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

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Chiara Drolsbach, Maximilian Maurice Gail and Phil-Adrian Klotz
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Justus-Liebig-University Giessen
Motivation

• Several European countries introduced temporary fuel tax reductions in 2022
  • Part of government subsidy programs to tackle high inflation rates of up to 10%.
  • e.g., France, Spain, Italy and Germany
• Open question whether the tax reductions have been passed to consumers by the petroleum companies
• Estimation of the pass-through rate and the effect on retail margins of the temporary fuel tax reductions in France, Germany and Italy using a staggered Difference-in-Differences approach
The Retail Fuel Market

- **Upstream market:**
  - Petroleum refineries process crude oil into several petroleum products
  - Number of refineries varies across our treatment countries (e.g., Germany: 12, Italy: 10, France: 6).

- **Intermediate Market:** Wholesale

- **Downstream market:**
  - Dominated by oligopolies that are operating nationwide and regionally operating companies (e.g., in Germany five oligopolists have a 2/3 market share)
  - Italy (21,700) has the largest number of service stations, followed by Germany (14,458) and France (11,151)

- Crude oil is most important share of price fluctuations.

- Fuel taxes constitute the largest share of fuel prices.
• Edgeworth price cycles as the leading theory to very specific cyclical pricing pattern in gasoline markets (Maskin and Tirole, 1988; Noel et al., 2011).
• Evidence for tacit collusion (e.g., Maskin and Tirole, 1988; Noel et al., 2011).
• Evidence for oil-gasoline relationship (e.g., Grasso and Manera, 2007; Noel, 2009; Noel, 2015).
• Evidence on pass-through of taxes and excise duties (e.g., Montag et al., 2021; Genakos and Pagliero, 2022; Harju et al., 2022).
• Evidence for the 2022 fuel tax reduction in Germany (e.g., Fuest et al., 2022; Dovern et al., 2022; Kahl, 2023).
Theoretical Background (Weyl and Fabinger, 2013)

- Theoretically, pass-through depends on
  - elasticity of demand ($\epsilon_D$) and supply ($\epsilon_S$),
  - the degree of competition in a market ($\theta$).
- The conduct parameter $\theta$ is equal to 0 in perfect and Bertrand competition, equal to 1 in a monopolistic market, and equal to $1/n$ in Cournot competition.
- Following Weyl and Fabinger (2013), the pass-through rate then can be determined independently of the specific model by

$$
\rho = \frac{1}{1 + \frac{\theta}{\epsilon_D} + \frac{\epsilon_D - \theta}{\epsilon_S} + \frac{\theta}{\epsilon_{ms}}}. 
$$

(1)

- Formula (1) implies that the sign and magnitude of an increase in $\theta$ is ambiguous, especially for oligopolistic markets
  - Effect can be either positive or negative
  - Under certain assumptions also pass-through rates larger than one are possible.
- Impact of the intensity of competition on the pass-through rate in an oligopolistic market remains an empirical problem (Genakos and Pagliero, 2022).
Four different data sources

1. Daily average gasoline and diesel consumer prices from the information platform *Fuelo*
2. Crude oil price Brent and exchange rates from *Onvista*
3. Country level-data from the *Google Mobility Reports*.
4. Data on refinery capacities from *Concawe*

Panel dataset on daily fuel prices for the period January 3 to August 31, 2022 for five European countries (Germany, France, Italy, Austria and Switzerland)
## Descriptive Statistics I

<table>
<thead>
<tr>
<th>Country</th>
<th>Fuel tax reduction</th>
<th>Treatment</th>
<th>Pre</th>
<th>Post</th>
<th>Difference</th>
<th>Difference incl. VAT</th>
<th>Pre</th>
<th>Post</th>
<th>Difference</th>
<th>Difference incl. VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>NO</td>
<td></td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>YES</td>
<td>04/01/2022</td>
<td>0.68</td>
<td>0.53</td>
<td>- 0.15</td>
<td>- 0.18</td>
<td>0.59</td>
<td>0.44</td>
<td>- 0.15</td>
<td>- 0.18</td>
</tr>
<tr>
<td>Germany</td>
<td>YES</td>
<td>06/01/2022</td>
<td>0.65</td>
<td>0.36</td>
<td>- 0.29</td>
<td>- 0.352</td>
<td>0.49</td>
<td>0.33</td>
<td>- 0.16</td>
<td>- 0.167</td>
</tr>
<tr>
<td>Italy</td>
<td>YES</td>
<td>03/22/2022</td>
<td>0.73</td>
<td>0.48</td>
<td>- 0.25</td>
<td>- 0.305</td>
<td>0.62</td>
<td>0.37</td>
<td>- 0.25</td>
<td>- 0.305</td>
</tr>
<tr>
<td>Switzerland</td>
<td>NO</td>
<td></td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• staggered Differences-in-Differences (DiD) design to causally estimate the effect of temporary fuel tax reductions on fuel prices

• ("Standard") canonical DiD suffers from several pitfalls when observing time-varying treatments
  • time-varying treatment effects can create a bias in the static TWFE DiD estimate since earlier-treated units act as effective controls for later-treated units
  • in contrast to the canonical DiD setup, the staggered design allows to estimate treatment effect when there are more than two time periods and variation in timing of the treatment

• In our analysis we follow the approach of Callaway and Sant’Anna (2021) as it allows to estimate time-varying and cohort-specific ATT using not-yet-treated and/or never-treated as clean controls
Empirical Analysis II

• Baseline DiD regression model:

\[ y_{it} = X' \beta + \rho_{it} \cdot TAX_{it} + \eta_i + \lambda_t + \epsilon_{it}, \]  

(2)

• Variables:
  
  ● \( y_{i,t} \) - consumer price of gasoline or diesel in country \( i \) at date \( t \),
  
  ● \( TAX_{it} \) - dummy variable that equals one when country \( i \) implements a temporary fuel tax reduction at date \( t \)
  
  ● \( X' \) - contains control variables (refinery capacity and Google Mobility)
  
  ● \( \eta_i \) - country fixed effects
  
  ● \( \lambda_t \) - day fixed effects
Results: Pass-through

<table>
<thead>
<tr>
<th></th>
<th>(I) Gasoline</th>
<th>(II) Diesel</th>
<th>(III) Gasoline</th>
<th>(IV) Diesel</th>
<th>(V) Gasoline</th>
<th>(VI) Diesel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results ATT Italy</td>
<td>-0.34*** (0.01)</td>
<td>-0.35*** (0.04)</td>
<td>-0.32*** (0.00)</td>
<td>-0.28*** (0.01)</td>
<td>-0.31*** (0.01)</td>
<td>-0.28*** (0.01)</td>
</tr>
<tr>
<td>Results ATT France</td>
<td>-0.20*** (0.00)</td>
<td>-0.22*** (0.03)</td>
<td>-0.20*** (0.00)</td>
<td>-0.18*** (0.01)</td>
<td>-0.20* (0.08)</td>
<td>-0.17* (0.07)</td>
</tr>
<tr>
<td>Results ATT Germany</td>
<td>-0.47*** (0.01)</td>
<td>-0.19*** (0.00)</td>
<td>-0.45*** (0.00)</td>
<td>-0.20*** (0.00)</td>
<td>-0.43*** (0.01)</td>
<td>-0.17*** (0.02)</td>
</tr>
<tr>
<td>Simple Weighted Average</td>
<td>-0.34*** (0.01)</td>
<td>-0.25*** (0.02)</td>
<td>-0.32*** (0.00)</td>
<td>-0.22*** (0.00)</td>
<td>-0.31*** (0.03)</td>
<td>-0.21*** (0.02)</td>
</tr>
<tr>
<td>Pass-Through Rates Italy</td>
<td>137.42%</td>
<td>139.70%</td>
<td>127.05%</td>
<td>111.55%</td>
<td>124.34%</td>
<td>110.87%</td>
</tr>
<tr>
<td>Pass-Through Rates France</td>
<td>112.44%</td>
<td>119.69%</td>
<td>111.98%</td>
<td>98.28%</td>
<td>108.57%</td>
<td>95.12%</td>
</tr>
<tr>
<td>Pass-Through Rates Germany</td>
<td>157.58%</td>
<td>137.95%</td>
<td>153.31%</td>
<td>140.13%</td>
<td>147.15%</td>
<td>118.91%</td>
</tr>
<tr>
<td>Time FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Country FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Covariate Included</td>
<td>No</td>
<td>No</td>
<td>Cap</td>
<td>Cap</td>
<td>Cap &amp; Mob</td>
<td>Cap &amp; Mob</td>
</tr>
</tbody>
</table>
• In general, very high pass-through rates which are mostly larger than 100% → highly competitive markets
• Effect is very large in Italy and Germany, slightly smaller in France
  • More inelastic supply in France compared to the other two countries
• Compared to previous tax reductions: higher public awareness and the threat of policymakers to pursue antitrust measures
• Pass-through rates higher for gasoline compared to diesel
  • Counterintuitively as the literature finds a more inelastic demand for diesel than for gasoline
  • Most probably due to the unusually high demand for heating diesel in spring/summer 2022
• Estimated effects on retail margins are in line with findings for pass-through rates
Conclusion and Policy Implications

• Temporary fuel tax reductions in Western Europe are passed on to the consumers disproportionately.

• From a competition policy perspective, our results hardly allow any conclusions on possible competition restrictions. High pass-through rates suggest that alleged restrictions can at least not hinder pass-through of tax reductions.

• Due to distributional- and climate-economical shortcomings as well as the relatively high fiscal burden it is debatable whether it is an efficient intervention.

• Work in progress: event study design, more countries, further robustness checks
Thank You!