MAGYAR TUDOMÁNYOS AKADÉMIA
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MŰHELYTANULMÁNYOK **DISCUSSION PAPERS**

MT-**DP – 2011/18**

Separating the ex post effects of mergers: an analysis of structural changes on the Hungarian retail gasoline market

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BUDAPEST, 2011

Discussion papers
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May 2011

ISBN 978-615-5024-54-2
ISSN 1785 377X

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Abstract

This paper develops an empirical method to identify the price effects of simultaneous mergers and to separate the different effects on the prices of the buyer and seller firms and on the prices of their respective competitors. Our difference-in-differences approach exploits variation in the presence of merging firms across local markets to form different treatment-control group pairs in order to estimate separate effects for each type of firms affected by the mergers.

We apply this method to provide an ex post evaluation of two almost simultaneous mergers in the Hungarian retail gasoline market. We show that both mergers resulted in a significantly positive but economically negligible price effect, but while the first merger affected only the prices of buyer firm's stations, the second had an effect on the prices of seller's stations and of its competitors. We also demonstrate that the results are not sensitive to the assumed dates when the mergers effectively change the firms' pricing policy.

Keywords: ex post evaluation, mergers, difference-in-differences estimation, treatment effects, retail gasoline

JEL Classification: D43, L13, L49

Acknowledgement:

We would like to thank Pierre Dubois, Daniel Hosken, Gábor Kézdi, Aliz McLean, David Meyer, Massimo Motta, Damien Neven, Patrick Rey and participants of the 2009 ZEW Evaluation of Competition Policy conference (Mannheim), the 2009 EARIE Conference (Ljubljana), the 2009 RNIC Conference (Vienna) and seminars at the Barcelona Graduate School of Economics, Copenhagen Business School, DIW Berlin and Toulouse School of Economics for insightful comments. This research was partly funded by OTKA grant 73777. The views expressed are those of the authors only, and should not be interpreted as the opinion of the Hungarian Competition Authority (GVH) or the European Commission.

Összefonódások ex post hatásainak szeparálása: magyar benzinpiaci strukturális változások értékelése

Csorba Gergely – Koltay Gábor – Farkas Dávid

Összefoglaló

A tanulmány az azonos időben történő összefonódások árhatásainak identifikálására, az összefonódásoknak a felvásárló, a felvásárolt vállalat és versenytársaik áraira gyakorolt hatásainak szeparálására ad egy empirikus módszert. Panelbecslési megközelítésünk a fuzionáló cégek különböző piaci jelenlétét használja fel az egyes lokális piacokon ahhoz, hogy különböző kontrollcsoportokat alkosson, és így szeparálni tudja a különböző hatásokat.

Ezt a módszert a magyar benzinpiacon végbement két összefonódás ex post értékelésére használjuk fel. Kimutatjuk, hogy mindkét fúziónak pozitív hatása volt az árakra, de ennek nagysága elhanyagolható volt. Ugyanakkor az egyik fúziónak csak a felvásárló vállalat áraira volt hatása, míg a másik esetében a hatás kimutatható a felvásárolt cég és versenytársainak áraiban. Ezek az eredmények nem érzékenyek arra, hogy mely időponttól tételezzük fel, hogy a fúziók ténylegesen megváltoztatják a vállalatok árazási politikáját.

Tárgyszavak: ex post értékelés, összefonódások, panelbecslések, hatásértékelés, kiskereskedelmi üzemanyagpiacok

JEL kódok: D43, L13, L49

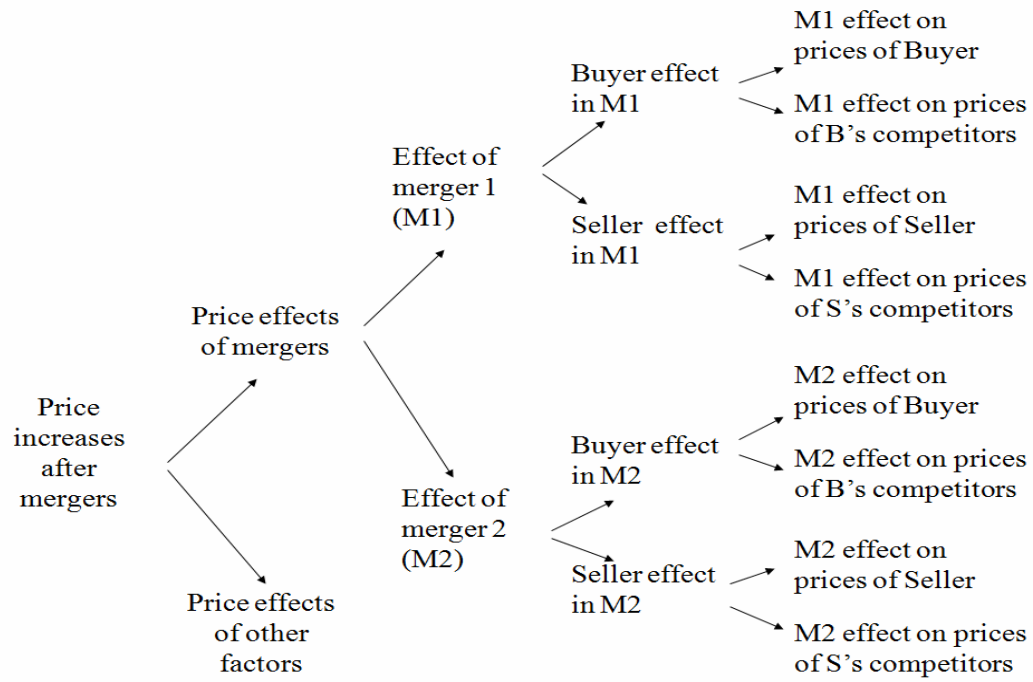
INTRODUCTION

From the late 1990s, there has been a growing need to evaluate the performance of antitrust policies, and especially whether mergers contributed to the observed price increases in their respective industries.1 The goal of ex post merger evaluation is to identify the price change due to the merger itself and separate it from the price effect of any other economic factors such as changes in demand and cost conditions. The central question of most previous studies was to find the total (average) price effect attributed to the merger, but less attention has been given to analyzing the difference in the effects a merger can have on the various firms affected by the mergers. In this paper, we develop an empirical method to identify the price effects of simultaneous mergers, and break down the total effect of each merger by separating the effects on the prices of the buyer and seller firms and on the prices of their respective competitors.

Figure 1 illustrates the eight different merger effects we aim to separate in our ex post evaluation of two mergers.

Figure 1.

The different merger effects to separate



[1] See the LEAR (2006) report prepared for the DG Competition European Commission, Office of Fair Trading and Competition Commission (2005) and contributions to the "Measuring the Economic Effects of Competition Law Enforcement" conference organized by the Dutch Competition Authority (NMa) in 2007, which were published in the December 2008 issue of *De Economist*.

Our method of separating these effects enables us the testing of some important predictions of academic and antitrust literature, which argue that a merger can result in different price changes for different firms, depending on their role in the merger. First, the most robust prediction is that a merger will result in a larger change in merging firms' pricing than in competitor firms' pricing as the former can fully internalize the effect of eliminating the competitive constraint (externality) the two firms had on each other before the merger.[2] Second, in mergers with local markets, a larger price increase is expected on markets where both merging firms are present (or are closer competitors to each other), since the merger removes a direct competitive constraint between their respective outlets.[3] Third, a merger might have a different effect on the two firms involved, as the business policies and supply conditions of the firms will likely converge towards each other, and the change is usually conjectured to be larger for the case of the acquired firm than for the buyer firm.[4]

In this paper, we provide an ex post assessment of two mergers on the Hungarian retail gasoline markets, which happened almost simultaneously: the acquisition of Jet by Lukoil in February 2007 and the acquisition of Esso by Agip in July 2007.[5] Our detailed panel on station-level prices offers an intuitive way to estimate the price effects of the two mergers with difference-in-differences methods, where we exploit the variation in the presence of merging firms across local markets. Because we observe almost all possible combinations of the four firms' stations in distinct local markets, we can form different treatment-control group pairs to identify separate effects for each merging firm and their competitors.[6]

As a preliminary illustration of our results, Table 1 shows the mergers' partial effects on the retail prices of different parties, estimated under the initial assumption that the change in the firms' pricing policies all took place in January 2008.[7]

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[2] See the classical Davidson and Deneckere (1985) price competition model with differentiated products or Vives (1999) on more general results in various oligopolistic settings.

[3] Levy and Reitzes (1992) develop a merger model of spatially differentiated firms leading to this result.

[4] Although there is no theoretical model backing this last result, this conjecture is based on the fact that it is usually the management of the buyer firm that takes over the business and pricing decisions of the acquired firm. We can also have more reason to believe that the buyer firm already had a more successful business strategy in place.

[5] Both mergers were of moderate size, the fifth and fourth biggest firm taking over the stations of the seventh and sixth firm, respectively.

[6] For this reason, our methodology cannot be used for the ex post evaluation of a merger affecting all (product or geographical) markets in the same way, or when there are too few distinct markets.

[7] The positive elements are parameters significant even at 1%, zero elements indicate parameters that are not significant at 5%.

Table 1.

Illustrative results for separate merger effects

	Agip/Esso	Lukoil/Jet
Own effect on buyer firm's stations	0	+0.8%
Own effect on acquired firm's stations	+0.7%	0
Competitor effect on stations in buyer's vicinity	0	0
Competitor effect on stations in acquirer's vicinity	+0.5%	0

Our first result is that neither merger contributed substantially to retail price increases, as all estimated price changes are less than one percent. Second, both mergers had different effects on the prices of the firms depending on their role in the merger and the differences are mostly in line with the theoretical predictions given before. For the Agip/Esso merger, there are significant effects on the pricing of the acquired Esso stations and their competitors, and the price change is larger at Esso stations than at competitors' stations (although the difference is not significant). For the Lukoil/Jet merger, we also find that own effects are larger than competitor effects, but a significant effect is found only for the buying firm's stations. These different patterns of price effects for the two mergers may be explained by the difference in the merging firms' pricing policies and possible efficiency effects.

Unfortunately, the date when a merger effectively has an actual economic effect on the respective firms (the so-called effective merger date) is usually unknown to researchers, and changes in pricing policies might even be gradual. Therefore, great care should be taken when selecting the effective merger date to use in estimating the price effects of mergers, as this choice my have large impact on results. We apply several methods to show that the qualitative results discussed above emerge robustly when different effective merger dates are assumed. The magnitude of the estimated effects can change, but the estimated price changes due to the two mergers always remain negligible.

OVERVIEW OF THE RELEVANT LITERATURE

The number of ex post merger evaluations (or so called merger retrospectives) has been growing considerably since 2000, partly because of an increased need to evaluate the performance of antitrust policies.[8] The principal statistical method used in these studies

[8] Weinberg (2008) and Hunter et al (2008) provide two comprehensive reviews on ex post merger evaulations. Weinberg also discusses alternative methods to difference-in differences estimations.

was difference-in-differences estimation, as is typical in program evaluation literature.[9] These ex post evaluations mostly studied transactions in industries with high merger activity, where price changes affected a wide range of consumers (and interested a lot of politicians and policy makers): hospital services,[10] airline ticketing,[11] banking products, basic consumer goods (typically food),[12] and gasoline.

Gasoline markets have always received attention, in particular during the recent years of large price changes, as fluctuations in petroleum prices were often followed by quick reactions in retail prices. Therefore, it was questioned whether the changes in wholesale conditions offered the only plausible explanation or whether certain anticompetitive practices also played a role.13 A restructuring has taken place in many countries by a series of acquisitions on all supply levels, and therefore it is crucial to determine how the price effects of changes in wholesale conditions can be separated from changes in retail market structure.14 Mergers involving companies with production facilities have always received more attention because of their ability to affect wholesale prices, but retail mergers are typically easier to analyze due to the availability of a larger amount of more transparent price data and variation in local market structure.

A widely-cited paper by Hastings (2004) uses a simple difference-in-differences estimator to analyze how the acquisition of an independent station network by a branded network affected local retail prices in different geographic areas. She finds that removing an independent station raises retail prices significantly, but the increase in the share of branded (so called company-operated) stations alone does not explain higher prices. Hastings thus concludes that the identity of competitors is as important as their number in determining market conduct, which she interprets as support for a model with some product differentiation and brand loyalty on retail gasoline markets.15 However, Hastings analyzes only the change in the pricing of competing stations to derive conclusions on the

[9] Imbens and Wooldrige (2009) give a detailed general review on the methodological problems arising in program evaluation.
[10] See Farrell et al (2009) for a recent overview on hospital merger retrospectives.
[11] See Armantier and Richard (2008).
[12] See Ashenfelter and Hosken (2008) for the ex post evaluation of five mergers in this sector.
[13] See for example the questions raised by the US Congress to the Federal Trade Commission in 2004. The summary of the FTC's view can be found at http://www.ftc.gov/opa/2004/07/gastest2.shtm
[14] The US Government Accountability Office reports 2600 mergers in the petroleum industry from 1990 till 2004. The GAO's econometric models analyzed the effects of the eight biggest transactions in detail. The report can be downloaded from http://www.gao.gov/products/GAO-04-96
[15] This paper was criticized by Taylor et al (2010) both from a theoretical and empirical point of view. They failed to reproduce her results by using alternative data and also showed that her empirical result would not lead to unambiguous welfare effects in the underlying model she assumes.

effect of the merger,[16] while theory suggests – and our paper also demonstrates – that the change in the pricing of acquired stations may be larger.

Taylor and Hosken (2007) use an approach similar to Hastings's in measuring the effect of a joint venture, but find no retail price increases resulting from the change in market structure.[17] The paper also illustrates some important implications for further ex post reviews: (1) it is more important to analyze the merger effects on retail prices than rack (wholesale) prices, (2) variation in gasoline supply should be taken into account whenever possible, and (3) the estimated effects can depend on the control regions used, therefore robustness checks are crucial when selecting the counterfactual.[18] The substantive difference between Taylor and Hosken's paper and ours is that while Taylor and Hosken examine the overall effect of the merger on city-level (average) prices, our paper takes a further step by separating the different effects a merger may have on various market players in each market.

The few studies analyzing the merger effects on rivals' prices used it to answer different research questions than we do. Kim and Singal (1993) find larger price effects for competitor airlines than for the merging airlines, which they attribute to merger-specific efficiencies passed on to consumers. In studying hospital mergers, Dafny (2009) argues that researchers should look at the effect on competitor prices particularly if it can be conjectured that the merger event might be correlated with the unobserved characteristics of the acquired hospitals, in order to avoid selection bias. However, as we have already mentioned, if there are no efficiencies realized by the merger, then these outsider effects provide only a lower bound for the insider effects.

STRUCTURAL CHANGES ON THE HUNGARIAN RETAIL GASOLINE MARKET

The Hungarian retail gasoline market is moderately concentrated, with five main international oil companies (Hungary-based MOL, OMV, Shell, Agip (Eni) and Lukoil) owning almost 75% of petrol stations and likely accounting for an even higher share of revenues. MOL's market share is the largest in terms of stations and it also has a leading role at the wholesale level with an upstream market share of at least 70%.

[16] Not enough data was available on the acquired stations, as this was a random sample on prices in which minor brands and independent stations were underrepresented.

[17] Another merger concerning the same firm Marathon-Ashland was similarly analyzed by Simpson and Taylor (2008), and this study found no ex post evidence of a price increase either.

[18] Choné and Linnemer (2010) also use various local market definitions in order to find the robust ex post effect of a merger between two large parking companies.

In 2007, Agip and Lukoil acquired all retail stations of the other two international oil companies present in Hungary, Esso (Exxon) and Jet (ConocoPhillips) respectively. Both acquisitions were part of large transactions involving business activities in multiple countries.[19] Table 2 summarizes the key facts concerning the two mergers.

Table 2.

Summary of the two mergers analyzed

	Agip/Esso[20]	**Lukoil/Jet**[21]
Case number	COMP/M.4723	COMP/M.4532
Stations sold in countries	Belgium, Czech Republic, Finland, Hungary, Poland, Slovakia	Czech Republic, Hungary, Slovakia
Number of stations and market shares in Hungary	102 (9%) / 36 (3%)	42 (4%) / 30 (3%)
Transaction date	27-04-2007	18-12-2006
Notification date	19-06-2007	17-01-2007
Clearance date	24-07-2007	21-02-2007
First public sign of change in Hungary	November 2007	November 2007

Note that before receiving the clearance decision, the merging companies should act independently of each other. However, the change in business and pricing policies due to the merger usually takes place some months after the clearance, but this so-called effective merger date is not publicly known. The only publicly observable fact in our case is the date when the acquiring firms started repainting the acquired stations to their brand colors, which happened in November 2007 for both mergers.

Apart from the branded stations mentioned, the remaining 25% of stations are owned by a large number of small competitors. Only three chains had a larger than 1% market share based on the number of its stations in the relevant period of 2007-2008, and all three faced major changes during this time. The previously largest entrant Tesco continued to build new stations till the end of 2008.22 The alliance of independent (white) stations Klub Petrol exited the market at the end of 2007 due to financial difficulties. Finally, a new alliance of independent (white) stations named Avia entered in 2008; several former Klub Petrol stations joined this alliance.

[19] For this reason, the mergers were notified to the European Commission, which investigated and cleared them in quick Phase I investigations.

[20] The publicly available decision can be downloaded from http://ec.europa.eu/competition/mergers/cases/decisions/m4723_20070724_20310_en.pdf

[21] The publicly available decision can be downloaded from http://ec.europa.eu/competition/mergers/cases/decisions/m4532_20070221_20310_en.pdf

[22] Later in 2009, Tesco stations were acquired by Shell. This long-term lease agreement was cleared by the Hungarian Competition Authority (GVH), case number Vj-17/2009.

The evolution of the relevant firms' shares in station numbers is summarized in Table 3.

Table 3.

Changes in station shares in 2007-2008

	Station shares 2007-01	*Station shares 2008-12*
MOL	29%	28%
Shell	16%	15%
OMV	14%	13%
Agip	9%	12%
Esso	3%	
Lukoil	4%	7%
Jet	3%	
Tesco	3%	4%
Klub Petrol	3%	0%
Avia	0	3%
Other stations[23]	16%	18%
Total station number	1229	1335

PRICE DATA AND STYLIZED PRICE DEVELOPMENTS

We analyze a panel database containing daily retail gasoline prices in from the beginning of January 2007 till the end of December 2008. The database contains the price of 95-octane gasoline only, but 96% of gasoline sales are of this type. The source of our data is a public website helping consumers to compare gasoline prices: www.holtankoljak.hu (Where Should I Refuel?), run by a private company.[24] We will analyze retail prices on Fridays, as the Hungarian wholesale price changes each Wednesday morning,[25] and therefore most retail price changes occur on Wednesday and Thursday.[26] In total, we have 81253 price observations in 96 weeks for 1303 gas stations, more than 95% of stations in

[23] The number of independent white pumps is slightly uncertain, as their presence is not properly reported at the beginning of the observation period.

[24] The company conducting the price comparisons is independent of the retail firms, and is financed by online advertisements placed primarily by car manufacturers and insurance companies.

[25] Strictly speaking this is only the price change of the dominant wholesale company (Hungary-based firm MOL), but it supplies at least 70-80% of gasoline sold in Hungary. The change in the wholesale price is made public the previous Monday.

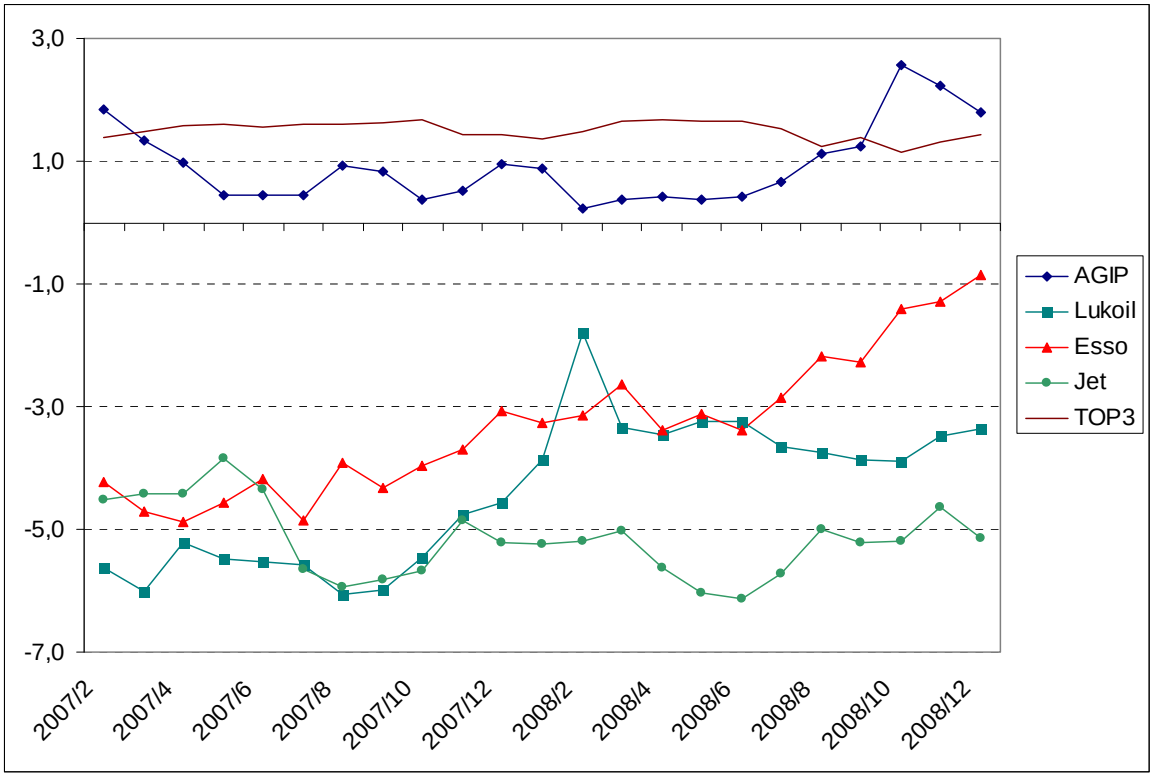
[26] Data gathered is based on the self-reporting of the stations by phone, and the biggest inquiry conducted is on Wednesday and Thursday. Therefore the Friday data are expected to be the most accurate, and we also have the most observations for Fridays.

Hungary.[27] The panel is unbalanced, but the majority missing data corresponds to the fringe white stations that are less relevant for our analysis.

In the observed period, the price of gasoline fluctuated between 230 and 310 Hungarian Forints (HUF), with an average of 281 HUF.[28] In order to filter out common shocks (particularly the change of the wholesale price), Figure 2 below shows the differences between firm-specific average price and the national average price. Note that here the brand of the station refers to its original brand at the beginning of the observation period before either merger, so there is no composition effect in the changes.

Figure 2.

Monthly differences between firm-level and national average price



These price differences show that the three largest firms (MOL, OMV and Shell) were able to maintain slightly higher prices then their competitors,[29] and Agip's prices gradually became closer to them in 2008. There is also a visible change in the pricing of Esso stations acquired by Agip in the middle of 2007, as their prices increased from the

[27] The missing stations are all white stations or belong to small brands with few stations. Price data are not reported for 8 weeks, which was because of holiday periods and a shutdown problem of the website.

[28] The exchange rate also fluctuated during these two years, but one can make easy conversions with the approximation of 250 HUF = 1 Euro.

[29] The graph shows the average of the top 3 firms' prices together as no substantial differences can be observed between their average prices.

level of low-pricing firms to the national average. On the other hand, Lukoil and Jet stations appear to have maintained their low-pricing policies, although Lukoil's prices increased slightly starting from the second part of 2007.

Although we cannot observe the individual costs of retail firms, we do have a good proxy for the wholesale price of gasoline we can use. Each Monday, the change in MOL's wholesale list price becomes publicly known, and as MOL serves most retailers and has significant market power upstream, we believe that the change of this wholesale price can serve as a good indicator of the change in marginal costs. Therefore, we will refer to MOL's wholesale list price as the wholesale price, and define the margin of a brand or station as the simple difference of the respective retail price and the wholesale price. The average margin varies between 10 and 18 HUF with an average of 15 HUF, which is about 5% of the retail price.

We should note that both the retail prices observed at the stations and the wholesale price are only list prices, while most retailers offer loyalty discounts in the form of loyalty cards or fleet programs. If larger retailers offer larger discounts,[30] the actual price differences between smaller and larger retailers might be smaller than shown in Figure 2. Similarly, at the wholesale level retailers receive individual discounts from the list price, which are not observed. However, assuming the size of these discounts remains stable over the observed period, these measurement errors are mostly taken care of by the difference-in-differences estimation method we use. Of course, it might be the case that a merged firm achieves a larger quantity discount due to increased sales or changes its consumer discount policy, but this change will be captured by our estimated merger-specific effects.

LOCAL MARKETS AND CHARACTERISTICS OF LOCAL COMPETITION

In order to analyze the effect of structural changes on local prices, we should first define the areas where a given station's pricing policy might constrain other stations' pricing, and therefore a structural change concerning the given station would have an effect on the other stations. This approach to delineating local markets is very similar to the usual first step in competition policy of "defining the relevant markets", where the competitive assessment should be carried out.[31]

[30] This conjecture is hard to test correctly, because the discounts often do not take the form of a direct price decrease for gasoline, but for example bonus points (price discounts) for shop purchases.

[31] Note, however, that competition policy cases analyzing retail gasoline markets took a rather conservative approach by defining the relevant geographical market as national. It was only in a recent merger case in 2008 where DG Competition took the view that although the market is

In this paper, we use an economically reasonable proxy for local markets:[32] the 168 statistical municipalities defined by the Hungarian Central Statistical Office (KSH). These statistical municipalities are delineated by various survey techniques as distinct geographical areas where inhabitants perform the majority of their social and economic activities (such as traveling, working and shopping), so it seems reasonable to assume that consumers shop around primarily in this area and retailers consider the stations in the municipality as their main local competitors.[33] It might be of course the case that two competitors in the same local area do not exert the same degree of competitive pressure on a given station due to the varying distance between the stations, but further station-level controls in our estimations can partially take care of this problem.

An alternative way to delineate local markets would be to define a catchment area around each station, in which the given station provides a viable alternative to consumers visiting the other stations.[34] Note, however, that the choice of driving time / distance used in these delineations remains arbitrary, and the stations falling in the same catchment area are still assumed to exert the same competitive constraint – so the shortcomings of the previous approach are not completely solved.[35] However, it can be useful to carry out this more tedious exercise in order to test the sensitivity of the estimation results to differently delineated local markets.

We do not include gasoline stations located on highways in our analysis, because substitution possibilities and therefore competitive conditions are markedly different at these stations.[36] The capital of Hungary (Budapest) with its 183 stations is defined as one statistical municipality, and therefore this outlier is also excluded.

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defined as national, the competitive assessment should take local aspects into account – see COMP/M.4723 StatoilHydro/ConocoPhillips decision §26-29, downloadable from http://ec.europa.eu/competition/mergers/cases/decisions/m4723_20070724_20310_en.pdf

[32] Local markets were also defined in several papers by taking some kind of artificial proxy. Hortacsu and Syverson (2007) for example use the regional economic areas defined by the Bureau of Economic Analysis (BEA) to delineate cement markets in the USA; Focarelli and Panetta (2003) and Sapienza (2002) delineate Italian provinces as relevant geographic markets for bank deposits.

[33] There are two further practical advantage of using statistical municipalities. First, the ZIP code of each station can be automatically linked to a municipality, which ensures that local markets do not overlap and their number can be kept at a tractable level. Second, the Statistical Office also discloses economic indicators (such as population, number of cars, taxable income) for each of them, which can be used to control for local differences in our estimations.

[34] For example, Hastings (2004) uses circles of a one-mile radius around each gasoline station, but estimates some of her results by using different radiuses. It is also possible to work with different measures of distances, like traveling time, which is more typical in analyzing supermarket mergers for example (see for example Ashenfelter et al (2006)).

[35] Note also that distance might not be the only source of horizontal differentiation between stations.

[36] In Hungary, highways can be entered only after paying the toll, and exits can be quite far from each other. Therefore it seems unlikely consumers would enter and exit the highway for the sake of a potentially lower pump price. The average price at petrol stations on highways is only 3-4% higher than at other stations, but we see a slightly different trend in highway prices than in off-

Descriptive statistics of the remaining 167 statistical municipalities seem to indicate oligopilistic market structures with a few market players, which might signal that these municipalities constitute indeed a good approximation of local markets.[37] The average number of differently branded stations (major firms) in a local market is 3.2 (standard deviation 1.8), while the average number of stations in a local market is 6.3 (standard deviation 6.7).[38]

On top of the variance between the average characteristics of local markets, the major firms are also differently distributed among these markets, and it is this variance in market structure that we will heavily exploit. Table 4 and 5 illustrates the overlap of the merging firms in local markets and shows a different geographical pattern emerge for the two mergers to be analyzed.

Table 4.

Number of local markets where Agip and Esso are present

	Esso present	Esso not present	*Total*
Agip present	12	52	*64*
Agip not present	4	96	*87*
Total	*16*	*135*	

Table 5.

Number of local markets where Lukoil and Jet are present

	Jet present	Jet not present	*Total*
Lukoil present	6	32	*38*
Lukoil not present	11	115	*113*
Total	*17*	*134*	

Esso stations acquired by Agip were direct competitors of Agip in 75% of the local markets where Esso is present, while this overlap is only 35% for the Lukoil/Jet merger. On the other hand, the acquisition of Jet stations increased Lukoil's presence on local markets by almost 30%, but this expansion is only 6% for Agip. Therefore, the acquisition of Esso can be seen more as a merger with a direct competitor, while the Lukoil/Jet merger

highway prices. Because of these facts, it is usual to define gasoline stations on highways as different geographical markets.

[37] Bresnahan and Reiss (1991) studied oligopolistic markets with entry costs and analyzed the relationship between local market size and the number of sellers (see also Campbell and Hopenhayn (2005)), and they found similar distributions of firms in some industries to ours - see especially the distribution of automobile dealers in their Table 2, which probably has the closest connection to the gasoline market in their sample. We can also check in our case that the number of firms is strongly correlated with indicators proxying local market size (0.96 with taxable income, 0.97 with population).

[38] Note that firms (brands) can have multiple stations in some local markets (usually in the larger ones), and we include white stations as well when looking for the total number of stations.

resulted more in market expansion. This may lead to a conjecture of a larger price effect resulting from the Agip/Esso merger, which may look consistent with the evolution of average prices at the firm-level presented on Figure 2.

However, the analysis of descriptive data can give only preliminary conjectures on merger effects. Definitive results can only be obtained by the thorough analysis of changes in local prices while controlling for other factors affecting the prices.

ESTIMATION METHOD AND IDENTIFICATION OF EX POST MERGER EFFECTS

Our main aim is to differentiate and estimate eight types of price effects resulting from the two mergers, as demonstrated at Figure 1 in the Introduction. First, we separate the price effects of the two mergers (Agip/Esso and Lukoil/Jet effects). Second, we separate the price effects associated with the two different parties in each merger (buyer and seller effects). Third, for each merger we differentiate between the direct effects of the merger on the prices of the buyer and seller (buyer and seller own effect) and the indirect effect on the prices of their respective competitors (buyer and seller competitor effect). At the end, four own effects correspond to the merging firms and four effects to their competitors.

We believe that there are two reasons for the analyzed mergers to be considered good exogenous firm-specific shocks, whose effects can be therefore identified. First, the Hungarian acquisitions formed only small parts of larger transactions involving stations in multiple countries, and all Esso and Jet stations in Hungary were sold to their respective buyers. Both factors considerably decrease the chance for a selection bias. Second, the stations' individual prices are usually set at firms' headquarters, so it reasonable to assume the merger changes the pricing policy of the firm itself. We can then estimate the average change in the realized station-level prices after the adjustment took place.[39]

We use a difference-in-differences method that compares pre- and post-merger price differentials between stations that were affected by the merger (treatment group) and stations that were not (control group). The motivation behind such a comparison is that observations on unaffected stations can form a counterfactual by informing us about what would have happened to the merged stations had the merger not taken place.

[39] A structural model of horizontal differentiation could for example lead to an equilibrium pricing condition for a firm that sets a uniform price P with the condition that any station should decrease its local price by X if firm A is present and Y if firm B is present. The merger can change the parameters in this equilibrium price setting rule to X' and Y', which could imply different price changes for two stations of the same firm, as they face different competitors on their local markets.

In order to implement this approach, we use a panel regression framework with station and time fixed effects. Our estimated equations will take the following general form:

$$y_{it} = \sum_{j \in Agip.Esso,Lukoil,Jet} \alpha_{1j} own_{jit} + \sum_{j \in Agip.Esso,Lukoil,Jet} \alpha_{2j} competitor_{jit} + \beta \cdot controls_{it} + u_i + v_t + \varepsilon_{it}, \qquad (1)$$

where □ș and □-s are parameters to be estimated, i indexes stations, t indexes time and j indexes the merging parties. Our dependent variable yit will be our main variable of interest, which can be the price or the price-cost difference in absolute (margin) or in relative terms (markup). Dummy variables ownjit capture the merger effect on merging parties and take the value of one after the merger treatment for the stations of each merging firm and zero otherwise. Variables competitorjit capture the merger effect on competitors and take the value of one if station i has merging party j as a competitor after the merger treatment and zero otherwise. Depending on additional data possibilities and considerations, we can add further variables (summarized now in controlsit) to the model to control for other factors than the merger that can affect price changes. Finally, the error component u_i is the station fixed effect, v_t is the time fixed effect and ε_{it} is the disturbance term.

Station fixed effects control for unobserved heterogeneity, which is important in our case because assignment to treatment and control status is not random, as it is the outcome of the decisions made by buyers Agip and Lukoil. Additionally, we do not fully observe all relevant characteristics of different stations and the size of local demand for gasoline. Time fixed effects control for changes in common unobservable variables to all stations in a given period.

Station and time fixed effects also capture treatment-control group and merger date indicators, and merger effects will be captured by a cross-term generated as the product of the merger date indicator and the eight indicator variables for merging parties and their competitors. These cross-terms capture the change in the price difference between treatment and control stations, as station and time fixed effects basically transform the data into differences from the respective means.

FORMING TREATMENT AND CONTROL GROUPS

In the current context treatment and control groups can be formed based on the different presence of merging stations in local markets. For example, the Esso own merger effect can be identified based on the comparison of an Esso station's price in a market where no other merging firm is present and the price of a station with no merging firm presence at all. We will use variation in the composition of merging firms in distinct local markets to form different treatment-control group pairs that identify each merger effect of interest.

If the mergers represented an ideal experimental situation, then there would be distinct treatment and control groups for each effect being measured.[40] This is not the case in our application, however, due to the presence of multiple merging parties in several local markets. For example, each Esso station is a member of the treatment group for the Esso own effect, but can be a member of several control (and even treatment) groups for Agip, Lukoil and Jet effects. For this reason, the aforementioned treatment-control pair for the identification of the Esso own effect is not the only source of identification: it is also identified by the differences between prices at Esso stations in markets where only Esso and Lukoil are both present (from the merging firms) and prices at stations in markets where only Lukoil is present from among the merging firms. Competitor effects are identified similarly to own effects.[41]

In fact, for each merger effect there are eight possible presence combinations that can be used to form treatment groups. Of course, not all of these combinations are necessarily present in the sample. In order to give a precise picture of these sources of identification, Table 6 shows for the case of Esso the number of local markets and station-week observations in each treatment group and the corresponding control group. The 4-digit code indicates the respective presence of Agip, Esso, Lukoil and Jet stations in a local market, where 1 indicates the presence of respective firm and 0 its absence. For example, in control group 1010 Agip and Lukoil are present with Esso and Jet absent, and it corresponds to treatment group 1110 where one or more Esso stations are present as well.

[40] This is the case for example in Prager and Hannan (1998) who compare interest rates of banks in regions where both merging firms compete to regions where they do not, or in Vita and Saches (2001) who compare hospitals with a similar number of beds, size and location differing only in whether they were present in a county where the merger occurred or not.

[41] For example, the Esso competitor effect is identified based on the price differences between Esso competitor stations in a market with only Esso present from among the merging firms and stations in markets where no merging firm is present. Identification is also based, however, on the differences between stations that are competitors of both Agip and Esso and stations that are only competitors of Agip.

Table 6.

Treatment / control groups identifying Esso own and competitor effects

Treatment				Control		
Presence combination (AELJ)	Number of local markets	Number of station-week observations: Own stations	Number of station-week observations: Competitor stations	Presence combination	Number of local markets	Number of station-week observations
0100	3	214	2143	0000	75	21284
1100	4	324	4035	1000	37	12359
0110	0	0	0	0010	16	6,491
0101	1	155	778	0001	4	2690
1101	3	222	5079	1001	3	2548
1110	2	257	3061	1010	10	3564
0111	0	0	0	0011	1	496
1111	3	240	6785	1011	2	1491
Sum	**16**	**1412**	**21881**	**Sum**	**135**	**43936**

There are eight possible subsets that include an Esso presence, but two of these subsets are not observed in the sample. All of the 16 markets where Esso is present also include other merging firms. It is not the number of markets, however, that identifies the difference-in-differences estimator but the number of station-week observations in these markets. There are 1412 such observations in the treatment group that we use to estimate the Esso own merger effect and 21881 for the Esso competitor effects,[42] while the number of available controls is 43936 for both.

Similarly, we can combine the 16 differently structured local markets to form treatment-control groups to separate the effects belonging to the other three merging firms. Table 7 summarizes the number of markets and station-week observations used for the identification of each merger effect.

[42] The much larger number of observations to identify competitor effects might lead researchers to rely on them more in estimating merger effects (see for instance Hastings (2004)), but as we will see from our results, competitor effects are only a lower bound for own effects.

Table 7.

Treatment and control groups identifying all own and competitor effects

	Treatment groups			Control groups	
	No of local markets	No of stations-week observations		No of local markets	No of stations-week observations
		Own stations	Competitor stations		
Agip	59	6861	39830	92	36010
Esso	16	1412	21881	135	43936
Lukoil	34	3400	23002	117	53009
Jet	17	1464	20690	134	60547

ESTIMATED EX POST MERGER EFFECTS BY ASSUMING A KNOWN TREATMENT DATE

When we estimate the price effects of mergers in this Section, we make an assumption on the exact time when the two mergers started to affect the pricing of each firm, and that it takes place as one discrete change with immediate effect for all firms. We set this so-called effective merger date at the first day of January 2008 for both mergers, implying that we have exactly one year before the treatment and after the treatment. In the next Section, we discuss how to relax this assumption and the effect is has on our results, and also explain why January 2008 can be a good candidate for both effective merger dates.

We estimate the following version of Equation (1):

$$y_{it} = \sum_{j \in Agip.Esso,Lukoil,Jet} \alpha_{1j} own_{jit} + \sum_{j \in Agip.Esso,Lukoil,Jet} \alpha_{2j} competitor_{jit} + \\ + \beta_0 + \beta_1 size_{it} + \beta_2 size_{it}^2 + \sum_{k=3}^{12} \beta_k type_{it} + u_i + cm_{it} + v_t + \varepsilon_t \quad (2)$$

Although our main variable of interest is the price and the price effects, we will use the margin - the absolute difference of retail price and cost (wholesale price) - as our dependent variable. The main reason to do so is that prices are non-stationary while margins are, but we will show that running estimations on prices and controlling for costs

does not change our results considerably. However, with the margin as a the dependent variable, the estimated values of α can be still interpreted as price effects if the wholesale price does not change due to the merger. Even if the merger does affect the firm-specific wholesale price (due to a volume discount for example),[43] the change in costs is passed on almost completely to retail prices (as our later estimations will show), so it can be interpreted as a price effect.

We take into account changes in market structure other than the two mergers by including the number of stations ($size_{it}$ and also its square) and indicator variables for ten largest firms' presence in the same local market ($type_{it}$) in the regressions. In order to control more strictly for common time variation we also use county-time fixed effects.[44]

Table 8 shows our estimation results. Of the control variables, we only provide results for those that we interpret later. [45]

Table 8.

Results of estimating Equation (2)

Dependent variable	Margin (in HUF)
Merger effects	
Agip own	0.10
Agip competitor	0.15
Esso own	1.78**
Esso competitor	1.24**
Lukoil own	1.95**
Lukoil competitor	0.20
Jet own	-0.43
Jet competitor	0.00
Controls (selected)	
Tesco	-1.04**
Klub Petrol	-0.71**
Avia	0.48**
No of stations	0.08
No of stations squared	-0.002**
Number of observations	82701
Within R^2	0.2682

* significant at 5% level, ** significant at 1% level

[43] As we do not observe the firm-specific wholesale price at which the retailer buys the gasoline it resells, but only a publicly observable proxy, we cannot test this hypothesis.

[44] There are 19 counties in Hungary, each containing 8 local markets (municipalities) on average.

[45] The estimated controls for the presence of merging firms are not significant, so there is no need to correct the estimated merger effects accordingly.

The estimated merger effects are only significant for Lukoil and Esso. In order to see the magnitude of these price effects, we show the relative change in retail prices and firm-level margins (in parentheses) in Table 9.

Table 9.

Relative price (margin) changes due to different merger effects

	Agip/Esso	Lukoil/Jet
Own effect on buyer firm's stations	0	+0.8% (+13.1%)
Own effect on acquired firm's stations	+0.7% (+11.4%)	0
Competitor effect on stations in buyer's vicinity	0	0
Competitor effect on stations in acquirer's vicinity	+0.5% (+8.7%)	0

The results show that both mergers had a positive but non-substantial effect on retail prices, as all significant effects are less than 2 HUF that is less than 1% of the average price. In terms of margins, however, the mergers provided a substantial change in Esso and Lukoil stations' margins and also for stations in Esso's vicinity.

In line with our initial expectations, we see that both mergers resulted in different effects on the various firms, depending on their role in the merger. The Agip/Esso merger increased the prices of the seller's stations and also of their competitors, but the Lukoil/Jet merger had a positive effect on the prices of the buyer's stations only. Concerning the main theoretical prediction, the own effect is indeed significantly larger from the competitor effect in the case of the Lukoil/Jet merger. For the Agip/Esso merger, the point estimates also indicate a larger own effect than competitor effect, but this difference is not statistically significant.

We can provide a possible economic interpretation of the two transactions that may also explain why different patterns emerge in the price effects of the two mergers. In the case of the Agip/Esso merger, it is likely that the acquisition of Esso did not change the potential competitive pressure on Agip from low-pricing brands,[46] which can support why the Agip effects are not significant. On the other hand, the Esso stations became part of a larger firm with a reputation for higher quality, so the price increase on Esso stations (and therefore of its local competitors) can be likely attributed to an upwards brand repositioning of the Esso stations.

The acquisition of Jet expanded Lukoil's presence and recognition considerably, providing a plausible explanation for the increase in Lukoil prices.[47] However, no significant effect is found on the Jet stations, despite both firms having a similar pricing

[46] As it can be computed from Table 6 listing the treatment and control groups, the low-pricing brands Lukoil or Jet are also present in 8 of the 12 markets where both Agip and Esso are present.

[47] Lukoil competitor effects are significant at the 10% level, but are non-substantial.

profile before the merger. A possible explanation could be that as Lukoil is a vertically integrated company and so the marginal cost of the Jet stations could have decreased because of the emerging self-supply opportunities. Therefore, an efficiency effect might have cancelled the otherwise positive price effect on Jet.[48]

The difference-in-differences approach also allows us to interpret some of the control variables as the effects of actual entry and exit of stations during the observed period.[49] The parameter estimate of the Tesco dummy for example indicates that the entry of a Tesco station to a given local market decreased prices by 1 HUF. The parameter estimate for Klub Petrol should be interpreted as the exit of a Klub Petrol station increasing prices by 0.7 HUF. Surprisingly, the entry of an Avia station increased prices by 0.5 HUF, but as a good part of bankrupt Klub Petrol's stations joined the Avia alliance, they likely could not sustain the very low prices they charged before.[50] A change in the number of stations in a given local market does not have a substantial price effect either (the squared variable is statistically significant, but very small).[51]

SEPARATING THE EFFECT OF LOCAL COMPETITIVE INTERACTIONS BETWEEN MERGING PARTIES

An additional important theoretical prediction to consider is that a merger may lead to larger price effects on those local markets where the two merging firms' stations were direct competitors of each other before the merger compared to those where only one was present. Testing this hypothesis requires the separation of yet another set of effects: eight effects if the respective firm is without its merging party ("alone") in the local market, and eight effects if both merging firms are present in the local market.

Table 6 shows that there is enough variation in the composition of merging firms in distinct local markets for the formation of different treatment-control group pairs to identify each effect. We then estimate Equation (2) with sixteen treatments and report the

[48] Unfortunately, our data does not allow to separate efficiency effects as we do not observe firm-level costs (input price).

[49] Such methods are usually called event or shock analysis. Ashenfelter et al (2007) discuss the pros and cons of using these techniques by presenting the econometric methods used in the famous Office/Staples merger. For a more general overview, see Davis and Garces (2010, Chapter 5).

[50] When they were still active, the average price of Klub Petrol stations was 7 HUF below the average national level (Lukoil's and Jet's average prices were about 5 HUF below national average).

[51] In this price-concentration relationship, theory predicts that the entry of a new firm has a negative effect on price, but this price effect is smaller in absolute value when there are more firms on the market. So the parameter of station number is expected to be negative, but the parameter of the squared number is expected to be positive.

results in the first two columns of Table 10. The third column of Table 10 contains the effects without taking into account the sole or joint presence of merging firms (our first estimates from Table 8), which are naturally the weighted averages of parameters in the first and the second column.

Table 10.

Estimation results separated by sole/joint presence of merging firms

	Effect if present alone	Effect if both present	Overall effect
Agip own	0.23	-0.41	0,10
Agip competitor	0.26	0.00	0,15
Esso own	2.91**	1,25**	1,78**
Esso competitor	1.57**	1.15**	1,24**
Lukoil own	1.99**	1.54**	1,95**
Lukoil competitor	0.26	0.00	0,20
Jet own	-1.03	0.71	-0,43
Jet competitor	0.17	0.01	0,00

* significant at 5% level, ** significant at 1% level

Our first result is that the set of significant effects does not change if we separate the effects by the sole and joint presence of the merging firms (Esso own and competitor effects and Lukoil own effect). Second, the parameter estimates for the respective effects are in most cases not statistically significant different from each other depending on whether only one or both merging firms are present, the exception being the Esso own effects and Jet own effects (the latter only at 10%).

In the case of the Esso own effect, a significantly larger price effect can be observed for those Esso stations with no Agip stations in the same local market. While this result may seem counterintuitive at first, it can support our previous discussion that the price increase at Esso stations was not caused by the elimination of a previously existing competitive pressure between Agip and Esso. On the local markets where Agip was not present before, the larger change may well have been due to the emergence of a more recognized brand.

In the case of Jet own effects, the point estimates show a negative effect on those markets where a Lukoil station was also present and a positive effect where there was not. This weakly significant difference is also consistent with the conjecture presented before that while the merger removed some competitive pressure exerted by Lukoil, Jet stations without the presence of Lukoil could have decreased their prices. Overall, the positive price effect was offset by an opposite effect that can be attributed to efficiencies.

To sum up, the separation of effects based on the sole and joint presence of merging firms in local markets does not bring strong evidence for the "significant lessening of competition". This is consistent with our previous result of non-substantial price effects

and the fact that the Hungarian mergers only formed parts of large international transactions, and were not necessarily aimed to take over a strong local competitor.

ESTIMATING ALTERNATIVE SPECIFICATIONS

We now check whether alternative specifications of our estimated equation substantially modify our results. Table 11 shows the estimates of the eight merger effects for six different specifications.

Table 11.

Estimated effects for various specifications of Equation (1)

Dependent variable	(I) Margin	(II) Margin	(III) Margin	(IV) Price	(V) Log(Price)	(VI) Markup
Agip own	0,03	0,20	0,10	010	0,0002	0,0003
Agip competitor	-0,01	0,15	0,15	0,15	0,0004	0,0004
Esso own	1,49**	1,10*	1,78**	1,78**	0,0080**	0,0082**
Esso competitor	1,05**	0,67**	1,24**	1,24**	0,0052**	0,0054**
Lukoil own	1,98**	2,04**	1,95**	1,95**	0,0082**	0,0086**
Lukoil competitor	0,19	0,20	0,20	0,20	0,0009	0,0010
Jet own	-0,04	-0,16	-0,43	-0,43	-0,0003	-0,0004
Jet competitor	0,39*	0,30	0,00	0,00	0,0004	0,0004
Competitor controls	No	Yes	Yes	Yes	Yes	Yes
Time-county Fes	No	No	Yes	Yes	Yes	Yes
Within R^2	0,17	0,19	0,27	0,99	0,99	0,46

* significant at 5% level, ** significant at 1% level

The first three columns demonstrate how additional control variables affect our results. Specification (I) is the basic form of Equation (1) with only the necessary treatment dummies and standard cross-section and time fixed effects. In specification (II), we add controls for local competitors (number and type of rival stations), and also add time-county fixed effects in specification (III), which is the previously estimated and discussed Equation (2). These results demonstrate that the qualitative results do not change substantially, the statistically significant parameters are the Esso own and competitor effects and the Lukoil own effect. As the added controls are significant and the estimates provide economically sensible results, we include both sets of controls in all of our subsequent estimations.

The last three columns demonstrate the results of estimating the merger effects on other dependent variables: the price and the markup. As neither of these variables are stationary, we should treat these estimation results with reservations. It is worth noting, however, that the regressions on price (specification IV) and the logarithm of price

(specification V) produce similar results to estimates from our Equation (2). In these specifications, we include the cost (wholesale price) on the right-hand side as a control.[52] Specification (VI) shows the change in the markup (the price-cost difference divided by the price, also called the Lerner-index). This estimation is also in line with the margin estimate from Equation (2): a 0.8 percentage points change in the markup for Esso station corresponds to an increase of 13%.[53]

SENSITIVITY OF THE RESULTS TO THE EFFECTIVE MERGER DATES

Up to this point, we made strong assumptions on the effect mechanism of the mergers. First, we assumed that the effective merger date – that is the date the merging firms actually change their business and pricing policies – can be observed by the researcher, which is hardly ever the case. Typically, the only public information concerns the clearance date of the merger after which the merging firms are allowed to coordinate their business policies, but the change in firm's actual pricing may take several months. Some observable information may be available on firing managers or on rebranding decisions, but these are imperfect proxies of the effective merger date.[54] Second, we assumed that the change in pricing policy is a sudden discrete jump that is simultaneously happening for all firms, but adjustments could be gradual and competitors may not instantaneously react. It is therefore crucial to test the sensitivity of our results with regards to these assumption.

Initially, we analyze only the case when the two mergers takes effect at unobservable and potentially different dates, yet the effects are immediate. In our application, we estimate the merger effects in Equation (2) by gradually changing the effective merger date month-by-month from the first week of August 2007 till April 2008 for the Agip/Esso merger, and from the first week of March 2007 till March 2008 for the Lukoil/Jet merger.[55]

Figures 3 and 4 show the own and competitor effects for Agip/Esso and then Lukoil/Jet for a range of effective merger dates, keeping the respective other effective

[52] In specification (IV), the estimated cost parameter is not significantly different from 1, which signals an (almost) complete pass-through at the retail level.

[53] The average markup is about 6% at the retail level.

[54] In our case, the only information is that both Agip and Lukoil started to repaint the acquired stations in November 2007, but the brand of some stations was changed only several months later.

[55] Agip/Esso was cleared at 24-07-2007, Lukoil/Jet at 17-02-2007.

merger date constant at January 2008.[56] We show only those estimates that are significant at 5%.

Figure 3.

Significant Agip and Esso results for Agip/Esso effective merger dates

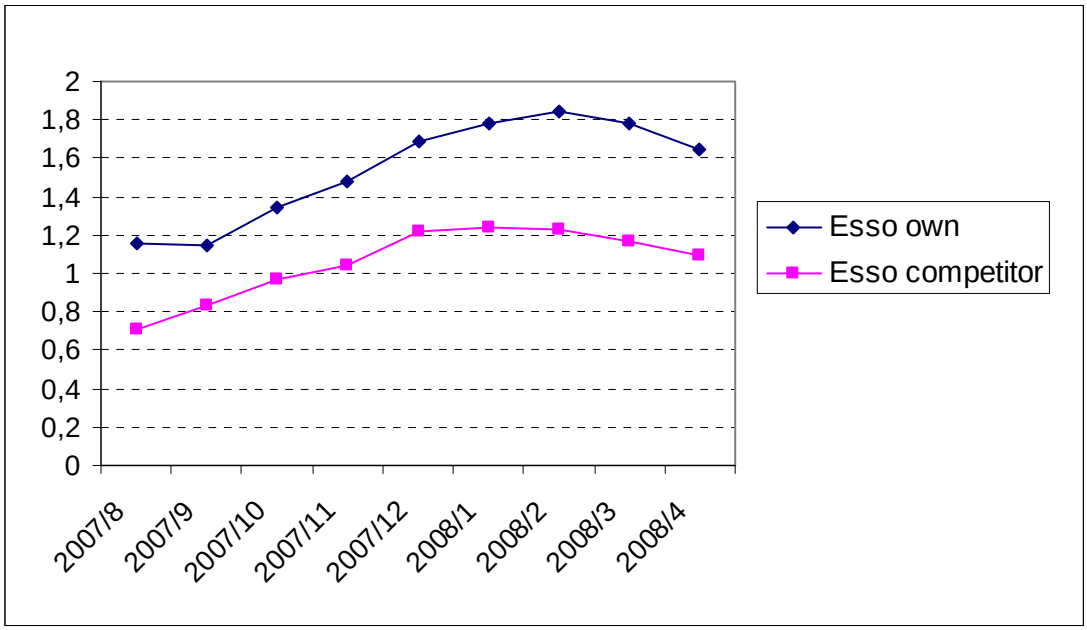
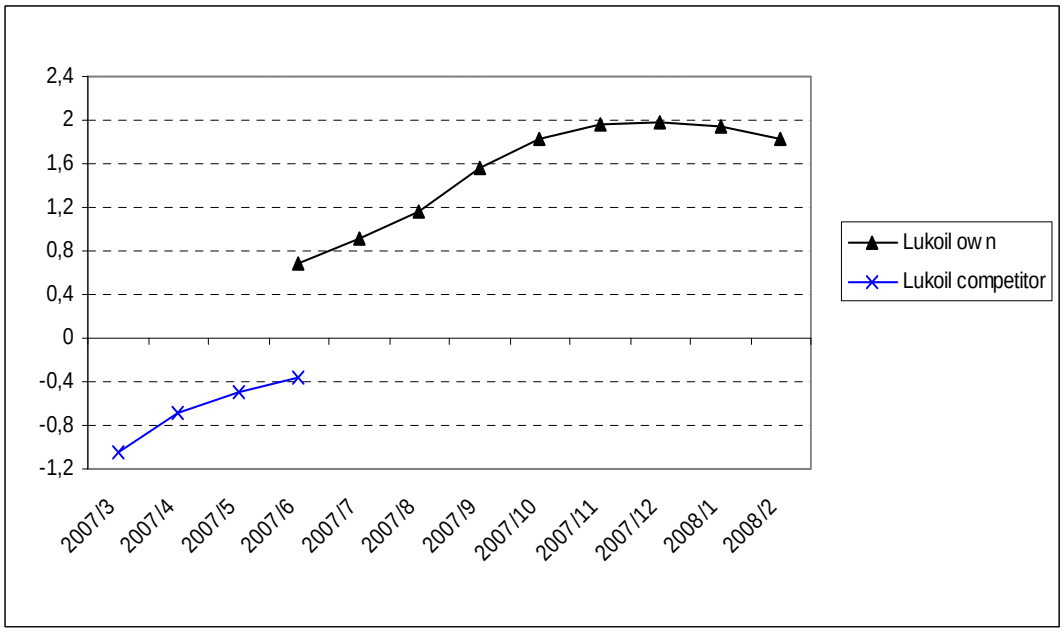


Figure 4.

Significant Lukoil and Jet results for Lukoil/Jet effective merger dates



[56] Changing the Agip/Esso effective merger dates does not change substantially the estimated effects for Lukoil and Jet and vice versa, so we do not show results for all possible pairs of effective merger dates.

In the case of the Agip/Esso merger, the own and competitor effects are always significant and positive for Esso, but never significant for Agip.[57] For this merger, the choice of the effective merger date does not change the qualitative results, but the estimated effects almost double if the merger is assumed to make an effect six months half a year after clearance rather than immediately. In the case of the Lukoil/Jet merger, however, we find only negative Lukoil competitor effects with effective merger dates before June 2007 and only positive Lukoil own effects with effective merger dates after this time. Therefore, for the second merger we may reach different qualitative conclusions if the effective merger date lies close to the clearance date, and the quantitative changes can be higher as well (the Lukoil own effect almost triples if effective merger date is December 2007 instead of June 2007). We see that all effects increase if we start to move the effective merger date from the clearance date, and the point estimates reach their peaks between December 2007 and February 2008.

We may use the above results for a speculative reasoning on the effective merger date. If the treatment indeed causes a discrete and immediate price increase and there are no other shocks affecting the industry, then the estimates for the assumed effective merger dates should be increasing before the actual effective merger date and decreasing after. Therefore, if we observe a (statistically significant) peak in the pattern of estimated merger effects then the date of this peak can be a candidate for the effective merger date. This is what we have done in Section 7 by pinning down both effective merger dates to January 2008 and even these estimates showed negligible price effects for both mergers. Note that one should be cautious with this approach of selecting the effective date, but we can use the results to find an upper bound for effects of a merger.

We now turn to the second potential issue, namely that the change due to the merger can be gradual, because of lengthy adjustment periods or differences in firms' reaction time. In this case, some observations fall in an intermediate period, and it might be beneficial to exclude this "window" period from the before-after comparisons.[58] In our application, we estimate Equation (2) by excluding a window starting from September 2007 for the Agip/Esso merger and July 2007 for the Lukoil/Jet merger,[59] and change the end of the window month-by-month till March 2008.

[57] The own effect is also always larger than the competitor effect, although the difference is not statistically significant.

[58] For the same reasons, Ashenfelter and Hosken (2008) estimate merger effects by leaving out observations within 3 months of the clearance date.

[59] If we start the Lukoil/Jet window before June 2007, only the Lukoil competitor effects will be significant.

Figures 5 and 6 show the significant effects (at 5%) of the respective merger for different window end dates, by keeping the other effective merger date at January 2008. The qualitative results do not change significantly on whether we include a window period or not: the set of significant effects remain the same and the effects are always larger when fewer observations from 2007 belong to the "after treatment" regime.

Figure 5.

Significant effects for different Agip/Esso window end dates

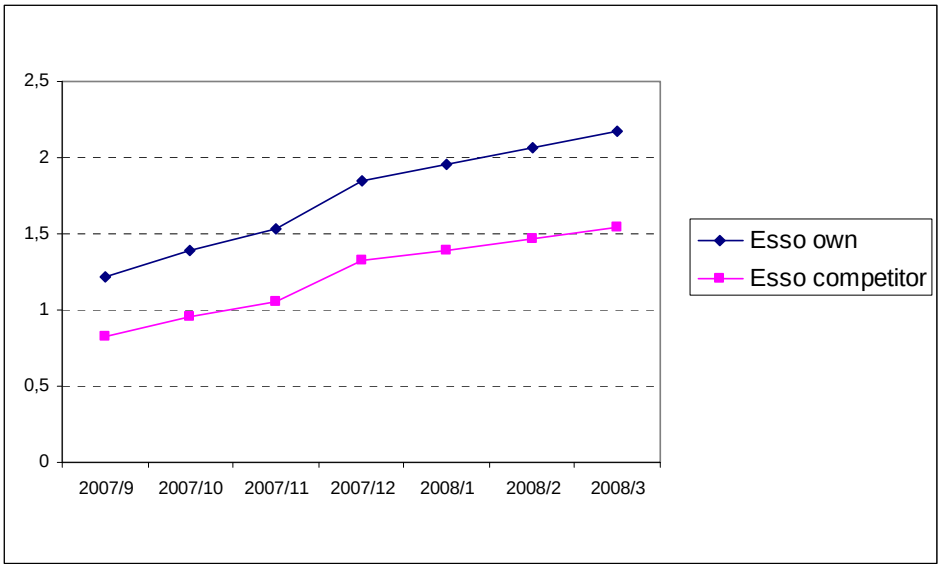
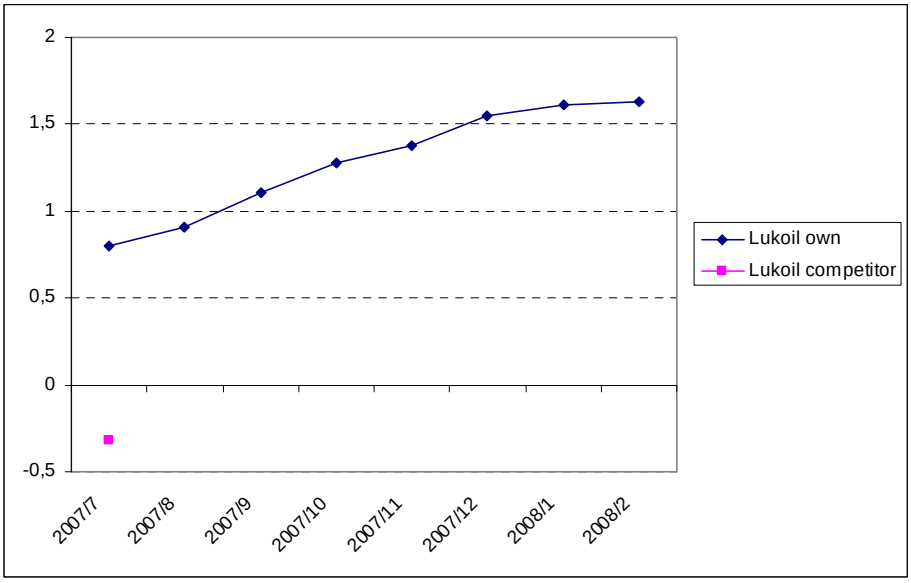


Figure 6.

Significant effects for different Lukoil/Jet window end dates



So far, we estimated and compared the average price differential between stations in treatment and control groups for the entire "before merger" and "after merger" regimes. We can gain a further insight on the timing of the mergers' impact by estimating this price differential for smaller time period (for example weeks or months). Although these estimates cannot be interpreted in a standard before-after comparison, the evolution of these differentials might give an additional indication on when and how the firms started to price differently. Note however, that it is not the pricing dynamics of the affected and non-affected stations that we estimate here, so this method should be seen as only complementary to other approaches disentangling the effect mechanism of the two mergers.

In our application, we estimate the monthly price differentials for the stations of the four merging firms and of their competitors with the specification of Equation (2). For the firms affected by the respective merger, we normalize the monthly price differentials to zero in the month of the clearance (February 2007 for Lukoil/Jet and July 2007 for Agip/Esso). Figures 7 and 8 show the evolution of these differentials, where we plot only parameter estimates that are significant at 5%.

Figure 7.

Significant monthly differentials of treatment and control stations for Agip and Esso and their competitors

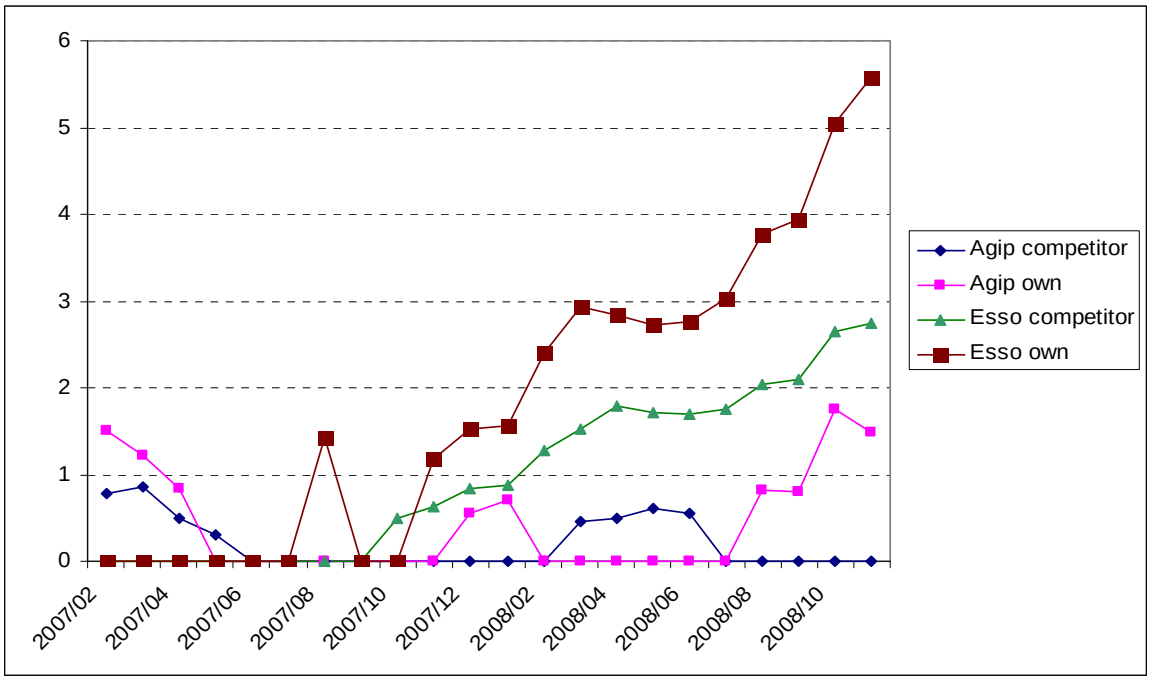
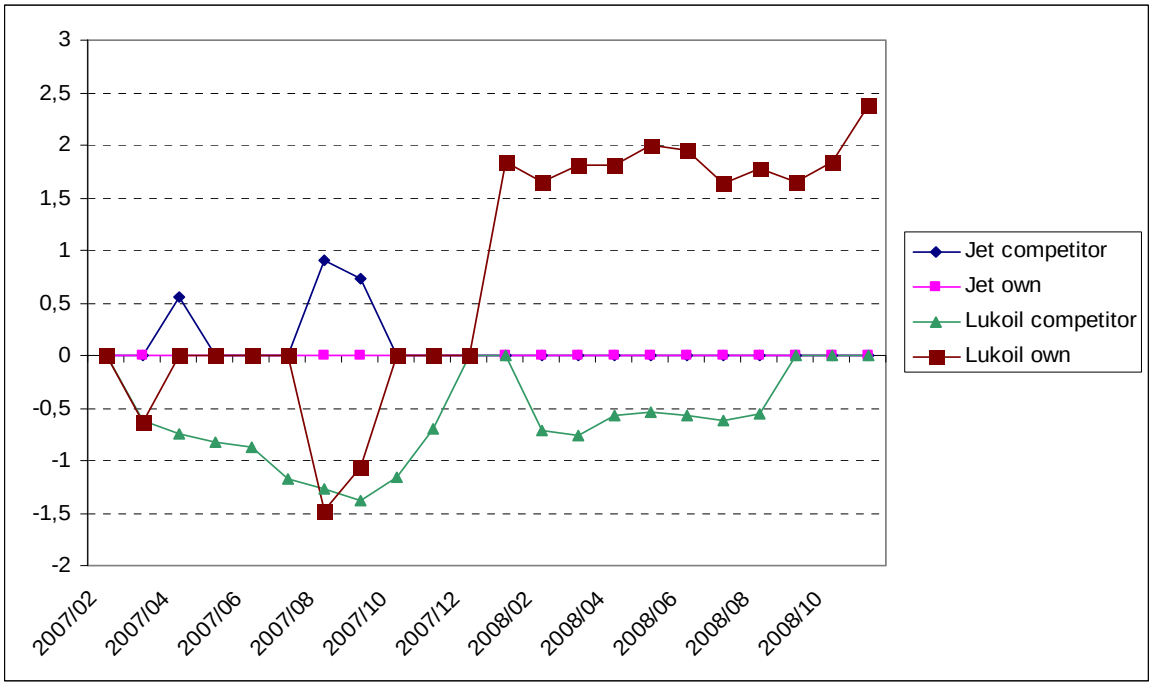


Figure 8.

Significant monthly differentials of treatment and control stations for Lukoil and Jet and their competitors



These results show a visible difference emerging between the prices of treatment and control stations for both mergers from the end of 2007. In the case of the Agip/Esso merger, the price differentials are steadily increasing for the treatment group belonging to Esso own and competitor effects, which can be consistent with the gradual brand repositioning explanation we discussed earlier. In the case of stations used in estimating the Lukoil own effect, however, there is a discrete jump in the monthly price differentials between stations in the treatment and control group, which can indicate a sharp change in the firms' pricing policy.

Finally, the estimation of monthly differences can help us to understand why some results are more sensitive to the choice of the effective merger date than others. We can use the fact that the standard difference-in-differences estimator of any merger effect is the difference between the average of the respective monthly differentials in months before and after the effective merger date. For example, as the monthly differential is almost never significant in the case of Jet, the difference-in-differences estimator robustly shows zero Jet own and competitor effects to all effective merger dates; while the increase of Esso monthly differentials explains why we estimate larger Esso effects if the effective merger date lies further away from the clearance date.

CONCLUSIONS

This paper showed how to separate the ex post effects of simultaneous mergers on the prices of buyer and seller firms and their competitors. We exploit variation in the combination of affected firms' presence in distinct local markets to identify and estimate these effects by difference-in-differences methods. The separation of these effects enables us the testing of previous theoretical predictions of the merger literature explaining how the firms' different role in the merger may result in different price changes after the merger.

As an application, we used a sufficiently rich panel database of station-based prices to analyze two almost simultaneous mergers in the Hungarian retail gasoline market. We concluded that a positive but negligible price effect can be attributed to both mergers, but one merger resulted in higher prices for the buyer firm's stations only, while the other increased prices of seller's stations and of its competitors. We also checked whether these results were sensitive to the (unobservable) dates when the mergers effectively changed the firms pricing, and found that our qualitative implications robustly emerge.

Our method for separating the different price effects of mergers can be applied to any merger where there is some variation in the activities of the affected firms among distinct local markets (or in some cases, among distinct products). Therefore, given appropriate data one could use this approach in the ex post evaluation of airline, hospital or supermarket mergers, which typically attract public and political attention. The method can also be modified to study research questions emerging from the specific needs of a policy case. In our application, for example, we could have easily studied how the mergers affected the pricing of stations owned by vertically integrated companies and individual stations differently by appropriately selecting the local markets identifying this effect.

In the future, we plan to complement our database with data on driving distances between stations. This feature will allow us to fine-tune the local market approach we have been working with, and check the robustness of our results in this respect. We can also add a further set of station characteristics to control for additional services like dining or car wash facilities, which could shed further light on the competition between leading brands offering a full range of services and discount stations supplying only gasoline.

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