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Marco Horvath

Germany's Market Transparency Unit for Fuels: Fostering Collusion or Competition?

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Marco Horvath[1]

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Abstract

To increase competition in the retail market for gasoline, Germany's Federal Cartel Office established the so-called Market Transparency Unit for Fuels (MTU). Drawing on a panel data set covering 6,834 stations in Germany and employing both fixed effect methods and a difference-in-difference approach, this study investigates the impact of the MTU on the price margins of gas stations. We find that the MTU fostered a more intense competition, with a reduction in price margins of 1-2 cents per liter.

JEL-Code: Q41, D43, D83, L13

Keywords: Retail gasoline; market transparency; price margin; competition

December 2019

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1 Introduction

Most people in industrialized countries are heavily reliant of gasoline for their everyday mobility. Changes in gas prices consequently have an immediate impact on consumer welfare, especially among low-income people. Scholarship on this issue has focused on whether markets are competitive by studying price cycles and asymmetry (for example Carranza et al., 2015; Deltas, 2008) as well as consumer search in gasoline markets (Atkinson, 2008; Byrne and de Roos, 2017; Lewis and Marvel, 2011).

In Germany, the Federal Cartel Office investigated whether gasoline stations exert market power (FCO, 2011). The Federal Cartel Office's resulting report concluded that the German market is dominated by five vertically integrated oil companies that operate as oligopolists, which consequently lead to higher prices. Following this finding, the Federal Cartel Office mandated the establishment of a publicly accessible, obligatory on-line price disclosure portal for gasoline prices in Germany in December 2013, the so-called Market Transparency Unit for Fuels (MTU). By improving market transparency for consumers, the goal was to increase price competition among gasoline stations and, as a result, to dampen prices.

Whether this outcome transpires in practice is theoretically ambiguous. Schultz (2005), for example, derives theoretical conditions in which increased market transparency leads to less competition: On the on hand, sustaining tacit collusion can become more difficult, as the benefits of undercutting the competitors prices increase with more market transparency. On the other hand, if tacit collusion persists, deviating from the optimal outcome can also be observed more easily by other oligopolists and therefore be punished more quickly and harshly.

There are a number of empirical studies in which this latter effect is found. Albæk et al. (1997), for instance, show an example from Denmark where the publishing of prices in a market for a highly homogenous good increased prices as market trans-

parency facilitated tacit collusion and helped to reduce the intensity of oligopoly price competition. In a study that is closely related to the present study, Luco (2019) analyzes the retail gasoline market in Chile, where an intervention similar to the German MTU was introduced in 2012. In line with Albæk et al. (1997), Luco finds that the intensity of competition significantly decreased with more price disclosure and margins of gasoline stations increased by 9%.

For the German gasoline market, a study by Frondel et al. (2020) investigates whether the introduction of the MTU changed price cycles. They find that before the introduction of the price portal, German gasoline prices exhibited the classic "rockets and feathers"-pattern, wherein output prices (i.e. gasoline prices) rise like rockets in response to an input price (i.e. oil prices) increase, but fall like feathers after an input price decrease (Noel, 2016). In the aftermath of the introduction the pattern vanished. Frondel et al. (2020) conclude that the MTU resulted in stronger competition between German gasoline stations and therefore price savings for consumers. Dewenter et al. (2017) look at the impact of the MTU on gasoline prices in Germany. In contrast to the present analysis they use a much longer time span and find an increase in prices in the aftermath of the MTU. In line with Luco (2019), the present study opted to only look at a shorter time span with regard to probable changes in the market structure both in the treatment country as well as the control countries.

Furthermore, this paper investigates changes in the margins of German gas stations following the introduction of the MTU, while for example the study by Frondel et al. (2020) focused on price asymmetry and a change in the price adjustments over time. Because price in a perfectly competitive market should equal marginal costs, we interpret a reduction of price margins as an indication of intensifying competition. Using fixed effect methods to analyze changes in the price margins and a difference-in-difference approach as a robustness check, this study finds a reduction of price

margins of around 1 to 2 cents/liter in Germany, which corresponds to a reduction of margins of around 20 to 25%. Thus, we conclude that the MTU indeed was associated with more intense competition between gasoline stations and, hence, significant price decreases, which lead to welfare gains for German consumers. Nevertheless, in terms of economic relevance, we find that this reduction was moderate and that the welfare gains therefore were not very perceptible for the average consumer.

The following section provides a summary of the data, followed by a discussion of the methods applied in Section 3. Section 4 presents the results and Section 5 summarizes and concludes.

2 Data

In this analysis we use data on gasoline prices (retailed E10, a 10% bio-ethanol fuel mixture) and the wholesale price of refined fuel of Rotterdam, where the major pipeline into Germany originates. While the refinery data was taken from the trade magazine EID[1], we use two different sources for the gasoline prices. In 2013, Germany implemented the Market Transparency Unit for Fuels (MTU). Officially starting in December of that year, all gasoline stations in Germany where mandated to post price changes within five minutes to the online portal. A beta-phase while the official start date of the MTU was December 1st, 2013. We test the robustness of the estimates using both start dates.

In addition to fuel prices, the MTU records a number of station specific characteristics, such as the brand of the station, its geographical coordinates, and opening hours. This data is then shared by the MTU with a number of different internet providers that process and publish the data in order to make it useable for consumers. The

[1]For more information on the *E*nergie Informationsdienst (EID), see `http://www.eid-aktuell.de/`.

aim is then to allow consumers to compare prices for retail gasoline stations in their vicinity. To access the data, a script was written that continuously retrieves entries from the site and stores these on a server (Frondel et al., 2016). The accuracy of the MTU data is high, and it has served as the basis for a growing body of research that analyzes fuel price setting in Germany (e.g. Frondel et al., 2016; Haucap et al., 2016; LeSage et al., 2017).

To compare how prices changed for individual stations before and after the introduction of the MTU, we additionally draw on another data set that was assembled by Kihm et al. (2016), covering a time-span before the introduction of the MTU. This data set comprises retail fuel prices retrieved from the site www.clever-tanken.de, which is currently one of a handful of sites that publishes real-time data from the MTU. Prior to the introduction of the MTU, the Clevertanken site relied on price postings voluntarily provided by customers of the stations via mobile apps. Kihm et al. (2016) created a panel of daily fuel prices from these postings covering 13,701 stations, i. e. about 95% of the market. Frondel et al. (2020), as well as Kihm et al. (2016), furthermore test how well the Clevertanken and the MTU data correspond for the brief overlap of the beta testing phase (September 2013 through November 2013). This comparison shows that the correspondence is very tight, with a correlation of 99.7%.

Using the stations' locations and brands, we merge the two data sets by appending the MTU data from September 25th, 2013, onwards to the Clevertanken data. The time span we have data for is May 2013 until March 2014. Therefore, we have a total of ten months with about two months overlap of the two data sets. In line with Frondel et al. (2020), we ensure that we have an identical set of stations before and after the introduction of the MTU. From a total set of 9,834 stations, we eliminated 3,450 stations for which we do not have broad temporal coverage in both periods. To this end, we restrict our sample to stations that exhibit at least 50 days of price

postings both in the period before the MTU as well as at least 50 price postings after. The final panel data set, which spans from May 2013 until March 2014, consists of 1,620,637 observations from 6,384 stations.

The main variables of interest are the fuel price net of taxes and the margin of each station. The price is the daily average gasoline price (E10) for each station, where we take out the value added tax (19%) and also the fuel tax (65.45 cents/l). For wholesale refined gasoline, we have the highest and the lowest average Rotterdam trade price per day in Dollar/ton. We take the daily average of these two prices and convert the prices in EUR/l, using the specific weight of refined gasoline and the daily Dollar-Euro-Exchange Rate. Similarly, we convert the Brent price from Dollar/barrel to EUR/l.

To calculate price margins, we subtract the Rotterdam refined gasoline import price, which is the main input factor to retail gasoline, from the daily average price of each gasoline station in Germany:

$$Margin_{it} := Price_{it} - Refined\ Gasoline_t,$$

with i indicating the individual station and t the day.

It bears noting that there are negative margins (see Table 1), but only for a very small amount of retailers. The 1%-percentile of price margins is at 0.029 EUR/l, while the 99%-percentile of price margins is at 0.149 EUR/l.

As a robustness check, we use country-level data from the 19 EU countries that are currently members of the Eurozone, provided by the Weekly Oil Bulletin of the European Commission. We focus on weekly average prices for gasoline E5, net of taxes. As control variables, we include quarterly country information on GDP per capita, population density, as well as unemployment, taken from Eurostat. Furthermore, we match this data with refined gasoline and Brent prices. On this basis, we then cal-

Table 1: Summary Statistics (German daily data)

Variable	Description	Mean	Std. Dev.	Min.	Max.
Price	Daily average net price of gasoline (in EUR/l)	0.625	0.038	0.185	1.218
Refined Gasoline	Daily average of wholesale price of refined fuel (in EUR/l)	0.537	0.024	0.499	0.614
Margin	Price margin (in EUR/l)	0.087	0.026	-0.321	0.694
Brent	Daily average of Brent oil price (in EUR/l)	0.469	0.015	0.438	0.523

Note: Number of observations for all variables: 1,620,637. Time span: May 2013 until March 2014. Data sources: MTU, clever-tanken.de, EID

culate average margins per week per country. We construct a sample spanning from the beginning of the year 2012 until the end of 2014, which covers a comparable time period as the station data set with daily prices: starting one year before the introduction of the MTU and ending one year after. As Luco (2019) points out, analyzing a shorter time period limits the extent in what changes in the market structure both for Germany as well as in the control countries impacts the analysis.[2] This might also explain the difference in results compared to the study by Dewenter et al. (2017), who use a much longer time span. Table 2 provides a descriptive overview of this data set.

Table 2: Summary Statistics (EU weekly data)

Variable	Description	Mean	Std. Dev.	Min.	Max.
Price	Weekly average price of gasoline (in EUR/l)	0.691	0.055	0.488	0.836
Margin	Price margin (in EUR/l)	0.128	0.038	-0.024	0.389
Refined Gasoline	Weekly average of wholesale price of refined fuel (in EUR/l)	0.564	0.061	0.322	0.693
Brent	Weekly average of Brent oil price (in EUR/l)	0.509	0.051	0.299	0.609
GDP per capita	Quarterly GDP per capita (in 1000 EUR)	7.222	4.248	2.597	23.002
Population density	Quarterly country population per km^2	0.200	0.293	0.016	1.393
Unemployment	Quarterly country unemployment	11.53%	5.90%	4.6%	27.7%

Note: Number of observations for all variables: 2,790. Time span: January 2012 until December 2014. Data sources: Weekly Oil Bulletin (EU Commission), Eurostat, EID

[2]For example, in Spain and France similar regulations have been put in place in 2007, which requires gas stations to report price changes to a Government agency. In addition, during the 2000s Austria, Belgium and Luxemburg have introduced regulations limiting price changes of gas stations.

3 Methodology

We use a number of different specifications with which we test the effect of the MTU introduction on the development of the price margins of German gasoline stations. As, according to theory, price margins greater than zero are associated with a non-competitive market, we interpret a reduction of price margins as an indication of intensifying competition, while an increase in price margins is interpreted as less competition in the market.

In the baseline specification, we estimate a fixed effects regression using the gas station data:

$$Margin_{it} = \alpha_i + \beta_1 Brent_t + \beta_2 MTU_t + \epsilon_{it}, \tag{1}$$

where ϵ_{it} is an idiosyncratic shock, *Brent* is a control for developments on the world oil market[3] and α_i are station-specific fixed effects. The key variable, MTU_t, is a dummy indicating whether the MTU was already launched. In two alternative definitions of the variable MTU_t, we first use the start date of the beta-period (September 25th, 2013) and subsequently the official launch of the MTU (December 1st, 2013). Standard errors are clustered at the station level.

In an alternative specification, we replace the MTU_t indicator with dummy variables for all dates after the introduction of the MTU:

$$Margin_{it} = \alpha_i + \beta_1 Brent_t + \sum_{\tau} \beta_\tau MTUdate_{\tau t} + \epsilon_{it}, \tag{2}$$

$$\text{with } \tau \in [25\ Sep\ 2013,\ 26\ Sep\ 2013, ..., 24\ Mar\ 2014,\ 25\ Mar\ 2014],$$

[3]The Brent price was used as the main input price instead of the price of refined gasoline as the refined gasoline price was already used in the calculation of the price margins and this could potentially lead to collinearity in the estimation. However, it bears noting that the results are virtually the same when using the refined gasoline price instead of Brent as a control.

where *MTUdate* are indicators for the sequence of dates τ that occur after the launch of the MTU, i.e. from September 25th onwards. If $\tau = t$, the indicator equals one. The reference category are all days before the introduction of the MTU. With this specification, we can check the evolution of the effect over time . Again, equation 2 is estimated with station-specific fixed effects and clustered standard errors.

Finally, the EU weekly data is used to estimate a difference-in-difference-Regression with which we compare the treatment country Germany with a group of 18 other European countries to causally estimate the effect of the MTU introduction on price margins in Germany. While the data used is aggregated to the country-level, this approach has the advantage of accounting for changes that affect gasoline prices over all European countries. The following specification is estimated:

$$\begin{aligned} Margin_{cw} &= \beta_c + \beta_1 Brent_w + \beta_2 GDP\ per\ capita_{cw} + \\ &\quad + \beta_3 Population\ density_{cw} + \beta_4 Unemployment_{cw} \\ &\quad + \beta_5 postMTU_{cw} + \beta_6 postMTU * Germany_{cw} + \epsilon_{cw}, \end{aligned} \tag{3}$$

where $Margin_{cw}$ is the weekly price margin in a given week w, in country c. β_c are country fixed effects and ϵ_{ct} is an idiosyncratic error. $postMTU_{cw}$ is an indicator of whether the time period was after the introduction of the MTU and $postMTU * Germany_{cw}$ interacts this with a dummy variable for Germany. Additionally, GDP per capita, population density and unemployment on a quarterly basis for all countries are included as controls.

4 Empirical Results

The results of the baseline specifications on the gas station data are shown in Table 3. This estimation already shows a first indication that the price margins have decreased with the introduction of the MTU, suggesting that competition intensified. Both specifications exhibit a reduction of price margins of German gasoline stations of around 2 cents per liter. Given the mean of the price margins of about 8.7 cents per liter, this is a rather high effect of about 20%.

Moreover, we find a negative effect of increases in the Brent price on price margins, which suggests that with higher input prices firms cannot pass on the total input price increases to consumers, but only a share of the input price increase. Nevertheless, with an average Brent price of 0.47 EUR/l and a standard deviation of 0.02, in the time period the study investigates, this effect is rather small.

Table 3: Baseline Estimation of the Price Margins

Brent	-0.011**	(0.002)	-0.115**	(0.002)
MTU (Sep)	-0.017**	(0.001)	–	–
MTU (Dec)	–	–	-0.024**	(0.001)
Constant	0.106**	(0.001)	0.153**	(0.001)
Number of Observations	1,620,637		1,620,637	
Adjusted R^2	0.136		0.228	

Note: * denotes significance at the 5%-level and ** at the 1%-level, respectively. Standard Errors (clustered on the station level) are in parentheses.

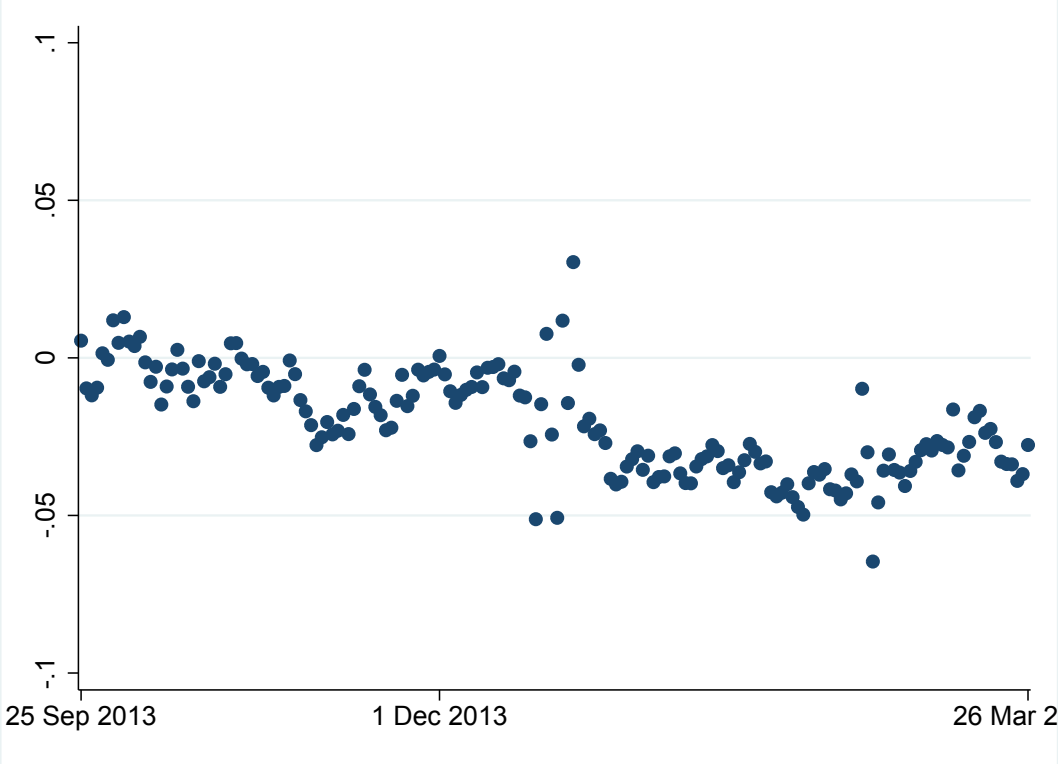
The results of specification 2, which includes a dummy for each date after the launch of MTU, are reported graphically. Figure 1 shows the distribution of the MTU-date coefficient estimates starting with the dummy for September 25th, 2013 on the left side and completed by the dummy for March 26th, 2014 on the far right.

Keeping in mind that these estimates should all be interpreted in relation to the time period before the introduction of the MTU, the graph confirms the results of our

first specification. As almost all estimates are negative, price margins seem to have consistently fallen after the introduction of the MTU.

Additionally, this graph allows us to analyze in more detail how the decrease of the price margins has developed during this time period. In the beginning of the beta phase of the MTU, price margins were still relatively stable with the estimates are clustered around 0. Subsequently, coefficients indicate a slightly lower price margin level than before.[4] Larger decreases appear to have happened later on with the official launch of the MTU in December. This may be due to consumers needing some time to learn about the availability of the MTU and potential greater press exposure after the official launch.

Figure 1: Plot of MTU date coefficients[5]of specification 2



[4]As can be seen in Figure 1 there are some outliers in Decemeber 2013, which owes to a dearth of observation. his may have something to do with lax adherence to the rules of the MTU during the holiday season directly following its initiation.

To check the results provided by the station data, we estimate the difference-in-difference model with the EU weekly data, depicted in equation 3. The results, which are shown in Table 4, also support the previous results of a negative effect of the introduction of the MTU on price margins in Germany. In this specification the treatment effect is slightly smaller than before at around 1 cent per liter, but still highly significant. The *postMTU*-indicator shows that price margins in general over all countries seem to have fallen in the period after the introduction of the MTU. However, looking at the interaction of the *postMTU*-indicator with the Germany dummy variable, we can see that in Germany margins have fallen even more with the treatment effect being at around 1 cent per liter over both specifications.

Table 4: Difference-in-Difference Estimations for the Price Margins using EU weekly data

Brent	-0.366**	(0.011)	-0.387**	(0.011)
GDP per capita	-0.011**	(0.003)	-0.008**	(0.002)
Population density	0.271*	(0.106)	0.286**	(0.104)
Unemployment	-0.001*	(0.000)	-0.001*	(0.000)
postMTU (Sep)	-0.011**	(0.001)	–	–
post MTU * Germany (Sep)	-0.009*	(0.004)	–	–
postMTU (Dec)	–	–	-0.016**	(0.001)
post MTU * Germany (Dec)	–	–	-0.011**	(0.004)
Constant	0.353**	(0.026)	0.343**	(0.025)
Number of Observations	2,790		2,790	
Adjusted R^2	0.286		0.311	

Note: * denotes significance at the 5%-level and ** at the 1%-level, respectively. Standard Errors are in parentheses.

In Tables A1 and A2 as well as Figure A1 of the Appendix we repeat all estimations with the price as dependent variable instead of the margin. The results of these esti-

[5]The estimate for Brent is -0.237 with the standard error at 0.003. The number of observations is 1,620,637.

mations mimic our main results conducted with the margin as dependent variable in terms of signs, magnitude and significance.

Finally, to test the robustness of our results, we conduct a number of placebo regressions, testing for a treatment effect given arbitrary changes in the time span of the data. As examples, Table A3 of the Appendix shows three specifications using data before and after the actual time of the introduction of the MTU. As we do not have the refinery gasoline price for these time spans, we use the price as a dependent variable in these regressions. The coefficient for the *post Germany* indicator variable is always insignificant and we thus conclude that the effect in our main specification did not result out of arbitrary chance.

Overall, the MTU seems to have achieved its purpose set by the Federal Cartel Office to increase competition and thereby decrease stations' margins and consequently also consumer prices. Turning to the economic significance of the results, we note that the magnitude of the reduction remains small from the perspective of consumers. If we make a quick back-of-the-envelope calculation and look at an average consumer whose daily consumption is 6 liters, our results imply that this consumer would save between 6 to 12 cents per day. Calculated over a month, this amounts to monthly savings of between 1.80 Euro and 3.60 Euro. Therefore, even though the effect on the stations was high, with a margin decrease of 20% to 25%, for the average consumer the welfare effects are modest.

5 Summary and Conclusion

This study analyzes the effect of the introduction of the Market Transparency Unit for Fuels (MTU) – a mandated on-line price portal in German retail gasoline market – which was established by the Federal Cartel Office in 2013 after concerns about market power by a small number of vertically integrated oligopolists emerged (FCO,

2011). To this end, the portal was intended to intensify competition and consequently decrease consumer prices in the market.

However, different studies on market transparency show that the effect of market transparency is ambiguous. Theoretically there can be two opposing effects: First, competition may increase by decreasing search costs for consumers. Conversely, increased market transparency can also ease tacit collusion, as prices of other stations can easily be observed and, hence, deviation from the optimal outcome can be punished quickly (Schultz, 2005). This opposite effect can be found, for example, in a study by Luco (2019) analyzing the Chilean gasoline market.

Using a data set consisting of price postings before and after the introduction of the MTU of 6,384 gasoline stations in Germany from May 2013 until March 2014, we investigate whether the MTU intensified or weakened competition between gasoline stations in Germany. We analyze this data set using panel methods. Additionally, we check the robustness of our results using a difference-in-difference approach with weekly European data.

Overall, we confirm the result of Frondel et al. (2020) that the introduction of the MTU induced welfare gains for consumers by reducing market power of gasoline stations and thus achieved the goal set by the Federal Cartel Office. Over the different specifications, we consistently find a negative effect of the MTU on price margins, accounting for a reduction for 1 to 2 cent per liter, which we interpret as a result of more intense competition due to easier price comparison possibilities for consumers.

While the magnitude of this reduction is large from the perspective of retailers, translating into a roughly 20% reduction of the price margin, it is relatively moderate from the perspective of consumers. Our calculations suggest that an average driver saves about 3.60 Euro per month as a result of the MTU, hence, these savings are probably of low economic significance for the average consumer.

6 Appendix

Table A1: Baseline Estimation with price as dependent variable

	Price		Price	
Brent	0.691**	(0.002)	0.887**	(0.002)
MTU (Sep)	-0.050**	(0.001)	–	–
MTU (Dec)	–	–	-0.031**	(0.001)
Constant	0.338**	(0.001)	0.226**	(0.001)
Number of Observations	1,620,637		1,620,637	
Adjusted R^2	0.720		0.489	

Note: * denotes significance at the 5%-level and ** at the 1%-level, respectively. Standard Errors (clustered on the station level) are in parentheses.

Figure A1: Plot of Coefficient Estimation of estimation 2 with price as dependent variable

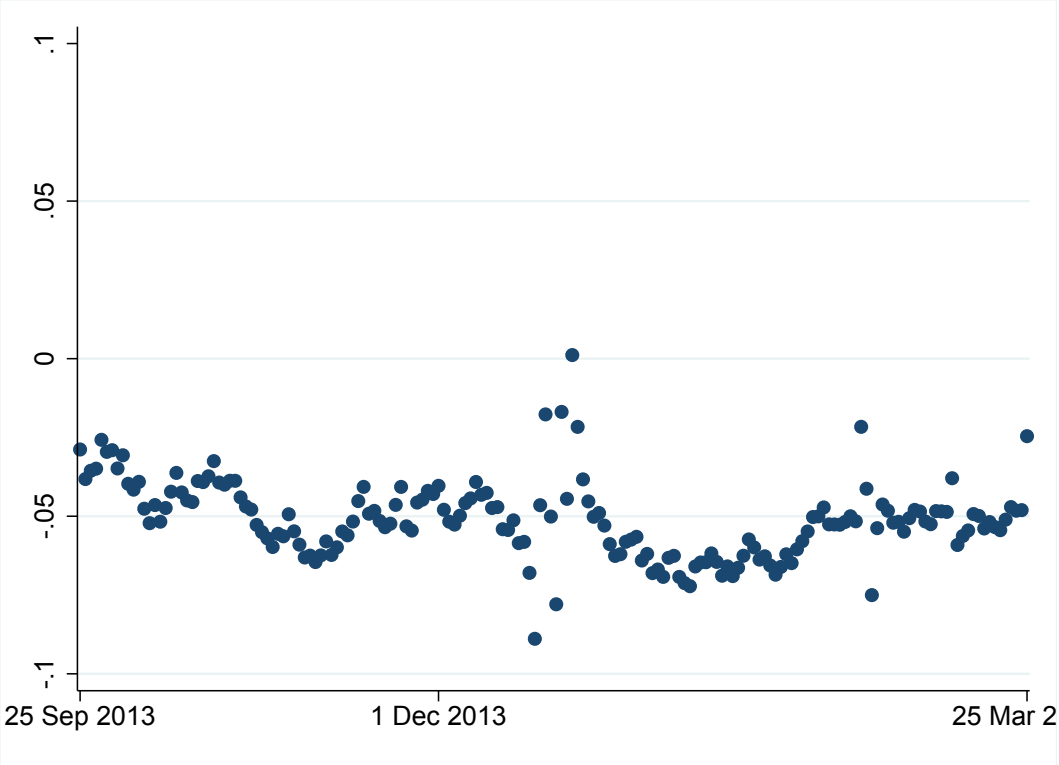


Table A2: Difference-in-Difference Estimations with Prices

Brent	0.652**	(0.013)	0.690**	(0.013)
GDP per capita	-0.002	(0.003)	-0.007*	(0.003)
Population density	0.326**	(0.117)	0.271*	(0.122)
Unemployment	-0.001*	(0.001)	-0.002**	(0.001)
postMTU (Sep)	-0.027**	(0.001)	–	–
post MTU * Germany (Sep)	-0.010*	(0.005)	–	–
postMTU (Dec)	–	–	-0.019**	(0.001)
post MTU * Germany (Dec)	–	–	-0.011*	(0.005)
Constant	0.336**	(0.029)	0.362**	(0.030)
Number of Observations	2,826		2,826	
Adjusted R^2	0.702		0.678	

Note: * denotes significance at the 5%-level and ** at the 1%-level, respectively.
Standard Errors are in parentheses.

Table A3: Placebo Difference-in-Difference Estimations with Prices

	(1)		(2)		(3)	
	Placebo 2007–2009		Placebo 2010–2011		Placebo 2016–2018	
Brent	0.849**	(0.010)	1.016**	(0.010)	0.760**	(0.013)
GDP per capita	0.009**	(0.003)	0.010**	(0.002)	0.011**	(0.002)
Population density	0.895**	(0.343)	-2.170**	(0.325)	-0.871**	(0.065)
Unemployment	0.001**	(0.0004)	0.003**	(0.0004)	-0.008**	(0.001)
post Sep2008	-0.016**	(0.002)	–	–	–	–
post Germany Sep2008	0.007	(0.006)	–	–	–	–
post Sep2010	–	–	-0.006**	(0.002)	–	–
post Germany Sep2010	–	–	-0.006	(0.004)	–	–
post Sep2017	–	–	–	–	-0.017**	(0.002)
post Germany Sep2017	–	–	–	–	0.006	(0.004)
Constant	-0.034	(0.071)	0.494**	(0.061)	0.446**	(0.022)
Number of Observations	2,826		2,808		2,728	
Adjusted R^2	0.853		0.938		0.805	

Note: * denotes significance at the 5%-level and ** at the 1%-level, respectively.
Standard Errors are in parentheses.

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