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Clustering or scattering: the underlying reason for regulating distance among retail outlets*

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Abstract

Concerns on the clustering of retail industries and professional services in main streets had traditionally been the public interest rationale for supporting distance regulations. Although many geographic restrictions have been suppressed, deregulation has hinged mostly upon the theory results on the natural tendency of outlets to differentiate spatially. Empirical evidence has so far offered mixed results. Using the case of deregulation of pharmacy establishment in a region of Spain, we empirically show how pharmacy locations scatter, and that there is not rationale for distance regulation apart from the underlying private interest of very few incumbents.

JEL Codes: L51; K23; H42.

Keywords: distance, location, regulation, retailing.

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1 Introduction

Concerns on the clustering of retail industries and professional services in main streets had traditionally been the public interest rationale for supporting distance regulations. However, during the last decades we have witnessed a wide deregulation process by which not only entry restrictions, but also distance regulations among retail outlets and professional premises have been suppressed.

This has been the case for many industries and professional services such as the gas station industry, the dentist profession, and other industries and professions operated in retail outlets.

Pharmacies remains as one professional sector in which there is still many entry restrictions in place, particularly in Europe: 20 out of 27 EU Member States operate entry restrictions based on geographic and demographic criteria, a situation that contrasts markedly with that in the US and Canada where no restrictions are operative.[1] Among these 20 EU Member States, there are six that have explicit distance regulations by which new pharmacies can only be opened leaving in between 150 to 400 meters of distance from the incumbents.[2] Furthermore, European entry restrictions are typically coupled with price or retail margin regulations.[3]

In the industries where entry has been deregulated, the rationale supporting such deregulation has hinged more upon theory results than on empirical evidence. Address models tend to suggest that there is a natural tendency of outlets to differentiate spatially. While empirical evidence showing that firms do not cluster together is scarce.

As stated by Netz and Taylor (2002), almost any equilibrium configuration can be obtained depending on the assumptions of the model, including the minimum differentiation suggested by Hotelling's (1929) seminal work and maximum differentiation proved by Aspremont, Gabszewicz and Thisse (1979). All in all, theory has been more supportive of

[1] See ÖBIG (2006) report for the European Commission and COFV & FEFE (2007). In most Member States, the establishment of new pharmacies is restricted on geographic and demographic criteria. Only in the UK, Ireland and the Netherlands entry is restricted by the contracts with the tax-funded health care organizations. Outside the EU, Mossialos and Mrazek (2003) also report that entry is restricted in Norway.

[2] EU Member States that operate minimum distance regulations are Austria, Greece, Hungary, Portugal, Slovenia and Spain.

[3] ÖBIG (2006) reported to the European Commission that 18 out of 25 Member States set the pharmacy markups by regulation and discounts are not allowed, while the other 7 set maximum markups or fees for services while allowing for free discounts to clients.

differentiation than of clustering as highlighted by Netz and Taylor (2002) and by Irmen and Thisee (1998).

By contrast, the empirical evidence has so far offered mixed results: contrary to theory predictions, most papers have found that firms tend to cluster together; a few do not obtain clear cut results (i.e. Borenstein and Netz 1999); and only one so far has shown the retail firms tend to differentiate locating away from competitors using the case of gas stations in California (Netz and Taylor, 2002).

In this paper we use the case of partial deregulation of pharmacy establishment in a region of Spain (Navarra), we show that new pharmacy outlets differentiate locating away from incumbents and from downtown. This case is particularly interesting and useful to identify and quantify the impact of competition on location patterns, and to assess the impact of distance regulations.

As we will see below, the regulatory reform makes that the total number of pharmacies in Navarra almost doubled as entry became free (before it was restricted) and distance regulation became weaker (minimum distance decreased from 250 to 150 meters).

Given that, we are able to describe the dynamics of entry into a set of well defined relevant local markets. Using geographical geocoding routines, we have been able to calculate the distance among all incumbent and new pharmacies opened to the public in Navarra before and after partial deregulation. Using this information we have estimated the impact of competition on the distance among pharmacy outlets.

We find that regardless that there is a National Health System (NHS) health center in the town or not pharmacies do not cluster, except for the case of the first one or two pharmacies of municipalities that have a health center. This suggests that the principle of maximum differentiation rules in pharmacy sector.

Indeed, results show that in those municipalities in which there is a NHS health center two pharmacies locate near the health center clustering around it at a distance close but larger than the regulated 150 minimum distance. But, further entry increases the distance among pharmacies well above the minimum regulated distance.

By contrast, in the municipalities in which there is not a health center, pharmacies locate far away from the other. As the number of competitors increases, the distance among pharmacies decreases only gradually but it remains far larger than the minimum

regulated distance.

From this evidence, the paper argues the rationale for having minimum distance regulations. As pharmacies do not generally cluster, there is not public interest rationale for supporting distance regulation. Only those incumbent pharmacies located close to the health centers benefit from distance regulation as the second pharmacy would like to come close or even leapfrog the incumbent locating next door to the health center. If this is the case, there is therefore not rationale for distance regulation apart from the underlying private interest of very few incumbents.

The paper is organized as follows. Section 2 reviews the literature on spatial competition and the need for regulation. Section 3 outlines the empirical framework and the particularities of the case we are using to identify and quantify the impact of competition on distance among competitors. Section 4 details the empirical results, and section 5 concludes.

2 Literature review

Hotelling (1929) seminal paper that claimed that firms have a tendency to cluster spatially has been followed by a very large theory literature that shows that spatial competition can render any equilibrium of minimum or maximum differentiation, or not equilibrium at all.

The paper by Aspremont, Gabszewicz and Thisse (1979) clearly showed what are the details of one-dimensional space competition models that lead to different implications: apart from the difficulties of characterizing the equilibrium, the principle of minimum differentiation suggested by Hotelling seminal paper (as named by Boulding, 1948) turned out to be not robust to slight changes in the transportation costs. By allowing transportation costs to be quadratic rather than linear, outlets maximum differentiate in the Hotelling line.

As suggested by Netz and Taylor (2002), the large literature on one-dimensional space competition has identified the drivers of the equilibrium location: the sprawl of consumers promotes differentiation (Eaton and Lipsey 1976), the elasticity of demand mitigates clustering (Smithies, 1941; Eaton, 1971), non-linear transportation cost promotes differenti-

ation (Aspremont, Gabszewicz and Thisse, 1979), and consumer heterogeneity promotes clustering (De Palma et al, 1985).

When analyzing empirically the impact of competition on location patterns, we should control for all these drivers that have been identified by the theoretical literature.

However, when dealing with the pharmacy sector it is difficult to bridge the gap between the theory of location and the empirical analysis. First, we need to take into account that professionals use non-price competition strategies, such as differences in quality of care. Additionally, as stated before, the pharmacy sector is not only characterized by entry and distance regulations, but also by price regulation. Therefore, we should look at the theory that has analyzed not only horizontal but also vertical differentiation, and also that has studied entry and location patterns when price is regulated.

On the one hand, the paper by Neven and Thisse (1990) analyzes location equilibrium when firms compete in prices, location and quality. When the range of quality options is larger than the location options, firms tend to maximum differentiate in quality but cluster in location. On the contrary, when the range of quality options is smaller than the location choices, firms tend to cluster in quality and maximum differentiate in location. Therefore, when competition is multi-dimensional, the degree of space differentiation depends also on whether there is differentiation in other dimensions such as quality of service.

On the other hand, Ma and Burguess (1993) introduce price regulation in a model of vertical differentiation, that is, a model of competition in quality but not in location. Nuscheller (2003) offers a model of vertical (quality) and horizontal (location) differentiation with price regulation. This latter paper allows professionals to compete in a game in which they first decide whether to enter or not the market, then where to locate, and finally the quality of service they offer given the price set by the regulator.

In this model, the closer two professionals locate, the tighter the non-price competition and the higher the quality of service they have to offer.

So far the scarce number of empirical papers that have focused on studying the relationship between competition and differentiation have offered mixed results. Netz and Taylor (2002) is almost the unique paper that finds robustly that firms locate gas stations in an attempt to spatially differentiate as market competition increases.

Before that paper, most empirical studies suggest that outlets tend to cluster: Pinske

and Slade (1998) suggested that gasoline stations with similar characteristics (such as those that have similar contractual agreements with refiners) tend to cluster; and interestingly for our case, Borenstein and Netz (1999) and Salvanes et al (1997) found that an increase in competition leads to clustering of departure times of airlines for the United States and Norway when prices are set exogenously: regulated or allegedly set by a cartel. By contrast, Borenstein and Netz (1999) found mixed results after entry and price deregulation of airlines.

The deregulation of entry in the pharmacy sector in one region of Spain offers us a very convenient setting for studying the impact of competition on the location patterns in a price regulated environment. Taking into account the priors that theory offers us, we will study the underlying effects of competition on distances among pharmacies.

The contribution of the paper is to make clear when the principle of maximum differentation on location rules in the pharmacy sector.

3 Empirical Framework

3.1 Background on the policy change

Entry regulations for pharmacies in Spain, apart from pure licensing, date back to the 19th century. In 1854, the central government ruled that local governments should guarantee the existence of at least one pharmacy for every given number of inhabitants so as to attend the needs of the poor and to perform certain public health duties.

This was a typical public service obligation whereby local governments had to contract-out to one particular pharmacy certain specified retail pharmacy services, while the other pharmacies in town were free to enter the market to serve their clients without any contract with the government.

The legislation sought to secure a broad and balanced distribution of pharmaceutical services throughout the territory, specifically securing some activities and income to rural pharmacies by contract.

It was not until 1941 that the government restricted the number of pharmacies, with entry regulations being made more tight in more-populated areas, and less so in less-populated areas. These entry rules were desigmend to safe-ward the income of senior

incumbents in the more-populated urban areas, and to promote the entry of junior professionals in the less-populated rural areas.

The new law ruled that there should be no more than one pharmacy for every 5,000 inhabitants in each municipality. It also introduced minimum distance requirements.[4]

Permits became tradable, with the result that senior incumbent pharmacists tend to sell their pharmacy license before the mandatory retiring age, or transfer them to their sibling if they had got a degree in pharmacy.

Junior pharmacists with professional experience attending rural pharmacies enjoy a priority in the opening of new pharmacies that fill up the cap due to population growth in cities. But juniors do not enjoy priority in buying the permits of the retiring senior pharmacists. These entry restrictions were coupled with linear regulated mark-ups for pharmacies.

These regulatory reforms shifted the burden of public service obligations in rural areas from local public finance to the clients of the pharmacies located in urban areas.[5]

Entry restrictions have changed little since then, although the enforcement of entry regulations was devolved to the regions in the 1980s and 1990s. The current Spanish legislation regulating the establishment of new pharmacies, introduced in 1997, fixes a ratio of one pharmacy per 2,800 inhabitants in each health care zone (although the ratio may be as large as 4,000 inhabitants).[6]

A health care zone is a part of a municipality or group of municipalities in which there should be at least one public, National Health System (NHS), primary health care

[4]The quantitative limit was more restrictive in more-populated areas: one pharmacy for every 10,000 inhabitants in municipalities with a population greater than 50,000 inhabitants. The distance regulation was also more restrictive in more-populated areas: new pharmacies could only open 250 meters away from existing ones in cities larger than 100,000 inhabitants, 200 meters away in cities with between 50,000 and 100,000 inhabitants and 150 meters away in cities with between 5,000 and 50,000 inhabitants.

[5]Before 1941, local governments in less-populated areas always struggled to meet their public service obligations. This burden shifted back gradually to the central government as it undertook to fund as much as three quarters of the pharmaceutical bill from the late 1980s onwards. Although the main source of income of pharmacies comes from the central government budget, entry regulations continue to safeguard the income of pharmacies in the cities and, eventually, to offer the prospect of opening a pharmacy in a well-remunerated urban site for the junior pharmacists that start their careers attending rural communities at a loss.

[6]The regulation has a non-linearity in the authorization of the second pharmacy in any health care zone. An additional pharmacy can be established whenever the population of the health zone is 2,000 people larger than the number resulting from multiplying the number of pharmacies already open to the public by 2,800. Therefore, a municipality needs a population of 2,800 inhabitants to obtain the permit for the first pharmacy, 4,800 for the second, 7,600 for the third, and 10,400 for the fourth and so on.

center.[7] The minimum distance between pharmacies is fixed at 250 meters, while the regulated mark-up was fixed at 27.9% of the retail price.

In 2000, the Parliament of the Foral Community of Navarra, a small region in the North of Spain, with just over 543,757 inhabitants at that moment, challenged these national entry restrictions. Navarra passed a law which reverted to a regulation of minima, i.e., the regional government allowed new pharmacies to be opened and sought to ensure that there was at least one pharmacy in each health care zone.[8]

The policy shift in Navarra can be seen as a natural experiment, since it was unexpected and undesired. In fact, the sponsor of the legislative proposal, the region's Health Minister, was a doctor whose original intention was to obtain rebates from pharmacies in the distribution of medicines prescribed by doctors working in the public sector. Paradoxically, pharmacy mark-ups are fixed by Spain's central government, while health care is fully managed by the regions.

The aim of Navarra's Health Minister was to change the contract between the pharmacists and the regional government, under whose terms pharmacists would have had to give rebates to the NHS. Given the fierce opposition expressed by the incumbent pharmacists to renegotiate the contract, the new bill provided for the unrestricted opening of new pharmacies, which had to accept the rebates as laid down in the contract for the new pharmacies in order to be allowed to provide the prescriptions for public sector doctors.

During the passage of the bill through Parliament, confrontations between the regional government and the pharmacists were frequent and often acrimonious. The pharmacists even took strike action, and public health care centers were exceptionally given judicial permission to dispense medicines during the strike action.

The new legislation was finally introduced by the regional parliament, coming into force late in the year 2000. In the end, however, the new law did not change the terms of the contract between the pharmacists and the regional government, but it did partially deregulate the opening of new pharmacies. It was widely perceived that the policy changes

[7] Zones vary in population size. For instance, the median health care zone is around 6,100 inhabitants in one region of Spain (Navarra in 2000), while it is 24,000 in another (Andalusia in 2008).

[8] This experiment in partial deregulation ended in December 2008 when the Navarra Parliament passed a new law restricting entry again: the opening of the first pharmacy in each municipality is now without restriction, but authorization to open a second and further pharmacies is only granted if each pharmacy can serve 700 inhabitants in each municipality. However, this entry regulation is still the least restrictive in Spain.

suggested initially were less likely to be upheld by the Constitutional Court than the eventual modifications.[9]

The new regulation guarantees that there is at least one pharmacy per health care zone, a global maximum for the region so as to avoid region wide excessive entry (though this has never been binding). The new regulation reduced the minimum distance between incumbent and new businesses from 250 meters to just 150 meters.

By contrast, the other regions of Spain have continued to adhere, more or less, to the national mandate of capping the number of pharmacies and maintaining tight distance regulations of 250 meters.

The legal dispute eventually reached the Constitutional Court in 2004, where it was held that the regional government was respecting the provisions laid down by the constitution and Spain's pharmacies law. The Court recognized that the regions have the duty of guaranteeing a balanced geographic coverage of pharmaceutical services, albeit that the new law was adopting a less interventionist approach. The situation was held to be consistent with EU policy and case-law of only maintaining trade and professional regulations that are non-discriminatory, necessary, adequate and proportional to the public aim they pursue.

3.2 Data

Partial deregulation almost doubled the number of pharmacies in the region: the total number of pharmacies increased from 310 in 2000 to 580 in 2008 (increased by 87%). Following Schaumans and Verboven (2008), we are going to focus the empirical analysis in the municipalities with less than 15000 inhabitants and less than 800 inhabitants per square kilometer which here we consider as constituting the local market for pharmaceutical services.

By so doing, we focus our attention on what can be assumed to be relatively isolated markets since pharmaceutical services are overwhelmingly local by nature. The total number of pharmacies located in such sample increased from 157 in 2000 to 278 in 2008

[9] According to Spanish law, all pharmacies have the right and the duty to provide the medicines prescribed by public and private sector doctors under the terms laid down in central government rules. Although regulations governing the opening of pharmacies have been devolved, the way in which pharmacies enter into contract with the public health system has not.

(increased by 77%). [10]

Table 1 shows the structure of the markets at the municipal level before (2000) and after (2008) deregulation. Almost half of the municipalities with less than 15000 inhabitants and less than 800 inhabitants per square kilometer had not pharmacy at all before deregulation (44.7%). And among the municipalities with pharmaceutical services, most of them had only one pharmacy (52.7%).

Deregulation increased slightly the number of municipalities without pharmacy from 117 to 124, that is from 44.7% to 47.3%.[11] The number of municipalities with only one pharmacy decreased strongly, from 52.7% to only 29.4%. By contrast, the number of municipalities with 2 or more pharmacies increased even strongly, from just 2.7% to 23.3%.

Insert table 1 here

Table 2 shows the transition matrix before and after partial deregulation. Entry restrictions were very arbitrary by its nature: in one municipality with no pharmacy, deregulation drove the opening of as much as 6 pharmacies; while in many municipalities with just one pharmacy, deregulation drove the opening of as much as 3 or 4 more pharmacies. By contrast, 10 municipalities lost their unique pharmacy.

Insert table 2 here

Using geographical geocoding algorithms, we have been able to map all pharmacies open to the public in Navarra by mid 2008. The figure shows the geocoding (latitude and longitude) of pharmacies and health centers in Navarra as of July 2008 by year of opening.[12]

[10] In Borrell and Fernandez-Villadangos (2009), we test whether our choice of the municipalities as the relevant markets was correct, since we were able to check whether the unregulated opening of pharmacies in Navarra had any significant effect on the payoff functions of the municipalities across the border in the region of Euskadi. We did not find any cross border significant effect, and therefore the market definition at the municipal level is the relevant choice for our purposes.

[11] In Borrell and Fernandez-Villadangos (2009), we analyze the effect of entry restrictions on the dynamics of entry across municipalities, and discuss the impact of restraining entry in urban areas to promote (slightly and at a huge distortionary cost) the opening of pharmacies in rural locations.

[12] Based on the name and address information provided by the Navarra Health Department (Section of Pharmacy Regulation and Inspection), we used the web based freeware routine in batchgeocode.com

It clearly shows that some new pharmacies locate very close to incumbents and health centers, while others cover places where there were not pharmacies before deregulation. From the picture, it is not possible to tell whether deregulation fosters the clustering or scattering of pharmacy locations.

Insert figure here

In this paper we take advantage of this regional change in pharmacy entry regulation. As we have just explained, it can be considered an experiment in the sense that the shift from full regulation (entry restricted plus a tight 250 meter minimum distance regulation) to partial regulation (free entry and just 150 meters minimum distance regulation) was unexpected and undesired. We will use this evidence on the sudden and unexpected variation in the regulatory framework to assess the impact of the number of competitors on the locational pattern of professional retail outlets.

3.3 Method

As theory is not conclusive regarding the impact of competition on the degree of clustering or spatial differentiation of retail outlets or professional premises, we will look at the data for identifying and quantifying this relationship.

The policy experiment in Navarra offers a setting in which we can observe the equilibrium outcome of the locational game before and after partial entry deregulation. Theory is not offering us a prior regarding the relationship between competition and distance among competitors.

As pharmacies compete only in location and non-price variables (quality), according to one-dimensional location games we may find clustering a la Hotelling (1929), or locational differentiation a la Aspremont et al. (1979). Additionally, according to Neven and Thisse (1990) we should find spatial clustering when the range of quality options is larger than the range of location choices. Alternatively, we should find locational spreading when the range of locational choices is larger than the range of quality options.

We will approach the empirical study of clustering versus scattering starting from the

(Phillip Holmstrand) that maps multiple addresses using Yahoo! Geocoding API, and also Google Earth.

simple model proposed by Netz and Taylor (2002) in which spatial differentiation is a function of the degree of competition and a set of control variables related to demand conditions and entry costs.

However, as we are able to gather information before and after deregulation, we will enrich the model using the techniques proposed by the literature on experimental designs and policy evaluation. Meyer (1995) describes the strengths and weaknesses of using quasi-experiments in economics, but among the good natural experiments he cites those induced by policy changes such as the one we are studying, as they allow a researcher to obtain exogenous variation in the main explanatory variables.

Departing from Netz and Taylor (2002) we will estimate the model at the market level. In the case of pharmacies, as we have already noted, we count with a good definition of the relevant markets. We will use two measures of clustering. Distance to the closest pharmacy is our first measure of clustering. We want to see whether the new opening of pharmacies cluster together all the pharmacies of the average local market, the municipality. We will estimate the following relationship,

$$D^1{}_{it} = f\left(C_{it}, X_{it}, \epsilon_{it}; \theta_1\right),$$

where i indexes municipalities and t indexes whether we are before or after deregulation. D^1 measures the average distance to the closest pharmacy at the municipality level. The vector C measures competition before and after deregulation, that is the number of pharmacies at the municipal level, and the matrix X contains control variables related to demand and entry conditions at the municipal level. This matrix will contain a variable for controlling whether average distance among competitors changes due to the regulatory reform, as minimum distance drops from 250 to 150 meters after partial deregulation. [13]

We also allow the coefficient measuring the impact of competition to differ before and after deregulation, $\beta_t : \beta_{before}, \beta_{after}$ where $\beta_t \in \theta$, as entry is restricted before partial deregulation, and pharmacies might take into account this constraint when deciding were to locate. By contrast, after deregulation, there is free entry. Additionally the impact of

[13] We model the relationship between distance and competition using a log-linear and a log-quadratic functional form. The model including squared competition takes into account that in any given local area, distance among outlets in the limit should decrease as the number of competitors increases irrespective of the degree of clustering or scattering of the spatial distribution of the outlets before reaching such limit.

competition on average distance may change due to the drop of the minimum distance regulation.

Among the municipalities characteristics, we will control for density, the number of towns and suburbs in each municipality, and whether there is a public health center in the municipality. All are affecting strongly the geographic distribution of consumers which theory clearly shows that may affect location choices. In Spain, around three quarters of the prescriptions are filled by doctors of the public sector health care services (National Health System). Therefore, having a public health center in the municipality may change dramatically the distribution of effective demand, and the equilibrium location of pharmacies as we will see.[14]

We will also control for other demographic characteristics affecting demand or costs such as the percentage of population under the age of 14, the percentage over the age of 75, and the percentage of foreigners before and after deregulation (2000 and 2008). We will also control whether average distance to the health center changes after partial deregulation as free entry and the reduction in the minimum distance may switch the equilibrium outcome of the location game.[15]

The second measure of distance that we will use is the average distance of all pharmacies of each municipality to the health center if there is one. We want to see whether new pharmacy opening cluster around the health center.

$$D^2{}_{it} = g\left(C_{it}, X_{it}, \epsilon_{it}; \theta_2\right)$$

Using the geocode of each pharmacy, we calculated the Euclidean distance among all pharmacies and health centers. We then computed the distance to the closest pharmacy within the same municipality and to the health center. And then, we computed the average distance to the closest pharmacy and to the health center within each municipality among

[14] Around a quarter of the population prefer to go to the private primary care sector, although most of this number obtain their prescriptions with very low co-payments from the public health care centers. Co-payments stand at 6% on average: pensioners obtain their medicines free of charge, while the rest of the population pays 40% of the price for acute indications, and a reduced rate of 10% up to a maximum co-payment of 2.64 euros for chronic indications.

[15] Data on demographics at the municipal level are from the Spanish Statistical Office. We have no information on average income at municipal level. We do have information on average education and unemployment only for the 2001 census year. However, we do not use them as controls as remain always not significant when explaining distance measures in any of the functional specifications.

the incumbent pharmacies before 2000 deregulation, and among all incumbent and new pharmacies opened to the public in Navarra between 2000 and mid 2008. Using this information we have been able to estimate the impact of competition on the distance to the closest pharmacy and on the distance to the health center.

Competition is measured by the number of pharmacies per municipality. As explained above, pure licensing regulations and restrictions whereby only pharmacists can own pharmacies that open to the public and the one-pharmacy per pharmacist rule go back to 1860. This regulation do not allow pharmacy chains. Therefore, the number of independent pharmacist is proxying competition in location with little measurement error, except if there is familiar ties between pharmacist of which we only have anecdotal evidence.

4 Results

Tables 3 and 4 show some summary statistics of the data. Table 3 focus on the municipalities with two or more pharmacies in which our first measure of clustering makes sense: the average distance to the closer pharmacy within the same municipality. We split this sample in three. We observe 36 municipalities that have no public health center. In those municipalities the number of pharmacies was always one or zero before partial deregulation and so, they are not relevant for our analysis. But all of them have two or more pharmacies after partial deregulation. Mean distance to the closer pharmacy is 884 meters, and the mean number of pharmacies is 2.50.

On the other hand, we observe only 7 municipalities that have one or two health centers, and that also have two or more pharmacies before partial deregulation. For this group, mean distance to the closer pharmacy is 1,279 meters, and the mean number of pharmacies is 2.57 before partial deregulation. Finally, after deregulation the number of municipalities that have one or two health centers, and that have two or more pharmacies, increased up to 25. Mean distance among the pharmacies of this group is lower, 637 meters, and the mean number of pharmacies is 4.12.

Demographics are very similar across sub-samples, except for density and the percentage of foreigners. Comparing the before and after sub-samples of municipalities with one or two health centers, the increase in these two controls is due to population growth and

immigration in the region between 2000 and 2008. Comparing the sub-samples after partial deregulation, municipalities with no health center have less density than municipalities with one or two health centers as expected. Health care centers are public facilities set up by the regional government according to social needs, not according to profit considerations.

Insert table 3

Table 4 shows the summary statistics for all the 31 municipalities that have only one health center. All of them have one or more pharmacies before and after partial deregulation. We will look at these municipalities to assess the impact of competition on the average distance of pharmacies to the health center within the municipality. We are mainly interested in assessing whether mean distance to the health centers decreases after partial deregulation, and what is the relationship between mean distance to the health center and the number of competitors. We want to know whether pharmacies cluster or scatter around after partial deregulation, and whether pharmacies cluster or spread in the municipalities with more competitors. [16] Before partial deregulation, mean distance to health center is around than 2.2 kilometer, and the mean number of pharmacies is just 1.26. After partial deregulation, mean distance to the health center is just slightly over 3 kilometers while the number of pharmacies is 3.23. Demographics remain very similar before and after on average, except for density and the percentage of foreigners that increase due to population growth and immigration in the region between 2000 and 2008.

Table 5 shows the relationship between the number of competitors and the demographics on the average distance among retail outlets. The evidence shows that this relationship is completely different in the case of the municipalities in which there is no public health care center with respect to the municipalities that count with one or two health centers.

The estimates of the impact of the number of pharmacies on average distance to the closer competitor are quite precise. All competition coefficients are statistically significant

[16] We will not include in the sample the municipality with two health centers, as then the average distance to the health centers is not a good measure of clustering as some pharmacies may cluster around one health center, while others around the other while average distance may increase, decrease or stay put.

at 5% except two of them that are significant at 6% and 8% respectively. The relationship appears to be linear or log-linear (this latter one is shown in the table, although the former yields very similar results).

In the municipalities with 1 or 2 health care centers, pharmacies spread over the territory as the number of competitors increases. And, this scattering effect is stronger before partial deregulation. Additionally, mean distance to the closer competitor seem to be larger after partial deregulation, although the impact is not statistically significant.

By contrast, in the municipalities with no health center, pharmacies maximize locational differentiation but tend to cluster together as the number of competitors increases.

Insert table 5

Demographics turn out to be statistically significant in the case of the municipalities without health care centers where demand is more disperse. Population density cluster the outlets together, as it also does the percentage of old population, the percentage of young population, and the percentage of foreigners. In municipalities with a larger number of towns and suburbs, average distance among retail outlets is larger.

Theory suggested that density drives clustering, and the percentage of young and old population might reflect the larger transport cost of the families and the elderly. The percentage of foreigners might be picking some income related effect such as lower access to private vehicle transportation.

By contrast, control variables do not appear to play such a statistically significant role in municipalities that have a health care facility. Although the estimates are less precise, all keep their signs, except for the number of towns and suburbs that in those municipalities is a driver of the clustering rather than the scattering of outlets. The town or suburb that has the health center probably is a magnet for pharmacies, the more so the more the number of smaller suburbs around within the same municipality.

Table 6 shows our best prediction according to the estimated relationship between the given market structure and the equilibrium location of retail outlets, while setting the demographics at the average of the respective sub-sample. When there is not health care center, the municipalities with only two pharmacies have them at a large distance

of around two kilometer after partial deregulation. The municipalities with 3 pharmacies have them around 1 kilometer away each one from their closest rival. The municipalities with 4 pharmacies would have them 572 meters away one from each other on average. Finally, the municipalities with four pharmacies have them only 306 meters each one from their closest rivals.[17]

Insert table 6

By contrast, if there is a public health care center, the municipalities with only two pharmacies would have them clustered together near the health center (only around 500 meters away one to the other) before and after partial deregulation. After partial deregulation, average distance to the closer competitor increases gradually with the number of pharmacies in the municipalities. We predict that municipalities with three pharmacies have them 528 meters apart to their closest rivals, and 622 meters in the case of four pharmacies, 732 meters in the case of five, 861 meters in the case of six, and so on, until as much as 2.3 kilometers in the case of 12 pharmacies. The average distance to the closest rival increases substantially with the number of competitors.

A less gradual increasing scattering with respect to the number of competitors is also observed before partial deregulation in the municipalities with health center. Entrants prefer to locate far away from incumbents when entry is restricted, much further away than the tight 250 meters minimum distance regulation commands.

Additionally, from the location patterns of pharmacies before deregulation, it is clear that entry regulations that constrain the number of pharmacies promote pharmacies to differentiate spatially. Distance to the closest rival is larger before partial deregulation for any given market structure. New entrants fill the spots available between incumbents.

Table 7 shows the relationship between the number of competitors and the demographics on the average distance to the health center only in those municipalities with one health center, before and after deregulation. In this case the relationship appears to be non-linear. We opt for a log-quadratic functional form that appears to fit better the data. As the number of pharmacies increases, the average distance to the health center

[17] It should be noted that we have computed Euclidean distances, while regulation sets walking distances. Therefore, depending on the street grid regulation may be binding in some municipalities.

first goes down and then increases back up.

Insert table 7

The estimates of the linear and the quadratic impact of the number of competitors on the average distance to the health center are statistically significant before and after deregulation. Those are not so precisely estimated before deregulation. Average distance to the health center increases after deregulation, although this estimate is not statistically significant either. Demographics are not quite precisely estimated, except for density. Density appears to drive significantly the pharmacies together to the health center as theory suggests. All the other demographic co-variates show negative sings suggesting also that they may drive the clustering.

Table 8 offers the best prediction of the impact of the number of pharmacies on the average distance to the health center keeping the demographics at the sub-sample average before and after partial deregulation. Average distance is decreasing from 1.5 kilometers in the case of one pharmacy municipalities before partial deregulation, to just 1.4 kilometers in the case of two pharmacies municipalities, while it goes up to 2.7 kilometers in the case of three pharmacies municipalities, and as much as 10.9 kilometers in the case of four pharmacy municipalities. There is not further evidence with municipalities with more pharmacies before deregulation.

Insert table 8

By contrast, average distance to the health center appears to increase substantially after partial deregulation. And this swing movement towards some clustering appears to expand from the municipalities with just 1 pharmacy up to the municipalities with 4 pharmacies after deregulation. And, then we see pharmacies increasingly scattering over the territory in the case of municipalities with 4 or more pharmacies.

This evidence suggests that, although pharmacies tend to increasingly separate one to the other and that average distance to the health center increases substantially after deregulation, the health center is still a magnet for those pharmacies that enter first, while

it is not longer so when the number of pharmacies reaches a high enough number. It is then around the health center that the minimum distance regulation may be constraining the locational choices of the pharmacies, and protecting the incumbents from the competitive pressure of the newcomers. And restricting the number of entrants, restrains the scattering of pharmacies around the territory.

5 Concluding remarks

Summing up, the evidence from partial deregulation of entry in the pharmacy professional sector shows that pharmacies do not cluster together except for the case of a rather small number of incumbent pharmacies in those municipalities that have a health center.

This is very consistent with the predictions of Aspremont et al (1979) that state the principle of maximum differentiation in the location strategies of firms. It applies in this work when we study the locational choices of pharmacies in the municipalities without health center.

At its turn, in the municipalities with a health center and a small number of pharmacies, there is some clustering around the health center. But new pharmacy opening spans on the location options away from the health center and increasingly away from competitors, and increasingly so as the number of competitors dooms large.

From this evidence, we challenge the rationale for having minimum distance regulations. As pharmacies do not generally cluster, there is not public rationale for supporting distance regulation. Our results suggest that distance regulation may only be binding for the very few pharmacies located near the health center.

Only those incumbent pharmacies that located close to the health centers benefit from distance regulation as the second pharmacy in any municipality would like to come close or even leapfrog the incumbent locating next door to the health center. If this is the case, there is therefore not rationale for distance regulation apart from the underlying private interest of very few incumbents.

Finally, the evidence not only shows that entry restrictions do actually reduce the total number of pharmacies and the accessibility to pharmacy services in some municipalities, but that entry restrictions also lead those small number of pharmacies to open to the

public locating far apart from each other and from the health center. Free entry allow many new pharmacies to fill the gap scattering around between incumbent pharmacies that remain mostly open at such distant locations.

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Table 1.- Market structures before & after deregulation (n = 262)

# pharmacies per municipality	# municipalities before	# municipalities after	% municipalities before	% municipalities after
0	117	124	44.7%	47.3%
1	138	77	52.7%	29.4%
2	5	25	1.9%	9.5%
3		20		7.6%
4	1	4	0.4%	1.5%
5	1	6	0.4%	2.3%
6		2		0.8%
7		3		1.1%
12		1		0.4%

Table 2. Transition matrix before and after partial deregulation

		# of new pharmacy openings after								
		-1	0	1	2	3	4	5	6	7
# pharmacies per municipality before	0		114	2					1	
	1	10	75	25	20	4	4			
	2					2	1	2		
	4					1				
	5									1
	Total	10	189	27	20	7	5	2	1	1

Table 3.- Summary statistics: Municpalities with 2 or More Pharmacies

	After - Municipalities with no Health Center				
	#obs	Mean	Std. Dev.	Min	Max
distance to closer pharmacy	36	884.08	1,059.81	16.94	3,734.46
#pharmacies	36	2.50	0.70	2.00	5.00
#towns	36	3.39	4.66	1.00	22.00
density	36	85.48	100.12	1.88	565.93
%young	36	0.13	0.04	0.05	0.25
%old	36	0.11	0.04	0.02	0.18
%foreigners	36	0.08	0.04	0.01	0.18
	Before: Municipalities with 1 or 2 Health Centers				
	#obs	Mean	Std. Dev.	Min	Max
distance to closer pharmacy	7	1,278.91	1,118.97	169.47	3,057.78
#pharmacies	7	2.57	1.13	2.00	5.00
#towns	7	1.29	0.76	1.00	3.00
density	7	133.69	94.50	14.38	262.39
%young	7	0.13	0.02	0.08	0.15
%old	7	0.10	0.03	0.07	0.15
%foreigners	7	0.02	0.01	0.01	0.03
	After - Municipalities with 1 or 2 Health Centers				
	#obs	Mean	Std. Dev.	Min	Max
distance to closer pharmacy	25	637.06	668.75	89.17	2,586.44
#pharmacies	25	4.12	2.20	2.00	12.00
#towns	25	2.32	3.13	1.00	13.00
density	25	125.71	132.11	14.02	590.64
%young	25	0.14	0.02	0.09	0.18
%old	25	0.09	0.03	0.03	0.17
%foreigners	25	0.08	0.03	0.02	0.16

Table 4.- Summary statistics: All Municipalities with 1 Health Center

	Before - All Municipalities with 1 Health Center				
	#obs	Mean	Std. Dev.	Min	Max
distance to health center	31	2,200.97	3,155.86	37.85	13,529.86
#pharmacies	31	1.26	0.63	1.00	4.00
#towns	31	3.84	7.63	1.00	40.00
density	31	90.44	108.24	3.63	539.84
%young	31	0.13	0.02	0.08	0.17
%old	31	0.10	0.03	0.03	0.16
%foreigners	31	0.02	0.01	0.00	0.06
	After - All Municipalities with 1 Health Center				
	#obs	Mean	Std. Dev.	Min	Max
distance to health center	31	3,065.47	2,740.10	103.83	13,529.86
#pharmacies	31	3.23	1.87	1.00	7.00
#towns	31	3.84	7.63	1.00	40.00
density	31	103.18	126.06	3.27	590.64
%young	31	0.14	0.02	0.09	0.18
%old	31	0.10	0.04	0.03	0.18
%foreigners	31	0.07	0.05	0.02	0.22

Table 5.- Impact of competition on distance differentiation (municipalities with 2 or more pharmacies)

	Municipalities No HealthCenter						Municipalities 1 or 2 Health Centers					
	Log mean distance (meters)			Log mean distance (meters)			Log mean distance (meters)			Log mean distance (meters)		
	Coeff.	(Std. Err.)	*t-stat*	Coeff.	(Std. Err.)	*t-stat*	Coeff.	(Std. Err.)	*t-stat*	Coeff.	(Std. Err.)	*t-stat*
constant	6.90	(0.67)	*10.27*	13.83	(1.70)	*8.15*	5.18	(0.84)	*6.20*	7.03	(4.04)	*1.74*
after							0.15	(0.90)	*0.17*	0.39	(0.96)	*0.41*
#pharmacies before							0.57	(0.23)	*2.50*	0.46	(0.21)	*2.24*
#pharmacies after	-0.36	(0.25)	*-1.45*	-0.62	(0.27)	*-2.24*	0.15	(0.06)	*2.40*	0.16	(0.07)	*2.24*
#towns				0.075	(0.033)	*2.30*				-0.10	(0.09)	*-1.08*
density				-0.002	0.001	*-1.78*				-0.001	(0.002)	*-0.54*
%young				-24.68	(5.01)	*-4.93*				-8.77	(17.37)	*-0.50*
%old				-27.59	(8.26)	*-3.34*				-0.44	(15.34)	*-0.03*
%foreigners				-2.33	(5.72)	*-0.41*				-6.45	(5.90)	*-1.09*
F test	36			36			32			32		
Observations	2.1			1.18			9.13			7.09		
R square	0.03			0.36			0.21			0.34		

Table 6.- Distance to closer pharmacy (meters) best prediction

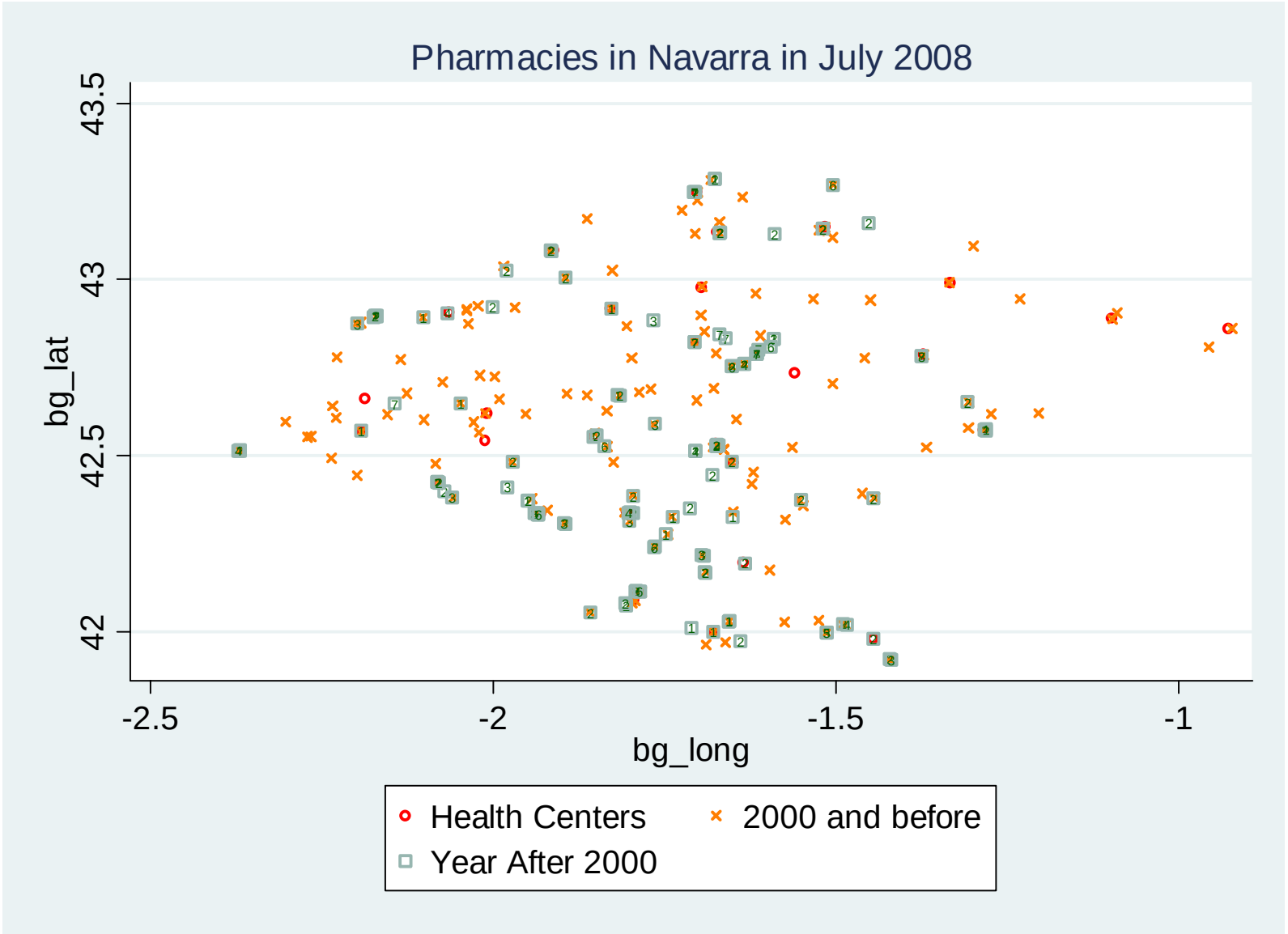
	No Health Center	Health Center	
# of pharmacies	After	Before	After
2	1,962	552	449
3	1,060	878	528
4	572	1,395	622
5	309	2,217	732
6			861
7			1,013
8			1,193
9			1,404
10			1,652
11			1,944
12			2,288
Controls	Yes	Yes	Yes

Table 7.- Impact of competion on distance to health center (all municipaliteis with one health center)

	Log mean distance (meters)			Log mean distance (meters)			Log mean distance (meters)		
	Coeff.	(Std. Err.)	*t-stat*	Coeff.	(Std. Err.)	*t-stat*	Coeff.	(Std. Err.)	*t-stat*
constant	6.32	(0.61)	*10.36*	7.88	(1.24)	*6.33*	9.83	(2.35)	*4.18*
after	1.34	(0.75)	*1.78*	0.81	(1.41)	*0.57*	2.19	(1.57)	*1.39*
#pharmacies before	0.16	(0.32)	*0.51*	-1.76	(1.18)	*-1.49*	-1.14	(1.42)	*-0.80*
#pharmacies after	-0.03	(0.09)	*-0.32*	-0.76	(0.37)	*-2.05*	-1.00	(0.45)	*-2.21*
#pharmacies before^2				0.44	(0.22)	*1.99*	0.36	(0.30)	*1.19*
#pharmacies after^2				0.10	(0.04)	*2.17*	0.14	(0.06)	*2.48*
#towns							-0.021	(0.03)	*-0.81*
density							-0.005	(0.001)	*-4.10*
%young							-4.13	(12.73)	*-0.32*
%old							-14.56	(8.62)	*-1.69*
%foreigners							-5.80	(4.05)	*-1.43*
F test		2.93			2.21			2.12	
Observations		62			62			62	
R square		0.12			0.16			0.29	

Table 8.- Mean distance to health center (meters) best prediction

# of pharmacies	Municipalities with 1 Health Center	
1	1,449	7,088
2	1,373	3,911
3	2,687	2,836
4	10,858	2,702
5		3,383
6		5,566
7		12,032
Impact	Quadratic	Quadratic
Controls	Yes	Yes
Time	Before	After


Pharmacies in Navarra in July 2008
bg_lat
43.5
43
42.5
42
-2.5
-2
-1.5
-1
bg_long
Health Centers
2000 and before
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