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Conference Paper

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2023: Growth and the "sociale Frage"

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Drolsbach, Chiara Patricia; Gail, Maximilian Maurice; Klotz, Phil-Adrian (2023) : Pass-through of Temporary Fuel Tax Reductions: Evidence from Europe, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2023: Growth and the "sociale Frage", ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/277655>

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Pass-through of Temporary Fuel Tax Reductions: Evidence from Europe

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Abstract

Several European countries have implemented temporarily fuel tax reductions in 2022 to relieve the financial burden on their citizens. This paper provides estimates of the pass-through rates as well as the effect on retail margins for France, Germany and Italy. Using a unique data set containing daily consumer prices for gasoline and diesel in five European countries, we employ a staggered Difference-in-Differences design. Our results show a very heterogeneous pass-through of the fuel tax reductions depending on the country and on the type of fuel. These findings also have important implications for the effective design of unconventional fiscal policy as well as for competition policy in the fuel market.

Keywords: Fuel Prices, Pass-through, Environmental taxes, Staggered DiD

JEL: H23, L13, L91, Q48

Declarations of interest: None

1. Introduction

More than two years after the beginning of the COVID-19 pandemic many countries worldwide exhibit very high inflation rates. The reasons are a recovering demand in combination with ongoing supply chain problems as well as the war of aggression in the Ukraine. In April 2022, the inflation rate of Germany has reached 7.4%, the highest rate since 1981.

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Other western countries have similar rates: the inflation rate of the whole EU has been 8.1%, the US even had a rate of 8.3% in April 2022. In autumn 2022, inflation in some countries has already risen to around 10%.¹

In this situation many governments try to relieve their citizens with tax reductions or transfer payments. On April 27, 2022, the German government announced a (second) stimulus package worth 14-16 billion Euro.² Beside new transfer payments and a cheap, nationwide public transport ticket (*€9 ticket*), it also included a temporary reduction of the energy tax rate from June 1 to September 30, 2022 at an estimated cost of 3.15 billion Euro.³ Since the energy tax is levied on fuel products in Germany, this might also have an effect on retail fuel prices. Also other countries of the EU as France, Spain or Italy have implemented a temporary fuel tax reduction.

In this paper, we estimate the pass-through rate and the effect on the retail margins of the temporary fuel tax reductions in France, Germany and Italy. Using a unique data set containing daily consumer prices for gasoline and diesel in five European countries, we compute the pass-through rates and changes in the margins by employing a staggered Difference-in-Differences (DiD) approach. Our results suggest a very heterogeneous passing on of the fuel tax reductions depending on the country as well as on the type of fuel. While there is almost no pass-through in Italy at all, the pass-through rates in France and Germany are between 75 and 100%.

Our results have implications for the effective design of unconventional fiscal policy and are also relevant for competition policy. In the most cases, we find that pass-through of the fuel tax reductions is fast and substantial but remains incomplete. Beside the incomplete

¹See <https://www.global-rates.com/de/wirtschaftsstatistiken/inflation/inflation.aspx>. (Last accessed: October 19, 2022).

²See <https://www.bundesfinanzministerium.de/Content/DE/Pressemitteilungen/Finanzpolitik/2022/04/2022-04-27-zweites-entlastungspaket.html>. (Last accessed: October 19, 2022). The package was approved by the German parliament on May 13.

³See <https://www.bundestag.de/dokumente/textarchiv/2022/kw20-de-energiesteuersenkungsgesetz-894664>. (Last accessed: October 19, 2022).

passing on, such fuel tax reductions also have distributional- and climate-economical shortcomings. While the discount acts like a redistribution from bottom to top as particularly high-income consumers with large cars are benefiting, it is generally questionable whether subsidizing fossil fuels is a good idea in times of climate change.

The rest of the paper is structured as follows. Section 2 describes the retail fuel industry with a focus on Germany. We give an overview of the data and present some descriptive statistics in Section 3. In Section 4 we explain our empirical strategy and then present the estimation results in Section 5. We conclude in Section 6.

2. The Retail Fuel Market

We incorporate five European countries into our empirical analysis: Austria, France, Germany, Italy and Switzerland. While Germany as well as France and Italy have implemented temporary fuel tax reductions, Austria and Switzerland have not so far. In this Section, we describe the retail fuel market with a focus on Germany. The German retail fuel market is characterized by an oligopoly of five members dominating the market. Shell, BP/Aral, Esso, Total and Jet operate a nationwide network of petrol stations and have together market shares of about two third. Besides, the so-called Freie Tankstellen (independent stations) are only operating regionally. In 2019, there were 14,449 petrol stations in Germany responsible for total fuel sales of 14.7 billion Euros.⁴

In the upstream market, the petroleum refineries process crude oil into many different petroleum products, which are sold to the petrol stations. Germany currently has 16 refineries, which is more than any other country in our data set.⁵ In addition to crude oil, refineries also add other oils and liquids to the finished products that are sold to the petrol stations. A barrel (42 gallons) of crude oil can be refined into 19 gallons of gasoline, 12

⁴See <https://www.bft.de/aktuelles/presse/bft-veroeffentlicht-branchenstudie-20192020>. (Last accessed: October 19, 2022)

⁵Austria and Switzerland only have one refinery respectively, in France there are six and Italy has ten.

gallons of diesel and 13 gallons of other products.⁶ This information is particularly relevant for our calculation of the retail margins (see Section 3).

In our study, we only focus on fuel prices for passenger vehicles. In Germany, gasoline has a volume share of 57 percent of fuel sales for passenger vehicles with combustion engines and diesel accounts for the remaining 43 percent.⁷ Within gasoline, there is a further distinction between standard gasoline (5 percent ethanol share, commonly referred to as *E5*) and the relatively new type of gasoline *E10* (10 percent ethanol share) introduced in 2011. The aim of the *E10* introduction is to reduce greenhouse gas emissions, but in 2019 it only had a volume share of 14.4 percent in German gasoline engines. In this paper, we are focused on *E5* (=gasoline) and diesel only.

Even though crude oil accounts for an important share of the fuel prices and is the most important source of price fluctuations, taxes constitute the largest share of fuel prices. In Germany, there is an energy tax of 65.45 cents (47.04 cents) per liter and a fuel carbon tax of 7.2 cents (8.03 cents) per liter levied on gasoline (diesel).⁸ In addition, a 19 percent value-added tax is levied on the fuel prices. Between June and August 2022, the energy tax has been reduced to 35.9 cents (-29.55 cents) per liter for gasoline and to 33 cents (-14.04 cents) per liter for diesel.⁹

Beside the temporary energy tax reduction in Germany, also the federal governments in Italy and France have introduced (temporary) fuel tax reductions. In Italy, fuel taxes on gasoline as well as on diesel have been reduced by 25 cents per liter (30.5 cents including VAT) from May 3, 2022 on.¹⁰ The French government has passed a law that reduces the

⁶See <https://www.eia.gov/energyexplained/oil-and-petroleum-products/refining-crude-oil-inputs-and-outputs.php>. (Last accessed: October 19, 2022)

⁷See <https://www.umweltbundesamt.de/daten/verkehr/kraftstoffe>. (Last accessed: October 19, 2022)

⁸An additional fuel storage fee of 0.27 cents (0.30 cents) per liter is levied on gasoline (diesel).

⁹This reduced fuel taxes to the minimum level permitted by EU law. Also including the VAT reduction, the taxes for gasoline (diesel) have fallen by 35.2 cents (16.7 cents) due to the energy tax reduction in Germany.

¹⁰In Italy, the temporary tax reduction was extended several times and is expected to run until the

taxes for all important fuel products by 15 cents per liter (18 cents including VAT) from April 1, 2022 on.¹¹ The other two countries in our data set, Austria and Switzerland, have not introduced temporary fuel tax reductions so far.

Since gasoline markets are typically characterized by a very specific cyclical pricing pattern, academia as well as competition authorities are highly interested in analyzing this industry sector. The leading theory to explain price cycles in gasoline markets are Edgeworth price cycles. This theory has been formalized by Maskin and Tirole (1988) and assumes a dynamic oligopoly game where firms compete in prices and sell homogeneous goods. Starting at a supra-competitive price, firms undercut each other until the price reaches marginal costs. Given that there is no gain to lowering prices further, firms play a war of attrition. After one firm relents the price back to a high level, the other follow and the cycle begins anew (see Noel et al. (2011)).

In contrast to the literature mentioned above, other authors discuss the possibility of tacit collusion in gasoline markets. Since petrol stations can easily observe and monitor price changes as well as learn the price setting behavior of their competitors, an explicit agreement is not necessary to establish such an behavior. Evidence for collusion in gasoline markets has been found for Australia (Byrne and De Roos (2019)) and Norway (Foros and Steen (2013)). With respect to Germany, Dewenter et al. (2017) show that the introduction of the 'Markttransparenzstelle für Kraftstoffe' (market transparency unit for fuels, MTS-K)¹² in 2013 has increased both gasoline and diesel prices. Assad et al. (2020) find that algorithmic pricing has a significant effect on competition in the German gasoline market.

Another strand of the literature analyzes the effects of changes in the crude oil price

beginning of October 2022.

¹¹Also the French government has extended the temporary tax reduction until October 2022. Since September 1, the fuel discount has even been increased from 15 to 25 cents per liter there.

¹²The MTS-K is an independent unit of the German competition authority. All petrol stations in Germany are legally bound to inform the MTS-K about price changes in real time (see https://www.bundeskartellamt.de/EN/Economicsectors/MineralOil/MTU-Fuels/mtufuels_node.html;jsessionid=0E947D4936B3B12872C630A4005CED95.2_cid378).

on refined petroleum products. Here, most of the papers are focused on the oil-gasoline relationship. It has been shown that downstream prices seem to respond to increases in upstream prices more rapidly than their responses to decreases in upstream prices, so that there is a potentially asymmetric pass-through of increasing and decreasing costs ('rockets and feathers') (e.g., [Grasso and Manera \(2007\)](#); [Noel \(2009\)](#); [Noel \(2015\)](#)).

Recent papers also analyze the pass-through of taxes and excise duties on fuel prices. In general, pass-through rates depend on consumer behavior as well as on competition parameters (e.g., [Montag et al. \(2021\)](#); [Genakos and Pagliero \(2022\)](#); [Harju et al. \(2022\)](#)). The effect of tax changes on market prices primarily depends on supply and demand elasticities ([Edgeworth \(1897\)](#)). However, theoretically it is not clear what effect market power has on the pass-through of taxes ([Weyl and Fabinger \(2013\)](#)). Besides, not only the horizontal market structure but also vertical market power have to be considered ([Fuest et al. \(2020\)](#)). Some empirical results indicate that the coefficient associated with taxes on gasoline prices is not statistically different from one (or slightly less than one) (e.g., [Marion and Muehlegger \(2011\)](#); [Bello and Contín-Pilart \(2012\)](#); [Li et al. \(2014\)](#)). In contrast, other studies find that a higher percentage of a tax increase is passed to consumers than a tax reduction ([Doyle Jr and Samphantharak \(2008\)](#); [Silvia and Taylor \(2014\)](#)) or identify state-specific rates of pass-through ([Kaufmann \(2019\)](#)).

3. Data and Descriptive Statistics

Our analysis is based on three different data sources. First, we scraped data on daily average gasoline and diesel consumer prices from the information platform *Fuelo*.¹³ Second, we use data on the crude oil price Brent and exchange rates from *Onvista*.¹⁴ Third, to control for different national COVID-19 policies, we incorporate the stringency index from

¹³See <https://de.fuelo.net/?lang=en>.

¹⁴See <https://www.onvista.de/>.

Our world in Data.¹⁵

Our data set includes price data for five European countries during the period from January 3 to June 19, 2022. Table 1 presents the summary statistics on prices and margins for diesel and gasoline, respectively. To calculate the margins, we simply subtract taxes and duties as well as the share of the crude oil price (Brent price) attributable to the production of diesel and gasoline from the gross consumer prices.¹⁶ Even though these margins still contain different cost types (e.g., cost of refining, transportation costs), with the crude oil price we can eliminate the main source of input cost variation.

		Austria	France		Germany		Italy		Switzerland
			Pre	Post	Pre	Post	Pre	Post	
Prices	Gasoline	1.701202	1.880909	1.980575	1.958852	2.007105	1.956950	2.006813	1.944149
	Diesel	1.741006	1.852955	1.997800	1.893872	2.014316	1.886792	1.971375	2.049443
Margins	Gasoline	0.216928	0.252409	0.025841	0.214420	0.406640	0.196802	0.348076	0.316412
	Diesel	0.337357	0.344979	0.156468	0.337524	0.435760	0.252429	0.432602	0.386437
Brent Price		0.602063	0.550358	0.658938	0.588437	0.708917	0.568653	0.685587	0.602063
Stringency		48.247440	60.858523	23.150000	41.487450	17.590000	66.226000	25.579167	23.350774

Table 1: Summary statistics (All numbers in Euro per liter).

Table 1 reports that the average price level of diesel and gasoline is very similar across the five countries, although prices are smaller in Austria, which is mainly driven by the low fuel taxes in this country. Concentrating on the treated countries (France, Germany, Italy), we always observe higher average consumer prices after the fuel tax reductions (compare *Pre* and *Post* in Table 1).¹⁷ Even though this seems to be counterintuitively at first glance, this is mainly driven by the increasing price for crude oil during our observation period (see row *Brent Price* in Table 1), which has mostly overcompensated the decreased fuel taxes.

¹⁵See <https://ourworldindata.org/covid-stringency-index>. The stringency index is a Oxford Coronavirus Government Response Tracker (OxCGRT) project. It is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100.

¹⁶An important note is that our measure of retail margins includes the refinery margin, the station margin, as well as different cost types such as the cost of refining or the cost of transportation. For a detailed description on the calculation of margins see Appendix 6.

¹⁷It is worth mentioning that the definition of the *Pre* and *Post* periods is distinct for the three treated countries due to the different implementation dates of the fuel tax reductions.

Table 1 also shows that the retail margins for diesel and gasoline have increased in Italy and Germany after the fuel tax reductions, while they started to decrease in France after the introduction (on average).

	Austria	France		Germany		Italy		Switzerland
		Pre	Post	Pre	Post	Pre	Post	
Gasoline Taxes	0.48	0.68	0.53	0.67	0.36	0.73	0.48	0.77
Diesel Taxes	0.40	0.59	0.44	0.49	0.33	0.62	0.37	0.80

Table 2: Excise Taxes in Euro per liter (excluding VAT). Source: <https://taxfoundation.org/gas-taxes-in-europe-2022>.

Table 2 summarizes the excise duties on gasoline and diesel for the countries in our data set. Value-added taxes (VAT), which all five countries also levy on gasoline and diesel, are not included in these excise taxes. All countries except Switzerland also levy a lower excise duty on diesel than on gasoline, with Germany having the largest diesel privilege (at least without taking into account the temporary fuel tax reductions). Without considering any temporary tax reductions, Austria has the lowest excise duties for fuel and Switzerland has the highest ones. As already mentioned in Section 2, Germany has lowered the energy tax by 29.6 cents per liter for gasoline and by 14 cents per liter for diesel (without including the VAT reductions).¹⁸ France and Italy have implemented a uniform discount for gasoline and diesel of 15 cents (France) or rather 25 cents (Italy) without including VAT reductions.¹⁹

Figure 1 presents the development of the consumer prices (above) and retail margins (below) for gasoline (left) and diesel (right) in the five European countries during our observation period. The vertical lines reflect the introduction of the respective tax reductions in France (April 1, blue), Italy (May 3, yellow) and Germany (June 1, red). In fact, the prices as well as the margins in the five countries tended to follow the same trend before the policy

¹⁸In our empirical analysis (see Section 4 and 5), we have to compare our estimated coefficients with the overall tax reductions (also including the changed VAT), which are equal to 35.2 cents (16.7 cents) for gasoline (diesel) in Germany (cf. footnote 24).

¹⁹Even though technically the tax reductions in Italy and France are different compared to the German one, basically they have a similar effect on the costs of the retailers.

changes. In all countries, there is also a noticeable increase in both, prices and margins, at the end of February when the war in the Ukraine has started.

With respect to the diesel and gasoline consumer prices, Figure 1 shows that both have decreased in the first phase after the respective fuel tax cuts in the three treated countries. However, they tended to increase again after a while which is mainly driven by the increased price for crude oil.²⁰ In contrast, the effect on retail margins is very different between the three treated countries. While the margins have increased in Italy as well as in Germany for diesel and gasoline, in France they immediately started to decrease after the tax reduction.

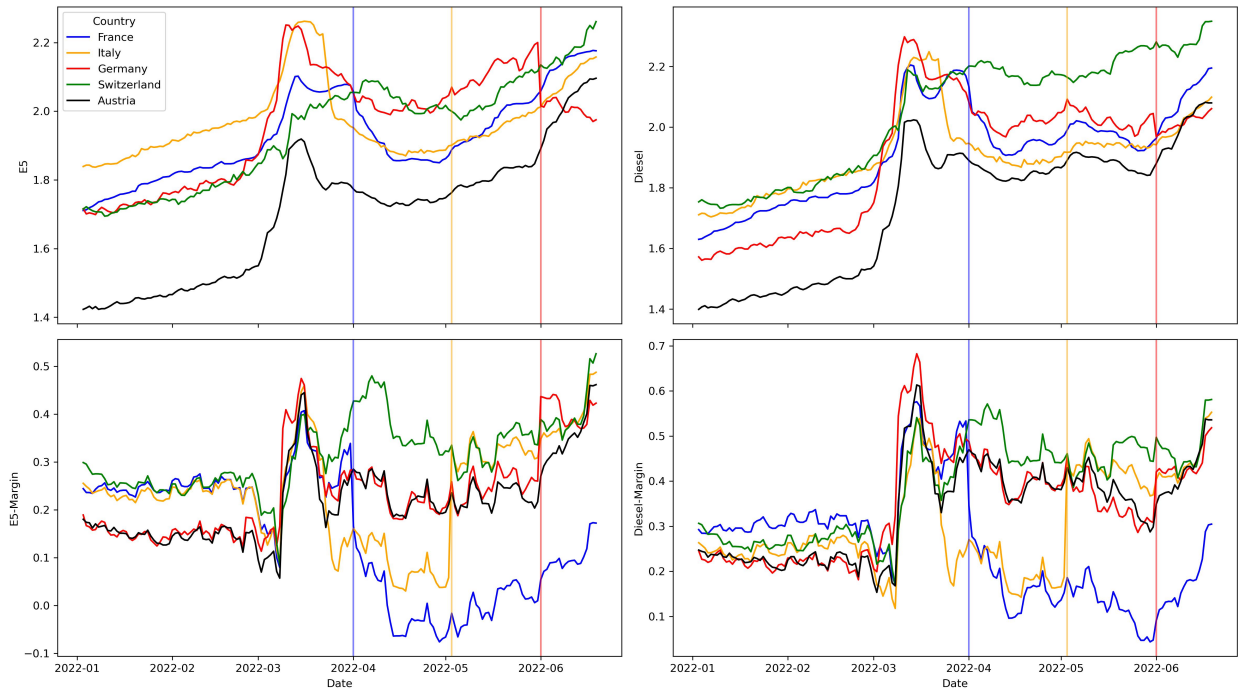


Figure 1: Development of consumer prices (above) and retail margins (below) for gasoline (left) and diesel (right). The vertical lines reflect the introduction of the respective tax reductions in France (April 1, blue), Italy (May 3, yellow) and Germany (June 1, red).

²⁰To have a better understanding of the individual consumer price curves, we additionally present the gasoline and diesel price development for the five countries separately in Figure 2 of Appendix 6.

4. Methodology

In our empirical analysis, we estimate the impact of the temporary fuel tax reductions on fuel prices and retail margins. In order to do this, we compare the evolution of consumer prices and retail margins at fuel stations in Germany, France, Italy, Austria and Switzerland, before and after the reductions of the fuel taxes.

We apply a staggered Difference-in-Differences (DiD) design to causally estimate the effect of the temporary fuel tax reduction on fuel prices and retail margins. In contrast to the canonical DiD setup, the staggered design allows to estimate the unbiased average treatment effect on the treated (ATT) when there are more than two time periods and variation in timing of the treatment. This design is more credible and robust than the canonical DiD with a single treatment period because including multiple treatments plausibly alleviates concerns that contemporaneous trends drive the observed treatment effects (see, e.g., [Baker et al. \(2022\)](#)). [Goodman-Bacon \(2021\)](#) shows that time-varying treatment effects can create a bias in the static two-way fixed effects (TWFE) DiD estimate since earlier-treated units act as effective controls for later-treated units so that the resultant DiD estimates could reflect differences in treatment effects over time between different treatment groups.

Hence, more recent papers propose alternative DiD estimators that do not suffer from the pitfalls associated with TWFE described above ([De Chaisemartin and d’Haultfoeulle \(2020\)](#); [Sun and Abraham \(2021\)](#); [Callaway and Sant’Anna \(2021\)](#)). We follow the approach of [Callaway and Sant’Anna \(2021\)](#) as it allows to estimate a time-varying and cohort-specific ATT using not-yet-treated or never-treated as clean controls. Specifically, we estimate the following (stylized) regression:

$$y_{it} = x_{it}\beta + \tau_{it} \cdot TAX_{it} + \eta_i + \lambda_t + \epsilon_{it}, \quad (1)$$

where y_{it} is the consumer price or retail margin of gasoline or diesel in country i at date t ,

and TAX_{it} is a dummy variable that equals one when country i implements a temporary fuel tax reduction at date t (note that France, Italy and Germany implemented there reductions at different dates, see Section 2). The vector x_{it} contains different control variables, η_i corresponds to state fixed effects and λ_t is a time fixed effect.

Let us further assume that G_i contains i different states treated at different points of time and C_i is a set of never treated states. Then, under the parallel trend and anticipation assumptions (Wooldridge (2021)) we can estimate the ATT for a treatment-timing group g at a point in time as the group-time average treatment effect using never-treated (2) or not-yet-treated (3) units as controls:

$$ATT(g, t) = E[Y_t - Y_{g-1} | G = g] - E[Y_t - Y_{g-1} | C = 1]. \quad (2)$$

$$ATT(g, t) = E[Y_t - Y_{g-1} | G = g] - E[Y_t - Y_{g-1} | D_t = 0, G \neq g]. \quad (3)$$

Finally, we can also average the $ATT(g, t)$ over all groups:

$$\Theta(g) = \frac{1}{T - g + 1} \sum_{t=2}^T 1\{g \leq t\} ATT(g, t). \quad (4)$$

Equation (4) then gives the time-average for each group and the overall average respectively. As already mentioned above, we use the fuel prices of five different European countries to causally identify the effect of the temporary fuel tax reductions. Thereby, Germany, Italy, and France are the treated countries and Austria as well as Switzerland are the never-treated countries in our staggered DiD approach.

The countries in our data set should be very comparable in general. Except Switzerland, they are all members of the European Single Market, which implies harmonized border checks, common customs policy, and identical regulatory procedures on the movement of goods within the European Union (EU). Switzerland has several bilateral trading agreements with the EU. Beyond, the five countries are similar in their geographic location and have

highly correlated public and school holidays. In our observation period, also the travel restrictions put in place due to the COVID-19 crisis were similar in the five countries²¹ and no major reforms, which could also affect fuel prices, were implemented.²²

To causally identify an unbiased ATT of the temporary fuel tax reductions on fuel prices, there should also be no other transitory shocks that would differently affect fuel prices in the individual countries before and after the tax reduction. Due to their geographic proximity the petroleum companies in the five countries procure most of their crude oil from similar sources. Moreover, the country fixed effects in our estimation approach control for any time-invariant differences between the different countries, and the date fixed effects capture the transitory shocks, such as fluctuations in the price of crude oil. Finally, we also focus on a relatively narrow window around the tax reductions, which should alleviate concerns on transitory shocks differently affecting the five countries.

5. Results

Table 3 presents the results of estimating regression equation (1) using the consumer price for gasoline and diesel as outcome variables. The coefficients in columns (I) and (II) correspond to the effect of the temporary fuel tax reductions on gasoline and diesel in France, Italy and Germany without any other control variables. Columns (III) and (IV) show the effects on consumer prices when we control for the German €9 ticket and distinct national COVID-19 policies.²³

²¹In one of our specifications, we also use a COVID-19 stringency index to control for distinct pandemic policies, which might have affected the mobility of consumers.

²²One exception might be the €9 *ticket* temporary introduced in the German railway sector, which allows to travel by train in whole Germany for a very low price. This policy could (*c.p.*) lower the demand for fuel in Germany so that we control for the introduction of this ticket in one of our specifications.

²³Since the COVID-19 stringency index is only updated weekly, the number of observations is slightly lower in this specification.

	Diesel	E5	Diesel	E5
	(I)	(II)	(III)	(IV)
Simple Weighted Average	-0.100*** (0.009)	-0.145*** (0.020)	-0.092*** (0.000)	-0.138*** (0.000)
France	-0.181*** (0.010)	-0.128*** (0.011)	-0.185*** (0.000)	-0.123*** (0.000)
Italy	-0.008* (0.005)	-0.008 (0.016)	-0.007*** (0.000)	-0.013*** (0.000)
Germany	-0.110*** (0.042)	-0.298*** (0.032)	-0.083*** (0.000)	-0.277*** (0.000)
Pass-through France	97.8%	69.2%	100%	66.5%
Pass-through Italy	2.6%	—	2.3%	4.3%
Pass-through Germany	65.9%	84.7%	49.7%	78.7%
Date fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
€9 Ticket	No	No	Yes	Yes
Stringency Index	No	No	Yes	Yes
Obs.	840	840	595	595

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Staggered DiD approach with consumer prices as outcome variable.

The results in the first two columns show that the fuel tax reductions led to a decline in the prices of both fuel types for France and Germany, which is statistically significant at the 0.1 percent level. In contrast, for Italy the effect is insignificant for gasoline and only significant at the 5 percent level for diesel. For instance, in Germany the average price for diesel decreases by 11 cents per liter after the fuel tax reduction (column (I)), whilst the average price for gasoline decreases by about 30 cents per liter (column (II)). Including additional control variables does not dramatically change our estimates, even though the price effect for gasoline in Italy becomes significant and the estimated coefficients for Germany decline (see columns (III) and (IV)).

In a next step, we can calculate the pass-through rates of the fuel tax reductions. There-

fore, we divide the estimated coefficients by the actual tax reductions in the three countries.²⁴ In Italy, the pass-through rate is very low or non-existent. On the contrary, in France basically the entire tax reduction has been passed-through for diesel and about two-thirds of the reduction for gasoline. The pass-through rate for gasoline is similar in Germany, as about 80% of the tax reduction has been passed on to the consumers. However, the difference in the pass-through rates for diesel between France and Germany is noticeable since in Germany only about 50-66% of the fuel tax reduction has been passed-through for this type of fuel.

Table 4 shows the results of estimating regression equation (1) using the retail margins for gasoline and diesel as outcome variables. The coefficients in columns (I) and (II) correspond to the effect of the temporary fuel tax reductions on retail margins in France, Italy and Germany without incorporating any other control variables. Columns (III) and (IV) present the effect on retail margins when we control for the German €9 ticket and different national COVID-19 policies.

The results in the first two columns imply that the reduction in fuel taxes had a very heterogeneous effect in the three countries. While in Italy the retail margins have significantly increased by about 24 cents per liter for diesel as well as for gasoline, the margins in France have significantly decreased. In Germany, the fuel tax reduction had no significant effect on the retail margins for diesel and only a small positive effect on the gasoline margins (significant on the 5 percent level). However, when including our control variables also the effect on the diesel margins becomes significant for Germany (column (III) in Table 4).

²⁴For instance, in our baseline estimation for diesel (column (I) of Table 3) the pass-through rate for Germany can be calculated as follows: $passthrough = \frac{EstCoeff}{TaxReduction} = \frac{11}{16.7} = 0.6587 = 65.9\%$.

	Diesel	E5	Diesel	E5
	(I)	(II)	(III)	(IV)
Simple Weighted Average	-0.015** (0.006)	-0.002 (0.014)	-0.008*** (0.000)	0.003*** (0.000)
France	-0.332*** (0.009)	-0.288*** (0.008)	-0.336*** (0.000)	-0.284*** (0.000)
Italy	0.239*** (0.006)	0.238*** (0.010)	0.241*** (0.000)	0.234*** (0.000)
Germany	0.047 (0.034)	0.043* (0.024)	0.070*** (0.000)	0.059*** (0.000)
Date fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
€9 Ticket	No	No	Yes	Yes
Stringency Index	No	No	Yes	Yes
Obs.	840	840	593	593

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Staggered DiD approach with retail margins as outcome variable.

These findings are mostly in line with the estimated pass-through rates (see Table 3). In Italy, where the tax reduction was hardly passed-through to consumers, there is large increase in retail margins for both fuel types. In contrast, the French gasoline stations have passed-through almost the entire tax decline so that we even estimate negative retail margins there. For Germany we observe a very modest increase in retail margins. An important note is that our measure of retail margins includes the refinery margin, the station margin, as well as different cost types such as the cost of refining or the cost of transportation (see Section 3 for details on the calculation). Hence, our retail margins are an overestimate of the actual retail margins.

6. Conclusion and Policy Implications

This paper provides empirical evidence on the pass-through of temporary fuel tax reductions in three different European countries, which were part of their fiscal responses on high inflation rates in 2022. We find a very heterogeneous passing-on in the observed countries. While the tax reduction was almost not passed on in Italy for diesel as well as for gasoline, in France and Germany there was a passing-on between 50 and 100% for both fuel types. Remarkably, in France we find a higher pass-through for diesel than for gasoline, whereas in Germany it is the other way around.

Our findings for the retail margins are mostly in line with the estimated pass-through rates. While in Italy the very low pass-through rates lead to a relatively high increase in retail margins, for France we even find negative margins after the fuel tax reduction. For Germany we observe a very modest increase in the margins.

We also find a high degree of heterogeneity between the estimated pass-through rates for diesel and gasoline. While for Germany our estimates show a pass-through of 65.9% for diesel and 84.7% for gasoline, in France the results are 97.8% (diesel) and 69.2% (gasoline).²⁵ Different authors have shown that demand characteristics as well as competitive pressure play an important role in how a temporary tax reduction is passed on to consumers ([Montag et al. \(2021\)](#); [Genakos and Pagliero \(2022\)](#)). Nevertheless, the more elastic consumers of a particular fuel type are, the higher (*c.p.*) should be the pass-through rate for this fuel type ([Edgeworth \(1897\)](#)). This might also explain the differences in the pass-through rates for France and Germany because the diesel privilege in Germany is much larger compared to France so that relatively more inelastic consumers (high-income, frequent and business drivers) should drive a diesel car in Germany.

Our results for the Italian fuel market are in line with previous studies as well. [Galetti et al. \(2003\)](#) have found that cost reductions (oil price shocks in their case) in the

²⁵See columns (I) and (II) in Table 3.

Italian downstream market (distribution stage) are not passed on in a similar way than cost increases. In a similar analysis, also [Apergis and Vouzavalis \(2018\)](#) show that there is a short-run asymmetry in the Italian gasoline market, which those authors justify by the high degree of regulation. They (ibid.) argue that the Italian policy makers should attempt to enhance the level of competition by allowing a further opening of the market to new entrants (e.g., by removing certain legal barriers for the establishment of new filling stations).

A key takeaway from our paper for policymakers is that temporary fuel tax reductions basically can lower the consumer prices for diesel and gasoline in the short run, although this passing-on mostly remains incomplete. However, due to the distributional- and climate-economical shortcomings as well as the relatively high fiscal burden of this unconventional policy intervention it is debatable whether it is an efficient intervention.

From a competition policy perspective, our results hardly allow any conclusions to be drawn about whether there are competition restrictions in the fuel market at all. However, the estimated pass-through rates in Germany and France imply that the alleged restrictions can at least not hinder a relatively high pass-through of the tax reductions. In general, comprehensive sector analyses by the competition authorities to find the mildest means of competition policy seem to be more appropriate than short-term government interventions in the fuel market.

Acknowledgements

In particular, we would like to thank Georg Götz, Daniel Herold and Jan Thomas Schäfer. The authors alone are responsible for the content.

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Appendix A

To compute the daily average retail margins for the five countries in our data set, we subtract a fuel share of the crude oil price (major input cost) as well as the country-specific taxes and duties (see Montag et al. (2021)). For each country in our raw data set, we observe a daily average gross consumer price. In a first calculation step, we calculate the average consumer prices without VAT taxes for every day and country.²⁶ To get the daily average net price, we then also subtract the excise duties for the individual countries (see Table 2). Thereby, for the treated countries we have to differentiate between the period before and after the fuel tax reductions.

In a final step, we have to subtract the input cost of crude oil (Brent) from the daily net price. Therefore, we use the information that around 54% of the Brent oil price per barrel corresponds to the production of 19 gallons of gasoline and around 34% to the production of 12 gallons of diesel.²⁷ We further transform these measures into the input cost per liter of gasoline and diesel. The retail margins of gasoline and diesel are then computed as the average gross consumer price per liter adjusted to VAT taxes and excise duties minus the share of crude oil price per liter of a corresponding fuel product.

²⁶The VAT taxes are very heterogeneous in the five countries: 22% in Italy, 20% in Austria and France, 19% in Germany, and 7.7% in Switzerland.

²⁷See <https://www.eia.gov/energyexplained/oil-and-petroleum-products/refining-crude-oil-inputs-and-outputs.php>. (Last accessed: October 19, 2022)

Appendix B

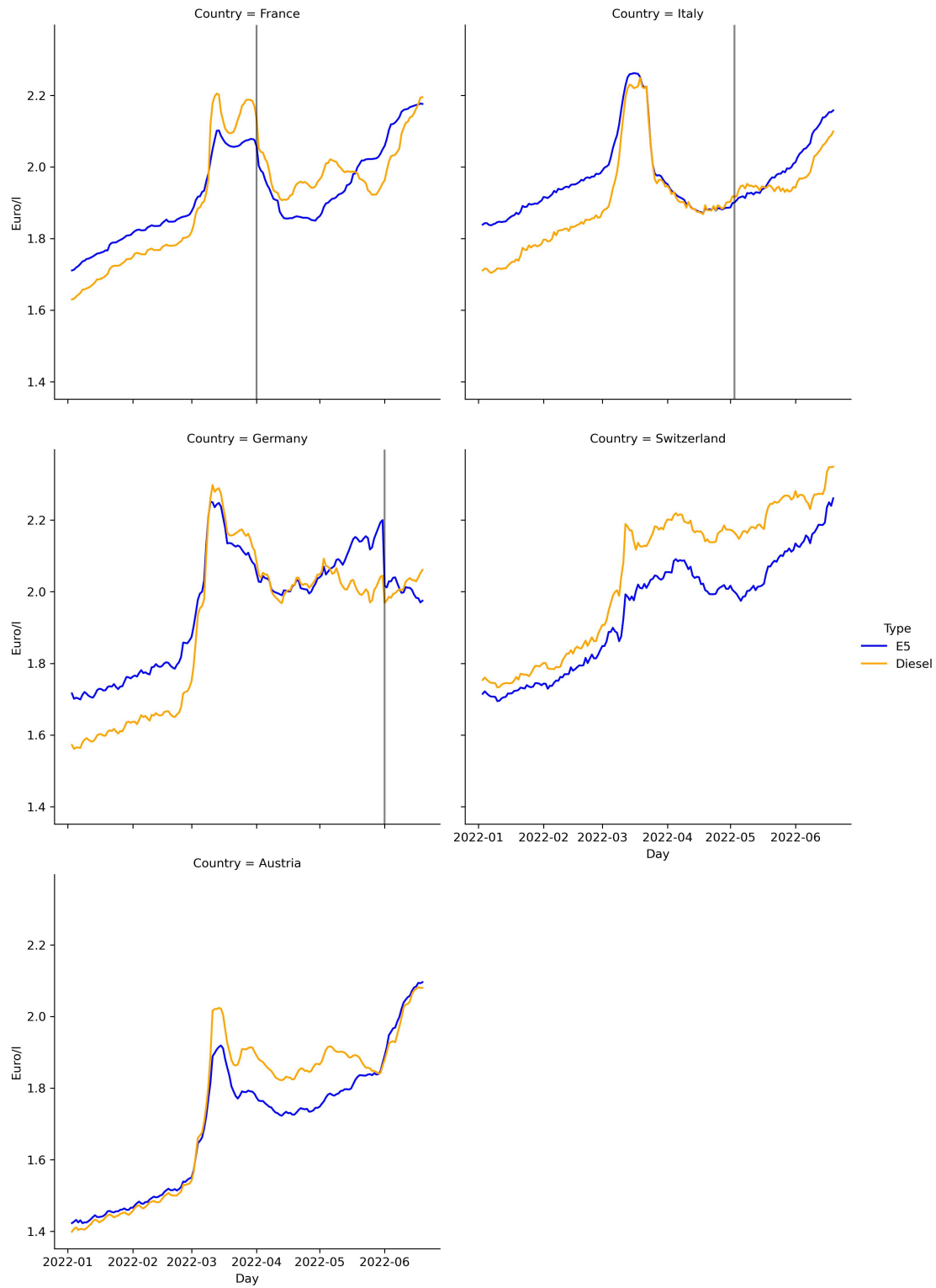


Figure 2: Development of gasoline and diesel consumer prices for the five countries in our data set. The vertical lines reflect the introduction of the respective tax reductions.