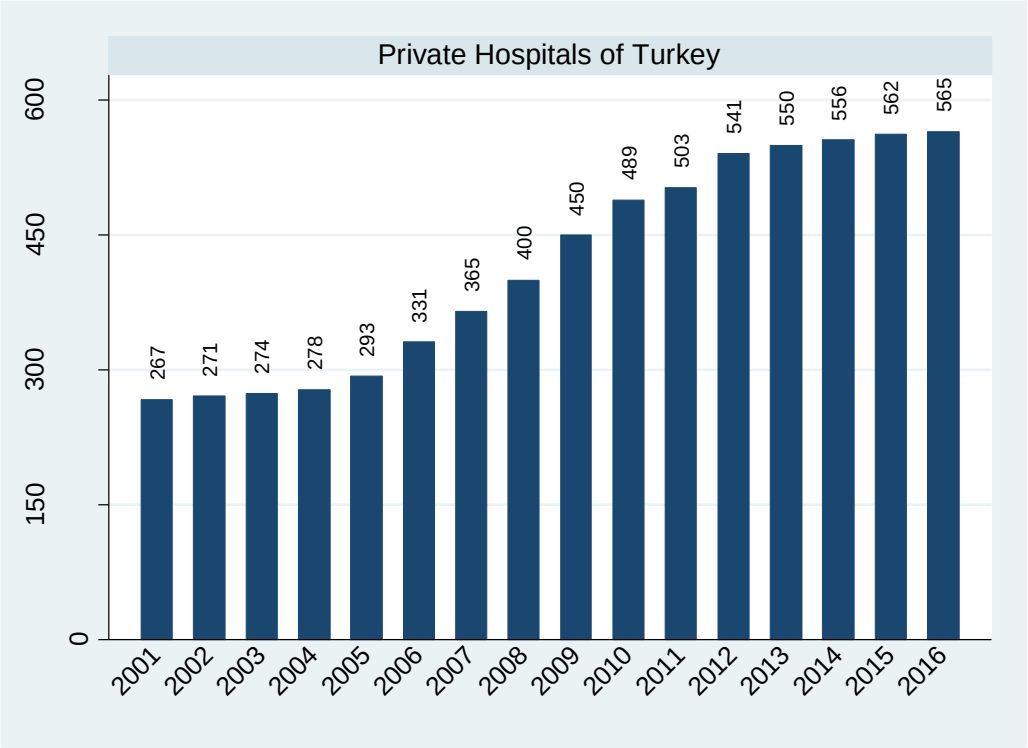
**Figure 1** Number of total private hospitals in Türkiye from 2001 to 2016




Source: Authors' collection from the MoH's Health Statistics Yearbooks.

**Table 1** Sample market counts for each category of N and their populations in 2002 and 2010

| Number of Hospitals in a Local Market, N | Number of Districts with N | Population Mean | Std Dev | Min | Max |
|---|---|---|---|---|---|
| Year: 2010 | | | | | |
| N=0 | 128 | 87,488 | 43,145 | 50,041 | 331,113 |
| 1 | 35 | 146,319 | 64,797 | 61,173 | 354,913 |
| 2 | 24 | 203,557 | 76,776 | 103,922 | 364,547 |
| 3 | 9 | 262,524 | 145,860 | 117,890 | 477,580 |
| 4 or more | 9 | 459,693 | 108,866 | 229,744 | 585,934 |
| Year: 2002 | | | | | |
| N=0 | 164 | 100,250 | 50,052 | 28,087 | 356,494 |
| 1 | 30 | 187,592 | 87,637 | 65,765 | 389,619 |
| 2 | 7 | 354,754 | 133,915 | 149,151 | 465,370 |
| 3 | 2 | 373,020 | 39,173 | 345,320 | 400,719 |
| 4 or more | 1 | 340,825 | - | 340,825 | 340,825 |
| Total sample markets | 205 | | | | |

**Table 2** Summary of the definitions of variables in the model and data sources

| Variable Name | | Definition and source |
|---|---|---|
| Dependent Variable | | |
| PHOSP | N | Number of private general hospitals in local districts - Ministry of Health (MoH) |
| Market size | S | |
| DPOP | Y1 | Population of districts, Address-based Population Recording System (ADNKS hereafter) - Turkish Statistical Institute (TUIK hereafter) |
| NEARPOP | Y2 | Total population of nearby districts in the same pivotal district, ADNKS |
| NGRW00 | Y3 | Negative change in district population between 2000 and 2010; zero otherwise |
| PGRW00 | Y4 | Positive change in district population between 2000 and 2010; zero otherwise |
| PDISTRICT | D1 | Dummy for whether a district is a pivotal district or not based on the MoH`s Health Service Area identification |
| Demand shifters | Z | |
| SEGE04 | Z1 | Socio-Economic Development Ranking Survey of Districts, SEGE-2004 index - Ministry of Development |
| FURBAN | Z2 | Rate of district urban population - TUIK |
| FCHILD | Z3 | Fraction of district children, the population aged 0-14 years - TUIK |
| FELDER | Z4 | Fraction of district population over 65 years - TUIK |
| MOHHOSP | Z5 | Number of public general hospitals in a district - Ministry of Health |
| NBMOHHOSP | Z6 | Number of public general hospitals in nearby districts |
| Fixed cost shifters | W | |
| WAGE index (TTBCOST) | W1 | Hospital cost index regarding factor prices, including labor and rent, which is used to guide minimum price levels in each province - Turkish Medical Association |

**Table 3** Ordered probit estimations of the number of private hospitals in local districts of Türkiye for the years 2010 and 2002

| | | (1) | | (2) | | (3) | |
|---|---|---|---|---|---|---|---|
| Variable Names and Coefficients | | 2010 | 2002 | 2010 | 2002 | 2010 | 2002 |
| Market size | S | | | | | | |
| DPOP | $\lambda_0$ | 1 (offset) | 1 (offset) | 1 (offset) | 1 (offset) | 1 (offset) | 1 (offset) |
| NEARPOP | $\lambda_1$ | -0.11* | -0.08* | -0.10 | -0.04 | -0.10 | -0.06 |
| | | (0.06) | (0.17) | (0.06) | (0.13) | (0.06) | (0.15) |
| NEARPOP | $\lambda_2$ | 0.44** | 0.23 | 0.58*** | 0.53* | 0.57*** | 0.37 |
| x[PDISTRICT=1] | | (0.21) | (0.31) | (0.22) | (0.28) | (0.22) | (0.28) |
| NGRW00 | $\lambda_3$ | 2.72** | 1.28** | 2.78** | 1.34 | 2.86** | 0.92 |
| | | (1.16) | (2.27) | (1.18) | (1.58) | (1.20) | (1.77) |
| PGRW00 | $\lambda_4$ | 1.29 | 0.96 | 1.43 | 1.67* | 1.34 | 1.32 |
| | | (0.99) | (0.96) | (1.04) | (0.92) | (1.04) | (0.90) |
| Demand shifters | Z | | | | | | |
| SEGE04 | $\beta_1$ | 0.07 | 0.34** | | | 0.03 | 0.23 |
| (Development index) | | (0.05) | (0.15) | | | (0.07) | (0.19) |
| FURBAN | $\beta_2$ | | | 1.20*** | 0.01 | 1.13*** | -0.35 |
| | | | | (0.38) | (0.33) | (0.40) | (0.50) |
| FCHILD | $\beta_3$ | | | 1.26 | -2.88** | 1.61** | -0.19 |
| | | | | (1.21) | (1.44) | (0.69) | (2.45) |
| FELDER | $\beta_4$ | | | 4.33 | 3.53 | 4.57* | 9.80 |
| | | | | (4.23) | (5.60) | (2.54) | (7.80) |
| MOHHOSP | $\beta_5$ | -0.23** | -0.21 | -0.37*** | -0.08 | -0.38*** | 0.02 |
| | | (0.12) | (0.51) | (0.13) | (0.36) | (0.13) | (0.41) |
| NBMOHHOSP | $\beta_6$ | 0.004 | 0.03 | -0.01 | -0.05 | -0.01 | -0.02 |
| | | (0.27) | (0.06) | (0.03) | (0.04) | (0.03) | (0.06) |
| Fixed cost shifters | W | | | | | | |
| WAGE | $\gamma_L$ | -0.74 | 1.14 | -1.01* | 0.79 | -1.01* | 0.93 |
| | | (0.52) | (1.45) | (0.56) | (1.55) | (0.56) | (1.58) |
| $V_1$ | $\alpha_1$ | 1.30*** | 0.09 | 0.08 | 1.81** | (omitted) | 0.47 |
| | | (0.29) | (0.64) | (0.61) | (0.87) | | (1.34) |
| $V_1$ - $V_2$ | $\alpha_2$ | 0.09 | 0.11 | (omitted) | 0.05 | (omitted) | 0.16 |
| | | (0.19) | (0.29) | | (0.23) | | (0.27) |
| $V_2$ - $V_3$ | $\alpha_3$ | 0.29 | 0.43 | 0.19 | 1.79 | 0.22 | 1.36 |
| | | (0.19) | (2.07) | (0.17) | (2.24) | (0.18) | (2.28) |
| $V_3$ - $V_4$ | $\alpha_4$ | 0.01 | 1.81** | 0.01 | 1.92** | 0.02 | 1.74* |
| | | (0.15) | (0.88) | (0.17) | (0.89) | (0.18) | (0.90) |
| $F_1$ | $\gamma_1$ | 4.07*** | | 5.02*** | | 5.00*** | |
| | | (1.66) | | (1.79) | | (1.78) | |
| $F_2$ - $F_1$ | $\gamma_2$ | 0.97*** | | 1.16*** | | 1.16*** | |
| | | (0.36) | | (0.17) | | (0.17) | |
| $F_3$ - $F_2$ | $\gamma_3$ | 0.42 | | 0.70 | | 0.64 | |
| | | (0.49) | | (0.53) | | (0.53) | |
| $F_4$ - $F_3$ | $\gamma_4$ | 0.89 | | 1.12 | | 1.08 | |
| | | (0.67) | | (0.84) | | (0.84) | |
| Log Likelihood: | | -139.77 | -61.34 | -132.97 | -58.39 | -132.84 | -57.10 |
| Sample Size: 205 | | | | | | | |

Notes: Standard errors are in parentheses. ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

**Table 4** Hospital entry threshold estimates in local districts of Türkiye for 2010 and 2002

| | | (1) | | (2) | | (3) | |
|---|---|---|---|---|---|---|---|
| Years | | 2010 | 2002 | 2010 | 2002 | 2010 | 2002 |
| Entry Thresholds (market size in terms of district population, including nearby population and market growth variables) | S1 | 163,567 | 407,878 | 180,892 | 308,215 | 178,738 | 304,626 |
| | S2 | 274,599 | 980,339 | 290,287 | 539,310 | 288,497 | 613,593 |
| | S3 | 443,867 | | 435,680 | | 438,944 | |
| | S4 | 573,370 | | 569,746 | | 578,757 | |
| Per Firm Entry Thresholds $S_N/N$ | S1/1 | 163,567 | 407,878 | 180,892 | 308,215 | 178,738 | 304,626 |
| | S2/2 | 137,299 | 490,169 | 145,144 | 269,955 | 144,248 | 306,797 |
| | S3/3 | 147,956 | | 145,227 | | 146,315 | |
| | S4/4 | 143,342 | | 142,437 | | 144,689 | |
| Per Firm Entry Threshold Ratios $s_{N+1}/s_N$ | $s_2/s_1$ | 0.83 | 1.20 | 0.80 | 0.88 | 0.81 | 1.00 |
| | $s_3/s_2$ | 1.08 | | 1.00 | | 1.01 | |
| | $s_4/s_3$ | 0.97 | | 0.98 | | 0.99 | |

Notes: Estimates are based on the coefficient estimates in Table 3.

**Table 5** Predicted carrying capacities of the central districts in 2014

| Districts | | | | | Estimated cutoffs | | | | | Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| District Name | District Population in 2014 | Actual # of private hospitals in 2010 | Actual # of private hospitals in 2014 | Prediction of market sizes in 2014 using the estimated coefficient of 2010 | No potential entrant S < 1 80,892 | One potential entrant 180,892 < S < 290,287 | Two potential entrants 290,287 < S < 435,680 | Three potential entrants 435,680 < S < 569,746 | Four or more entrants S > 569,746 | Entry / Exit / Stable between 2010 and 2014 |
| Adıyaman M. | 283,556 | 0 | 2 | 318,369 | | | x | | | entry |
| Afyonkarahisar M. | 274,639 | 2 | 2 | 415,866 | | | x | | | - |
| Ağrı M. | 146,007 | 1 | 1 | 247,259 | | x | | | | - |
| Aksaray M. | 278,171 | 2 | 1 | 343,188 | | | x | | | exit |
| Amasya M. | 135,950 | 0 | 0 | 193,446 | | x | | | | - |
| Ardahan M. | 40,960 | 0 | 0 | 55,459 | x | | | | | - |
| Artvin M. | 34,050 | 0 | 0 | 53,497 | x | | | | | - |
| Aydın M. | 270,835 | 1 | 1 | 431,711 | | | x | | | - |
| Balıkesir M. | 342,799 | 2 | 2 | 576,244 | | | | | x | - |
| Bartın M. | 145,230 | 0 | 0 | 183,165 | | x | | | | - |
| Batman M. | 408,248 | 6 | 5 | 568,434 | | | | x | | exit |
| Bayburt M. | 63,848 | 0 | 0 | 37,796 | x | | | | | - |
| Bilecik M. | 72,611 | 0 | 0 | 135,928 | x | | | | | - |
| Bingöl M. | 147,087 | 1 | 1 | 212,683 | | x | | | | - |
| Bitlis M. | 66,732 | 0 | 0 | 115,598 | x | | | | | - |
| Bolu M. | 177,855 | 2 | 2 | 237,226 | | x | | | | - |
| Burdur M. | 99,333 | 0 | 0 | 143,297 | x | | | | | - |
| Çanakkale M. | 155,657 | 1 | 1 | 292,719 | | | x | | | - |
| Çankırı M. | 86,381 | 1 | 1 | 113,321 | x | | | | | - |
| Çorum M. | 275,610 | 2 | 2 | 360,920 | | | x | | | - |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Denizli M. | 592,084 | 5 | 5 | 851,190 | | | | | x | - |
| Düzce M. | 214,991 | 1 | 1 | 336,829 | | | x | | | - |
| Edirne M. | 165,979 | 2 | 2 | 200,113 | | x | | | | - |
| Elazığ M. | 412,220 | 3 | 3 | 504,800 | | | | x | | - |
| Erzincan M. | 149,879 | 1 | 1 | 111,287 | x | | | | | - |
| Erzurum M. | 348,078 | 0 | 1 | 243,051 | | x | | | | entry |
| Giresun M. | 126,172 | 2 | 2 | 201,433 | | x | | | | - |
| Gümüşhane M. | 52,628 | 0 | 0 | 46,390 | x | | | | | - |
| Hakkari M. | 79,335 | 0 | 0 | 90,058 | x | | | | | - |
| Iğdır M. | 132,110 | 0 | 1 | 190,803 | | x | | | | entry |
| Isparta M. | 228,730 | 3 | 3 | 356,312 | | | x | | | - |
| Kahramanmaraş M. | 589,413 | 4 | 5 | 779,850 | | | | | x | entry |
| Karabük M. | 127,658 | 1 | 1 | 180,996 | | x | | | | - |
| Karaman M. | 181,383 | 2 | 2 | 213,070 | | x | | | | - |
| Kars M. | 111,278 | 0 | 0 | 183,469 | | x | | | | - |
| Kastamonu M. | 137,391 | 3 | 2 | 216,134 | | x | | | | exit |
| Kilis M. | 103,531 | 0 | 0 | 128,502 | x | | | | | - |
| Kırıkkale M. | 197,037 | 0 | 1 | 167,287 | x | | | | | entry |
| Kırklareli M. | 92,514 | 0 | 0 | 125,097 | x | | | | | - |
| Kırşehir M. | 134,367 | 1 | 1 | 171,632 | x | | | | | - |
| Kocaeli M. | 523,217 | 3 | 4 | 919,274 | | | | | x | entry |
| Kütahya M. | 253,175 | 2 | 2 | 344,801 | | | x | | | - |
| Malatya M. | 299,863 | 9 | 9 | 596,743 | | | | | x | - |
| Manisa M. | 370,879 | 2 | 2 | 617,745 | | | | | x | - |
| Muş M. | 186,097 | 1 | 1 | 231,330 | | x | | | | - |
| Nevşehir M. | 127,891 | 3 | 2 | 222,224 | | x | | | | exit |
| Niğde M. | 205,753 | 1 | 1 | 298,791 | | | x | | | - |
| Ordu M. | 195,817 | 2 | 3 | 274,117 | | x | | | | entry |
| Osmaniye M. | 249,136 | 4 | 4 | 339,843 | | | x | | | - |
| Rize M. | 141,250 | 1 | 1 | 199,708 | | x | | | | - |
| Sakarya M. | 494,977 | 5 | 5 | 890,834 | | | | | x | - |
| Samsun M. | 570,676 | 5 | 7 | 983,421 | | | | | x | entry |
| Şanlıurfa M. | 837,180 | 2 | 4 | 1,528,471 | | | | | x | entry |
| Siirt M. | 152,539 | 3 | 3 | 274,769 | | x | | | | - |
| Sinop M. | 59,571 | 0 | 0 | 104,636 | x | | | | | - |
| Şırnak M. | 91,573 | 0 | 0 | 130,897 | x | | | | | - |
| Sivas M. | 351,431 | 1 | 1 | 464,891 | | | | x | | - |
| Tekirdağ M. | 182,522 | 2 | 2 | 213,098 | | x | | | | - |
| Tokat M. | 185,626 | 1 | 1 | 237,503 | | x | | | | - |
| Trabzon M. | 314,246 | 2 | 2 | 476,366 | | | | x | | - |
| Tunceli M. | 38,015 | 0 | 0 | 61,843 | x | | | | | - |
| Uşak M. | 231,563 | 2 | 2 | 340,654 | | | x | | | - |
| Van M. | 424,802 | 5 | 4 | 722,118 | | | | | x | exit |
| Yalova M. | 127,670 | 2 | 2 | 218,559 | | x | | | | - |
| Yozgat M. | 96,831 | 1 | 0 | 72,490 | x | | | | | exit |
| Zonguldak M. | 210,103 | 0 | 1 | 323,750 | | | x | | | entry |

Notes: Includes only the Central (*Merkez* abbreviated by M.) districts of the sample provinces. Predictions are based on the coefficients and threshold estimates for the year 2010 at the specification (2) of Table 3.

**Table 6** Actual and predicted market configurations in 2014

| Actual \ Predicted | N = 0 | N = 1 | N = 2 | N = 3 | N ≥ 4 | Total |
|---|---|---|---|---|---|---|
| N = 0 | 14 | 3 | 0 | 0 | 0 | 17 |
| N = 1 | 4 | 8 | 6 | 1 | 0 | 19 |
| N = 2 | 0 | 8 | 5 | 2 | 1 | 16 |
| N = 3 | 0 | 2 | 1 | 1 | 0 | 4 |
| N ≥ 4 | 0 | 0 | 1 | 1 | 8 | 10 |
| Total (number of districts) | 18 | 21 | 13 | 5 | 9 | 66 |

**Supplementary Materials**

(Available online.)

## Appendix A: Region-based Healthcare Planning – Health Service Areas

In 2011, the Ministry of Health (MoH) published the Inpatient Health Facilities Planning Guidebook (*Yataklı Sağlık Tesisleri Planlama Rehberi,* see Akdağ 2011). The guidebook identifies the districts that have more pivotal roles in their region. It presents long-term foresight of the allocation of health facilities in the country and their bed capacities.

According to the projections in the guidebook, considering the healthcare needs of the local areas, a range of services for every catchment population is provided in each region so that citizens can timely navigate to receive healthcare. The criteria considered during this district-based partition of the country land are stated in the guidebook as population, geographic features, transportation, and habits of residents in receiving healthcare. With this region-based planning practice, the MoH aims' are that patients can receive the public healthcare services they need in the most appropriate setting within the geographic boundaries of the health service area they live in.

According to the guidebook, the Health Services Planning Department of the MoH identifies 30 Health Service Areas (HSAs) countrywide. Each healthcare service area covers one or more provinces that are together relatively self-contained in terms of hospital care. Each area hierarchically comprises central provinces *(bölge merkezi konumundaki iller)*, subcentral provinces, pivotal districts *(güçlendirilmiş ilçeler)* of provinces, and other districts that are associated with these more central pivotal districts. Thus, the MoH located a total of 243 pivotal districts in these 30 HSAs. They consist of one or more adjacent districts to the core district with a higher degree of geographic, social, and economic integration. Such a classification of all the districts has been helpful for the empirical analysis in defining the geographic boundaries of the neighboring population of each local market.

## Appendix B: Derivation of the Likelihood Function of Observed Market Structure

The total profit function in a market with $N$ firms is decomposed as $\Pi_N = \overline{\Pi}_N + \varepsilon$,

where $\overline{\Pi}_N$ is the latent variable; $\varepsilon$ is the unobserved error term, $\varepsilon \sim i.i.d\ N(0, \sigma)$. The model assumes that the successive entrants' profits differ only through the deterministic component. This setup makes it possible to derive a likelihood function for the number of firms a market can sustain and allows for a probit estimation of the discrete ordered dependent variable, $N$, as follows.

The equilibrium inequality conditions are: a market has $N$ entrants if $\Pi_N \geq 0$ and $\Pi_{N+1} < 0$; that is, if one more firm enters, it will make negative profits. Then, the probabilities of each state of the market structure are calculated as:

$$Pr(N = 0) = \Pr(\Pi_1 < 0) = \Pr(\overline{\Pi}_1 + \varepsilon < 0) = 1 - \Pr(\varepsilon \leq \overline{\Pi}_1) = 1 - \Phi(\overline{\Pi}_1)$$

$$Pr(N = 1) = \Pr(\Pi_1 \geq 0\ and\ \Pi_2 < 0) = \Pr(\overline{\Pi}_1 + \varepsilon \geq 0\ and\ \overline{\Pi}_2 + \varepsilon < 0)$$
$$= \Pr(\varepsilon \leq \overline{\Pi}_1\ and\ \varepsilon \geq \overline{\Pi}_2\ ) = \Phi(\overline{\Pi}_1) - \Phi(\overline{\Pi}_2)$$

Similarly, $Pr(N = 2) = \Phi(\overline{\Pi}_2) - \Phi(\overline{\Pi}_3)$ and $Pr(N = 3) = \Phi(\overline{\Pi}_3) - \Phi(\overline{\Pi}_4)$, and the remaining probability of observing four or more firms is $Pr(N \geq 4) = \Phi(\overline{\Pi}_4)$. Finally, the product of probabilities for each observed state of the market in the sample gives the likelihood

function of the observed market configuration, which is maximized to obtain the estimates of parameters.[27]

### Appendix C: Administration Structure of Türkiye

Türkiye has a unitary administration structure. The country is subdivided into 81 provinces (*il*) as the first-level administrative units; each province is divided into districts (*ilçe*) at the secondary level. The districts are further subdivided into urban neighborhoods (*mahalle*), semi-urban towns (*belde-kasaba*), or rural villages (*köy*). Highly-populated provinces with more than 750,000 population have metropolitan municipalities, and their districts are in the metropolitan district status.[28]

The country is not very densely populated compared to, for example, England or Germany. In 2014, the population density was 101 people per km2 on average; however, it ranges from 45 to 270 among provinces. Some provinces have exceptionally high population densities, namely İstanbul (2,767), Kocaeli (477), İzmir (342), Gaziantep (277), Bursa (267), Yalova (267), Hatay (261), Ankara (210); the most densely populated districts are in İstanbul, İzmir, Kocaeli, Bursa, Ankara, and Antalya, respectively.[29]

The district centers typically represent areas of administrative and economic activity. According to population census data, as of 2010, there were a total of 957 districts in 81 provinces of Türkiye; the number was 923 in the 2000 and 2007 censuses and increased to 970 districts in the 2014 census. In 2010, the districts had 77,036 population on average, ranging from 1,731 to 817,262 people, with a standard deviation of 123,885 people. There appears large variation in the population of the districts of Türkiye. The majority of the districts have a population below 50,000 people. The rest, about 35% of all districts, show large variations in population size (see Figure A.1).

### Appendix D: Variations among Sample Hospitals

Table A.1 shows the degree of variation among all general hospitals in Türkiye in terms of size. It provides a breakdown of the hospital bed numbers. About 54% of the private hospitals have less than 50 beds, and around 85% of them have less than 100 beds.

Table A.2 presents the distribution of hospitals in the sample with respect to their bed capacities. There do not seem to be large variations in bed capacities. To provide further breakdowns of the market configuration in the sample by hospital types, Table A.3 displays the observed number of markets with each configuration. For that, we first categorized each hospital with respect to bed capacity as SMALL or BIG and with respect to its being part of a hospital chain as SINGLE or CHAIN. The table reveals that the markets are rather homogeneous, and the differentiated configurations in terms of both hospital size and being owned by a chain are not common. For instance, as the middle horizontal panel indicates, in the

[27] The STATA codes for the BR-style empirical analysis is available thanks to Balmer (2013).

[28] In 1984, Ankara, İstanbul and İzmir were the first three metropolitan provinces. As of 2012, the number of provinces with metropolitan municipalities has reached to 30 in total. The list includes Adana, Bursa, Gaziantep, Konya (1987) and Kayseri (1988); Antalya, Diyarbakır, Eskişehir, Erzurum, Mersin, Kocaeli, Samsun (1993); Sakarya (2000); Aydın, Balıkesir, Denizli, Hatay, Kahramanmaraş, Malatya, Manisa, Mardin, Muğla, Ordu, Şanlıurfa, Tekirdağ, Trabzon, Van (2012); see http://www.tbb.gov.tr/en/local-authorities/municipalities-in-turkey/.

[29] We collected Surface Areas data from the website of the General Command of Mapping, Ministry of National Defense: https://www.hgk.msb.gov.tr/images/urun/il_ilce_alanlari.pdf . Then, we calculated the population density of each province (district) by dividing surface area with province (district) population.

23 markets with two hospitals, only three of them consist of one small and one big hospital, and only six of them consist of one independent and one chain hospital.

### Appendix E: Socio-Economic Development Ranking Survey – SEGE-Index

In 1996, with the aim of comparatively measuring the level of development of the provinces, the State Planning Organization of Türkiye (later the Ministry of Development) published research that provides rankings of all 76 provinces (at that time) of Türkiye in terms of socio-economic development level. The study uses Principal Component Analysis based on 58 different social and economic indicators; social indicators include demographic, education, health, employment, and infrastructure variables; economic indicators consist of manufacturing, construction, agriculture, and financial variables. The SEGE-index, providing a countrywide ranking of 81 provinces, constitutes the basis of the government incentive programs on local development support. The SEGE index layers 81 provinces of Türkiye into six development categories.

The Ministry repeated the research with the same design in 2003 and 2011 for all 81 provinces. They were calculated with the same research design and they provide ranking on the development level of provinces/regions for different years, but the dataset used for the calculations of the environmental, technological, living standards, economic, and social aspects were altered in 2011. The SEGE-2011 utilizes 61 variables from eight different dimensions. In addition to the indicator groups on demography, employment, education, health, and finance, some more variables on competitive and innovative capacity, accessibility, and life quality are included in the calculations published in 2011. Thus, it does not allow for a direct comparison of the level of SEGE-2011 with SEGE-2003.[30]

The development ranking was published in 2004 at the district level as well. It is based on 32 variables and ranks all 872 districts of Türkiye. In the empirical analysis, the SEGE-2004 index as an overall indicator of the wealth level of the districts was employed.

### Appendix F: Descriptive Statistics of Sample Local Markets

See Table A.4

### Appendix G: Further Comparative Discussion of Estimation Results

Bresnahan and Reiss (1991) study the entry of five retail and professional industries (e.g., doctors, dentists, druggists, plumbers, and tire dealers) in isolated U.S. towns. They find that competitive conduct usually falls monotonically as the number of firms rises; most of the increase in competition comes with the entry of the second and third firms; and, once the market has between three and five firms, the next entrant has little effect on competitive conduct. Similarly, Abraham, Gaynor, and Vogt (2007) find the entry threshold ratios of $\{s_{n+1}/s_n\}_{n=1}^{n=3} = \{1.97, 1.44, 1.06\}$ for the hospital industry in the U.S. cities, and they conclude that entry of a second or third hospital has considerable estimated effects on competition. In another study, Balmer (2013) concludes that two firms in newspaper sellers' markets of Swiss communes seem sufficient to ensure competition with the estimated ratios of $\{s_{n+1}/s_n\}_{n=1}^{n=4} = \{1.91, 1.09, 1.03, 1.07\}$.

On the other hand, there are few studies that investigate healthcare markets with similarly regulated market environments, with which our result on the nonmonotonic nature of

[30] We refer the interested readers to Ministry of Development of the Republic of Türkiye (2004, 2013) for the full texts of the publications on Research on Socio-Economic Development Index (SEGE).

the entry threshold ratios seems to be in line. Dranove, Gron, and Mazzeo (2003) examine the Health Maintenance Organization (HMO) markets in the U.S. They initially proceed as if the HMOs are homogeneous markets and employ the BR model, and they find a nonmonotonic relationship between the predicted entry threshold ratios and the number of firms as $\{s_{n+1}/s_n\}_{n=1}^{n=5} = \{0.93, 1.58, 1.50, 1.30, 1.20\}$, which implies that the market size required to support a second firm is roughly the same as the average market size of monopoly markets. Then, to explore whether product differentiation can explain this pattern, they apply Mazzeo's (2002) model that endogenizes product type choice as well as entry decision. They distinguish the HMOs as 'local' operating in only one market and 'national' doing business nationwide. They examine to what extent additional same-type and different-type HMOs affect competition. This time, the entry threshold ratios that they calculated separately for the local and national HMOs are $\{s_{n+1}/s_n\}_{n=1}^{n=3} = \{3.38, 2.25, 2.08\}$ and $\{1.83, 1.42, 1.32\}$, respectively. The entry threshold ratios monotonically fall consistent with the pattern in the homogenous product industries, suggesting that competitors' effect on profitability comes almost exclusively from the same-type HMOs.

Similar to this paper, Schaumans and Verboven (2008) provide an example of market settings in which additional entry does not lead to more intensified competition. Using a Mazzeo-style econometric model of entry, they investigate two interdependent professions (namely, pharmacies and physicians) in Belgium, which are both subject to heavy regulations. Under a regime of regulated high markups and restricted entry, they find that (i) entry into one profession has a positive effect on the profitability of entry into another profession, suggesting that entry of different-type firms are strategic complements; (ii) entry does not lead to intensified competition among the same-same type competitors; thus, for both professions, the market size to support a certain number of firms increases roughly proportionally with the number of firms.

Hence, the comparison of our findings with the ones in the literature calls for more research on industries in which the public and private sector coexists in a highly regulated market environment.

A concern about modeling is that service characteristics of hospitals might differ between relatively small and large hospitals or between independent single-market hospitals and hospitals owned by a national multi-market chain hospital group. Different types of firms may react differently to similar determinants of firm entry. Also, the presence of bigger (or smaller) hospitals may stimulate or deter entry into the market. For example, it could signal potential entrants for supernormal profit opportunities or future market growth.

In terms of firm size, there appear to be some variations in hospital sizes measured by the number of beds in the sample. Two-thirds, 102 of 157, of the private hospitals have fewer than 50 hospital beds, whereas 13 of the private hospitals have more than 100 beds. Also, only 6 of 35 single hospital districts have a hospital with more than 75 beds as a monopolist. In the duopoly markets, 11 (out of 24) districts have only small hospitals (with less than 50 beds), only 3 of them have one hospital with more than or equal to 75 beds, and no duopoly markets have two large hospitals. Even though there seem to be such variations in hospital sizes within local markets, the limited number of observations makes it difficult to detect a general pattern of firm asymmetry in hospital size. Hence, from this aspect, we could not explore the asymmetric market structure with nonstrategic and strategic interactions like capacity investments to deter entry in this paper. The size choice of hospitals necessitates their own research framework to be properly addressed, so we analyze the strategic capacity formation of hospitals in another paper within a different setting.

Among others, the paper's model does not consider the quality dimension of healthcare. The quality of the hospitals is taken as homogeneous across hospitals. Although Mazzeo (2002) provides a model to analyze equilibrium market structure in a differentiated product oligopoly where entrants can also choose their firm types (i.e., product quality), both the absence of a measure of hospital service quality and the very limited number of observations in our dataset on each market configuration make the Mazzeo-style models impractical for our analysis when we attempted to consider the hospital size as a quality indicator.

The paper has necessarily made some restrictive assumptions. There are still a number of topics on the hospital markets in Türkiye waiting to be addressed, which are beyond the scope of this paper. In addition to hospital entry decisions, the size choice of hospitals needs to be explored properly. Moreover, single-market independent firms may face some competition from multi-market chain hospitals. For instance, a national-brand hospital may have competitive advantages over inexperienced single-market independent entrants due to information asymmetries, such as foreseeing the market conditions for entry better. Furthermore, the timing of entry might have a strategic role in market competition if there is an early- or later-mover advantage in entering a local market. However, these research topics are more relevant for hospital markets in the big metropolitan cities, which are outside the sample of this paper, with half-dozen hospitals, compared to local districts with few hospitals. Despite their importance, these topics wait to be researched; yet, a critical reason for this omission might be the difficulty in obtaining and developing suitable datasets. This paper has potential to stimulate additional future research on these topics.

**Figure A.1** Variation in the population of the districts of Türkiye in 2010

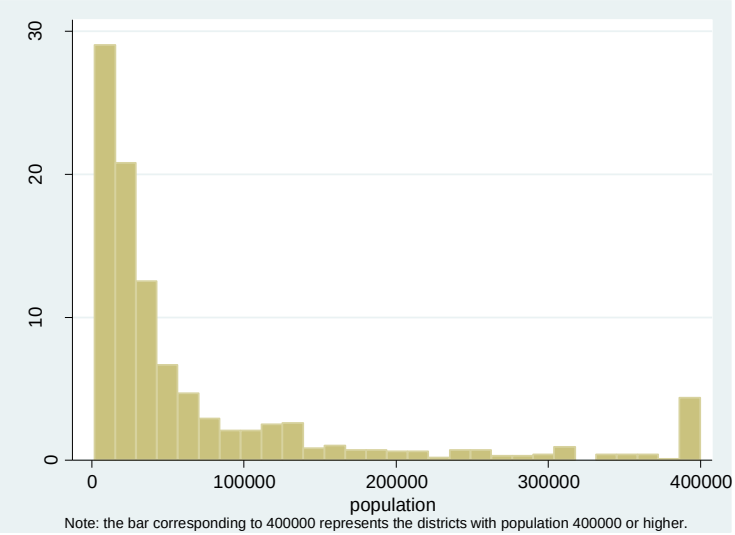



**Table A.1** Public and private general hospitals and their bed capacities in 2010

| Hospitals in 2010 | Private | | Public | |
|---|---|---|---|---|
| Number of beds | Frequency | Percent | Frequency | Percent |
| Less than 25 | 57 | 13.19 | 229 | 33.00 |
| 25-50 | 176 | 40.74 | 127 | 18.30 |
| 50-75 | 92 | 21.30 | 96 | 13.83 |
| 75-100 | 41 | 9.49 | 31 | 4.47 |
| 100-125 | 33 | 7.64 | 36 | 5.19 |
| 125-150 | 15 | 3.47 | 23 | 3.31 |
| 150-200 | 8 | 1.85 | 28 | 4.03 |
| 200-300 | 8 | 1.85 | 57 | 8.21 |
| Over 300 | 2 | 0.46 | 67 | 9.65 |
| Total | 432 | 100.00 | 694 | 100.00 |

Source: Author`s tabulations using the MoH data for the year 2010.

**Table A.2** Sample private general hospitals and their bed capacities in 2010

| Number of beds | Number of private hospitals | | |
|---|---|---|---|
| Year: 2010 | Frequency | Percent | Mean Beds |
| Less than 25 | 23 | 14.65 | 20 |
| 25-50 | 78 | 49.68 | 38 |
| 50-75 | 31 | 19.75 | 59 |
| 75-100 | 12 | 7.64 | 86 |
| 100-125 | 10 | 6.37 | 111 |
| 125-150 | 3 | 1.91 | 133 |
| Over 150 | 0 | 0.00 | - |
| Total | 157 | 100.00 | 50 |

Source: Author`s tabulations using the MoH data for the year 2010.

**Table A.3** Market configurations by hospital types in 2010

| Year: 2010 | | Number of SMALLER hospitals 75- beds | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4+ | Total |
| Number of BIGGER hospitals 75+ beds | 0 | 127 | 32 | 20 | 3 | 3 | 185 |
| | 1 | 5 | 3 | 6 | 3 | 1 | 18 |
| | 2 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 3 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 4+ | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | 132 | 35 | 26 | 8 | 4 | 205 |

| | | Number of SMALLER hospitals 100- beds | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4+ | Total |
| Number of BIGGER hospitals 100+ beds | 0 | 127 | 36 | 20 | 7 | 5 | 195 |
| | 1 | 1 | 3 | 2 | 1 | 1 | 8 |
| | 2 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 3 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 4+ | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | 128 | 39 | 22 | 10 | 6 | 205 |

| | | Number of SINGLE independent hospitals | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4+ | Total |
| Number of CHAIN hospitals | 0 | 127 | 32 | 16 | 6 | 3 | 184 |
| | 1 | 5 | 6 | 2 | 0 | 2 | 15 |
| | 2 | 1 | 1 | 0 | 1 | 1 | 4 |
| | 3 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 4+ | 0 | 0 | 0 | 1 | 0 | 1 |
| | Total | 133 | 39 | 19 | 8 | 6 | 205 |

Source: Author`s tabulations using the MoH data for the year 2010.

**Table A.4** Descriptive statistics for the sample market dataset used in the estimations

| | 2010 | | | 2002 | | |
|---|---|---|---|---|---|---|
| Variable Name | Mean | Std Dev | Range | Mean | Std Dev | Range |
| Market structure | | | | | | |
| PHOSP | 0.77 | 1.32 | [0, 9] | 0.26 | 0.62 | [0, 4] |
| Market size (in 100,000s) | | | | | | |
| DPOP | 1.35 | 1.05 | [0.50, 5.86] | 1.26 | 0.86 | [0.28, 4.65] |
| NEARPOP | 1.89 | 3.27 | [0, 19.89] | 1.73 | 2.55 | [0, 15.61] |
| NGRW00 | -0.06 | 0.11 | [-0.59, 0] | -0.06 | 0.11 | [-0.59, 0] |
| PGRW00 | 0.15 | 0.26 | [0, 1.64] | 0.15 | 0.26 | [0, 1.64] |
| PDISTRICT | 0.74 | 0.44 | [0, 1] | 0.74 | 0.44 | [0, 1] |
| Demand shifters | | | | | | |
| SEGE04 (index) | 0.52 | 1.13 | [-1.63, 5.08] | 0.52 | 1.13 | [-1.63, 5.08] |
| FURBAN | 0.61 | 0.21 | [0.09, 0.99] | 0.54 | 0.19 | [0.09, 0.93] |
| FCHILD | 0.27 | 0.09 | [0.14, 0.5] | 0.32 | 0.09 | [0.19, 0.55] |
| FELDER | 0.07 | 0.03 | [0.02, 0.15] | 0.06 | 0.02 | [0.02, 0.12] |
| MOHHOSP | 1.08 | 0.33 | [0, 2] | 0.95 | 0.23 | [0, 1] |
| NBMOHHOSP | 2.29 | 1.84 | [0, 7] | 1.56 | 1.37 | [0, 5] |
| Fixed cost shifters | | | | | | |
| WAGE (TTBCOST) | 3.08 | 0.20 | [2.4, 3.3] | 1.42 | 0.10 | [1.2, 1.5] |
| Sample Size: 205 | | | | | | |