18th International Scientific Conference "Enterprise and the Competitive Environment", March 5–6, 2015, Brno, Czech Republic

Local price competition: Evidence from the Czech retail gasoline market

Michal Kvasnička[1], Rostislav Staněk[2] and Ondřej Krčál[3]

[1] *Department of Economics, Faculty of Economics and Administration, Masaryk University, Lipová 41a, 602 00 Brno, Czech Republic, e-mail: michal.kvasnicka@econ.muni.cz*
[2] *Department of Economics, Faculty of Economics and Administration, Masaryk University, Lipová 41a, 602 00 Brno, Czech Republic, e-mail: rostanek@mail.muni.cz*
[3] *Department of Economics, Faculty of Economics and Administration, Masaryk University, Lipová 41a, 602 00 Brno, Czech Republic, e-mail: krcalo@mail.muni.cz*

Abstract

We analyze the effect of local competition on prices in the retail gasoline market in the Czech Republic. Our analysis suggests that spatial clustering of gas stations of the same brand increases the equilibrium prices. Using a flexible measure of local density, we also find that the number of competing stations in the proximity of a station reduces its price and that the effect fades out with the distance.

Keywords: gasoline prices, local competition, spatial clustering

1. Introduction

The gasoline market is an ideal place to study local competition thanks to a large variability in local competitive conditions in most national markets. This is due to large variability in population density between urban and rural areas that results in different density of gasoline stations (Clemenz and Gugler, 2006). Disparities in market power of individual stations can be further accentuated by local clustering of stations of the same brand (Pennerstorfer and Weiss, 2013). The analysis of local competition is further facilitated by the relative homogeneity in quality of gasoline and service provided by different stations. For this reason, there is a relatively large empirical literature studying the impact of local competition on gasoline prices in North America and Western Europe (Hastings, 2004; Eckert & West 2004; Chouinard and Perloff, 2007; Taylor and Hosken, 2007; Simpson and Taylor, 2008; Houde 2012; Van Meerbeeck, 2003; Pennerstorfer and Weiss 2013). To our knowledge, this is the first study of local competition in retail gasoline market in the Czech Republic.

In advanced economies, gasoline markets are among the most important retail markets in terms of consumer spending, which motivates the interest of competition authorities to promote competition in these markets (e.g. Bundeskartellamt 2011, 2014; FTC, 2011). In many countries, the local competitive conditions in gasoline industry have undergone substantial changes, mainly through acquisitions and mergers in the industry. While several studies find evidence that changes in local market conditions induced by mergers or acquisitions affect gasoline prices at the retail level (e.g. Hastings, 2004, Houde, 2012, Pennerstorfer and Weiss, 2013), others do not find any significant impact on prices (Taylor and Hosken, 2007, Simpson and Taylor, 2008, Taylor et al. 2010).

In this paper, we use this data to study local market competition in the Czech gasoline market using station-level price data reported to the collection site Pumpdriod by the drivers or gas stations. In particular, we examine the effects of the density of competing stations in the local market, using a new flexible measure of local density, and spatial clustering (SC) of gas stations of the same brand, using the SC measure of Pennerstorfer and Weiss (2013). We find the expected effects: Gasoline prices increase as spatial clustering rises and local market density decreases.

The rest of the paper is organized as follows. Section 2 surveys the existing studies and discusses the design of our research. Section 3 provides a short characterization of the Czech gasoline retail industry and a presentation of our data set. Section 4 reports results of the regression analysis. Section 5 concludes.

2. Literature review and research design

This paper builds on the literature that explores localized competition and price dispersion in gasoline markets. Since Eckert (2013) provides an excellent survey of the relevant literature, our review will focus only on measures of local competition, which is the aspect of literature related to this paper's main contribution.

There are four main types of measures of local competition used in the literature. The first type are measures of local density of gasoline stations that include the number of stations within a certain radius (e.g. Barron et al., 2004; Hosken et al., 2008), number of stations per km^2 in a local market (e.g. Van Meerbeeck, 2003; Clemenz and Gugler, 2006; Chouinard and Perloff, 2007), and the distance to the closest station (e.g. Barron et al., 2004; Cooper and Jones, 2007; Hosken et al., 2008). The second type measures the presence of a certain type of gasoline stations (usually independent or branded) in the local market (e.g. Van Meerbeeck, 2003; Hastings, 2004; Sen, 2005; Hosken et al., 2008; Pennerstorfer and Weiss, 2013). The third type includes concentration measures such as one- and four-firm concentration ratio or Hirschman-Herfindahl index (e.g. Sen, 2003, 2005; Clemenz & Gugler, 2006). Finally, the fourth type measures local clustering of gasoline stations. Van Meerbeeck (2003) uses a dummy variable that indicates whether a station of the same brand is located in the same local market. Pennerstorfer and Weiss (2013) introduce a more sophisticated measure of spatial clustering (SC) calculated from a network of Thiessen polygons.

We combine three measures of local competition: spatial clustering (SC) measure of Pennerstorfer and Weiss (2013), the distance to the closest competitor (i.e. station of a different brand), and the number of competing stations within certain distance ranges. The SC_i measures the degree to which the local market of station i consists of adjacent stations of the same brand (clusters). The measure decreases with the number of

Thiessen neighbors if station *i* and increases with the size of cluster of station *i* or its neighbors. The measure of spatial clustering, however, accounts neither for immediate competition nor for the density of the local market. The SC measure is therefore complemented by the distance to the closest competitor which should capture the effect of nearby competition, in particular for the frequent case of a competing station located right across the street. Local market density is measured as a number of competitors within specific distance ranges using both driving distance and great-circle distance (as the crow flies). The main advantage of this measure is that it does not assume any specific definition of local market, as is common in the literature.[1] Instead, it enables us to have local markets of different sizes and to differentiate the intensity of competition from surrounding gas stations by the distance.

3. Data

The total number of gasoline stations in the Czech Republic in 2014 was 7,013. Out of these, 3,792 were gasoline stations with public access. After excluding all public stations where gasoline (Natural 95) is not served, the number of gasoline stations falls to 2,782 (MPO 2014). We use data from Pumpdroid—a Czech mobile application that provides its users with information on gas stations and their prices.[2] Pumpdroid collects data through crowdsourcing from its users. Pumpdroid keeps track of 2,657 gas stations in the Czech Republic now. Its database records include the following variables:

- gas station's identification number assigned internally by Pumpdroid,
- gas station's brand name,
- gas station's location (latitude and longitude),
- date of observation,
- type of fuel (we use only Natural 95 within the present study), and
- price of gasoline in CZK per liter.

In the present study, we aim to explore how the local competition among the nearby gas stations influences their prices. To simplify the analysis, we have confined ourselves to the period of October 2014 when no takeovers or other ownership changes took place. We use the average gasoline price[3] for each gas station within this time period as the explained (dependent) variable to solve two problems: 1) various brands may not react to changes in the gasoline wholesale price simultaneously and 2) since our data originate in crowdsourcing, we cannot be certain that timing of each price change is recorded accurately in our data. The use of average prices alleviates these problems and

---

[1]For instance Shepard (1993) and Hastings (2004) assumes a fixed distance of 1 mile, Barron et al. (2004), Hosken et al. (2008) 1.5 miles, Pennerstorfer (2009) 15.5 km; the definition of Houde (2012) is based on three driving distance buffers and a discrete measure based on the connectivity of stations on the road network; Van Meerbeeck (2003) defines local markets as municipalities, Sen (2003, 2005) as cities, and Clemenz and Gugler (2006) as districts.

[2]The application is available both for Android and iOS. Google claims that it has been downloaded more than 100,000 times (the published range is from 100,000 to 500,000) on February 2015. The application's official web page is http://www.pumpdroid.com/.

[3]It seems that most Pumpdroid users submit new information about prices only after the price changes. It means there are gaps in each gas station's time series. However, these gaps have no economic consequences because the price stays the same when the data are missing. Moreover, we know from casual observation of other data sources on gasoline prices that most stations do not change their prices very often and there are hardly ever any spikes in their prices. For this reason, we substitute the missing data with the last available information when computing the price averages.

also simplifies the analysis since the resulting data are cross-sectional. Thus our observations correspond to average prices of Natural 95 in October 2014 on individual gas stations in the Czech Republic.

We add several measures of competition to our data—three measures of local competition density and a measure of spatial clustering. First, we measure number of competitors within a local market defined by the distance as the crow flies. The usual approach is to count all competing stations within a circle of some diameter. However, this seems too coarse: 1) the diameter must be set ad hoc and 2) it seems likely that closer competitors affect a station's price more than more distant competitors. We use a more flexible approach: we calculate the number of the competing stations within concentric annuli (rings) and estimate regression parameters for all these statistics. The first annulus includes competitors within the great-circle distance up to 1 km from the studied station, the second annulus includes the competitors within the great-circle distance up to 2 km from the studied station which are not included in the first annulus, and so forth. The great-circle distances among the stations are calculated from the locations provided by Pumpdroid.

Second, we construct similar measures for the driving distances. We again count the number of competing stations within several concentric rings but we use the driving distances instead of the great-circle distances. Thus the first ring includes competitors with the driving distance lower than 1 km from the studied station, the second ring includes competitors with the driving distance lower than 2 km from the studied station which are not counted in the first ring, and so forth. The driving distances between the stations are the fastest driving routes obtained from Google via the Google Maps API. Note that the distances are asymmetric: the distance from station A to station B is not in general equal to the distance from station B to station A.

Third, for the sake of completeness, we calculate the great-circle distance to the closest competitor for each gas station.

Fourth, we calculate the spatial clustering measure introduced by Pennerstorfer and Weiss (2013). The measure is motivated by the intuition of the Salop model that a firm in a spatial context can be somewhat protected from its competitors if its immediate neighbors are branches of the same company. The firm, its neighbors, and their neighbors can raise their prices. The spatial clustering measure is constructed in the following way: 1) We partition the landscape into Voronoi polygons (also called Thiessen polygons or Dirichlet tessellation). 2) We construct clusters of polygons of the same brand. Each cluster consists of all polygons with common borders which you can connect by a pencil stroke without touching any polygon of a competing firm. 3) For each station i, we calculate number of clusters M_i that touch the station i's polygon including the polygon of the station i itself, the number k_{m_i} of stations in each cluster m_i, and number of all stations N_i whose polygon has a common border with the polygon of station i including station i itself. The spatial clustering measure of station i is then $\mathrm{SC}_i = \sum_{m_i}(k_{m_i}/M_i)/N_i$. If each Voronoi neighbor of station i belongs to a different brand which is also different from the brand of station i, then $\mathrm{SC}_i = 1/N_i$. If all Voronoi neighbors of station i belong to the same brand as station i, then $\mathrm{SC}_i = 1$.

When calculating all these measures of the local competition, we assume 1) that each brand is independent (i.e. there are no holdings that own several brands and set their prices in such a way that these brands do not compete with each other) and 2) that each brand sets prices on all its stations jointly (however, local pricing is allowed). In other words, we assume that two stations of the same brand never compete with each other, i.e. they are not counted as competitors in competition density measures, but they may be part of the same cluster in the spatial clustering measure. Two stations of different brands always compete with each other, i.e. are counted as competitors in competition density measures, but they cannot be a part of the same cluster in the computation clustering measure.

We also add some controls in our data. First, we control for the city size. We have individual dummies for three biggest Czech cities, Prague, Brno, and Ostrava, and common dummies for cities from 100,000 to 300,000 inhabitants and towns from 20,000 to 50,000 inhabitants and from 50,000 to 100,000 inhabitants. Second, we control for stations located on highways and expressways outside the cities and towns. The data on stations' locations in cities, towns, and on roads are obtained from Google via the Google Maps API. We also control for brand names. We add 27 individual dummies for brands with at least 10 gas stations. The other brands are the contrast.

For econometric modeling, we omit observations with less than three price observations within the explored period of October 2014. Thus the used data set consists of 2,108 observations. However, the omitted stations are used in calculating all the measures of competitions.

4. Results

Since Moran test indicates presence of spatial effects, we estimate spatial error models (SEM). The spatial weights in our models decrease with the great circle distance between a station and its neighbor, and are zero beyond 20 km. Specifically, the weight (before normalization) is $1/d_{ij}$ if $d_{ij} < 20$ km, or zero if $d_{ij} \geq 20$ km where d_{ij} is the distance between station i and its potential neighbor j. All models are estimated on the cross-sectional data discussed in the previous section. The dependent variable is the average price of Natural 95 on individual gas stations in the Czech Republic in October 2014. In all models, we control for brand names (not reported in the regression tables to save the space), city size, and highways and expressways. The intercept of the model can be interpreted as the average gasoline price in the country controlled for the local competition and the above mentioned controls.

The explanatory variables of interests are the measures of competition. We use the following coding:

- $\mathrm{NGCDC}(\mathrm{d}_0, \mathrm{d}_1)$ stands for the number of competitors within great-circle distance between d_0 and d_1 km from a station,
- $\mathrm{NDDC}(\mathrm{d}_0, \mathrm{d}_1)$ stands for the number of competitors within driving distance between d_0 and d_1 km from a station,
- GCDCC stands for the great-circle distance to the closest competitor from a station, and
- SC stands for the spatial clustering measure of a station.

The parameter estimates of our models are presented in Tables 1 and 2. Table 1 includes the number of competitors within the great-circle distance $\mathrm{NGCDC}(d_0, d_1)$ statistics, Table 2 includes the number of competitors within the driving distance $\mathrm{NDDC}(d_0, d_1)$ statistics. The individual models differ in the way in which the inner radius d_0 and the outer radius d_1 of these statistics are set and the statistics are transformed.

Table 1: SEM models of the average gasoline price. NGCDC stands for the number of competitors within rings with radius measured in great-circle distances. GCDCC stands for the great-circle distance to the closest competitor. SC stands for the spatial clustering measure.

	(1)	(2)	(3)	(4)
NGCDC(0,1)	−0.040** (0.016)	−0.040** (0.016)	−0.046*** (0.016)	−0.045*** (0.016)
NGCDC(1,2)	−0.014 (0.009)			
NGCDC(2,3)	−0.010 (0.007)			
NGCDC(3,4)	−0.003 (0.007)			
NGCDC(4,5)	0.002 (0.007)			
NGCDC(1,3)		−0.012** (0.005)		
NGCDC(3,5)		−0.0004 (0.004)		
log2 NGCDC(1,3)			−0.039* (0.020)	
log2 NGCDC(3,5)			−0.006 (0.017)	
sqrt NGCDC(1,3)				−0.048** (0.021)
sqrt NGCDC(3,5)				−0.006 (0.018)
GCDCC	0.013* (0.008)	0.013* (0.008)	0.008 (0.009)	0.007 (0.009)
SC	0.668*** (0.173)	0.665*** (0.173)	0.674*** (0.173)	0.672*** (0.173)
highways and expressways	0.457*** (0.080)	0.457*** (0.080)	0.455*** (0.080)	0.455*** (0.080)
Praha	0.504*** (0.116)	0.506*** (0.116)	0.488*** (0.107)	0.504*** (0.110)
Brno	0.776*** (0.147)	0.778*** (0.147)	0.782*** (0.148)	0.790*** (0.148)
Ostrava	0.260* (0.147)	0.258* (0.147)	0.270* (0.150)	0.275* (0.149)
cities 100–300	0.008 (0.124)	0.005 (0.124)	0.017 (0.128)	0.023 (0.127)
towns 50–100	0.098 (0.075)	0.095 (0.075)	0.108 (0.080)	0.112 (0.078)
towns 20–50	0.080 (0.060)	0.079 (0.060)	0.094 (0.062)	0.095 (0.061)
intercept	35.992*** (0.060)	35.992*** (0.060)	36.031*** (0.069)	36.037*** (0.068)
Observations	2,108	2,108	2,108	2,108
$sigma^2$	0.319	0.319	0.319	0.319
Akaike Inf. Crit.	3,777.336	3,773.582	3,774.986	3,773.534
Note:	** p<0.1; ** p<0.05;* *** p<0.01			

Let us discuss the measures of local competition density first. Models (1) in both tables show the impact of the number of competitors within the individual rings with the annuli width of 1 km (i.e. $d_1 - d_0 = 1$). Only the parameters of first (several) rings are statistically significant. However, we can see the expected pattern: the sign of the parameters is almost always negative and their absolute values decrease with the rising distance. Moreover, it seems that the absolute values of the parameters decrease the less the farther the ring is (i.e. the impact of the number of competitors on the gasoline price is decreasing and convex). This seems intuitive. Some customers are not very price-sensitive, i.e. they prefer the closest gas stations. These customers strongly prefer a station one kilometer away to a station two kilometres away. Other customers are more price-sensitive. Gas stations within a radius of many kilometers are good substitutes for them. If there were only two groups of customers, we would expect a sharp drop of the absolute value of the parameter and leveling up beyond some distance. If the customers' price sensitivity differed continuously, we would expect a decreasing convex relationship between the absolute value of the parameters and the distance.

Consequently, some neighboring rings have similar parameters---especially the farther rings (e.g.NDDC(4,5), NDDC(5,6), NDDC(7,8), and NDDC(8,9)). This suggests that the annulus width of 1 km may not be the best one and it would be better to merge several rings together. This might also improve the statistical significance of the parameters since the standard errors of the parameters of the narrow rings are inflated because the numbers of competitors within neighboring rings are correlated—the correlation is the higher the narrower are the rings.

Table 2: SEM models of the average gasoline price. NDDC stands for the number of competitors within rings with radius measured in driving distances. GCDCC stands for the great-circle distance to the closest competitor. SC stands for the spatial clustering measure.

	(1)	(2)	(3)	(4)
NDDC(0,1)	−0.062** (0.030)			
NDDC(1,2)	−0.079*** (0.025)			
NDDC(2,3)	−0.050** (0.022)			
NDDC(3,4)	−0.047** (0.022)			
NDDC(4,5)	−0.035 (0.021)			
NDDC(5,6)	−0.018 (0.021)			
NDDC(6,7)	−0.018 (0.020)			
NDDC(7,8)	−0.024 (0.020)			
NDDC(8,9)	−0.023 (0.020)			
NDDC(0,2)		−0.074*** (0.019)		
NDDC(2,4)		−0.049*** (0.016)		
NDDC(4,9)		−0.025** (0.010)		
log2 NDDC(0,2)			−0.111*** (0.025)	
log2 NDDC(2,4)			−0.085*** (0.022)	
log2 NDDC(4,9)			−0.053*** (0.020)	
sqrt NDDC(0,2)				−0.126*** (0.027)
sqrt NDDC(2,4)				−0.100*** (0.025)
sqrt NDDC(4,9)				−0.062*** (0.023)
GCDCC	0.005 (0.008)	0.005 (0.008)	−0.004 (0.008)	−0.006 (0.008)
SC	0.660*** (0.173)	0.660*** (0.172)	0.660*** (0.172)	0.657*** (0.172)
highways and expressways	0.432*** (0.080)	0.429*** (0.080)	0.413*** (0.080)	0.407*** (0.080)
Praha	0.441*** (0.092)	0.444*** (0.092)	0.449*** (0.092)	0.447*** (0.092)
Brno	0.753*** (0.141)	0.756*** (0.141)	0.762*** (0.140)	0.761*** (0.140)
Ostrava	0.236* (0.143)	0.239* (0.142)	0.253* (0.142)	0.254* (0.142)
cities 100–300	0.020 (0.122)	0.020 (0.121)	0.033 (0.121)	0.035 (0.120)
towns 50–100	0.105 (0.074)	0.105 (0.073)	0.116 (0.073)	0.115 (0.073)
towns 20–50	0.085 (0.059)	0.083 (0.059)	0.095 (0.059)	0.096 (0.058)
intercept	36.077*** (0.067)	36.088*** (0.066)	36.162*** (0.071)	36.183*** (0.072)
Observations	2,108	2,108	2,108	2,108
$sigma^2$	0.316	0.316	0.315	0.314
Akaike Inf. Crit.	3,769.182	3,758.609	3,748.315	3,745.548

Note: ** p<0.1; ** p<0.05; *** p<0.01*

Models (2) in both tables have the rings with similar parameters merged. The overall pattern can be clearly seen now: the number of competitors lowers the prices but the effect decreases with the distance in both cases. The parameters of the number of competitors in rings of the great-circle distance (NGCDC) are statistically significant up to 3 km, the parameters of the number of competitors in rings of the driving distance (NDDC) are statistically significant up to at least 9 km. Models (3) and (4) are motivated by the intuition that the relative impact of the number of competitors within a ring on the prices may be concave in the number of competitors, i.e. the impact of the first competitor may be higher than an impact of the second competitor, and so forth. To test it, we use two concave transformations of the NGCDC and NDDC statistics: their logarithms and square roots. Qualitatively, the models behave the same. As for their fit (measured by the residual standard errors and Akaike's information criterion), it systematically improves only when the radius is measured for the driving distance. The square root transformation seems slightly better.

Overall, the number of competitor within rings with the radius measured in the driving distance outperforms the number of competitors within rings with the radius measured in the great-circle distance: the absolute values of the parameters of the former models are always higher, their statistical significance is better of the same, and they are significant for a longer distance. In contrast, the great-circle distance to the closest competitor (GCDCC) is a much weaker measure of the local competition density. Even though it has the expected sign in all the models, it is statistically significant only in models (1) a (2) in Table 1 (only on 10% significance level); it is never statistically significant when the number of competitors is measured with the driving distance (which is other sign of the superiority of this measure). In other words, it does not provide any measure independent from the previous approaches.

On the other hand, the spatial clustering measure (SC) is a surprisingly robust measure—its parameter is almost identical in all our models. The spatial clustering thus measures a different aspect of local competition than the density measures—they complement each other.

As for the other controls, we found that gas stations located on highways and express ways and in big cities are ceteris paribus more expensive than other stations. The higher prices in cities could be perhaps explained by higher costs of land and labor there. What we cannot explain is why Brno, the second largest city in the Czech Republic, has ceteris paribus higher gasoline prices than Prague since the land prices and labor costs are lower in Brno than in Prague.

Acknowledgements

We thank Mr. Marcel Matula of Pumpdriod for kindly providing us with the data. This paper was created as a part of the specific research project no. MUNI/A/1203/2014 at Masaryk University.

References

BARRON, J. M., TAYLOR, B. A. and UMBECK, J. R. (2004). Number of sellers, average prices, and price dispersion. *International Journal of Industrial Organization 22*(8): 1041–1066.

BUNDESKARTELLAMT 2011, Fuel Sector Inquiry, Final Report, May 2011 – Summary. Available at http://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Sector%20Inquiries/Fuel%20Sector%20Inquiry%20-%20Final%20Report.pdf?__blob=publicationFile&v=14 [Accessed: 10 February 2015].

BUNDESKARTELLAMT 2014, Ein Jahr Markttransparenzstelle für Kraftstoffe (MTS-K): Eine erste Zwischenbilanz. Available at http://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Ein_Jahr_MTS-K.pdf?__blob=publicationFile&v=4 [Accessed: 10 February 2015].

CHOUINARD, H. H., and PERLOFF, J. M. 2007. Gasoline price differences: Taxes, pollution regulations, mergers, market power, and market conditions. *The BE Journal of Economic Analysis & Policy*, *7*(1) Article 8. Available at: http://www.bepress.com/bejeap/ vol7/iss1/art8.

CLEMENZ, G. and GUGLER, K. 2006. Locational choice and price competition: Some empirical results for the Austrian retail gasoline market. *Empirical Economics* 31(2): 291–312.

COOPER, T. E. and JONES, J. T. (2007). Asymmetric competition on commuter routes: the case of gasoline pricing. *Southern Economic Journal* 74: 483–504.

ECKERT, A. and WEST, D. S. 2004. A tale of two cities: Price uniformity and price volatility in gasoline retailing. *The Annals of Regional Science* 38(1): 25–46.

FTC 2011, Gasoline Price Changes and the Petroleum Industry: An Update, Available at http://www.ftc.gov/sites/default/files/documents/reports/federal-trade-commission-bureau-economics-gasoline-price-changes-and-petroleum-industry-update/federal-trade-commission-bureau-economics-gasoline-price-changes-and-petroleum-industry.pdf [Accessed: 10 February 2015].

HASTINGS, J. S. 2004. Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California. *American Economic Review* 94(1), 317–328.

HOSKEN, D. S., MCMILLAN, R. S. and TAYLOR, C. T. 2008. Retail gasoline pricing: What do we know? *International Journal of Industrial Organization* 26(6): 1425–1436.

HOUDE, J. F. 2012. Spatial differentiation and vertical mergers in retail markets for gasoline. *The American Economic Review* 102(5): 2147–2182.

MPO 2014, Zpráva o aktualizaci a stavu. Evidence čerpacích stanic pohonných hmot v ČR k 31. 12. 2014. Available at http://www.mpo.cz/errmsg/error-lang.html . [Accessed: 11 February 2015].

PENNERSTORFER, D. 2009. Spatial price competition in retail gasoline markets: evidence from Austria. *The Annals of Regional Science* 43(1): 133–158.

PENNERSTORFER, D. and WEISS, C. 2013. Spatial clustering and market power: Evidence from the retail gasoline market. *Regional Science and Urban Economics* 43(4): 661–675.

SEN, A. 2003. Higher prices at Canadian gas pumps: international crude oil prices or local market concentration? An empirical investigation. *Energy Economics* 25(3): 269–288.

SEN, A. 2005. Does increasing the market share of smaller firms result in lower prices? Empirical evidence from the Canadian retail gasoline industry. *Review of Industrial Organization* 26(4): 371–389.

SHEPARD, A. 1993. Contractual form, retail price, and asset characteristics in gasoline retailing. *The RAND Journal of Economics* 24: 58–77.

SIMPSON, J. and TAYLOR, C. 2008. Do gasoline mergers affect consumer prices? The Marathon Ashland petroleum and Ultramar Diamond Shamrock transaction.*Journal of Law and Economics* 51(1): 135–152.

TAYLOR, C. T. and HOSKEN, D. S. 2007. The economic effects of the Marathon–Ashland joint venture: the importance of industry supply shocks and vertical market structure. *The Journal of Industrial Economics* 55(3): 419–451.

TAYLOR, C. T., KREISLE, N. M. and ZIMMERMAN, P. R. 2010. Vertical relationships and competition in retail gasoline markets: Empirical evidence from contract changes in Southern California: Comment. *The American economic review* 100(3): 1269–1276.

VAN MEERBEECK, W. 2003. Competition and local market conditions on the Belgian retail gasoline market. *De Economist* 151(4): 369–388.