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

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Work in progress, comments are welcome
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Abstract
This paper gives an ex post evaluation of two almost simultaneous mergers in the Hungarian retail gasoline market. By analyzing a detailed panel of station-level prices and using the fact that the two mergers affected regional markets differently, we are able to separate the price effects arising from the two mergers, and also differentiate between the price effects on buyer/acquired stations and on their direct competitors. We show that one merger was neutral and the other resulted in price changes smaller than 1%. For both mergers, we also find that the impact on merging parties' pricing was higher than on competitors' pricing, and the merger with larger overlaps in parties' local markets lead to (weakly) larger price increases.

Keywords: ex post evaluation, mergers, retail gasoline
JEL codes: D43, L13, L49
1. Introduction

In the past two decades, there has been a growing interest towards the analysis of gasoline markets, deriving mainly from political and public attention. The relatively large recent fluctuations in petroleum prices were often followed by quick reactions in retail prices, and it has been questioned whether the changes in wholesale conditions offer the only plausible explanation or whether one should be concerned about certain anticompetitive issues. Since, following a series of acquisitions, a restructuring has taken place on retail markets in many countries (which can also be looked upon as a rational consequence of less stable wholesale conditions), it is natural to ask whether these mergers contributed to retail price increases, and how the price effects of changes in wholesale conditions could be separated from changes in retail market structure. Studies of this type have received a further boost in the last few years, as there has been an increasing need for the evaluation of competition policy activities, and as a result, a growing number of competition authorities are now actively engaged in ex post evaluation.

There have been two recent academic contributions to the topic of ex post merger reviews in the gasoline sector, which specifically address these identification questions and use detailed micro-level data. Hastings (2004) uses a difference-in-difference 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 company-operated stations alone does not explain higher prices. Therefore, she concludes that the identity of competitors is as important as their number in determining market conduct, which supports a model with some product differentiation and brand loyalty for analyzing retail gasoline markets. Note however, that Hastings analyzes only the change in the pricing of competing stations, but the

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6 Another relevant policy question asked was how different forms of vertical integration have an effect on price increases, and whether vertical separation would be beneficial on gasoline markets. These issues have also been recently discussed at the OECD, see the submissions for the OECD Working Party No. 2 on Competition and Regulation in October 2008, to be published shortly at the OECD website.


8 The Hastings (2004) paper was criticized by Taylor et al (2007) 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.

9 Not enough data was available on the acquired Thrifty stations, as this was a random sample on prices in which minor brands and independent stations were underrepresented.
change in the pricing of acquired stations might actually be bigger than that, as will be explored in our paper.

Taylor and Hosken (2007) use a similar approach in measuring the effect of a joint venture uncontested by the US competition authorities, but find no retail price increases resulting from the change in market structure.\(^{10}\) This paper also illustrates important implications for further ex post reviews: (1) it is more important to analyze retail prices than rack prices, (2) differences 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 needed when selecting the counterfactual.\(^{11}\) The substantive difference between their paper and ours is that they examine the overall effect on merger on city-level (average) prices, while we take a further step in separating the different effects a merger might have on different market players in each market.

In this paper, we give an ex post assessment of two mergers on the Hungarian retail gasoline markets, which happened almost simultaneously: Lukoil/Jet in February 2007 and Agip/Esso in July 2007. Both mergers were of moderate size, the fifth and fourth biggest firm taking over the stations of the seventh and sixth firm, respectively. Our goal is analyze whether either merger contributed to the observed increases in retail prices, and to track the source of a potential price increase to the level of firm-specific pricing policies. To put it differently, we would like to separate the price effects between the two mergers and within each merger as well.

The expected results we would like to confirm are the following:

1. Theoretical industrial organization robustly suggests that a merger will result in a larger change in insider firms' pricing (reaction functions) than in competitor firms' pricing as the former can fully internalize the pre-merger competitive effect (externality) they had on each other.\(^ {12} \)

2. In mergers with local markets, a larger price increase is expected for a merger involving more markets where the two firms are direct competitors. Levy and Reitzes (1992) offer some theoretic foundation for this intuition, showing also that the closer...
the competitors are to the merger location, the better off they are, and thus insider effects are also larger than outsider effects.

3. From an organization theory viewpoint, it seems likely that the acquired firm's internal policies will change more after the merger than the buyer firm's, therefore we might expect a larger effect in the acquired firm's pricing than in the buying firm's pricing.\textsuperscript{13} By following the logic of the previous two points, this would furthermore result in a larger price effect for stations around the acquired firm's stations than around the buying firm's stations.

We argue that our detailed panel on station-level retail prices offers an intuitive way to separate the price effects of the two mergers. Because the pairs of merging firms were active on different regional markets, different treatment and control groups can be formed to identify the partial effects on different merging and competitor stations.\textsuperscript{14} A further advantage of our database is that we control for cost shocks by observing a signal of wholesale price and therefore are able to estimate margins on top of prices, and can observe the entire national market on which the merger had an effect instead of just some regions.

As a preliminary illustration of our results, Table 1 shows the mergers' partial effects on consumer prices and price-cost margins (the latter in parentheses) of different parties, estimated under the assumption that the change in the merged firm's pricing policy took place at the beginning of 2008.

| Table 1. Illustrative results for separate merger effects |
|---------------------------------|-------------|------------------|
| Own effect on buyer firm's stations | Not significant | +0.8% (+13.1%) |
| Own effect on acquired firm's stations | +0.7% (+11.4%) | Not significant |
| Competitor effect on stations in buyer's vicinity | Not significant | +0.1% (+1.6%) |
| Competitor effect on stations in acquirer's vicinity | +0.5% (+8.7%) | Not significant |

Our main conclusion is that neither merger contributed significantly to retail price increases, as all estimated effects are less than one percent. We also see our preliminary conjectures verified for the Agip/Esso merger: the significant effects are on the acquired Esso station's pricing, and the price change is larger at Esso stations than at competitors' stations. These results are also supported by the fact that the low-pricing Esso stations were mostly in the same local markets as Agip stations applying higher prices, and after having taken over a

\textsuperscript{13} We do not know of any theoretical paper backing up this conjecture, but it is conventional industry wisdom.

\textsuperscript{14} 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 different markets.
direct competitor, Agip might have imposed its pricing policy on these stations as well. For the Lukoil/Jet merger, we also find that own effects are larger than competitor effect (which is the most robust theoretical result), but significant effects are found only for the buying firm's stations and its direct competitors (the latter being very small, even on margins). However, in the Lukoil/Jet merger both firms had a low-pricing profile and there was much less overlap between their local markets, and we thus might suspect that the Lukoil/Jet merger had no price effect at the end and the own effect is due to some other firm-specific shock. Ultimately, the Agip/Esso merger lead to a larger price increase in total, which is in line with our initial expectations because of the large overlaps in their local markets.

However, the date when a merger effectively starts to have an economic effect on the respective firms is unknown; moreover, the change in pricing might be even gradual and outsiders might adjust later to insiders’ reactions. Therefore, we also estimate how the respective mergers affected prices each month after the clearance, and these methods might also help to approximate the date when the pricing policies might have changed. Our qualitative results cited above do not change, and we also show that the Agip/Esso merger had an almost immediate effect that gradually increased, while the Lukoil/Jet merger does not seem to have affected prices till the beginning of 2008.

2. Structural changes on the Hungarian retail gasoline market

The Hungarian retail gasoline market is moderately concentrated, with the four main players owning almost 70% of petrol stations (and likely account for an even higher share of revenues): Hungary-based MOL, Austria-based OMV, Shell and Agip (Eni). MOL owns a leading share of stations and has a leading role at the wholesale level as well (with an upstream market share of at least 70%). Three other international brands were also present in 2007: Esso (Exxon), Jet (ConocoPhillips) and Lukoil. From the early 2000s onwards, major supermarket chains (notably Tesco) began opening discount stations, and there has been a large number of independent retailers (so called white pumps).

Since 2007, the Hungarian retail structure has undergone a process of consolidation.

1. Cleared merger 1: in February 2007, Lukoil took over Jet's network of stations. As this acquisition was part of a larger transaction and the merging parties had a market share of less than 10% in Hungary, DG Competition cleared the merger in Phase I. The

15 See COMP/M.4532 Lukoil/ConocoPhillips decision.
replacement of station labels started only at the end of 2007, but Lukoil likely had an
effect on Jet stations' pricing from an earlier date following the merger.

a larger transaction and having a joint market share of less than 15% in Hungary, DG
Competition cleared this merger in Phase I as well. The replacement of station labels
began in November 2007, although Agip might have influenced Esso stations' pricing
earlier.

3. Failed merger: in September 2007, OMV launched a hostile takeover bid for MOL.
DG Competition ran an in-depth Phase II investigation in 2008, and OMV withdrew
its notification in August 2008.

4. Cleared merger 3: in February 2009, Shell notified the long-term lease agreement of
Tesco's stations, which was cleared by the Hungarian Competition Authority (GVH).
The evolution in the number of the biggest firms' stations can be tracked in the Table 2.

<table>
<thead>
<tr>
<th>Station no</th>
<th>2007-01</th>
<th>2008-12</th>
<th>Station shares 2008-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOL</td>
<td>355</td>
<td>355</td>
<td>26.5%</td>
</tr>
<tr>
<td>Shell</td>
<td>187</td>
<td>190</td>
<td>14.2%</td>
</tr>
<tr>
<td>OMV</td>
<td>160</td>
<td>165</td>
<td>12.3%</td>
</tr>
<tr>
<td>Agip</td>
<td>102</td>
<td>144</td>
<td>10.7%</td>
</tr>
<tr>
<td>Esso</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lukoil</td>
<td>42</td>
<td>75</td>
<td>5.6%</td>
</tr>
<tr>
<td>Jet</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tesco</td>
<td>38</td>
<td>47</td>
<td>3.5%</td>
</tr>
<tr>
<td>Other stations</td>
<td>186</td>
<td>256</td>
<td>15.5%</td>
</tr>
<tr>
<td>Sum</td>
<td>1159</td>
<td>1335</td>
<td></td>
</tr>
</tbody>
</table>

In what follows, we aim at pinning down the effects of the almost simultaneous 2007 mergers
on the merging parties' and competitors' pricing.

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16 See COMP/M.4723 Eni/Exxon Mobil (Hungarian, Czech and Slovak Package) decision.
18 See GVH decision Vj-17/2009.
19 The table lists only the companies owning a share larger than 1 percent (in terms of station numbers).
20 In our database, we track only 126 of OMV stations in the beginning of 2007, but we know from
official public sources that there were in fact 160. The price comparing website, which is the source of our data,
corrects this error in the middle of 2007, and begins to observe the previously missing OMV stations.
21 The number of white pumps is the least reliable data in this table, because an expansion from 186 to
256 in the number of white stations is unlikely, the price comparing website rather started to observe some white
petrol stations later. Some white pumps form common-brand alliances of 2-40 stations, but these stations remain
independent in their pricing and purchasing decisions. The largest alliance was Klub Petrol with 40 stations in
2007, but it went bankrupt; another rising alliance is Avia, which had 36 stations at the end of 2008.
3. Data

We are analyzing a panel database containing daily gasoline prices for 96 weeks in 2007 and 2008. The source of our data is a public website aimed at consumers to help gasoline price comparisons: [www.holtankoljak.hu](http://www.holtankoljak.hu) (Where To Fuel?), run by a private company.\(^\text{22}\) We will analyze prices uploaded on Fridays, as wholesale prices change each Wednesday morning,\(^\text{23}\) and therefore most price changes occur on Wednesday and Thursday.\(^\text{24}\) In total, we have 81253 price observations for over 1300 petrol stations, which cover more than 95% of stations in Hungary.\(^\text{25}\)

We have chosen to analyze the price changes for 95-type petrol only, as 96% of petrol sales are of this type. We also have data for diesel prices, but the results are very similar.

Although previous competition policy analyses usually defined the geographical market for gasoline as national, it is widely understood that gasoline pricing reflects regional characteristics. In a recent merger investigation, DG Comp also took the view that although the market is defined as national, the competitive assessment should take local aspects into account.\(^\text{26}\) In this paper, we use an economics-oriented proxy for local markets: the 168 statistical municipalities defined by the Hungarian Central Statistical Office (KSH). Statistical municipalities are 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 retail companies consider the stations in the municipality as their main local competitors. There are two further advantages to use statistical municipalities as local markets: 1) the ZIP code of each station can be automatically linked to a municipality, and 2) 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.

\(^{22}\) 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.

\(^{23}\) 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.

\(^{24}\) 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.

\(^{25}\) The missing stations are all white stations or belong to small brands with few stations.

\(^{26}\) See COMP/M.4723 StatoilHydro/ConocoPhillips decision, §26-29.
We did not consider gasoline stations located on highways, for two reasons: 1) in previous analyses, they were sometimes defined as a distinct relevant market, and 2) it was not always possible to connect them to a statistical municipality, as they often have no postal address and therefore no ZIP code. The capital of Hungary (Budapest) with its 183 stations is defined as one statistical municipality, and therefore this outlier is also excluded from the analysis.

4. Some illustrative statistics on market developments

The 150 local markets where there is at least one station from the top 10 brands are quite concentrated: the average number of branded stations in a municipality is 3.2, and more than 75% of municipalities have up to 4 different retail chains present.

By taking a closer look at the two mergers analyzed, there is a visible difference in the geographical patterns, as presented in Table 3 below. The Lukoil/Jet merger seems to have expanded Lukoil’s regional presence by entering new local markets, while the significant share of Esso stations acquired were direct competitors of Agip stations. Based on this simple fact alone, a higher price effect could be conjectured for the Agip/Essom merger.

Table 3. Overlaps between merger parties' stations

<table>
<thead>
<tr>
<th>Merger</th>
<th>No and share of local markets with seller's and buyer's stations both present</th>
<th>No and share of local markets with only seller's stations present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agip/Essom</td>
<td>35 88%</td>
<td>5 12%</td>
</tr>
<tr>
<td>Lukoil/Jet</td>
<td>13 43%</td>
<td>17 57%</td>
</tr>
</tbody>
</table>

This preliminary conjecture might be strengthened further if we look at the evolution of retail prices. In the observed period, the price of petrol fluctuated between 230 and 310 Hungarian Forints (HUF), with an average of 281 HUF. In order to filter out common shocks (particularly the change of the wholesale price), we show in Graph 1 below the differences between firm-specific average price and the national average price. The brand of the station refers to its original brand at the beginning of the observation period, which is before either merger.

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27. 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-highway prices.

28. The exchange rate also fluctuated during these two years, but the 250 HUF = 1 Euro exchange rate can serve as a good approximation.
Graph 1. Difference between firm-level and national average price

We see that the three largest firms MOL, OMV and Shell (the first two of which are vertically integrated) were able to maintain slightly higher prices then their competitors, and Agip's prices started to keep up with them in 2008. We also see a considerable change in the pricing of Esso stations acquired by Agip in the middle of 2007, as their prices increased from the level of low-pricing firms to the national average. On the other hand, the Lukoil and Jet stations appear to have maintained their low-pricing policies following the merger of their respective companies, although Lukoil's prices slightly increased from the second part of 2007.

Both from a theoretical and empirical industrial organization point of view, it is more instructive to analyze and estimate the evolution of price-cost margins. Although we are estimating a reduced form model, margin equations are closer to the equilibrium conditions derived from a structural model, and better capture the competitive interactions between firms. A further advantage from an econometric point of view is that our price time series are not stationary, while the approximated margin series are.

Unfortunately, we do not have data on the wholesale prices faced by the respective retail firms. However, we do know the weekly changes in the main wholesaler MOL's list prices, as

\[29\] On the graph, we plot the average of the top 3 firms' prices, as no substantial differences can be observed between their average prices.
these are publicly known. Since MOL has significant market power upstream, we believe that its wholesale price can serve as a good indicator of marginal costs. We will therefore refer to MOL's list price hereafter as the wholesale price, and to the margin of a station / brand as the simple difference of the respective retail and wholesale price.

By this definition, the patterns of margins follow a similar picture than the one on price comparisons shown above. The average margin varies between 10 and 18 HUF, with an average of 15 HUF (about 5% of the 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 consumer cards or fleet programs. As larger retailers seem to offer larger discounts,\(^\text{30}\) the real price differences between smaller and larger retailers might be smaller than shown above in Graph 1. Similarly, at the wholesale level retailers receive individual discounts from the list price (OMV and Lukoil are also vertically integrated companies), which are not observed. However, these measurement errors are mostly taken care of by the difference-in-difference estimation method we are using, assuming the size of these discounts remains stable over the observed period (there is no public indication otherwise).\(^\text{31}\)

However, the descriptive analysis of national trends cannot bring definitive results on the effects of concentration changes on competitive interactions, so we turn to the analysis of local prices.

5. Identification of ex post merger effects

As outlined in the Introduction, we aim to differentiate and estimate eight types of (price) effects resulting from the two mergers. First, in line with the basic motivation for the analysis, we separate the effects of the two mergers (Agip/Esso and Lukoil/Jet effects). Second, we differentiate between the direct effects of the merger on the merging parties (own effect) versus the indirect effect on their competitors (competitor effect). We do so in order to account for the fact that competitors are also affected by the merger and further to quantify the differences between the effects on insiders and outsiders. As above, competitors are identified on the basis of local markets as defined by municipalities. Third and finally, we separate the effects associated with the two different parties in each merger (buyer and

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\(^{30}\) This conjecture is hard to verify, because the discounts often do not take the form of a direct price decrease for gasoline, but give for example bonus points (price discounts) for shop purchases.

\(^{31}\) It might be the case that a merged company gets a larger quantity discount due to increased sales, but this change will be captured by our estimated merger-specific effects.
acquirer effects), as these might not be symmetric. Therefore, four effects correspond to the merging firms and four effects to their competitors.

In order to identify the eight merger effects, a simple difference in differences method is used 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. In the current context treatment and control groups can be formed based on the different presence of merging stations in the geographic 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. Therefore variation in the presence of merging firms across local markets enables us to form appropriate control groups that identify the merger effects of interest.

If the mergers would represent a truly experimental situation, then there would be distinct treatment and control groups for each effect being measured. This is not the case, however, due to the presence of multiple merging parties in a given market. For example, each Esso station is a member of the treatment group for these Esso own effect, but can be a member of several control (and even treatment) group 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 for identification: it is also identified by the differences between prices at Esso stations in markets where only Esso and Lukoil are present from among the merging firms and prices at Lukoil stations in markets where only Lukoil is present from among the merging firms. Competitor effects are similarly identified to own effects.32

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 4 shows for the case of Esso the number of local markets and stations-weeks 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 taking one if the firm is present and zero if it is not. For example, in control group 1010 Agip and Lukoil are

32 For example, the Esso competitor effect is identified based on the differences between Esso competitor stations in a market with only Esso present from among the merging firms and stations in markets where no
present, Esso and Jet are not, and it corresponds to treatment group 1110 where one or more Esso stations are present as well.

Table 4. Treatment and control groups identifying Esso own and competitor effects

<table>
<thead>
<tr>
<th>Presence combination</th>
<th>Number of local markets</th>
<th>Own stations</th>
<th>Competitor stations</th>
<th>Number of station-week observations</th>
<th>Presence combination</th>
<th>Number of local markets</th>
<th>Number of station-week observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100</td>
<td>3</td>
<td>214</td>
<td>2143</td>
<td></td>
<td>0000</td>
<td>75</td>
<td>21284</td>
</tr>
<tr>
<td>1100</td>
<td>4</td>
<td>324</td>
<td>4035</td>
<td></td>
<td>1000</td>
<td>37</td>
<td>12359</td>
</tr>
<tr>
<td>0110</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td>0010</td>
<td>16</td>
<td>6,491</td>
</tr>
<tr>
<td>0101</td>
<td>1</td>
<td>155</td>
<td>778</td>
<td></td>
<td>0011</td>
<td>4</td>
<td>2690</td>
</tr>
<tr>
<td>1101</td>
<td>3</td>
<td>222</td>
<td>5079</td>
<td></td>
<td>1001</td>
<td>3</td>
<td>2548</td>
</tr>
<tr>
<td>1110</td>
<td>2</td>
<td>257</td>
<td>3061</td>
<td></td>
<td>1010</td>
<td>10</td>
<td>3564</td>
</tr>
<tr>
<td>0111</td>
<td>0</td>
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<td>0</td>
<td></td>
<td>0011</td>
<td>1</td>
<td>496</td>
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<tr>
<td>1111</td>
<td>3</td>
<td>240</td>
<td>6785</td>
<td></td>
<td>1011</td>
<td>2</td>
<td>1491</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>16</strong></td>
<td><strong>1412</strong></td>
<td><strong>21881</strong></td>
<td></td>
<td><strong>Sum</strong></td>
<td><strong>135</strong></td>
<td><strong>43936</strong></td>
</tr>
</tbody>
</table>

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 for the own merger effects and 21881 for the competitor merger effects. This difference in available observations for own and competitor effects might be looked as an advantage of estimating merger effects based on competitors (see for instance Hastings, 2004), but as we will see from our result (and also as predicted by theory), this is not a reliable measure of own effects. The number of available controls is 43936.

Table 5 summarizes the number of markets and station-week observations used for the identification of each merger effect to be estimated.
### Table 5. Treatment and control groups identifying all own and competitor effects

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Number of local markets</th>
<th>Number of stations-week observations</th>
<th></th>
<th>Number of local markets</th>
<th>Number of stations-week observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Own stations</td>
<td>Competitor stations</td>
<td>Control</td>
<td>Own stations</td>
<td>Competitor stations</td>
</tr>
<tr>
<td>Agip</td>
<td>59</td>
<td>6861</td>
<td>39830</td>
<td>100</td>
<td>36010</td>
<td></td>
</tr>
<tr>
<td>Esso</td>
<td>16</td>
<td>1412</td>
<td>21881</td>
<td>135</td>
<td>43936</td>
<td></td>
</tr>
<tr>
<td>Lukoil</td>
<td>34</td>
<td>3400</td>
<td>23002</td>
<td>126</td>
<td>53009</td>
<td></td>
</tr>
<tr>
<td>Jet</td>
<td>17</td>
<td>1464</td>
<td>20690</td>
<td>147</td>
<td>60547</td>
<td></td>
</tr>
</tbody>
</table>

6. Empirical specification

Up to this point the discussion assumed that the date of regime change was directly observable, but this is hardly ever the case. Although we can determine which stations were affected by the respective mergers, we do not observe the exact date when the mergers started to influence pricing decisions, only the clearance date of the merger. This is not simply a deficiency of our dataset but a frequent characteristic of mergers, since in most cases it is impossible to directly observe when the economically relevant behavioral change induced by the merger took place. This problem poses a challenge to the difference-in-differences identification, since the before-after division becomes slightly arbitrary. Moreover, the change in pricing policies might even be gradual and competitors might adjust later to insiders' reactions. These features of the data warn against relying blindly on difference-in-differences methods in estimating merger effects and call for analyzing the sensitivity of the merger date assumption.

As a starting point we assume that the change in pricing policy occurred at one particular point in time. Although not completely realistic, the advantage of having one discrete change is that we will have an estimate for each treatment effect that can be directly interpreted. It is reasonable to expect that the effective merger date follow the clearance decision (2007 February for Lukoil/Jet, 2007 July for Agip/Esso) by no more then a year. In the sample we observe that the relabeling of acquired stations started at the end of 2007 for both consummated mergers, therefore we make the assumption that the effective merger date for both mergers was the 1st of January in 2008.

In order to investigate the sensitivity of this result, we estimate the price differential between treatment and control stations by months for the whole sample period. Note that this method generates only the difference between treatment and control groups but not the before-after differences based on the merger date. However, this approach allows us to observe the
monthly development of the price differentials, on which the merger effect estimates (the difference-in-differences) are based. Furthermore, we can show the trends of changes in the pricing policies, which can also give some indication of the effective merger date for both mergers.

The difference-in-differences approach is implemented in a panel regression framework using station and time fixed effects. 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 Agip and Lukoil. Additionally, we do not fully observe all relevant characteristics of different stations and the size of local demand for gasoline.

Station fixed effects control for the non-time varying part of these unobservables, while time fixed effects control for changes common to all stations in a given period and therefore account for the non-station varying part of the unobservables. In order to allow for a stricter control of common time variation we used county-time fixed effects. Additionally, we take into account changes in market structure other than the two mergers by including in the regressions the number of stations and indicator variables of the eight largest firms present in the local markets. These variables could also capture the effects of entry and exit of stations in local markets.

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.

Our dependent variable is the price-cost margin, which already controls for wholesale price movements during the sample period. We estimate the following specification:

\[
y_{it} = \beta_0 + \beta_1 \text{size}_{it} + \beta_2 \text{size}^2_{it} + \sum_{k=3}^{10} \beta_k \text{type}_{it} + \\
+ \sum_{j \in \text{Jet, Lukoil, Esso, Agip}} \alpha_{j, \text{own}}_{jit} + \sum_{j \in \text{Jet, Lukoil, Esso, Agip}} \alpha_{j, \text{competitor}}_{jit} + u_t + cm_t + v_t + \epsilon_{it}
\]  

(1)

---

33 There are 19 counties in Hungary, and these geographic units contain 8 municipalities on average.

34 Although the included variables describing local competition are similar to the common ones used in price-concentration studies (simple and squared number of competitors) and event studies (presence dummies for each type of competitors), one should not interpret the corresponding parameter estimates in the usual way, as we are analyzing differences and not levels.
where $\alpha$-s and $\beta$-s are parameters to be estimated, $i$ indexes stations, $t$ indexes time, $k$ indexes competitors and $j$ indexes the merging parties. Variable $y_{it}$ is the price-cost margin, $size_{it}$ indicates the number of competitors in the local market, while variables $type_{it}$ indicate the presence of the seven largest firms and white stations. The variables $own_{jit}$ capture the merger effect on merging parties and take the value of one after the merger for the stations of each merging firm and zero otherwise. Variables $competitor_{jit}$ 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 and zero otherwise. Finally, the error component $u_i$ is the station fixed effect, $v_i$ is the time fixed effect, $cm_{it}$ is the county-month fixed effect and $\varepsilon_{it}$ is the disturbance term.

7. Estimation results on ex post merger effects

First we assume that the effective merger date was the 1st of January 2008 for both mergers, and show the estimated merger parameters from Equation (1) in Table 6 below.

<table>
<thead>
<tr>
<th>Merger effects</th>
<th>Lukoil</th>
<th>Jet</th>
<th>Agip</th>
<th>Esso</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own effect</td>
<td>1.97**</td>
<td>-0.43</td>
<td>0.01</td>
<td>1.72**</td>
</tr>
<tr>
<td>Competitor effect</td>
<td>0.24*</td>
<td>0.03</td>
<td>0.13</td>
<td>1.23**</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitor types</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of competitors</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station fixed effects</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time-county fixed effects</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>82701</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within R²</td>
<td></td>
<td></td>
<td></td>
<td>0.2512</td>
</tr>
</tbody>
</table>

* Significant at 10%, **Significant at 5%, Panel-clustered standard errors

The estimated merger effects are significant only for Lukoil and Esso (regarding both own and competitor effects). In order to see the magnitude of the estimated price effects, we show the relative change in consumer prices and margins (the latter in parentheses) in Table 7 below.

<table>
<thead>
<tr>
<th></th>
<th>Agip/Esso</th>
<th>Lukoil/Jet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own effect on buyer firm's stations</td>
<td>0</td>
<td>+0.8% (+13.1%)</td>
</tr>
<tr>
<td>Own effect on acquired firm's stations</td>
<td>+0.7% (+11.4%)</td>
<td>0</td>
</tr>
<tr>
<td>Competitor effect on stations in buyer's vicinity</td>
<td>0</td>
<td>+0.1% (+1.6%)</td>
</tr>
<tr>
<td>Competitor effect on stations in acquirer's vicinity</td>
<td>+0.5% (+8.7%)</td>
<td>0</td>
</tr>
</tbody>
</table>
As all price effects are below 1%, we conclude that neither merger contributed significantly to retail price increases. However, some price-cost margin effects are non-negligible, and are large for some competitors' stations, especially in Esso stations' vicinity (almost 9%).

The ex post results on the Agip/Esso merger are also supported by the fact that the low-pricing Esso stations were mostly in the same local markets as higher pricing Agip stations; and after having taken over a direct competitor, Agip might have imposed its pricing policy on these stations as well. For the Lukoil/Jet merger, a considerable effect was found only for the buying firm's stations, but only a small and weakly significant effect on Lukoil stations' direct competitors. We also know that both firms in the Lukoil/Jet merger had a low-pricing profile and there was much less overlap between their local markets. Based on these facts, it is also possible that the Lukoil/Jet merger was neutral from a pricing point of view, and the estimated own effect is due to some other unobserved Lukoil-specific shock.

Another of our initial expectations was that the merger with larger overlaps in the respective firms' local markets resulted in larger price increases at the national level. This conjecture is proven by some straightforward calculations: the total price effect of the Agip/Esso merger was higher by about 0.1% than that of the Lukoil/Jet merger, but this difference is not significant from an economic point of view.

As outlined before, we can also estimate the monthly price differentials between treatment and control stations for the whole sample period, which we show separately for both mergers in Graphs 8 and 9 below.

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35 For the Agip/Esso merger, the estimated total change in price is 21 (number of Esso stations) \* 0.7\% + 315 (number of Esso stations' competitors) \* 0.5\%, divided by the total number of stations (1335), which gives 0.13\%. By similar calculations, the estimated total price effect for the Lukoil/Jet merger is 0.04\%.
Graph 8. Monthly margin differentials of treatment and control stations for the Agip/Esso merger

The clearance date for the Agip/Esso merger was June 2007, where the differences are by definition zero. For this merger, we see the trend of monthly differences reinforcing the qualitative results of difference-in-differences estimations. The merger begins having an almost immediate behavioral effect on Esso stations and direct Esso competitors, with the competitor effect always smaller than the own effect. Furthermore, both Esso trends are almost monotonically increasing, which might signal that the price effects were more gradual. Since there were considerable price differences before the merger, it very likely did not make business sense to rise Esso prices immediately to the level of Agip stations.
The Lukoil/Jet merger was approved in February 2007, which makes the method of evaluating monthly differences less reliable in this case, as there are only a few observations before the clearance date. The presence of negative Jet effects may be also a result of this shortcoming. However, these trends might also give some indication of the neutrality of the Lukoil/Jet merger: the sudden increase in Lukoil stations' (but not in direct competitors') pricing at the end of 2008 might be the result of another firm-specific shock.

8. Conclusions
This paper showed how to separate the ex post effects of simultaneous mergers on both the merging parties' and competitors' pricing policies. By using a sufficiently rich panel database of station-based prices, we were able to construct different control groups for each merger treatment that allowed us to estimate the partial effects. As an illustration, we analyzed two almost simultaneous mergers of similar size at the Hungarian retail gasoline market, and found that one merger had only a very small competitive impact (increased prices by less than 1%), while the other was neutral in this respect. We also showed for both mergers that the effect on insiders' prices was higher than on competitors' prices, and the merger involving larger overlaps in parties' local markets lead to (weakly) larger price increases.
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 regional market definitions 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 (sometimes automatic) stations supplying only gasoline.

References

36 This recommendation was also given by Taylor and Hosken (2007).