RESUMEN AMPLIADO

Título: Retail fuel prices and competition in local markets. Evidence from Spain

Autores y e-mails: Jacint Balaguer (coll@uji.es) and Jordi Ripollés (jripolle@uji.es)

Departamento: Economía

Universidad: Universitat Jaume I

Área Temática: Sostenibilidad urbana y de los territorios, recursos naturales, energía y medio ambiente

Palabras Clave: Competition, retail prices, transportation fuel, multimarket contact, Spain.

Clasificación JEL: L13; Q41; Q48.

Resumen: *(mínimo 1500 palabras)*

1. Introduction

A great amount of literature in industrial organization agrees that firms' behavior depends on factors concerning their local market. Indeed, the most traditional spatial competition models (e.g. Hotelling, 1929; Salop, 1979) consider that firms compete with their neighboring rivals. Inspired by these models, the economic theory currently provides different predictions about the linkage between firms' behavior and their local competition, which are critically dependent on the underlying assumptions. For instance, the conventional models based on monopolistic competition predicts lower prices as the number of close rivals increases (e.g., Chamberlain, 1933, Perloff and Salop, 1985; Carlson and McAfee, 1983; Anderson and De Palma, 2005). In contrast, the opposite result could arise under alternative considerations, such as the presence of captive consumers by well-positioned brands (Rosenthal, 1980) or the existence of increasing consumers' search costs as the density of rivals increase (e.g., Salop and Stiglitz, 1977; Varian, 1980). These models, however, are restrictive and often unrealistic when firms operate in multiple geographic markets. That is, companies do not only compete against their neighboring rivals, but can also interact with the same rivals simultaneously in other

markets. In this sense, Edwards (1955) extends the traditional point of view derived from the theories of localized competition, hypothesizing that the intensity of competition in a local market can also depend on the contacts in other markets. The reasoning behind this is that multimarket firms may compete less aggressively against a rival in one market if they fear retaliations by that rival in other markets. Therefore, repeated contacts between firms could reduce the local competition due to a mutual forbearance. Several works, such as Bernheim and Whinston (1999), Spagnolo (1999), or Sorenson (2007), have consistently provided theoretical support at this regard.

An increasing number of researches has been concerned with empirically examining the competition-price nexus, especially in those industries where regulatory authorities may be interested in designing measures capable of encouraging an efficient pricing behavior. They generally support that local markets served by firms with extensive multimarket contacts tends to exhibit higher prices in many industries, including airlines (Evans and Kessides, 1994; Ciliberto and Williams, 2014), telecommunications (Parker and Roller, 1997; Busse, 2000), advertisements (Waldfogel and Wulf, 2006), cement (Jans and Rosenbaum, 1996), grocery (Aalto-Setälä. 2002), hotels (Fernández and Marín, 1998; Silva, 2015), and banking (Coccorese and Pellecchia, 2013). Interestingly, some of these papers also highlight that neglecting the degree of multimarket contact could mislead the empirical assessment of channels through which competition can influence prices (e.g., Fernández and Marín, 1998; Coccorese and Pellecchia, 2013).

The transportation fuel industry is possibly one of the industries that has received more attention from researchers to empirically evaluate the relationship between sellers agglomeration and prices in the light of the traditional theories of localized competition. Along with the obvious economic importance of the sector, one of the main reasons for this interest is that fuel can be considered homogenous across the spatially-differentiated sellers, which matches well with the assumptions of many of models, as remarked by Barron et al., (2004). Indeed, today we have a great deal of evidence supporting that greater number of petrol stations in the local market pushes retail fuel prices down (e.g., Marvel, 1976; Shepard, 1993; Clemenz and Gugler, 2003; Barron, et al., 2004; Lewis, 2008; Perdiguero and Borrell, 2019). However, from our knowledge, there is surprisingly no available article in the empirical literature that combines the analysis of local market with the degree of the firms' multimarket contact, although oil companies simultaneously sell their fuel in multiple local markets.

In this paper we attempt to fill the gap by studying how retail prices respond to local market structure and the degree of firm's multimarket contact in the Spanish fuel industry. In turn, this analysis can be also useful for exploring the consequences of neglecting the degree of multimarket contact in the classical empirical framework oriented at estimating the effects of local agglomeration of petrol stations on retail fuel prices.

The paper is organized as follows. While Section 2 presents the econometric specification, the dataset and definitions of variables are discussed in Section 3. Finally, the estimation strategy and the expected empirical results are presented in Section 4.

2. Econometric specification

The multimarket contact hypothesis can be tested by using the following specification:

$$log(p_{it}) = \beta_1 MMC_{{it}_2} + \beta_2 N_{it}^R + \beta_3 N_{it}^O + \alpha_i + \lambda_t + u_{it} \qquad (1)$$

where the natural logarithm of retail prices (net of taxes) fixed by seller $i = 1, \dots, N$ in period $t = 1, \dots, T$ can be explained by the degree of firms' multimarket contact, MMC_{it}, and features of the local market where firm is operating, such as the number of rivals, N_{it}^R, and the number of own-brand firms, N_{it}^O. Additionally, we also insert as regressors individual and time fixed effects, which allow us to control for non-observed firm-specific and time-varying factors, respectively. Finally, u_{it} is the error term.

The interpretation of parameters is straightforward. On the one hand, when firms with higher multimarket contact charge higher prices, $\beta_1 > 0$ in accordance to Edwards' hypothesis. On the other hand, the coefficient associated to N_{it}^R (N_{it}^O) indicates the effect of local density of rivals (own-brand firms) on prices.

3. Data and empirical design

For this study, we count with detailed information on quarterly prices on diesel, coordinates and brand identity for all petrol stations operating in the Spanish Peninsula from 2011 to 2016.[1] The resulting dataset, which have been collected from the Hydrocarbons Geoportal of the Spanish Ministry of Industry, Trade and Tourism (www.geoportalgasolineras.es), comprises information for a maximum of 10,876 petrol stations during 20 quarters.

In order to conduct our empirical analysis based on Eq. (1), we need to define the relevant local market as precisely as possible. In doing so, we take as a reference the empirical paper of Perdiguero and Borrell (2019), whose results indicate that the relevant geographic market in the Spanish fuel sector is delineated by a 5-min driving-time isochrone around each station. Hence, considering the coordinates information of our dataset, we define 5-min isochrones surrounding each sampled station by using the Open Source Routing Machine service (www.project-osrm.org), based on the optimal car route in roads networks available at OpenStreetMap.

Regarding the degree of the firms' multimarket contact, similarly to the empirical strategy followed by Evans and Kessides (1994) and Jans and Rosenbaum (1996), we construct three different measures from our dataset. For the purpose, as a starting point it is necessary to determine which brands actively operate in each market. To do this, in every period of time we build a JxK matrix **D** denoting the geographical distribution of firm's brands, whose generic elements d_{jk} indicate the number of active sellers associated to brand $j = 1, \dots, J$ that set prices in each market $k = 1, \dots K$. Then, from this matrix we can construct the JxK binary matrix **U** with the elements $u_{jk} = 1$ if $d_{jk} > 0$, and $u_{jk} = 0$ otherwise.

[1] While prices are expressed in quarterly average terms, the remaining information (i.e., coordinates and brands) is referred to the first day of each period.

Our first measure of multimarket contact, $MMC1_k$, is the average number of contacts in all markets outside k per contact in market k, concerning the brands operating in this market. To build this measure, considering the above definitions we create a JxJ matrix $\mathbf{A} = \mathbf{U} \cdot \mathbf{U}'$, where each off-diagonal element $a_{lm} = \sum_{k=1}^{K} u_{lk} u_{mk}$ represents the number of markets where brands l and m meet, while the diagonal elements a_{kk} denote the number of markets where brand j operates. From this matrix, we compute $MMC1_k$ as:

$$MMC1_k = \frac{\sum_{l=1}^{J-1} \sum_{m=l+1}^{J} a_{lm} u_{lk} u_{mk} - f_k (f_k - 1)2}{f_k (f_k - 1)2} \quad (2)$$

where f_k is the number of brands operating in market k, and $f_k (f_k - 1)2$ the total number of pairings between these brands.

Our second measure of firms' multimarket contact, denoted as $MMC2_j$, takes into consideration the relative presence of brands in each market (in percentage terms). To develop this second measure, we define for each market k a JxJ matrix $\mathbf{B}^{(k)}$ with the elements $b_{lm}^{(k)} = \sum_{p \neq k} u_{lp} u_{mp} (ms_{lp} + ms_{mp})$, which represent the sum of brand j's market shares (in terms of number of stations) in markets $p \neq k$ in which they meet. Then, we can compute $MMC2_k$ as the average sum of market shares in markets outside k per contact in the same markets, concerning the brands operating in market k:

$$MMC2_k = \frac{\sum_{l=1}^{J-1} \sum_{m=l+1}^{J} b_{lm}^{(k)} u_{lk} u_{mk}}{\sum_{l=1}^{J-1} \sum_{m=l+1}^{J} a_{lm} u_{lk} u_{mk} - f_k (f_k - 1)2} \quad (3)$$

Finally, our third measure, $MMC3_k$, takes into account the concentration indexes (ranging from 0 to 1) in each market. In this last case we construct for each market k a JxJ matrix $\mathbf{C}^{(k)}$, whose elements $c_{lm}^{(k)} = \sum_{p \neq k} u_{lp} u_{mp} HHI_p$ represent the Herfindahl-Hirschman characterizing the markets $p \neq j$ in which brands l and m meet. Then, we calculate $MMC3_k$ as the average HHI in markets outside k per contact in the same markets:

$$MMC3_k = \frac{\sum_{l=1}^{J-1} \sum_{m=l+1}^{J} c_{lm}^{(k)} u_{lk} u_{mk}}{\sum_{l=1}^{J-1} \sum_{m=l+1}^{J} a_{lm} u_{lk} u_{mk} - f_k (f_k - 1)2} \quad (4)$$

4. Methodology

Given that retail prices and local market features could be simultaneously determined, we estimate Eq. (1) by two-stage least squares (2SLS) to prevent potential endogeneity. For this purpose, exploiting our panel data information, we instrument the number of rivals and the number of own-brand firms by their own lagged values (e.g., Evans et al., 1993; Reed, 2015). Moreover, similarly to other researches on the area (e.g., Clemenz and Gugler, 2009), we also employ a city-specific population as an instrumental variable of the changes in the number of sellers. In the estimation procedure we have applied the standard errors of Driscoll and Kraay (1998), which are robust to heteroscedasticity, serial correlation and general forms of cross-sectional dependence.

Our results can be useful for determining in which degree the above-described theories on multimarket contact are accomplished in the analyzed fuel sector. Moreover, they can be also useful for regulatory authorities, which could be interested in knowing to what extent the multimarket contact may be behind the high retail prices (net of taxes) that currently exist in the Spanish fuel industry.

References

Aalto-Setälä, V. (2002). The effect of concentration and market power on food prices: evidence from Finland. *Journal of Retailing*, *78*(3), 207-216.

Anderson, S. P., & De Palma, A. (2005). Price dispersion and consumer reservation prices. Journal of Economics & Management Strategy, 14(1), 61-91.

Barron, J. M., Taylor, B. A., & Umbeck, J. R. (2004). Number of sellers, average prices, and price dispersion. International Journal of Industrial Organization, 22(8-9), 1041-1066.

Bernheim, B. D., & Whinston, M. D. (1999). Anticompetitive exclusion and foreclosure through vertical agreements. CORE.

Busse, M. R. (2000). Multimarket contact and price coordination in the cellular telephone industry. Journal of Economics & Management Strategy, 9(3), 287-320.

Carlson, J. A., & McAfee, R. P. (1983). Discrete equilibrium price dispersion. Journal of Political Economy, 91(3), 480-493.

Chamberlain, E. (1933). The theory of monopolistic competition. Cambridge, MA 59.

Ciliberto, F., & Williams, J. W. (2014). Does multimarket contact facilitate tacit collusion? Inference on conduct parameters in the airline industry. The RAND Journal of Economics, 45(4), 764-791.

Clemenz, G., & Gugler, K. (2009). Locational choice and price competition: some empirical results for the Austrian retail gasoline market. In Spatial Econometrics (pp. 223-244).

Coccorese, P., & Pellecchia, A. (2013). Multimarket contact, competition and pricing in banking. Journal of International Money and Finance, 37, 187-214.

Edwards, C. D. (1955). Conglomerate bigness as a source of power. In Business concentration and price policy (pp. 331-359). Princeton University Press.

Evans, W. N., & Kessides, I. N. (1994). Living by the “golden rule”: Multimarket contact in the US airline industry. The Quarterly Journal of Economics, 109(2), 341-366.

Fernandez, N., & Marin, P. L. (1998). Market power and multimarket contact: Some evidence from the Spanish hotel industry. The Journal of Industrial Economics, 46(3), 301-315.

Hotelling, H. (1929). Stability in Competition. Economic Journal 239, pp. 41-57.

Jans, I., & Rosenbaum, D. I. (1997). Multimarket contact and pricing: Evidence from the US cement industry. International Journal of Industrial Organization, 15(3), 391-412.

Lewis, M. (2008). Price dispersion and competition with differentiated sellers. The Journal of Industrial Economics, 56(3), 654-678.

Marvel, H. P. (1976). The economics of information and retail gasoline price behavior: an empirical analysis. Journal of Political Economy, 84(5), 1033-1060.

Parker, P. M., & Röller, L. H. (1997). Collusive conduct in duopolies: multimarket contact and cross-ownership in the mobile telephone industry. *The RAND Journal of Economics*, 304-322.

Perdiguero, J., & Borrell, J. R. (2019). Driving competition in local markets with near-perfect substitutes: an application on the Spanish retail gasoline market. Empirical Economics, 57(1), 345-364.

Perloff, J. M., & Salop, S. C. (1985). Equilibrium with product differentiation. The Review of Economic Studies, 52(1), 107-120.

Rosenthal, R. W. (1980). A model in which an increase in the number of sellers leads to a higher price. Econometrica: Journal of the Econometric Society, 1575-1579.

Salop, S., & Stiglitz, J. (1977). Bargains and ripoffs: A model of monopolistically competitive price dispersion. The Review of Economic Studies, 44(3), 493-510.

Salop, S.C. (1979). Monopolistic competition with outside goods. Bell Journal of Economics 8, pp. 141-156.

Shepard, A. (1993). Contractual form, retail price, and asset characteristics in gasoline retailing. The RAND Journal of Economics, 58-77.

Sorenson, T. L. (2007). Credible collusion in multimarket oligopoly. Managerial and Decision Economics, 28(2), 115-128.

Spagnolo, G. (1999). On interdependent supergames: multimarket contact, concavity and collusion. Concavity and Collusion (March 17, 1999).

Varian, H. R. (1980). A model of sales. The American Economic Review, 70(4), 651-659.

Waldfogel, J., & Wulf, J. (2006). Measuring the effect of multimarket contact on competition: Evidence from mergers following radio broadcast ownership deregulation. The BE Journal of Economic Analysis & Policy, 5(1).