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# Bayesian Causal Estimation of Germany's Recent Fuel Price Policy: The High Noon Rule and the 2026 Fuel Tax Discount

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**Abstract**

Governments intervene in retail fuel markets in two broad ways: by restricting pricing behavior, and by adjusting the tax burden on consumers. We test both kinds of interventions as introduced by the German government in spring 2026, using a Bayesian Structural Time Series model to construct a probabilistic counterfactual from pre-intervention dynamics. First, the High Noon Rule, introduced on April 1, restricts fuel stations to a single permitted price increase per day at midday. The second measure is a two-month excise tax discount that cut the fuel duty by €0.14 per litre (€0.167 including VAT) and took effect on May 1. In the absence of a suitable comparison country that has not introduced its own fuel price interventions in response to the U.S.-Iran War, we use Rotterdam wholesale prices as a credibly exogenous comparison – and the most natural benchmark – for our Bayesian approach. Using daily station prices, we find that the High Noon Rule raised petrol prices by 8 cents per litre in its first week before the effect faded within two weeks, while it had no discernible effect on diesel prices over its first month. Over the first two weeks of the tax discount, pass-through amounted to 101% for diesel and 86% for petrol, figures consistent with full or near-full pass-through and close to those documented for Germany's 2022 fuel tax discount. Estimated pass-through rises over the two months of the discount, which we attribute in part to the difficulty of tracking falling wholesale costs over longer horizons. Together, the results are consistent with a largely competitive retail fuel market.

**JEL codes:** Q41, H22, L71, C11

**Keywords:** Retail fuel markets, Tax pass-through, Price regulation, Causal inference

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# 1 Introduction

The competitiveness of retail fuel markets is a longstanding concern for consumers and policymakers alike. Governments often intervene in these markets in two broad ways: by restricting the timing or level of price changes, and by adjusting the tax burden passed on to consumers. Economic theory makes predictions about how competitive markets respond to each type of intervention: Under perfect competition and perfectly elastic supply, tax reductions are fully passed through to consumers (Weyl and Fabinger, 2013), while pricing restrictions can raise prices by inducing firms to set strategically high prices in response to the restrictions (Obradovits, 2014; Denter, 2026). Both predictions are rarely tested against real-world data from the same market at the same time.

This paper provides such an empirical test, using two measures introduced by the German government in spring 2026 as a natural experiment to shed light on the competitive structure of Germany's retail fuel market. The first measure, the High Noon Rule, took effect on April 1 and restricts stations to a single permitted price increase per day, at 12:00. The second, introduced one month later on May 1, was a two-month excise tax discount that reduced the per-litre duty on both petrol and diesel by €0.14. Accounting for the value-added tax rate of 19%, the theoretical price reduction amounts to €0.167 per litre altogether. The two measures provide complementary lenses on the question of competition: the High Noon Rule allows us to test whether pricing restrictions in an otherwise competitive market protect consumers, while the tax discount allows for testing whether cost reductions are transmitted to consumers at the rates theory predicts under competition.

The High Noon Rule draws on Austria's experience, where a similar noon-pricing rule was introduced in 2011. The theoretical and empirical evidence on such regulations is mixed. Obradovits (2014) shows that pricing restrictions can induce firms to raise prices by distorting pricing intertemporally, while Denter (2026) shows in a related model that the regulation weakly raises expected average prices but may in-

crease consumer surplus when expected prices are unchanged. Siemroth (2026) takes the regulation as given and asks which reset hour minimises prices, finding that even under the most favourable implementation, the best-case price reduction amounts to only 0.2 cents per litre.

Empirical evidence from Austria is similarly mixed. Becker, Pfeifer, and Schweikert (2021) use a synthetic control design and find short-run gasoline price reductions of approximately 23% immediately after Austria's Fuel Price Fixing Act, though the effect dissipated substantially within a year and evidence for diesel prices is ambiguous. Fasoula and Schweikert (2020) find faster pass-through of input price changes after the Austrian reform and interpret this as evidence that the regulation may have fostered competition.

Conversely, Bernhardt, Breiderhoff, and Dewenter (2025) find that the price-reducing effect of Austria's revised Price Fixing Act was offset by the subsequent transparency policy, ultimately leading to higher petrol prices. Our results for Germany align with this more pessimistic reading, at least in the short run: the High Noon Rule raised petrol prices by 8 cents per litre in its first week and by about 4 cents in its second, before the effect faded. This result is far outside even the most optimistic theoretical scenario of Siemroth (2026): at least initially, the rule raised rather than lowered prices.

The literature on fuel tax pass-through provides a second lens on competition. Under imperfect competition, pass-through is generally incomplete, but converges to unity as markets become more competitive and demand less convex (Weyl and Fabinger, 2013). For Germany specifically, Frondel, Thiel, and Vance (2026) document that demand for fuel is not highly convex, implying that near-complete pass-through is a strong signal of competitive pricing rather than an artefact of demand curvature.

Several studies of Germany's 2022 fuel tax discount, introduced following the outbreak of the Ukraine War, broadly corroborate the competitive prediction. Fuest, Neumeier, and Stöhlker (2022), Dovern et al. (2023), and Schmerer and Hansen (2023) find near-complete average pass-through of Germany's 2022 tax discount, while Kahl (2024) uncovers substantial variation over space and time, with average rates of 82% in rural

areas and 92% in urban areas. Frondel, Thiel, and Vance (2026) indentify average rates of 96% for diesel and 82% for petrol, but find that pass-through dissipated sharply over the three-month discount period. When weighting price effects by quantities sold, Gregor and Haucap (2025) obtain smaller estimates of pass-through, amounting to about 70% for gasoline and 58% for diesel.

Beyond Germany, several studies of the gasoline market find that, consistent with linear or not too convex demand, pass-through increases with competition (Doyle and Samphantharak, 2008; Alm, Sennoga, and Skidmore, 2009; Byrne, 2019; Genakos and Pagliero, 2022). Marion and Muehlegger (2011) show that supply-side constraints, including refinery capacity utilization and inventory conditions, can attenuate pass-through independently of competitive intensity.

Many of the above studies use variants of difference-in-differences, event study, or synthetic control methods, all of which require credible external controls to support causal identification. In the present setting, identifying the causal impact of Germany's fuel price measures is complicated by the fact that almost all European countries simultaneously introduced their own interventions in response to the U.S.-Iran War, making it impossible to construct the clean control group such analyses require.

France, for example, was used as a control country in several studies of the 2022 episode (Kahl, 2024; Fuest, Neumeier, and Stöhlker, 2022; Frondel, Thiel, and Vance, 2026), but is unsuitable this time: TotalEnergies introduced a voluntary price cap in early April 2026 that triggered a surge in demand at capped stations, producing supply shortages affecting up to 18% of French petrol stations and generating significant regional heterogeneity in both prices and availability (France 24, 2026; Bloomberg, 2026). The remaining European countries either implemented their own relief measures during the same period, such as Germany's neighbors Austria and Poland (RTE News, 2026; VATupdate, 2026), or lack comparable daily station-level price data required for a rigorous comparison.

In the absence of a suitable control country, we use a Bayesian Structural Time Series (BSTS) model (Brodersen et al., 2015), following the potential outcomes framework

for causal inference in time series settings. Though widely applied to a range of questions — including vaccine efficacy (Bruhn et al., 2017), marine conservation (Favoretto et al., 2023), health-care interventions (Boussina et al., 2024), nutritional support during COVID (Bryant and Follet, 2022), and financial markets (Jalan, Matkovskyy, and Urquhart, 2021) — the approach remains less common in empirical economics, where difference-in-differences and synthetic control designs are more prevalent.

The BSTS approach is complementary to these designs: it estimates the same object — a counterfactual no-policy price path — but constructs it from pre-intervention dynamics. Most importantly, for this approach, we employ a contemporaneous price covariate drawn from the Northwest European wholesale market in Rotterdam, rather than from an external untreated market of a control country. Because Germany is a price-taker in the Northwest European wholesale market, Rotterdam prices absorb global input cost movements without being influenced by domestic policy, playing the role that an untreated control country would play in a difference-in-differences design. This makes the approach particularly well suited to the present setting, where simultaneous fuel-market interventions across Europe preclude the use of any European country as clean external control.

A further methodological contribution concerns the construction of daily prices. Because stations report prices only when they change them, we weight each reported price by the time it was in effect. This matters under the High Noon Rule, which concentrates price increases at noon, so that a simple average over price reports would overstate the prices consumers paid. We also select the specification of the Rotterdam covariate with a placebo test on 22 pseudo-intervention dates, using a selection rule fixed before any policy effect was estimated.

Our results indicate that the High Noon Rule did not lower prices: we find no statistically significant price reduction in any week or specification. Its only clearly measurable effect was a short-lived increase in petrol prices at its introduction, of 8 cents per litre in the first week, which faded within two weeks; for diesel, we find no discernible effect over the month as a whole. The subsequent fuel tax discount reduced

prices as intended. Over its first two weeks, pass-through reached 101% for diesel and 86% for petrol, figures that are consistent with full or near-full pass-through and close to those documented for the 2022 episode (Frondel, Thiel, and Vance, 2026). Placebo tests during the price spike of spring 2026 show that forecast errors are larger in turbulent periods than the model's credible intervals suggest, so that these rates should not be read as precise. Over the full two months, estimated pass-through rises to 121% and 103%, respectively, a drift that we attribute in part to the difficulty of tracking falling wholesale costs over longer horizons. Taken together, both results are consistent with a competitive retail fuel market, one in which pricing restrictions can increase prices and in which tax reductions are rapidly and largely transmitted to consumers.

# 2 Data and Methodology

The analysis draws on two data sources. Wholesale input costs are proxied by daily Rotterdam prices for petrol and diesel obtained from Argus Media, both denominated in Euro per litre.[1] Retail fuel prices come from the Market Transparency Unit for Fuels (MTU). Since September 2013, stations in Germany are legally obligated to report every price change to the MTU, along with the precise time stamp, geographic coordinates, operating hours, and brand (Haucap, Heimeshoff, and Siekmann, 2015). We retrieve the data from the repository hosted at `creativecommons.tankerkoenig.de`, which archives all station-level records since the MTU's inception.

## 2.1 Data

The estimation sample runs from January 1, 2023 through June 30, 2026, the last day of the fuel tax discount. With daily observations, this yields more than three years of pre-intervention data preceding the implementation of the High Noon Rule on April 1,

[1] Rotterdam prices reflect the conditions at the Northwest European wholesale market. We used the Gasoline 95r 10ppm NWE barge price for petrol and the Gasoil 10ppm German Rotterdam fob barge price for diesel.

2026, and covers the full two-month duration of the fuel tax discount. Our dependent variables are daily national retail prices for diesel and petrol.[2]

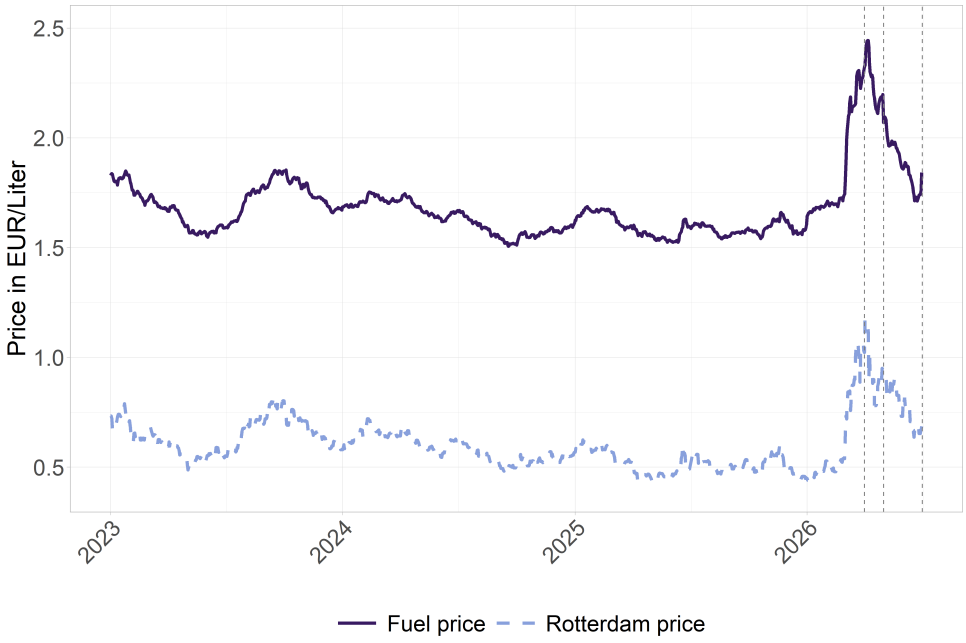
Because stations report a price only when they change it, the raw data consist of irregularly spaced price reports. We convert them into a daily price per station by weighting each price by the time it was in effect: a reported price holds until the station's next report, and the station's daily price is the mean of the prices in effect over the 24 hours of the calendar day.[3] Time weighting matters in the present setting. A simple average over price reports weights each price by how often it is reported rather than by how long it is charged. Under the High Noon Rule, stations may raise prices only once a day, at noon, while price cuts remain possible at any time, so that the low prices of the evening and night are typically set with few reports. An average over reports would give these prices too little weight and overstate the prices that consumers faced. The national series is the median of the station-level daily prices across the roughly 15,000 stations in Germany. While intraday price dynamics would offer a more direct lens on the High Noon mechanism, the daily median across all stations captures the net effect on the prices that consumers actually pay, which is the relevant welfare metric for our purposes.

As Rotterdam prices represent the pre-tax wholesale component of the retail price, the level gap between the two series in Figure 1 partially reflects excise duty and value-added tax. In particular, from the end of February 2026, both retail and wholesale prices rise sharply, reflecting broader market conditions associated with the U.S.-Iran War.

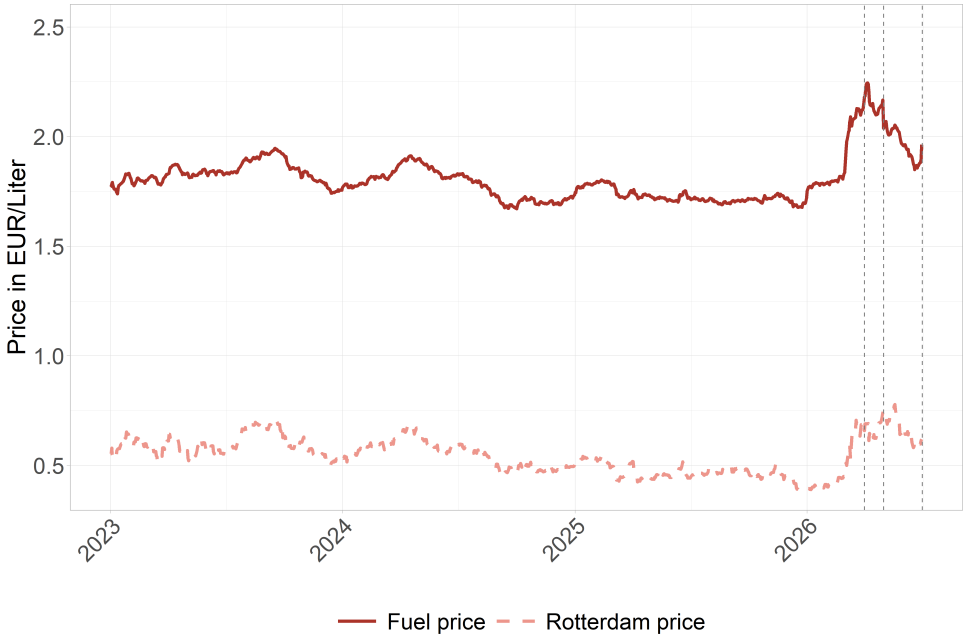
[2]Petrol prices are measured using Super E5, a 95-octane petrol containing up to 5% ethanol. Results for E10, a blend containing up to 10% ethanol, are virtually identical and are reported in Section 4.

[3]Reported prices outside the range of €0.50 to €4.00 per litre are treated as invalid, in which case the previous valid price continues to hold. A price is carried forward for at most seven days without a new report. We retain station-days on which valid prices cover at least 20 hours, which applies to more than 99% of station-days.

Figure 1: Time Series of Prices for Diesel and Petrol and Rotterdam Prices




(a) Diesel




(b) Petrol (E5)

*Notes*: Daily median across stations of time-weighted station prices; petrol is measured by E5. Rotterdam prices are carried forward over non-trading days. The vertical lines mark the High Noon Rule (April 1, 2026) and the start (May 1, 2026) and end (June 30, 2026) of the Fuel Tax Discount.

## 2.2 Method

We estimate the causal impact of each policy measure using the Bayesian Structural Time Series (BSTS) framework developed by Brodersen et al. (2015). The approach follows the potential outcomes framework for causal inference: it constructs a probabilistic counterfactual of what prices would have been absent the intervention by fitting a state-space model to the pre-intervention period and projecting it forward. The difference between the observed post-intervention prices and this counterfactual yields a posterior distribution over the treatment effect, allowing us to characterize not just the average impact but its full time path and associated uncertainty.

The BSTS approach generalises the logic of difference-in-differences to a time series setting. As Bryant and Follet (2022) note, standard difference-in-differences designs ignore autocorrelation and typically assume that the effect of an intervention is a static location shift, assumptions that may be inappropriate when impacts are temporary, lagged, or otherwise nonlinear. The BSTS framework relaxes these assumptions by using the full pre-intervention time series to fit the counterfactual, accommodating time-varying trends and seasonality, and yielding a full posterior distribution over the treatment effect rather than a single point estimate.

Rotterdam wholesale prices play the role of the control unit: the relationship between German retail prices and Rotterdam prices estimated over the pre-intervention period is used to project what retail prices would have been in the absence of policy. The key identifying assumption is that Rotterdam prices were unaffected by the German policy interventions, so that the pre-intervention relationship between retail and wholesale prices would have continued unchanged absent the treatment. This assumption is supported by the close tracking of the counterfactual and actual series in the weeks immediately preceding each treatment date, including during the early phase of the Middle East price spike (Figure 1).

The state-space model decomposes the observed retail price $p_t$ into structural com-

ponents:

$$p_t = \mu_t + \beta \cdot R_t + \gamma_t + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0, \sigma_\varepsilon^2), \tag{1}$$

where $\mu_t$ is a time-varying level, $\gamma_t$ is a weekly seasonal component capturing recurring intra-week price patterns, $R_t$ is the Rotterdam wholesale price serving as an exogenous covariate, $\beta$ is the corresponding coefficient, and $\varepsilon_t$ is an idiosyncratic error term. The level $\mu_t$ evolves according to a random walk, and the seasonal component sums to zero over a week up to a random disturbance:

$$\mu_t = \mu_{t-1} + \eta_t, \quad \eta_t \sim \mathcal{N}(0, \sigma_\eta^2), \qquad \gamma_t = -\sum_{s=1}^{6} \gamma_{t-s} + \omega_t, \quad \omega_t \sim \mathcal{N}(0, \sigma_\omega^2). \tag{2}$$

The local level allows the underlying price level to evolve over time rather than imposing a fixed global trend. Following Brodersen et al. (2015), we set the prior standard deviation of the level innovations $\eta_t$ to 0.01 (in units of the standard deviation of the standardised series), which keeps the level smooth, so that short-run price movements are attributed to the covariate rather than absorbed by the level. The inclusion of the Rotterdam price is central to identification: because Germany is a price-taker on the Northwest European wholesale market, $R_t$ tracks global input cost movements without being influenced by domestic policy, thereby separating market-driven price variation from policy effects.

Rotterdam quotes are available only on trading days, and retail prices adjust to wholesale prices with a lag. Both matter for how $R_t$ enters the model. Interpolating between quotes, for example with a spline, would fill weekends and holidays with information that was not yet available on those days. We therefore never use future quotes: on non-trading days, the last quote is carried forward, for at most seven days. A same-day quote, however, captures only the short-run co-movement of retail and wholesale prices. When wholesale prices move persistently, the random-walk level $\mu_t$ absorbs part of the movement, and the counterfactual follows costs too slowly. Our main specification therefore uses the seven-day trailing mean of the carried-forward

Rotterdam price,

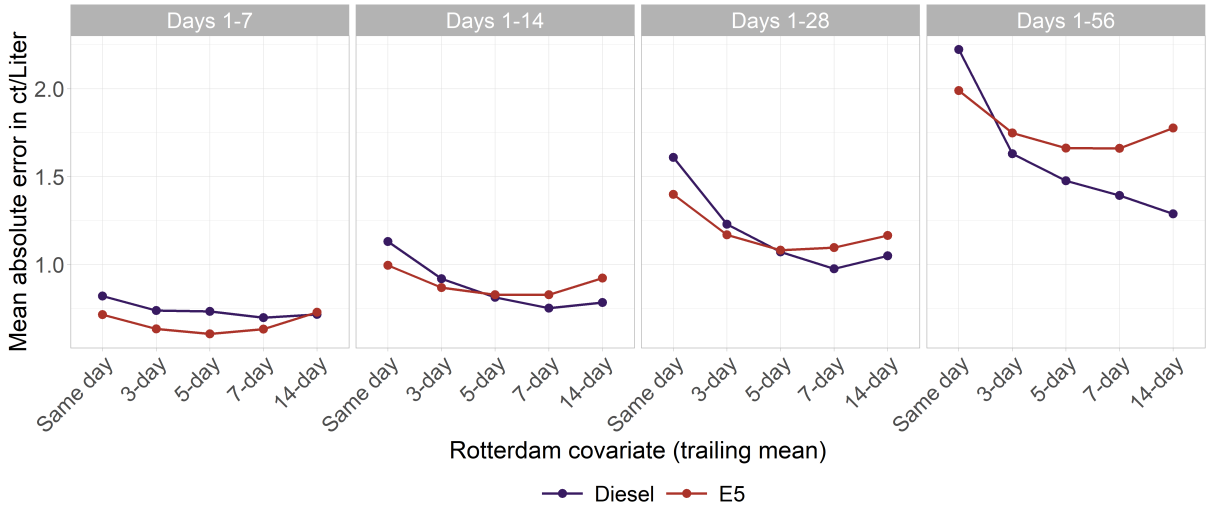
$$R_t = \frac{1}{7} \sum_{k=0}^{6} R_{t-k}^{\text{fwd}}, \tag{3}$$

which uses only past information and allows for delayed retail adjustment.

We chose the averaging window before estimating any policy effect. At 22 dates between January 2024 and January 2026 without a policy change, we fitted the model and forecast prices for the following 56 days, using either the same-day quote or trailing means over 3, 5, 7 and 14 days. Because the true effect at these dates is zero, any estimated effect is forecast error. As Figure 2 shows, trailing means clearly reduce the error, most of all at longer horizons, while the differences between the 5-, 7- and 14-day means are small. With the seven-day mean, the mean absolute error falls by 15–39% for diesel and 13–21% for petrol relative to the same-day quote, which meets the criterion we had set in advance (a reduction of at least 10% in every window); Table A1 in the Appendix gives the details. A richer lag structure does not improve on the seven-day mean. Adding a second covariate for delayed adjustment, the mean Rotterdam price of days 7–13 or 7–27 before $t$, changes the mean absolute error by at most about 10% (mostly for petrol), and it does not reduce the bias at longer horizons; we therefore retain the seven-day mean. Results with the same-day quote and with spline-interpolated quotes are reported in Section 4.2.

To estimate the causal impact of the High Noon and tax measures separately, we run the model twice for each fuel using the `CausalImpact` package in R (Brodersen et al., 2015). The first estimation covers the period from January 2023 through the end of April 2026, spanning the pre-intervention period and the first month of the High Noon regulation, but stopping just before the introduction of the Fuel Tax Discount on May 1. This yields a clean estimate of the High Noon effect. The second estimation uses the period through April 30, 2026 as pre-intervention period and the full discount period from May 1 to June 30, 2026 as post-intervention period. Because the Fuel Tax Discount follows shortly after the High Noon regulation, the pre-intervention period of the second model contains the first month of the High Noon Rule as well as the

Figure 2: Choice of the Rotterdam Covariate: Forecast Error at Placebo Dates




*Notes*: Mean absolute error of the estimated effect at 22 placebo dates (January 2024 to January 2026, true effect zero), by Rotterdam covariate and forecast window. Same day: quote carried forward over non-trading days; $k$-day: trailing mean over $k$ days. See Table A1.

weeks after the discount was announced on April 13; Section 4.3 reports estimates with shorter pre-intervention periods.

The model yields a posterior distribution of the counterfactual price for each day of the post-intervention period. We summarise the effect as the mean difference between actual and counterfactual prices over the whole post-intervention period and over shorter windows, in particular single weeks and the first 14 days, with 95% credible intervals taken from the posterior draws. For the Fuel Tax Discount, we express the effect as a pass-through rate, the estimated price change divided by the full pass-through benchmark of $-$€0.167 per litre, i.e. the energy tax reduction of €0.1404 plus value-added tax.

# 3 Results

The estimated BSTS model, fitted on more than three years of pre-intervention data, tracks the actual price trajectory closely throughout the pre-treatment period, including the Middle East price spike in the weeks before the High Noon Rule took effect on April 1 (Figure 3). This in-sample fit indicates that the Rotterdam wholesale price

absorbs most of the market-wide cost shock once the shock is part of the estimation sample. How well the model forecasts prices out of sample in such turbulent conditions is examined with placebo tests in Section 4.1. Table 1 summarises the estimated effects of both measures.

Table 1: Estimated Effects of the High Noon Rule and the Fuel Tax Discount

| | Diesel | | Petrol (E5) | |
|---|---|---|---|---|
| | Effect (ct/l) | Pass-through (%) | Effect (ct/l) | Pass-through (%) |
| *Panel A: High Noon Rule (April 1–30, 2026)* | | | | |
| Week 1 (April 1–7) | 3.8 [1.4, 6.4] | | 8.0 [6.0, 10.0] | |
| Week 2 (April 8–14) | 0.7 [−2.8, 4.1] | | 3.6 [0.8, 6.5] | |
| First 14 days | 2.3 [−0.4, 5.0] | | 5.8 [3.6, 8.0] | |
| Full month | 2.2 [−1.4, 5.3] | | 3.1 [0.3, 5.9] | |
| *Panel B: Fuel Tax Discount (May 1 – June 30, 2026)* | | | | |
| Week 1 (May 1–7) | −15.0 [−17.6, −12.5] | 90 [75, 106] | −13.2 [−15.4, −11.0] | 79 [66, 92] |
| First 14 days | −16.8 [−19.7, −13.9] | 101 [83, 118] | −14.4 [−17.0, −11.8] | 86 [70, 102] |
| Full period | −20.2 [−24.7, −15.6] | 121 [93, 148] | −17.3 [−21.5, −12.8] | 103 [76, 129] |

*Notes*: Mean difference between actual and counterfactual prices over the stated window, in euro cents per litre, with 95% credible intervals in brackets. Pass-through is the effect divided by the full pass-through benchmark of −16.7 cents. Main specification: seven-day trailing mean of the Rotterdam price as covariate.

## 3.1 High Noon Rule

For diesel, presented in panel (a) of Figure 3, the average effect over the first month of the rule is €0.022 per litre, with a 95% credible interval of [€-0.014, €0.053] that spans zero. We therefore find no statistically discernible effect of the High Noon regulation on diesel prices over the month as a whole. The weekly estimates in Figure 4 show a small increase of 3.8 cents per litre in the first week, which vanishes thereafter. With the same-day Rotterdam price as covariate, this initial increase is larger (Section 4.2), so that a short-lived price increase for diesel cannot be ruled out.

The picture is different for petrol. The estimated average effect is €0.031 per litre, with a 95% credible interval of [€0.003, €0.059] that lies above zero. Placebo tests in the turbulent weeks before the rule, however, yield forecast errors of similar size (Section 4.1), so that the monthly average alone is not firm evidence of a price increase.

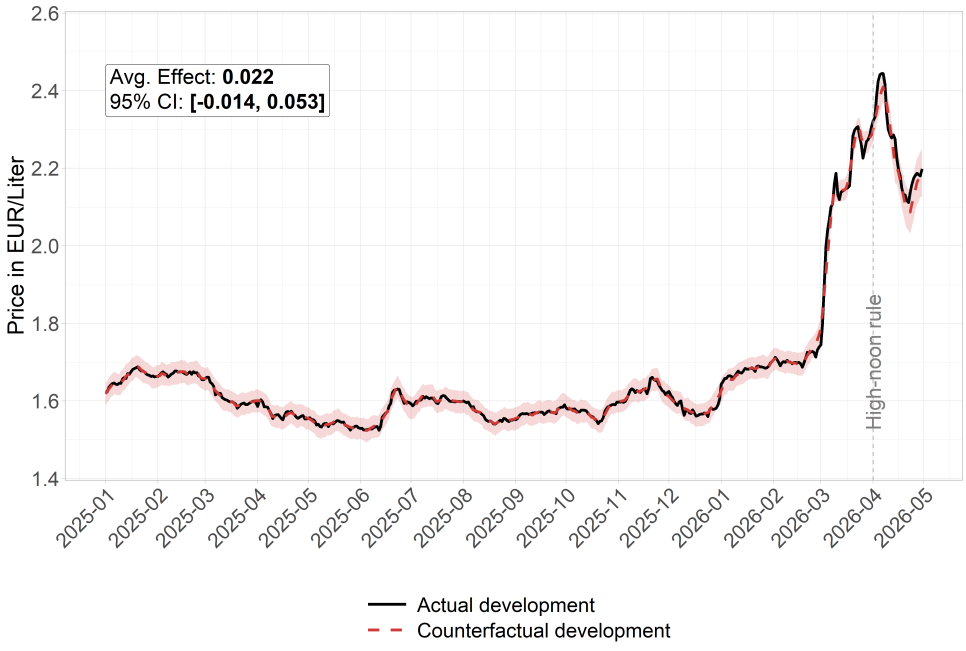
The weekly estimates are more informative: the increase is concentrated at the start of the regulation, with petrol prices 8.0 cents per litre above the counterfactual in the first week, well beyond the placebo errors, and 3.6 cents in the second, while the effects in the remaining weeks are below one cent and statistically indistinguishable from zero. Easter Sunday fell on April 5, 2026, within the first week of the rule. Placebo estimates for the Easter periods of 2024 and 2025, however, yield effects of at most about one cent in the corresponding week (Section 4.1), so that the holiday cannot account for the initial increase.

Rather than reducing consumer costs, the High Noon regulation thus appears to have raised petrol prices, if only temporarily. The initial increase is consistent with the theoretical predictions of Obradovits (2014) and Denter (2026) that pricing restrictions induce firms to set strategically high prices in anticipation of future constraints. That the effect faded within two weeks suggests an adjustment phase in which stations adapted their pricing to the new rule, rather than a lasting shift in the price level. Even if the monthly average cannot be distinguished from zero with confidence, the initial increase contrasts sharply with the most optimistic theoretical scenario of Siemroth (2026), who finds a best-case price reduction of only 0.2 cents per litre under optimal implementation of such a rule.

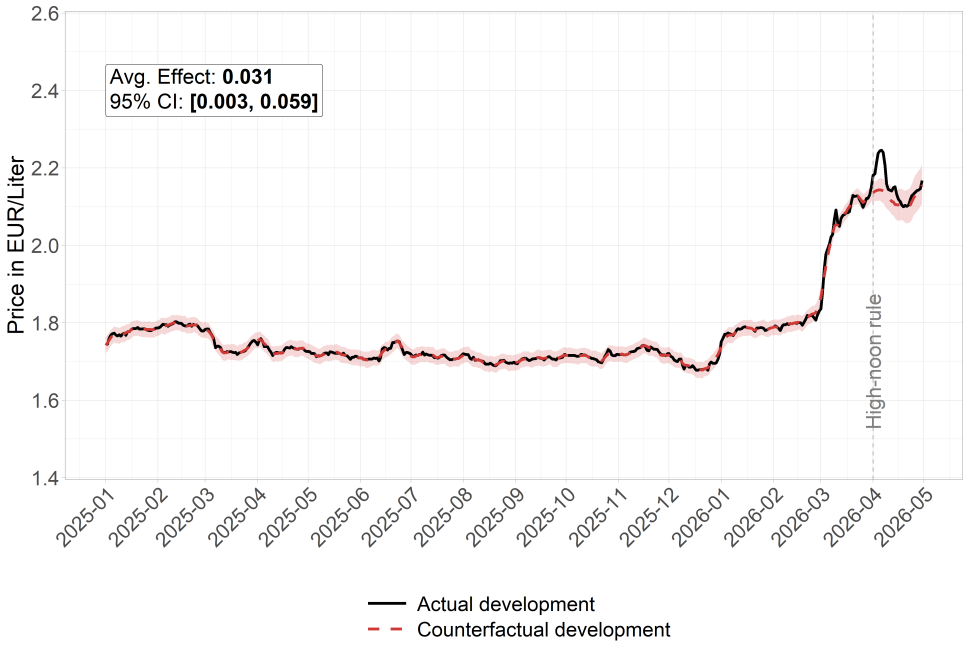
## 3.2 Fuel Tax Discount

Figure 5 presents the estimates for the Fuel Tax Discount over its full duration from May 1 to June 30, 2026, again with diesel in panel (a) and petrol in panel (b). We focus on the first 14 days of the discount as our headline estimate, for reasons discussed below. Over this window, the discount reduced diesel prices by 16.8 cents per litre (95% CI: [-19.7, -13.9]), corresponding to a pass-through rate of 101% (95% CI: [83%, 118%]). For petrol, prices fell by 14.4 cents per litre (95% CI: [-17.0, -11.8]), a pass-through rate of 86% (95% CI: [70%, 102%]). Both intervals include full pass-through. Already in the first week, pass-through reached 90% for diesel and 79% for petrol, indicating that

Figure 3: Predicted Time Series with respect to the High Noon Rule



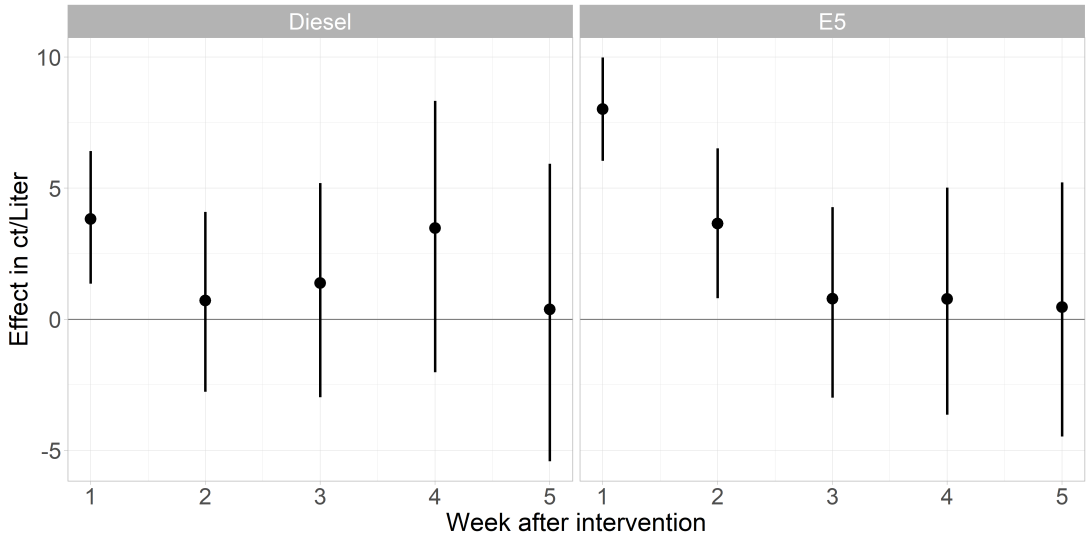

(a) Diesel




(b) Petrol (E5)

*Notes*: The High Noon Rule was implemented on April 1, 2026. For expositional purposes, the figure displays the series as of January 2025, although the estimation sample runs from January 2023. Effects in euro per litre.

Figure 4: Weekly Effects of the High Noon Rule




*Notes*: Mean difference between actual and counterfactual prices in each week after April 1, 2026, with 95% credible intervals. Week 5 covers April 29–30 only.

the tax reduction was transmitted to consumers within days. The placebo tests in Section 4.1 suggest that the credible intervals understate the uncertainty in the turbulent conditions of spring 2026: forecast errors of a few cents translate into 10 to 30 percentage points of pass-through. The estimates are therefore best read as consistent with full or near-full pass-through, rather than as precise rates.

Averaged over the full two months, the estimated effects are larger: €-0.202 per litre for diesel (95% CI: [€-0.247, €-0.156]) and €-0.173 for petrol (95% CI: [€-0.215, €-0.128]), corresponding to pass-through rates of 121% and 103%. Figure 6 shows that this reflects a gradual increase in the weekly estimates, from 90% in the first week to 146% in the eighth for diesel, and from 79% to 132% for petrol. In the final days of the discount, the estimated effects shrink again, as prices rose in anticipation of the tax returning to its normal rate on July 1.

We interpret the upward drift with caution. It coincides with a sustained decline in Rotterdam prices during the discount period (Figure 1). In the model, the Rotterdam coefficient mainly captures the short-run co-movement of retail and wholesale prices, while part of a persistent cost decline is absorbed by the random-walk level, which is held fixed in the forecast. The counterfactual therefore falls more slowly than costs, and

the estimated pass-through increases with the length of the window. Consistent with this explanation, the drift is strongest when the same-day Rotterdam price is used as covariate, which captures persistent cost changes least well (Section 4.2), and placebo tests during the price spike of March 2026 show directly that the model under-reacts to large, persistent cost movements (Section 4.1). The estimates for the first weeks of the discount are less exposed to this problem, which is why we regard them as the more reliable measure of pass-through.

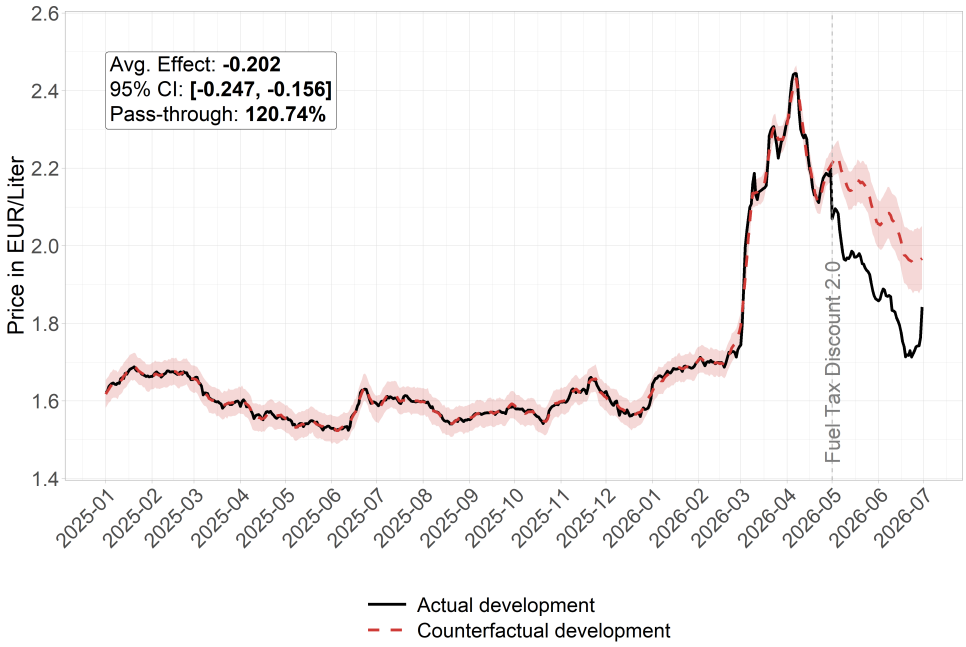
The first-14-day estimates of 101% for diesel and 86% for petrol are close to the average rates of 96% and 82% documented by Frondel, Thiel, and Vance (2026) for Germany's 2022 fuel tax discount. Unlike in 2022, however, we find no sign that pass-through dissipated over the course of the discount. The petrol estimates are robust to ending the pre-intervention period before the High Noon Rule and the announcement of the discount. For diesel, these alternatives yield a somewhat lower first-14-day pass-through of 87% to 91%, as diesel prices were slightly elevated in the second half of April (Section 4.3). Taken together, the pass-through estimates support the interpretation of a competitive retail fuel market in which tax reductions are rapidly and largely, if not fully, transmitted to consumers.

# 4 Robustness

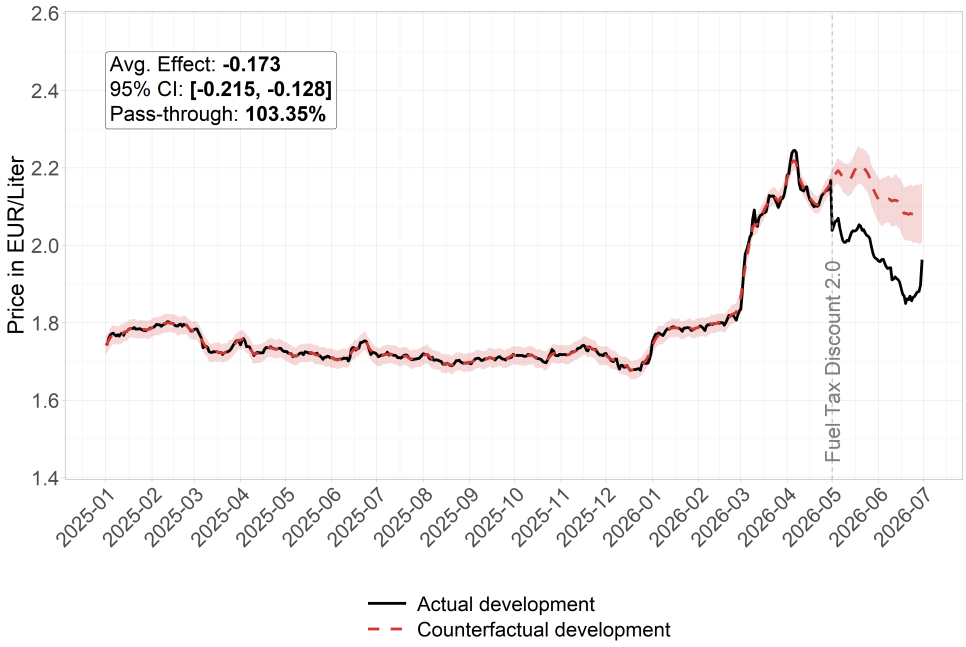
## 4.1 Placebo Tests

A natural concern with any time series counterfactual is whether the model generates spurious effects in the absence of a true intervention, particularly under the volatile market conditions of spring 2026. The 22 placebo dates used to choose the Rotterdam covariate (Section 2) provide a first answer. With the main specification, the mean absolute error at these dates is 0.70 cents per litre for diesel and 0.63 cents for petrol over the first week, and 0.75 and 0.83 cents over the first two weeks. These errors are an order of magnitude smaller than the estimated effects of the tax discount, of 13 to 17

Figure 5: Predicted Time Series with respect to Fuel Tax Discount



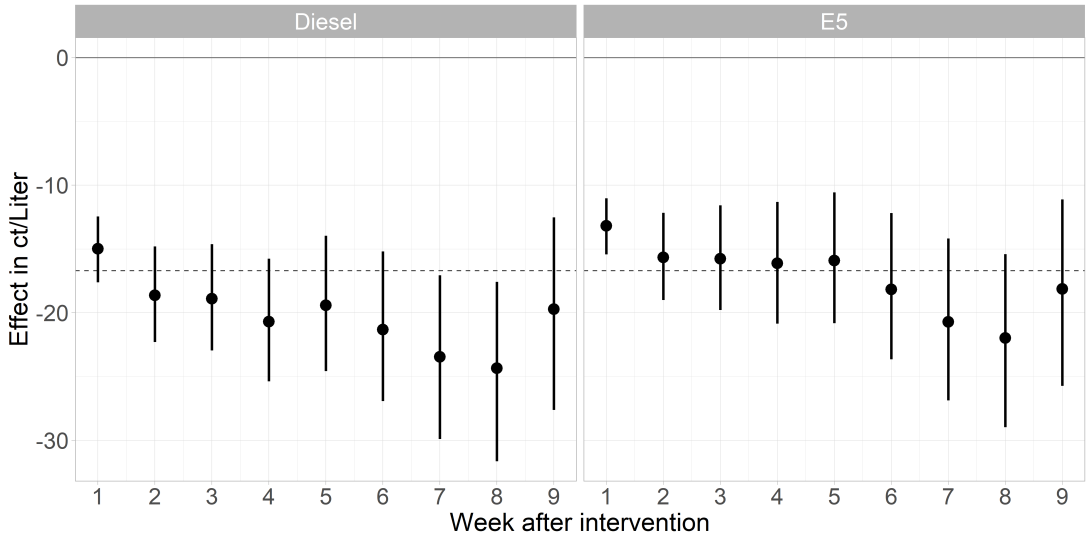

(a) Diesel




(b) Petrol (E5)

*Notes*: The Fuel Tax Discount was in effect from May 1 to June 30, 2026. For expositional purposes, the figure displays the series as of January 2025, although the estimation sample runs from January 2023. Effects in euro per litre; pass-through over the full discount period.

Figure 6: Weekly Effects of the Fuel Tax Discount




*Notes*: Mean difference between actual and counterfactual prices in each week after May 1, 2026, with 95% credible intervals. The dashed line marks full pass-through (−16.7 cents per litre). Week 9 covers June 26–30 only.

cents per litre over the same windows, and well below the first-week effect of the High Noon Rule on petrol of 8.0 cents. The placebo errors also show two limitations: the 95% credible intervals are somewhat too narrow, containing zero at 77–91% of the placebo dates for horizons of four to eight weeks, and the counterfactual is slightly too low on average (by about 0.3 cents over two weeks), which leads to a slight understatement of pass-through.

The 22 placebo dates lie in comparatively calm periods. We therefore add placebo tests at specific dates (Table 2): the 2025 price peak of each fuel, which replicates a volatile price environment, and the dates of both measures one year earlier, which replicates their seasonal context. These placebos yield effects of at most 1.8 cents per litre, all statistically indistinguishable from zero.

The most demanding test concerns the price spike of spring 2026 itself. We estimate placebo effects over the first week for start dates every two days between February 16 and March 24, 2026, all before the High Noon Rule took effect. The model fails to anticipate the onset of the spike: for start dates between February 26 and March 4, when the pre-intervention period contains little or only part of the price increase, the counter-

factual rises far less than actual prices, with first-week errors of up to 17 cents per litre for diesel and 12.5 cents for petrol. This is to be expected, as the relationship between retail and wholesale prices is estimated from calm years, in which the covariate mainly captures small day-to-day movements. Once about a week of the spike is part of the pre-intervention period, as is the case for both policy estimates, the errors fall to a few cents: for start dates from March 8 onward, the first-week error averages 2.9 cents for diesel (maximum 5.1) and 1.5 cents for petrol (maximum 3.8). These errors tend to be negative, i.e. the counterfactual is too high, and the 95% credible intervals contain zero in only one third (diesel) to two thirds (petrol) of cases.

These results have three implications. First, the effects of the tax discount, of 13 to 17 cents per litre, and the first-week effect of the High Noon Rule on petrol, of 8.0 cents, clearly exceed the forecast errors observed in turbulent conditions. Second, the monthly effects of the High Noon Rule, of 2 to 3 cents, lie within this range and do not constitute firm evidence of a lasting effect. Third, forecast errors of 3 to 5 cents correspond to 20 to 30 percentage points of pass-through for diesel, and errors of 1.5 to 4 cents to about 10 to 20 points for petrol, considerably more than the credible intervals suggest. The sweep covers a price increase, whereas the discount fell into a period of declining costs, so that it cannot be translated into a correction of our estimates. It does, however, show that the model under-reacts to large, persistent cost movements, which is the mechanism we hold responsible for the upward drift of the weekly pass-through estimates.

Finally, Easter Sunday fell on April 5, 2026, four days after the High Noon Rule took effect. Placebo models with pseudo-intervention dates four days before Easter Sunday in 2024 and 2025 yield first-week effects of at most 1.1 cents per litre, none of them statistically different from zero.[4] Easter effects of this size cannot explain the increase of 8.0 cents for petrol in the first week of the High Noon Rule.

[4]These models were estimated for diesel and E10, which yields virtually the same results as E5 (Section 4.2).

Table 2: Placebo Tests at Specific Dates

| Placebo | Window | Diesel | Petrol (E5) |
|---|---|---|---|
| *Design of the High Noon Rule (30 days)* | | | |
| 2025 price peak | from peak | 1.7 [−0.1, 3.6] | 0.4 [−1.3, 2.3] |
| One year earlier | Apr 1–30, 2025 | 1.8 [−0.1, 3.6] | 0.8 [−1.1, 2.5] |
| *Design of the Fuel Tax Discount (61 days)* | | | |
| 2025 price peak | from peak | 1.4 [−0.7, 3.5] | −0.7 [−3.0, 1.6] |
| One year earlier | May 1 – Jun 30, 2025 | −1.5 [−3.9, 0.9] | −1.7 [−4.0, 0.6] |

*Notes*: Mean difference between actual and counterfactual prices over the window, in euro cents per litre, with 95% credible intervals in brackets; the true effect is zero. Main specification (seven-day mean of the Rotterdam price). The 2025 price peak is on January 20 for diesel and February 11 for E5.

## 4.2 Alternative Covariates and E10

Table 3 compares the main specification with two alternatives: the same-day Rotterdam quote carried forward over non-trading days, and spline-interpolated quotes, which use future information on non-trading days. It also reports results for E10 instead of E5.

The E10 results are virtually identical to those for E5, with differences of at most 0.1 cents per litre. For petrol, the results are also robust to the choice of covariate. The estimated effect of the High Noon Rule over its first 14 days is 5.8 to 6.7 cents per litre and clearly positive in both specifications reported. Over the full month, the estimate is about 3 cents per litre in all specifications, although its credible interval excludes zero only with the seven-day mean. Full-period pass-through of the tax discount ranges from 99% to 103%. Pass-through over the first 14 days is somewhat lower with the same-day quote (74%) than with the seven-day mean (86%).

For diesel, the covariate matters more. Full-period pass-through rises from 121% with the seven-day mean to 138% with the same-day quote and 150% with spline-interpolated quotes. These are the specifications that capture persistent cost changes least well, in line with our interpretation of the upward drift of the weekly estimates in Section 3. For the High Noon Rule, the same-day quote yields a sizeable diesel price increase over the first 14 days of 7.0 cents per litre, against 2.3 cents with the seven-day mean. Over the whole month, the diesel effect is statistically indistinguishable from

zero in all specifications.

Table 3: Robustness: Rotterdam Covariate and E10

| Covariate | Diesel | Petrol (E5) | Petrol (E10) |
|---|---|---|---|
| *Panel A: High Noon Rule, first 14 days, effect (ct/l)* | | | |
| 7-day mean (main) | 2.3 [−0.4, 5.0] | 5.8 [3.6, 8.0] | 5.8 [3.6, 7.9] |
| Same day | 7.0 [3.3, 10.7] | 6.7 [4.1, 9.2] | 6.7 [4.1, 9.2] |
| *Panel B: High Noon Rule, full month, effect (ct/l)* | | | |
| 7-day mean (main) | 2.2 [−1.4, 5.3] | 3.1 [0.3, 5.9] | 3.1 [0.2, 5.9] |
| Same day | 1.1 [−3.9, 5.7] | 3.2 [−0.4, 6.3] | 3.1 [−0.4, 6.2] |
| Spline | −0.3 [−5.6, 4.6] | 2.7 [−1.0, 6.0] | 2.7 [−1.0, 6.0] |
| *Panel C: Fuel Tax Discount, first 14 days, pass-through (%)* | | | |
| 7-day mean (main) | 101 [83, 118] | 86 [70, 102] | 86 [70, 102] |
| Same day | 86 [62, 111] | 74 [56, 90] | 74 [56, 90] |
| *Panel D: Fuel Tax Discount, full period, pass-through (%)* | | | |
| 7-day mean (main) | 121 [93, 148] | 103 [76, 129] | 103 [76, 129] |
| Same day | 138 [97, 179] | 99 [70, 128] | 99 [70, 128] |
| Spline | 150 [105, 195] | 102 [71, 132] | 101 [70, 132] |

*Notes*: 95% credible intervals in brackets. Same day: Rotterdam quote carried forward over non-trading days. Spline: quotes interpolated over non-trading days (uses future quotes); not estimated for the first-14-day windows.

Results for E10 corresponding to Figures 3 and 5 are shown in Figures A1 and A2 in the Appendix.

## 4.3 Pre-intervention Period and Prior

The discount was announced on April 13, 2026, after a meeting of the coalition committee, and took effect on May 1. In the main specification, the pre-intervention period of the discount model runs to April 30 and thus contains the weeks after the announcement as well as the first month of the High Noon Rule. Table A2 in the Appendix reports two alternatives: a pre-intervention period ending on April 12, the day before the announcement, and one ending on March 31, before the High Noon Rule. In both, the remaining days of April are forecast but not used in estimating the effect of the discount, so the forecast horizon is longer and the credible intervals are wider.

For petrol, the variant that excludes both the High Noon Rule and the announcement yields a first-14-day pass-through of 82%, close to the main estimate of 86%. End-

ing the pre-intervention period on April 12 raises it to 104%, but this variant starts the forecast from the petrol price increase of the first High Noon weeks and therefore overstates the effect. For diesel, both alternatives give a lower first-14-day pass-through, 87% and 91% instead of 101%, with credible intervals that include full pass-through. Diesel prices in the second half of April were about 2 to 3 cents per litre above the counterfactual. This is consistent with anticipatory price setting after the announcement, but also with a small, persistent effect of the High Noon Rule on diesel (Table 3); the two cannot be separated. In either case, the main specification measures the diesel discount from a slightly elevated price level, so that the estimate of 101% lies at the upper end of a range of about 87% to 101%.

The results are insensitive to the prior on the level innovations. With a prior standard deviation of 0.05 or 0.1 instead of 0.01, first-14-day pass-through changes by at most 3 percentage points, the effect of the High Noon Rule on petrol over its first 14 days remains 5.7 to 5.8 cents per litre, and the weekly pass-through estimates show the same upward drift; only the credible intervals widen.

# 5 Conclusion

Using a Bayesian Structural Time Series framework, this paper has estimated the causal impact of two fuel price interventions introduced in Germany in spring 2026. These interventions provide complementary lenses through which to assess the competitive structure of Germany's retail fuel market. Two key results emerge. First, the High Noon Rule, which restricted stations to a single permitted price increase per day at midday, did not lower prices. Its only clearly measurable effect was a short-lived increase in petrol prices of 8 cents per litre in its first week, while we find no discernible effect on diesel prices over the month as a whole. The initial increase aligns with the theoretical predictions of Obradovits (2014) and Denter (2026) that pricing restrictions induce firms to set strategically high prices in anticipation of future constraints, leaving consumers worse off. Even under the most favourable implementation of such a rule,

Siemroth (2026) finds a best-case price reduction of only 0.2 cents per litre, while our first-week estimate lies well outside this range. The effect was short-lived, however: it faded within two weeks, suggesting that the rule caused a period of adjustment rather than a lasting increase in prices.

Second, the two-month fuel tax discount, which reduced the per-litre price by €0.167 including value-added tax, was passed through to consumers at 101% for diesel and 86% for petrol over its first two weeks, with credible intervals that include full pass-through. Placebo tests indicate that the uncertainty in the turbulent conditions of 2026 is larger than these intervals suggest, so that we read the estimates as evidence of full or near-full pass-through rather than as precise rates. These results are broadly consistent with standard competitive market predictions: given the non-convex demand for fuel documented for Germany (Frondel, Thiel, and Vance, 2026), near-complete pass-through is an informative signal of competitive pricing rather than an artefact of demand curvature. For petrol, the estimates are robust to excluding the High Noon period and the weeks after the announcement of the discount from the pre-intervention period; for diesel, doing so lowers first-14-day pass-through to about 90%, which remains consistent with near-full pass-through.

Our estimates cover the full duration of the discount. Evidence from Germany's 2022 fuel tax discount suggests that pass-through was strongest at the outset and varied over the life of the policy (Dovern et al., 2023; Kahl, 2024; Frondel, Thiel, and Vance, 2026). In particular, Frondel, Thiel, and Vance (2026) document a marked decline in pass-through over the three-month discount period, with rates falling well below 100% by the final month. We find no such dissipation in 2026. If anything, the estimated pass-through rises over the course of the discount, to 121% for diesel and 103% for petrol on average over the two months. We attribute this drift in part to a methodological limitation: during a sustained decline in wholesale prices, the counterfactual follows costs too slowly, so that pass-through estimates over longer horizons tend to be overstated. Placebo tests during the price spike of March 2026 confirm that the model under-reacts to large, persistent cost movements, and that it cannot antic-

ipate the onset of an unprecedented shock. Counterfactual methods that better track persistent cost movements, for instance by modelling the lagged adjustment of retail to wholesale prices explicitly, are a promising avenue for future work.

While consumers received the intended relief from the fuel tax discount, for the 2022 episode, Frondel, Thiel, and Vance (2026) gauged that such a measure came at a full fiscal cost of approximately one billion euro per month, a sum that will need to be recovered through future spending reductions or tax increases elsewhere. Distributional consequences compound this concern: fuel tax discounts disproportionately benefit higher-income households with larger vehicles and heavier fuel consumption, while providing little relief to those without cars or with low fuel use (Frondel, Thiel, and Vance, 2026). More broadly, insulating consumers from rising fuel prices during a period of genuine supply scarcity weakens the price signals that would otherwise encourage conservation and fuel switching, an effect that bears consideration in the political debate surrounding such measures.

## Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used Claude AI to improve writing. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the article.

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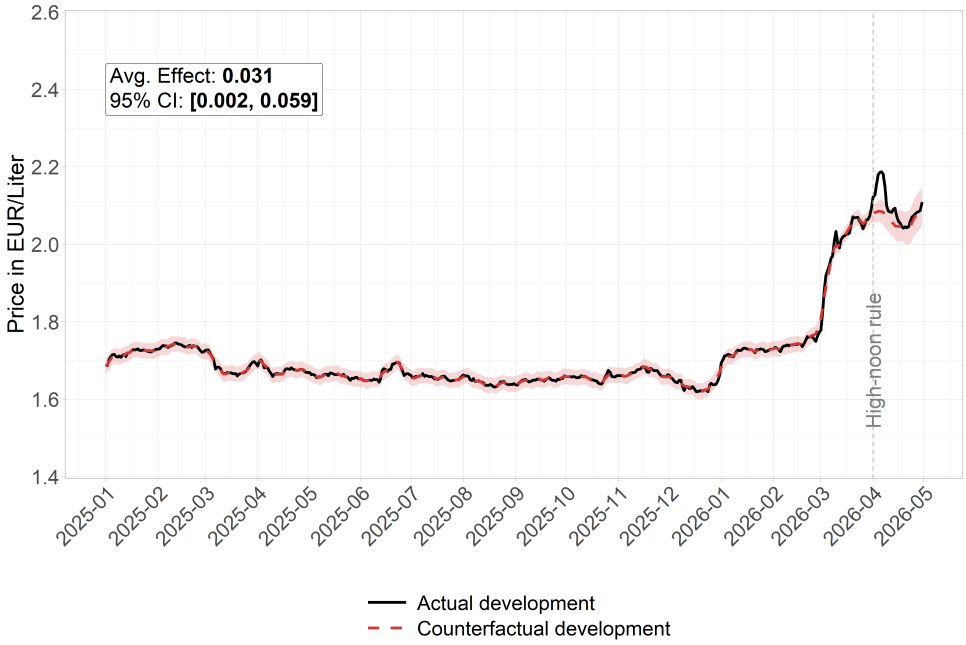
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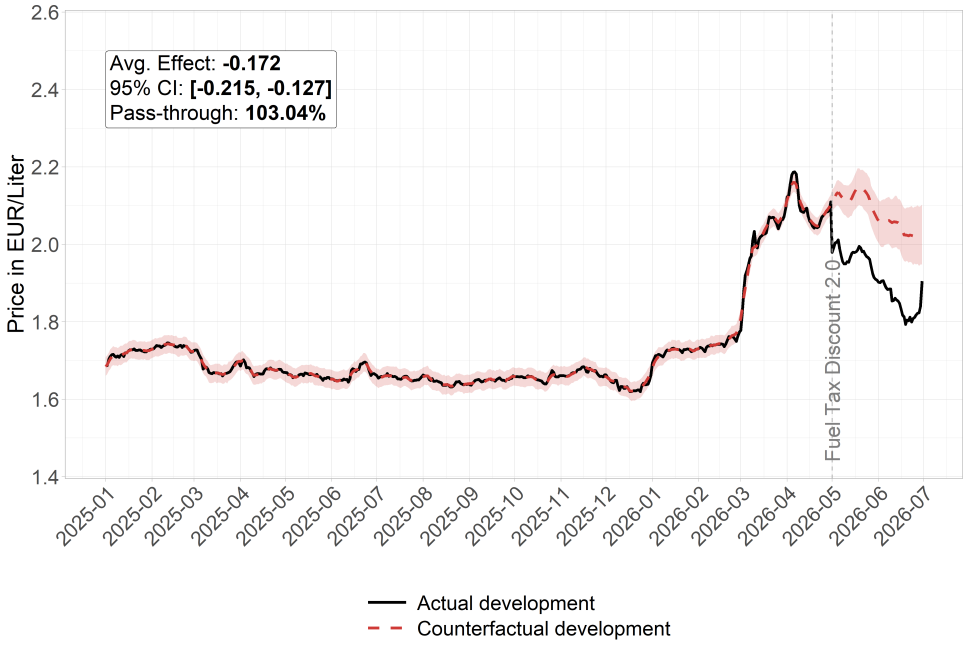
# Appendix

Figure A1: Predicted Time Series with respect to the High Noon Rule – E10




*Notes*: As Figure 3, for petrol measured by E10.

Figure A2: Predicted Time Series with respect to Fuel Tax Discount – E10




*Notes*: As Figure 5, for petrol measured by E10.

Table A1: Placebo Test: Forecast Error by Rotterdam Covariate

| | MAE (ct/l), days after start | | | | Bias (ct/l) | | Coverage (%) | |
|---|---|---|---|---|---|---|---|---|
| Covariate | 1–7 | 1–14 | 1–28 | 1–56 | 1–14 | 1–56 | 1–14 | 1–56 |
| *Panel A: Diesel* | | | | | | | | |
| Same day (carried forward) | 0.82 | 1.13 | 1.61 | 2.22 | 0.10 | 0.19 | 91 | 82 |
| 3-day mean | 0.74 | 0.92 | 1.23 | 1.63 | 0.22 | 0.40 | 91 | 86 |
| 5-day mean | 0.73 | 0.81 | 1.07 | 1.48 | 0.26 | 0.51 | 86 | 91 |
| 7-day mean (main) | **0.70** | **0.75** | **0.98** | 1.39 | 0.27 | 0.54 | 86 | 91 |
| 14-day mean | 0.72 | 0.78 | 1.05 | **1.29** | 0.13 | 0.44 | 91 | 91 |
| *Panel B: Petrol (E5)* | | | | | | | | |
| Same day (carried forward) | 0.72 | 1.00 | 1.40 | 1.99 | 0.14 | 0.32 | 95 | 73 |
| 3-day mean | 0.63 | 0.87 | 1.17 | 1.75 | 0.24 | 0.50 | 91 | 82 |
| 5-day mean | **0.61** | **0.83** | **1.08** | **1.66** | 0.24 | 0.55 | 91 | 73 |
| 7-day mean (main) | 0.63 | **0.83** | 1.10 | **1.66** | 0.19 | 0.53 | 91 | 77 |
| 14-day mean | 0.73 | 0.92 | 1.17 | 1.78 | 0.01 | 0.39 | 91 | 86 |

*Notes*: 22 placebo dates (January 2024 to January 2026), each with a 56-day forecast; same model as the main specification. Covariates are trailing means of the Rotterdam price carried forward over non-trading days. MAE: mean absolute forecast error of the average effect over the window; bias: mean error (actual minus counterfactual); coverage: share of dates whose 95% credible interval contains zero (nominal 95; one date = 4.5 points). Lowest MAE per column in bold.

Table A2: Robustness: Pre-intervention Period and Prior

| | Diesel | Petrol (E5) |
|---|---|---|
| *Panel A: Fuel Tax Discount, first 14 days, pass-through (%)* | | |
| Main (pre-period to April 30, prior 0.01) | 101 [83, 118] | 86 [70, 102] |
| Pre-period to April 12 | 87 [57, 115] | 104 [78, 130] |
| Pre-period to March 31 | 91 [57, 125] | 82 [52, 110] |
| Prior 0.05 | 99 [79, 119] | 86 [69, 102] |
| Prior 0.1 | 98 [74, 122] | 85 [68, 102] |
| *Panel B: Fuel Tax Discount, full period, pass-through (%)* | | |
| Main (pre-period to April 30, prior 0.01) | 121 [93, 148] | 103 [76, 129] |
| Pre-period to April 12 | 105 [68, 142] | 121 [87, 155] |
| Pre-period to March 31 | 112 [72, 152] | 100 [64, 132] |
| Prior 0.05 | 120 [87, 152] | 103 [75, 130] |
| Prior 0.1 | 120 [78, 160] | 103 [71, 133] |
| *Panel C: April 13–30 (announced, not yet in force), actual minus counterfactual (ct/l)* | | |
| Pre-period to April 12 | 3.2 [0.0, 6.5] | −2.2 [−5.0, 0.3] |
| Pre-period to March 31 | 2.3 [−2.1, 6.6] | 1.1 [−2.8, 5.1] |

*Notes*: 95% credible intervals in brackets. All models use the seven-day mean of the Rotterdam price; post-intervention period May 1 to June 30, 2026. With a shortened pre-intervention period, the days up to April 30 are forecast but not used in estimating the effect. Prior: standard deviation of the level innovations (in units of the standard deviation of the series). The pre-period ending April 12 includes the first two weeks of the High Noon Rule, when petrol prices were raised; for petrol it therefore starts the forecast from an elevated level.