

Driving competition in local markets

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Abstract

Relevant market definition is still a key element of economic analysis of competition. It is particularly difficult to handle when competition is local and market power is geographically constrained. We analyse how the application of the hypothetical monopolist or SSNIP test performs for defining isochrones using only information on prices and distance among competitors. We conclude that geographic information systems can be very successfully used to define more precisely relevant geographic markets. Applying the test to petrol stations, we conclude that isochrones in merger and entry regulation cases are usually too large. Localised market power should be taken into account when analysing the adverse effects of mergers and entry regulations in retailing. Only drawing small enough isochrones will drive competition in local markets because it is just close rivals that compete effectively with each other.

Keywords: Competition, Market definition, Geography, Retailing, Gasoline.

JEL Codes: L11, L12, L14, R12.

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1. Introduction

Market definition is a key element for competition policy enforcement, and also for retailing regulations. Although the use of estimation and simulation techniques allows to study market power directly without imposing any market definition, defining markets and studying the degree of concentration will remain as an important policy tool for long (see Brenkers and Verboven, 2005). Estimation and simulation are still depending too much in the assumptions regarding the demand and supply primitives, and also on the equilibrium condition chosen. Estimations and simulation of market power will be used together with more traditional market definition and concentration analysis for the time to come.

Competition authorities are increasingly using a more explicit hypothetical monopolist or SSNIP test to define markets. This test makes more explicit the economic fundamentals of the definition of markets. The US and EU merger guidelines are currently using the SSNIP test to define markets. The test measures to what extent a monopolist would be interested significantly increase prices (by more than a 5%-10%) permanently after getting the ownership of rival firms. If this is so, the products or outlets analysed are in the same relevant market. The aim is to identify the limits within which rivalry has beneficial effects for consumers.

In this paper, we analyse how the application of the hypothetical monopolist or SSNIP test performs for defining markets using information on prices and distance among retail outlets. The competition among petrol stations is a paradigmatic case of competition in local markets. It has the common characteristics of competition among retail outlets. There is a growing interest in defining local markets using isochrones of equal distance time to study rivalry can competition in retailing (Office of Fair Trading 2005, Competition Commission 2003 and Baker 1999). The key issue in the study of local competition is to analyse how large isochrones should be to drive competitors in.

We conclude that geographic information systems can be very successfully used to define more precisely relevant geographic markets. Applying the test to petrol stations, we find that smaller isochrones drive enough competitors in. Local market power is larger than usually thought in competition and retail regulation cases.

After this introductory section, section 2 proposes a method to apply the hypothetical monopolist test to define geographic relevant markets and to draw isochrones taking into account information about actual competition in the market. Section 3 describes the data used in the paper to apply this methodology to the case of competition among petrol stations in roads. Section 4 offers the results of the application of the test to the petrol station case. Section 5 concludes.

2. Hypothetical geographic monopolist test: drawing isochrones

Competition in physical space is a paradigmatic case of product differentiation. Each agent chooses location, and they set prices given the location of competitors. Methods

for analysing product differentiated markets have been developed and increasingly used by competition authorities. Berry (1994) and Berry, Levinshon and Pakes (1993 and 1995) set the framework for analysing empirically these markets. Ivaldi and Verboven (2005) show how they can be used in merger cases.

In these models, each firm (subindex f) maximize profits in a market in which competetes with other firms offering a set of differentiated products $j=1,2,..J$ (outlets, petrol stations in our case). In equilibrium, prices are larger for the products with a smaller own price elasticity ($\partial q_j / \partial p_j$). Additionally, prices are larger when more varieties are offered by each firm in the market (J_f), and whenever the cross price elasticity of the products offered by the same firms is larger ($\partial q_i / \partial p_j$) as it is shown in the system of equilibrium prices obtained from the first order conditions¹:

$$\underset{p}{Max} \quad \pi_f = \sum_{j \in J_f} (p_j - c_j) q_j - F_j$$

$$p_j = c_j + \frac{q_j}{\left| \partial q_j / \partial p_j \right|} + \sum_{i \in J_f} \frac{\partial q_i / \partial p_j}{\left| \partial q_j / \partial p_j \right|} (p_i - c_i)$$

Using this system of equilibrium prices, we can infer the market power of firms that sell more varieties in the market. Ivaldi and Verboven (2005) proponed a hypothetical market power test to analyze a merger proposal among truck firms in Europe using the information available on prices, sales, own and cross elasticities by simulating a model of equilibrium that includes a multinomial nested logit demand system.

We propose a geographic market power test that does not require specifying a demand system. We propose to use only the available information on prices and distances among outlets for defining relevant geographic markets, drawing isochrones.

If we assume that the cross elasticities of demand between each outlet in the relevant market are symmetric, the above equilibrium system of equations might be written as follows:

$$p_j = c_j + \frac{q_j}{\left| \partial q_j / \partial p_j \right|} + (J_f - 1) \frac{\partial q_i / \partial p_j}{\left| \partial q_j / \partial p_j \right|} (p_i - c_i)$$

In this system of equations, equilibrium prices increase with respect to the number of outlets owned by each competitor in the relevant market ($J_f - 1$). Additionally, we might assume that own price elasticity is decreasing with respect the number of outlets of the rivals established in the relevant market (J_f). Therefore, the system of equilibrium prices might be rewritten as a function of the number of rival outlets, the number of owned outlets, other controls (X), an i.i.d. error (ε), and a set of parameters to be estimated (θ).

¹ Equilibrium prices increases with respect to the *diversion ratio* which shows the proportion of sales that divert to some variety in the market as soon as the firm increases the price of any other variety in the market.

$$p_j = f(J_{-f}, J_f, X, \varepsilon; \theta)$$

We propose to estimate the system of equilibrium prices as a function of the number of rival outlets, the number of owned outlets and a set of controls conditioned to defining markets using isochrones of different distance time from 1 minute to 30 minutes.

From these estimations, we obtain 30 different estimates of the coefficient of the variable that shows the impact of the number of rival firms within the isochrones on equilibrium prices. We then define the relevant market using the geographic hypothetical monopolist test: on average the relevant market is the largest isochrone for which the coefficient estimate of the impact of the number of rivals on equilibrium prices is statistically and economically significant, that is, an additional rival within the isochrone decreases prices significantly.

3. Data

The geographic hypothetical monopolist test is very intensive in data requirements. We need to know not only the price of a homogeneous enough product sold at different outlets, but also the geographic location of each outlet, the distance time among all them all, and which outlets are owned by each competing firm.

We are going to use data from all 590 petrol stations open in the roads (not including stations in highways neither stations in cities and suburbs) of Catalonia, a region in the northeast of Spain with around 7 million of inhabitants that has the size of Belgium or Massachussets. Data on regular gasoline prices (unleaded 95 octane) sold at each outlet was obtained for the week around 31st July 2005 from the Ministry of Industry webpage. All petrol stations were geographically located in a graph, and all time distances by road from one petrol station to all other stations were computed (348,100 time distances in total). We identify the brand of the petrol station: that is, the name of the major petrol firm that owned or served by an exclusivity contract to each petrol station using the information provided in the firms' web pages. All petrol stations that are not branded by any major petrol firm are named independents. We also obtained information on traffic density near each petrol station and information on the population around each station from the Catalan Statistical Office (Idescat).

Table 1 shows the distribution of petrol stations by brand and the mean and standard deviation of prices for each firm.

Tabla 1. Number of road petrol stations in roads and average prices by firm

Brand	Number of petrol stations	Mean price	Standard deviation of prices
Repsol	259	1.032	0.009
Cepsa	100	1.029	0.007
Galp	16	1.031	0.011
Petrocat	15	1.029	0.002
Discount (near supermarkets)	10	1.002	0.030
Agip	6	1.030	0.010
BP	1	1.030	-
Others	182	1.025	0.015
Total	590	1.029	0.012

Source: Own calculations from the Ministry of Industry and major petrol firms web pages.

Using this data, we have computed for each petrol station a vector that contains the number of outlets of rival brands with which they compete given any time distance of isochrone going from 1 to 30 minutes. We are assuming that there is not intra-brand competition. We allow competition among any independent petrol station, that is, among any outlet not owned or served under the flag of the big petrol players. It is not clear to what extend stations under an exclusivity contract of the big petrol stations compete with each other. According to Contín, Correljé and Huerta (1998) most petrol stations under contract usually earn a fixed percentage on final prices set by the provider. Therefore, they have little or not room to alter the prices set in a coordinated fashion for all outlets by the brand owner.

Table 2 shows whether we find rivals when we define isochrones of 1 to 30 minutes of time distance from each petrol station in our database, and the mean number of rivals in the isochrones. Table 2 shows the number of markets in which we do not find rival outlets within the isochrones, and in those cases the number of markets in which there is more than one outlet of the same brand.

**Tabla 2. Market structure within isochrones
(distance time in minutes)**

Distance time (minutes)	Number of petrol stations with rivals in the isochrone	Mean number of rivals	Number of petrol stations without rivals nor same brand outlets
1	37	1.03	553
2	113	1.15	477
3	174	1.28	416
4	255	1.62	335
5	309	1.95	281
6	362	2.24	228
7	416	2.58	174
8	442	3.10	148
9	466	3.79	124
10	475	4.34	115
11	495	4.98	95
12	509	5.64	81
13	521	6.49	69
14	530	7.27	60
15	538	8.08	52
16	540	9.15	50
17	547	10.09	43
18	548	11.14	42
19	553	12.27	37
20	556	13.56	34
21	557	14.71	33
22	560	15.90	30
23	560	17.20	30
24	563	18.47	27
25	563	19.97	27
26	567	21.25	23
27	568	22.71	22
28	570	24.15	20
29	573	25.60	17
30	573	27.25	17

Source: Authors' calculations.

4. Results

We have estimated 30 linear regressions to infer the impact of rivalry on equilibrium prices, that is the coefficient α_1 in the following equation:

$$P_i = a_0 + a_1 N_rivals(.)_i + a_2 N_own(.)_i + a_3 MDI_i + \varepsilon_i$$

where $i=1,2,\dots,590$ petrol stations, $N_rivals(.)_i$ is the number of rival outlets within the isochrone of 1 to 30 minutes, $N(1')$, $N(2')$, ..., $N(30')$, and $N_own(.)_i$ is the number of petrol stations of the brand of outlet i within the isochrones. MDI_i is a control variable that measures the Mean Daily Intensity (MDI) of the traffic in the road in which the petrol station is located.

The number of rivals and the number of outlets of the same brand within the isochrone might not be exogenous because in equilibrium we expect the number of outlets to depend on potential demand, costs and the number and variety of brands that are already in the market. We have estimated the previous equations using not only OLS but also instrumental variables techniques using the brand of the nearest rivals and the population of the area of each petrol station as instruments. We have found that results are robust to endogeneity concerns. We have also double checked to what extent the control used in the equation (MDI) might be affecting prices not directly but indirectly through the number of outlets. We find that results are robust to letting MDI to be an instrument of the number of outlets and excluding it from the pricing regressions.

$$P_i = a_0 + a_1 N_rivals(.)_i + a_2 N_own(.)_i + \varepsilon_i$$

Table 3 and 4 show the IV results when $N_rivals(.)$ and $N_own(.)$ are endogenous drivers of prices, and the brand of the closest rival, population and MDI are the instruments of the system. Appendix 1 show the OLS results of the pricing equations including $N_rivals(.)$, $N_own(.)$, and MDI . In all specifications, standard errors are robust to correlation clustered geographically around roads.

Table 3. IV estimates

$$P_i = \alpha_0 + \alpha_1 N_{rivals(i)} + \alpha_2 N_{propias(i)} + \alpha_3 IMD_i + \epsilon_i$$

Observations: 590

Endogenous regressor: N_rivals(.); N_ own(.). **Instruments:** population, dummy brand of closest rival.

	1 minute	2 minutes	3 minutes	4 minutes	5 minutes	6 minutes	7 minutes	8 minutes
Constant	1.024*** (0.0039)	1.022*** (0.0038)	1.02*** (0.0039)	1.021*** (0.0028)	1.02*** (0.0035)	1.02*** (0.0036)	1.023*** (0.0039)	1.022*** (0.0044)
N_rival(.)	-0.0303 (0.0466)	-0.0388* (0.0207)	-0.0369 (0.0258)	-0.018* (0.0094)	-0.0139** (0.006)	-0.0108** (0.0047)	-0.0081** (0.0032)	-0.0063*** (0.0019)
N_ own(.)	0.0202** (0.0093)	0.0264** (0.0134)	0.0257** (0.0117)	0.0158*** (0.006)	0.0134** (0.0054)	0.0104*** (0.0039)	0.0068*** (0.0021)	0.0056*** (0.0019)
IMD	4.92e-08 (7.49e-08)	4.99e-08 (6.74e-08)	5.01e-08 (1.44e-07)	1.65e-08 (7.11e-08)	-2.64e-08 (8.40e-08)	-4.88e-08 (1.01e-07)	-2.82e-08 (7.88e-08)	-4.30e-08 (6.40e-08)
Overidentification Hansen J Statistic	12.002** (0.017)	2.626 (0.622)	2.37 (0.668)	4.981 (0.289)	2.592 (0.628)	2.44 (0.655)	2.231 (0.693)	3.031 (0.553)

	9 minutes	10 minutes	11 minutes	12 minutes	13 minutes	14 minutes	15 minutes	16 minutes
Constant	1.022*** (0.0041)	1.021*** (0.0046)	1.023*** (0.0049)	1.026*** (0.0046)	1.026*** (0.0045)	1.026*** (0.0045)	1.025*** (0.0047)	1.026*** (0.004)
N_rival(.)	-0.0037*** (0.0013)	-0.0032*** (0.0011)	-0.0028*** (0.0009)	-0.0022*** (0.0008)	-0.0018*** (0.0007)	-0.0015*** (0.0005)	-0.0014*** (0.0004)	-0.0011*** (0.0004)
N_ own(.)	0.0038*** (0.0014)	0.0034*** (0.0013)	0.0025*** (0.0011)	0.0016** (0.0009)	0.0014* (0.0007)	0.0011** (0.0006)	0.0011** (0.0005)	0.0008** (0.0004)
IMD	-5.76e-08 (7.31e-08)	-8.77e-08 (8.67e-08)	-2.66e-08 (7.65e-08)	2.67e-08 (7.26e-08)	1.83e-08 (7.26e-08)	1.65e-08 (6.79e-08)	1.36e-08 (6.79e-08)	3.10e-08 (5.95e-08)
Overidentification Hansen J Statistic	7.536 (0.11)	7.35 (0.119)	8.443* (0.077)	13.859*** (0.008)	17.383*** (0.002)	17.906*** (0.001)	16.163*** (0.003)	18.367*** (0.001)

	17 minutes	18 minutes	19 minutes	20 minutes	21 minutes	22 minutes	23 minutes	24 minutes
Constant	1.027*** (0.004)	1.028*** (0.004)	1.028*** (0.004)	1.028*** (0.004)	1.028*** (0.004)	1.028*** (0.004)	1.029*** (0.004)	1.028*** (0.004)
N_rival(.)	-0.0011*** (0.0003)	-0.001*** (0.0003)	-0.0009*** (0.0003)	-0.0009*** (0.0003)	-0.0008*** (0.0002)	-0.0008*** (0.0002)	-0.0007*** (0.0002)	-0.0007*** (0.0002)
N_own(.)	0.0007** (0.0004)	0.0006** (0.0003)	0.0006** (0.0003)	0.0005** (0.0002)	0.0005** (0.0002)	0.0005** (0.0002)	0.0004** (0.0002)	0.0004** (0.0002)
IMD	3.71e-08 (5.97e-08)	4.74e-08 (6.02e-08)	4.77e-08 (5.91e-08)	6.00e-08 (5.85e-08)	5.79e-08 (5.96e-08)	5.87e-08 (6.28e-08)	6.02e-08 (6.40e-08)	5.72e-08 (6.65e-08)
Overidentification Hansen J Statistic	16.609*** (0.002)	16.391*** (0.003)	16.615*** (0.002)	15.662*** (0.004)	14.873*** (0.005)	12.182** (0.016)	12.438** (0.014)	12.481** (0.014)

	25 minutes	26 minutes	27 minutes	28 minutes	29 minutes	30 minutes
Constant	1.028*** (0.004)	1.029*** (0.004)	1.029*** (0.005)	1.029*** (0.005)	1.029*** (0.005)	1.029*** (0.005)
N_rival(.)	-0.0006*** (0.0002)	-0.0006*** (0.0002)	-0.0006*** (0.0002)	-0.0006*** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0001)
N_own(.)	0.0004** (0.0002)	0.0003** (0.0002)	0.0003** (0.0001)	0.0003** (0.0001)	0.0003** (0.0001)	0.0003** (0.0001)
IMD	6.03e-08 (6.79e-08)	7.09e-08 (6.79e-08)	7.18e-08 (7.18e-08)	7.00e-08 (7.08e-08)	6.98e-08 (6.85e-08)	7.31e-08 (7.02e-08)
Overidentification Hansen J Statistic	12.438** (0.014)	12.585** (0.014)	12.48** (0.014)	11.914** (0.018)	12.196** (0.016)	11.881** (0.018)

Standard Errors within parenthesis (* 10%, ** 5%, *** 1%)

Endogenous regressor: N_rivals(.), N_own(.)

Instruments: population, dummy brand of closest rival.

Table 4. IV estimates.

$$P_i = \alpha_0 + \alpha_1 N_rivals(.) + \alpha_2 N_own(.) + \epsilon_i$$

Observations: 590

Endogenous regressor: Nrivales(.), Npropias (.). Instruments: population, dummy brand of closest rival, IMD.

	1 minute	2 minutes	3 minutes	4 minutes	5 minutes	6 minutes	7 minutes	8 minutes
Constant	1.022*** (0.0028)	1.02*** (0.0039)	1.018*** (0.0046)	1.02*** (0.0035)	1.021*** (0.0033)	1.021*** (0.0033)	1.024*** (0.0034)	1.024*** (0.0032)
N_rival(.)	-0.0113 (0.0301)	-0.0334 (0.0216)	-0.0326 (0.0227)	-0.0175* (0.0093)	-0.0141** (0.0061)	-0.0109** (0.0046)	-0.0082*** (0.0031)	-0.0064*** (0.0023)
N_own(.)	0.0239*** (0.0062)	0.0289** (0.0139)	0.0261** (0.012)	0.016*** (0.006)	0.0128*** (0.0046)	0.0095*** (0.0031)	0.0064*** (0.002)	0.0051*** (0.0015)
Overidentification	13.098**	2.883	2.714	4.992	2.717	2.795	2.474	3.613
Hansen J Statistic	(0.022)	(0.718)	(0.744)	(0.417)	(0.744)	(0.732)	(0.78)	(0.606)

	9 minutes	10 minutes	11 minutes	12 minutes	13 minutes	14 minutes	15 minutes	16 minutes
Constant	1.024*** (0.0025)	1.025*** (0.0023)	1.024*** (0.0027)	1.025*** (0.0027)	1.025*** (0.0027)	1.025*** (0.003)	1.024*** (0.003)	1.025*** (0.003)
N_rival(.)	-0.0037*** (0.0013)	-0.0033*** (0.0011)	-0.0028*** (0.001)	-0.0022*** (0.0009)	-0.0018** (0.0007)	-0.0015*** (0.0006)	-0.0014*** (0.0005)	-0.0011*** (0.0004)
N_own(.)	0.0032*** (0.0009)	0.0026*** (0.0007)	0.0023*** (0.0006)	0.0018*** (0.0005)	0.0015*** (0.0005)	0.0012*** (0.0004)	0.0011*** (0.0003)	0.0009*** (0.0003)
Overidentification	9.184	10.427*	8.943	13.737**	17.319***	17.918***	16.164***	18.751***
Hansen J Statistic	(0.102)	(0.064)	(0.111)	(0.017)	(0.004)	(0.003)	(0.006)	(0.002)

	17 minutes	18 minutes	19 minutes	20 minutes	21 minutes	22 minutes	23 minutes	24 minutes
Constant	1.025*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)
N_rival(.)	-0.0011*** (0.0004)	-0.0009*** (0.0003)	-0.0009*** (0.0003)	-0.0008*** (0.0003)	-0.0007*** (0.0002)	-0.0007*** (0.0002)	-0.0007*** (0.0002)	-0.0006*** (0.0002)
N_own(.)	0.0009*** (0.0002)	0.0007*** (0.0002)	0.0007*** (0.0002)	0.0007*** (0.0002)	0.0006*** (0.0002)	0.0006*** (0.0002)	0.0005*** (0.0001)	0.0005*** (0.0001)
Overidentification Hansen J Statistic	17.282*** (0.004)	17.817*** (0.003)	18.144*** (0.003)	17.654*** (0.003)	16.644*** (0.005)	13.674** (0.018)	14.074** (0.015)	13.935** (0.016)

	25 minutes	26 minutes	27 minutes	28 minutes	29 minutes	30 minutes
Constant	1.026*** (0.002)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)	1.026*** (0.003)
N_rival(.)	-0.0006*** (0.0002)	-0.0006*** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0001)
N_own(.)	0.0005*** (0.0001)	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0004*** (0.0001)
Overidentification Hansen J Statistic	13.967** (0.016)	14.643** (0.012)	14.537** (0.013)	13.724** (0.018)	13.809** (0.017)	13.696** (0.018)

Standard Errors within parenthesis (* 10%, ** 5%, *** 1%).

Endogenous regressor: N_rivals(.), N_own(.).

Instruments: population, dummy brand of closest rival, MDI.

As expected, the effect of rivals on equilibrium prices is negative and statistically significant at 1% in most cases. Additionally, as the isochrones get larger the effect of an additional competitor is decreasing. This result shows that the effect of having a close competitor is larger than the effect of having it far away.

Additionally, having more outlets of the same brand around has a positive and significant impact on equilibrium prices. As the number of outlets increases, larger is the market power of a brand.

Traffic intensity (MDI) has a mean positive impact on prices, but the effect is not significant. This result suggests that more traffic makes entry of more competitors likely. Therefore, equilibrium prices do not grow large as new outlets satisfy potential demand. This result suggests that there are not entry barriers preventing entry in profitable markets. It also suggests that MDI should be a good instrument for the number of firms. In both specifications, instruments are not rejected as valid as the over-identification Hansen J test is below the critical values. Instruments are also strong.

Using the estimates of the impact of rivals on equilibrium prices, we have computed the test of geographic hypothetical monopolist: we compute the likely mean increase in prices that would happen if a rival at different time distance is merged with the hypothetical monopolist. We compare then this price increase with the average gross margin of retailing for those markets with rivalry. Gross margins are computed using retail prices and gasoline prices at wholesale in the Mediterranean spot market in July 2005 of regular gasoline (unleaded 95 octane).

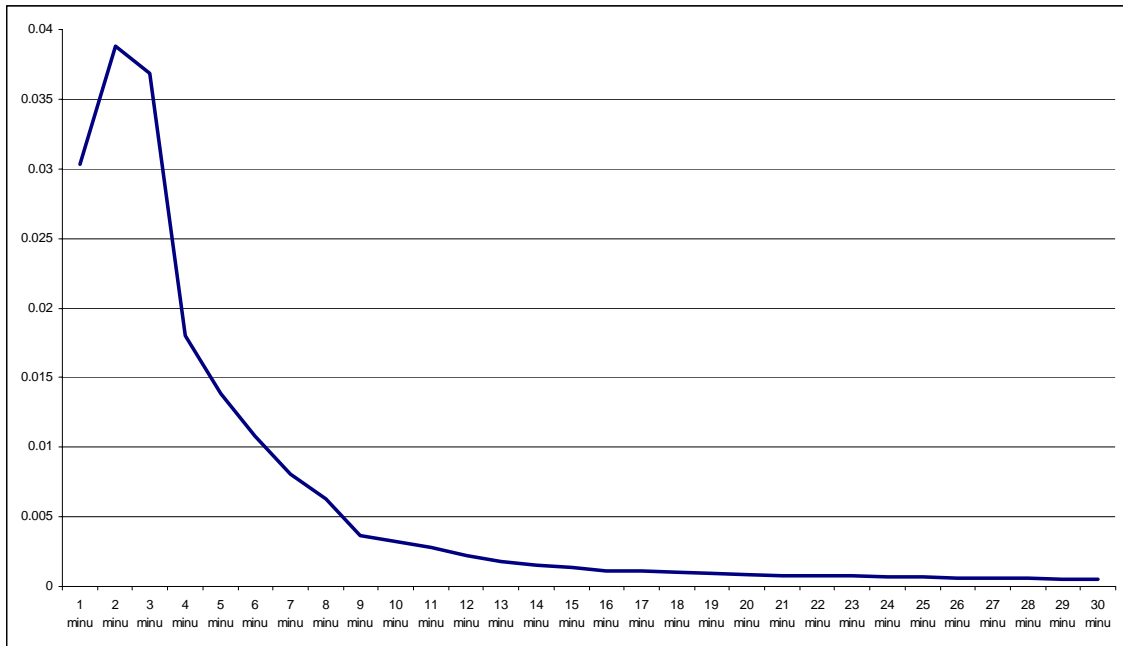
Table 5 show the test results when we include MDI as an exogenous control in the pricing equations for the 1 to 30 isochrones. Column 1 shows the impact of an additional rival on prices at different time distances. Column 2 shows the average retailing gross margin. Column 3 shows the relative impact of monopolization at different isochrones on gross margins. It is clear that the largest market for which monopolization causes a Small (of 5%) but Significant and Non-transitory Increase in Prices (SSNIP) is the one defined by an isochrone of 7 minutes of distance time.

Table 5. Increase in prices by the hypothetical monopolist with MDI as pricing control

Minutes	1 Price effect of rivals in the market (€)	2 Average gross retailing margin (markets with rivals, €)	1/2 = 3 Relative price effect of monopolization (%)
1	-0.0303054	0.1548178	19.57%
2	-0.0388045	0.1540163	25.20%
3	-0.036888	0.1553494	23.75%
4	-0.0180089	0.1548046	11.63%
5	-0.0138833	0.1548782	8.96%
6	-0.0108216	0.1547349	6.99%
7	-0.0080826	0.1547613	5.22%
8	-0.0062572	0.1547106	4.04%
9	-0.0036709	0.1545558	2.38%
10	-0.0032386	0.1545095	2.10%
11	-0.0027839	0.1544775	1.80%
12	-0.0022382	0.1545387	1.45%
13	-0.0018202	0.1544553	1.18%
14	-0.0015236	0.1544415	0.99%
15	-0.0013751	0.1544884	0.89%
16	-0.0011425	0.1543906	0.74%
17	-0.0011056	0.1544115	0.72%
18	-0.0009993	0.1544075	0.65%
19	-0.0009373	0.1543299	0.61%
20	-0.0008746	0.1543045	0.57%
21	-0.0007939	0.1543007	0.51%
22	-0.0007727	0.1543203	0.50%
23	-0.0007404	0.1543203	0.48%
24	-0.0006944	0.1542524	0.45%
25	-0.0006481	0.1542524	0.42%
26	-0.0006195	0.1542988	0.40%
27	-0.0005888	0.1543103	0.38%
28	-0.000578	0.1543044	0.37%
29	-0.0005418	0.1543236	0.35%
30	-0.0005065	0.1543236	0.33%

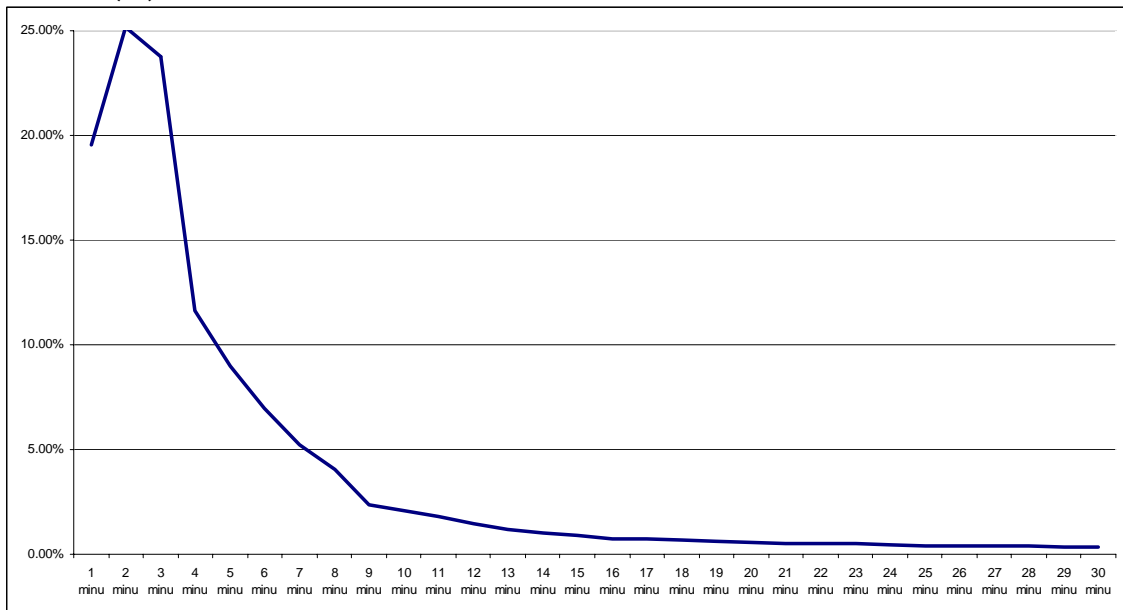
Source: Authors' calculations.

Graph 1. Increase in prices by the hypothetical monopolist with MDI as pricing control (€)



Source: Authors' calculations.

Graph 2. Increase in prices by the hypothetical monopolist with MDI as pricing control (%)



Source: Authors' calculations.

Grapas 1 and 2 show how the effect of monopolization is decreasing as the isochrone grows larger, and it crosses the 5% threshold in 7 minutes.

Table 6 show the same results using the traffic intensity control (MDI) as an instrument for the number of outlets rather than a pricing control.

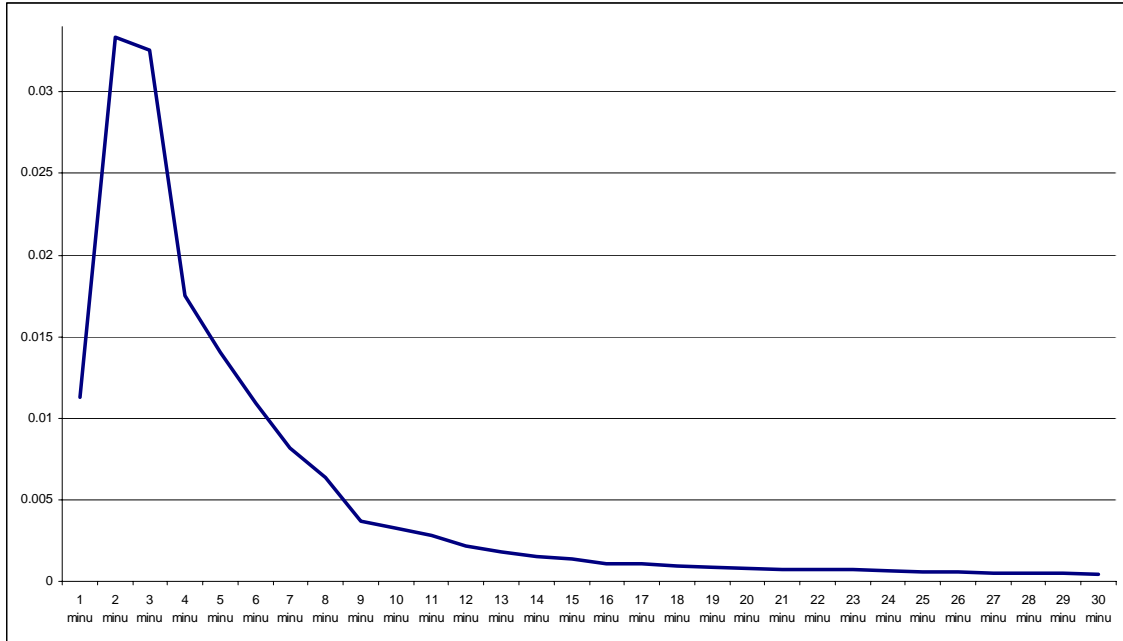
Table 6. Increase in prices by the hypothetical monopolist with MDI as instrument of the number of outlets

Minutes	1 Price effect of rivals in the market (€)	2 Average gross retailing margin (markets with rivals, €)	1/2 = 3 Relative price effect of monopolization (%)
1	-0.0113198	0.1548178	7.31%
2	-0.0333773	0.1540163	21.67%
3	-0.0325715	0.1553494	20.97%
4	-0.0174991	0.1548046	11.30%
5	-0.0140684	0.1548782	9.08%
6	-0.0109069	0.1547349	7.05%
7	-0.0081865	0.1547613	5.29%
8	-0.0063656	0.1547106	4.11%
9	-0.0037109	0.1545558	2.40%
10	-0.0032876	0.1545095	2.13%
11	-0.0028038	0.1544775	1.82%
12	-0.002176	0.1545387	1.41%
13	-0.0017859	0.1544553	1.16%
14	-0.0014938	0.1544415	0.97%
15	-0.0013564	0.1544884	0.88%
16	-0.0011059	0.1543906	0.72%
17	-0.0010614	0.1544115	0.69%
18	-0.0009411	0.1544075	0.61%
19	-0.000885	0.1543299	0.57%
20	-0.000811	0.1543045	0.53%
21	-0.0007324	0.1543007	0.47%
22	-0.0007174	0.1543203	0.46%
23	-0.0006905	0.1543203	0.45%
24	-0.0006485	0.1542524	0.42%
25	-0.0005994	0.1542524	0.39%
26	-0.0005586	0.1542988	0.36%
27	-0.0005282	0.1543103	0.34%
28	-0.0005215	0.1543044	0.34%
29	-0.0004896	0.1543236	0.32%
30	-0.0004537	0.1543236	0.29%

Source: Authors' calculations.

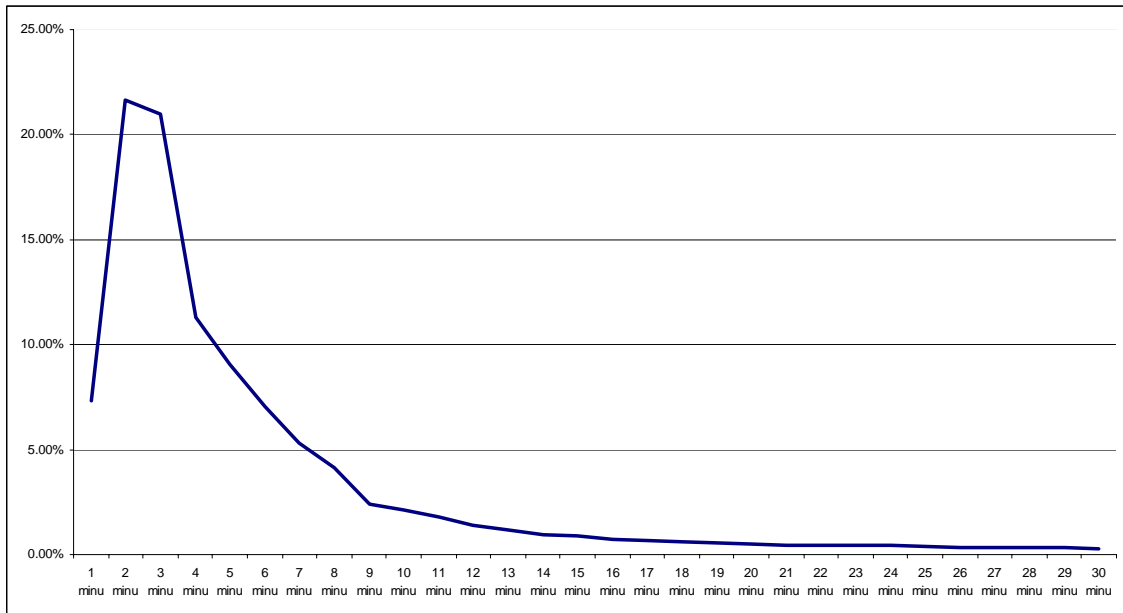
Figures 3 and 4 show again the marginal effect of monopolization on retail gross margins. We obtain again a market definition of 7 minutes within which rivalry have an economically significant impact on prices.

Graph 3. Increase in prices by the hypothetical monopolist with MDI as instrument of the number of outlets (€)



Source: Authors' calculations.

Graph 4. Increase in prices by the hypothetical monopolist with MDI as instrument of the number of outlets (%)



Source: Authors' calculations.

6. Concluding remarks

Geographic market definitions in merger and entry regulations tends to be too large to take into account that competition is only effective if it is close enough. Traditional analysis of geographic markets has relied on techniques such as price correlations or chain of substitutions that are not able to spot how interaction among outlets is depleted by distance.

We conclude that geographic information systems can be very successfully used to define more precisely relevant geographic markets. In the case of the petrol stations, we show that relevant markets are those isochrones of only 7 minutes car travel around each petrol station. Within each isochrone, without competition it is easy to exert localised market power. Only drawing small enough isochrones will drive competition local markets in because it is just close rivals that compete effectively with each other.

Referentes.

Argentesi, E., y Ivaldi, M. (2005) "Market Definition in the Printed Media Industry: Theory and Practice" *Discussion Paper Series CEPR*, N°5096.

Audy, E. Y Erutku, C. (2005) "Price Test to Define Markets: An Application to Wholesale Gasoline in Canada" *Journal of Industry, Competition and Trade*, Vol. 5. Issue 2. pp. 137-54.

Baker, J. (1999) "Econometric Analysis in FTC v. Staples", *Journal of Public Policy and Marketing*, 18:1, Spring, 11-21.

Berry, S. (1994) "Estimating Discrete-Choice Models of Product Differentiation" *Rand Journal of Economics*, Vol. 25. Issue 2. pp. 242-62.

Berry, S., Levinshon, J., y Pakes, A. (1995) "Automobile Prices in Market Equilibrium" *Econometrica*, Vol. 63. Issue 4. pp. 841-90.

Borenstein, S., y Shepard, A. (1996) "Dynamic Pricing in Retail Gasoline Markets" *Rand Journal of Economics*, Vol. 37. Issue 3. pp. 429-51.

Borrell, JR., y Perdiguero, J. (2007) *La Competència en la distribució de gasolina a Catalunya*. Tribunal Català de Defensa de la Competència. Generalitat de Catalunya.

Brekens, R., y Verboven, F. (2005) "Market Definition with Differentiated Products- Lessons from the Car Market" *Discussion Paper Series CEPR*, N° 5249.

Competition Commission (2003) "Safeway plc and Asda Group Limited: A Report on the Mergers in Contemplation", September.

CNE (2002) *Cronología del Sector Petrolero Español*, Dirección de Petróleo, Comisión Nacional de Energía, Madrid.

Contin, I., Correljé, A., y Huerta, E. (1998) "Estrategias de Fijación de Precios en el Mercado Español de la Gasolina (1990-1997). Factores Explicativos" *Economía Industrial*, N° 321. pp. 35-46.

Dobbs, I.M. (2003) "Demand, Cost Elasticities and Pricing Benchmarks in the Hypothetical Monopoly Test: The Consequences of a Simple SSNIP" *Applied Economics Letters*, Vol. 10. pp. 545-48.

Ivaldi, M., y Lörincz, S. (2005) "A Full Equilibrium Relevant Market Test: Application to Computer Servers" IDEI Working Papers N° 341.

Ivaldi, M., y Verboven, F. (2005) "Quantifying the Effects from Horizontal Mergers in European Competition Policy" *International Journal of Industrial Organization*, Vol. 23. Issue 9-10. pp. 669-91.

Jiménez, J., y Perdiguero, J. (2006) "¿Competencia o colusión en el mercado gasolina? Una aproximación a través del parámetro de conducta" *mimeo*.

Klein, C., Rifkin, E., y Noel, U. (1985) "A Note on Defining Geographic Markets" *Regional Science and Urban Economics*, Vol. 15. pp. 109-19.

Office of Fair Trading (1999) "Quantitative Techniques in Competition Analysis". *Research Paper OFT*, N° 17.

Office of Fair Trading (2005) "Acquisition by Terra For,a Investments (GP) 2 Ltd of United Cinemas International (UK) Limited and Cinema International Corporation (UK) Limited."

Markovits, R. (2002) "On the Inevitable Arbitrariness of Market Definitions" *Antitrust Bulletin*, Vol. 77. Issue 4. pp. 571-601.

Meyer, D. W. y Fischer, J.H (2004) "The Economics of Price Zones and Territorial Restrictions in Gasoline Marketing" *Federal Trade Commission Working Paper*, N° 271.

Motta, M. (2004) *Competition Policy. Theory and Practice*. Cambridge University Press, Cambridge y Nueva York.

Pakes, A., Berry, S., y Levinshon, J. (1993) "Applications and Limitations of Some Recent Advances in Empirical Industrial Organization: Price Indexes and the Analysis of Environmental Change" *American Economic Review*, Vol. 83. Issue 2. pp. 241-46.

Pleatsikas, Ch., y Teece, D. (2001) "The Analysis of Market Definition and Market Power in the Context of Rapid Innovation" *International Journal of Industrial Organization*, Vol. 19. Issue, 5. pp. 665-93.

Radecki, L. (2000) "Competition in Shifting Product and Geographic Markets" *Antitrust Bulletin*, Vol. 45. Issue 3. pp. 571-613.

Rey, P., y Stiglitz, J. (1995) "The Role of Exclusive Territories in Producers' Competition" *Rand Journal of Economics*, Vol.26, N° 3. pp. 431-51.

Slade, M.E. (1986) "Exogeneity Test of Market Boundaries Applied to Petroleum Products" *Journal of Industrial Economics*, Vol. 34.

Slade, M.E. (1992) "Vancouver's Gasoline-Price Wars: An Empirical Exercise in Uncovering Supergame Strategies" *Review of Economics Studies*, Vol. 59. Issue 4. pp. 257-76.

Stock, J.H., y Yogo, M. (2002) "Testing for Weak Instruments in Linear IV Regression" *NBER Technical Workin Paper, Series* N°. 284.

Uri, N., y Rifkin, E. (1985) "Geographic Markets, Causality and Railroad Deregulation" *The Review of Economics and Statistics*, Vol. 67. Issue 3. pp. 422-28.

Verboven, F. (2001) "Testing for "Monopoly" Market Power when Products are Differentiated in Quality" *The Manchester School – Special Issue on Industrial Organization*, Vol. 70. Issue 1, pp. 115-33.

Apéndice 1.

Tabla 7. Resultados econométricos. Estimación por variables instrumentales.

Ecuación estimada: $P_i = \alpha_0 + \alpha_1 \text{Nrivales}(\cdot)_i + \alpha_2 \text{Npropias}(\cdot)_i + \alpha_3 \text{IMD}_i + \varepsilon_i$ **N° de observaciones: 590**

Variable endógena: $\text{Nrivales}(\cdot)_i$; **Instrumentos:** población, variables dummy de la marca rival más cercana

	1 minute	2 minutes	3 minutes	4 minutes	5 minutes	6 minutes	7 minutes	8 minutes
Constante	1.029*** (0.0016)	1.032*** (0.002)	1.028*** (0.003)	1.027*** (0.0013)	1.028*** (0.0013)	1.029*** (0.0016)	1.031*** (0.0018)	1.032*** (0.002)
Nrivales(.)	-0.0339 (0.0312)	-0.0316** (0.0146)	-0.0041 (0.0124)	-0.00006 (0.0023)	-0.0017 (0.0018)	-0.0019 (0.0016)	-0.0031** (0.0013)	-0.0026** (0.0011)
Npropias(.)_i	0.0002 (0.0014)	0.0044** (0.0019)	0.0017 (0.0026)	0.0012 (0.0018)	0.0018 (0.0017)	0.002 (0.0017)	0.0029* (0.0016)	0.003** (0.0015)
IMD_i	1.11e-07* (5.67e-08)	1.86e-07** (8.22e-08)	9.42e-08 (8.48e-08)	6.39e-08* (3.71e-08)	9.60e-08** (4.17e-08)	1.05e-07** (4.42e-08)	1.49e-07*** (5.25e-08)	1.46e-07*** (5.49e-08)

	9 minutes	10 minutes	11 minutes	12 minutes	13 minutes	14 minutes	15 minutes	16 minutes
Constante	1.032*** (0.0017)	1.033*** (0.0018)	1.033*** (0.0018)	1.034*** (0.0021)	1.034*** (0.0022)	1.034*** (0.0022)	1.034*** (0.0021)	1.034*** (0.0021)
Nrivales(.)	-0.002*** (0.0008)	-0.0021*** (0.0007)	-0.0019*** (0.0006)	-0.0019*** (0.0006)	-0.0016*** (0.0005)	-0.0014*** (0.0005)	-0.0012*** (0.0004)	-0.001*** (0.0003)
Npropias(.)_i	0.003** (0.002)	0.0036** (0.0016)	0.0035** (0.0015)	0.0039*** (0.0015)	0.0039** (0.0016)	0.0036** (0.0017)	0.0033** (0.0016)	0.0029* (0.0016)
IMD_i	1.43e-07*** (5.27e-08)	1.48e-07*** (5.69e-08)	1.57e-07*** (5.76e-08)	1.74e-07*** (6.59e-08)	1.68e-07** (6.60e-08)	1.63e-07** (6.38e-08)	1.61e-07*** (5.90e-08)	1.53e-07*** (5.72e-08)

	17 minutes	18 minutes	19 minutes	20 minutes	21 minutes	22 minutes	23 minutes	24 minutes
Constante	1.034*** (0.0022)	1.035*** (0.002)	1.035*** (0.002)	1.035*** (0.0022)	1.035*** (0.0022)	1.035*** (0.0022)	1.035*** (0.0022)	1.035*** (0.0023)
Nrivaes(.)	-0.00096*** (0.0003)	-0.00089*** (0.0003)	-0.0008*** (0.0003)	-0.00073*** (0.0002)	-0.00068*** (0.0002)	-0.00065*** (0.0002)	-0.00059*** (0.0002)	-0.00055*** (0.0002)
Npropias(.)_i	0.0029** (0.0015)	0.0027* (0.0015)	0.0025* (0.0014)	0.0025* (0.0014)	0.0024* (0.0013)	0.0022* (0.0013)	0.0021 (0.0013)	0.0021 (0.0013)
IMD_i	1.61e-07*** (6.14e-08)	1.64e-07*** (6.21e-08)	1.63e-07*** (6.35e-08)	1.68e-07*** (6.46e-08)	1.69e-07*** (6.60e-08)	1.71e-07** (6.82e-08)	1.71e-07** (6.87e-08)	1.70e-07** (6.96e-08)

	25 minutes	26 minutes	27 minutes	28 minutes	29 minutes	30 minutes
Constante	1.035*** (0.0024)	1.035*** (0.0025)	1.036*** (0.0026)	1.036*** (0.0026)	1.036*** (0.0026)	1.036*** (0.0027)
Nrivaes(.)	-0.00051*** (0.00014)	-0.00048*** (0.00013)	-0.00047*** (0.00013)	-0.00045*** (0.00012)	-0.00042*** (0.00011)	-0.0004*** (0.00011)
Npropias(.)_i	0.002 (0.0013)	0.002 (0.0013)	0.002 (0.0013)	0.0019 (0.0013)	0.0019 (0.0013)	0.0018 (0.0013)
IMD_i	1.72e-07** (7.08e-08)	1.74e-07** (7.23e-08)	1.79e-07** (7.51e-08)	1.80e-07** (7.54e-08)	1.79e-07** (7.42e-08)	1.86e-07** (7.59e-08)

Error Estándar entre paréntesis. (* 10%, ** 5%, *** 1)

Tabla 8. Resultados econométricos. Estimación por variables instrumentales.

Ecuación estimada: $P_i = \alpha_0 + \alpha_1 N_{rival}(\cdot)_i + \alpha_2 N_{propias}(\cdot)_i + \varepsilon_i$

Nº de observaciones: 590

Variable endógena: $N_{rival}(\cdot)_i$; **Instrumentos:** población, variables dummy de la marca rival más cercana, IMD_i

	1 km	2 km	3 km	4 km	5 km	6 km	7 km	8 km
Constante	1.027*** (0.0013)	1.028*** (0.0014)	1.026*** (0.0017)	1.026*** (0.0013)	1.027*** (0.0013)	1.027*** (0.0014)	1.028*** (0.0014)	1.028*** (0.0015)
N_{rival}(.)	0.0181 (0.0217)	0.0012 (0.008)	0.0057 (0.0057)	0.0033 (0.0022)	0.0015 (0.0015)	0.001 (0.0012)	0.0001 (0.0008)	0.0001 (0.0007)
N_{propias}(.)_i	0.0018 (0.0013)	0.0012 (0.002)	0.0005 (0.002)	0.0002 (0.002)	0.0006 (0.002)	0.0008 (0.002)	0.0013 (0.0016)	0.0013 (0.0016)

	9 km	10 km	11 km	12 km	13 km	14 km	15 km	16 km
Constante	1.029*** (0.0015)	1.029*** (0.0016)	1.03*** (0.0015)	1.03*** (0.0016)	1.03*** (0.0017)	1.03*** (0.0017)	1.03*** (0.0017)	1.03*** (0.0017)
N_{rival}(.)	-0.0002 (0.0006)	-0.0003 (0.0005)	-0.0004 (0.0004)	-0.0003 (0.0004)	-0.0003 (0.0004)	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0003 (0.0002)
N_{propias}(.)_i	0.0015 (0.0016)	0.0018 (0.0016)	0.002 (0.0015)	0.002 (0.0016)	0.002 (0.0016)	0.002 (0.0016)	0.002 (0.0016)	0.002 (0.0016)

	17 km	18 km	19 km	20 km	21 km	22 km	23 km	24 km
Constante	1.03*** (0.0017)	1.03*** (0.0017)	1.03*** (0.0018)	1.03*** (0.0017)	1.03*** (0.0017)	1.03*** (0.0016)	1.03*** (0.0017)	1.03*** (0.0017)
Nrivaes(.)	-0.0003 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.00015)	-0.0002 (0.0001)	-0.00019* (0.0009)	-0.00016 (0.0001)	-0.00014 (0.0001)
Npropias(.)_i	0.002 (0.0015)	0.002 (0.0015)	0.002 (0.0015)	0.002 (0.0014)	0.002 (0.0013)	0.0018 (0.0013)	0.0017 (0.0013)	0.0017 (0.0013)

	25 km	26 km	27 km	28 km	29 km	30 km
Constante	1.03*** (0.0017)	1.03*** (0.0017)	1.03*** (0.0018)	1.03*** (0.0018)	1.03*** (0.0018)	1.03*** (0.0018)
Nrivaes(.)	-0.00013 (0.0001)	-0.00011 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Npropias(.)_i	0.0017 (0.0013)	0.0016 (0.0013)	0.0016 (0.0013)	0.0016 (0.0013)	0.0016 (0.0013)	0.0016 (0.0013)

Error Estándar entre paréntesis. (* 10%, ** 5%, *** 1%)

Variable endógena: Nrivaes(.),

Instrumentos: población, IMD_i, variables dummy de las marcas rivales

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