Do Consumers Pay the Corporate Tax?

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ABSTRACT

Using granular gas price data and rich variation in corporate tax rates, we find that corporate taxes increase consumer prices, especially when consumer demand is less elastic and markets are less competitive. The tax incidence on consumers is also stronger when tax avoidance opportunities and other tax shields are limited. We additionally show that shifting taxes to consumers reduces the impact of taxes on organizational form choice and growth. Our results suggest that firms reduce their tax burden by shifting taxes to stakeholders, which is rooted in firms' market power and the unavailability of other strategies reducing the tax burden.

Keywords: Corporate tax, tax incidence, tax policy

JEL classification: D12; H22; H25; H26

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1. Introduction

Fueled by salient examples of tax avoidance schemes, corporate tax avoidance has received much attention from media, policymakers, and research. While prior literature studies how firms reduce tax payments by shifting profits to low-tax countries, we study whether firms reduce their tax burden by shifting corporate taxes to consumers. This issue of tax incidence is less salient and observable than effective tax rates (ETRs), but theory (e.g., Slemrod and Yitzhaki 2002, Dyreng et al. 2020) highlights important interactions between how much firms bear in taxes (affecting their pretax income) and how much they avoid taxes (affecting taxes paid). However, there is little evidence of firms passing on corporate taxes to their stakeholders and how such a transfer interacts with theory and evidence relevant to tax research in accounting and to policymakers who usually assume that consumers do not bear the corporate tax.[1] Using granular consumer price data and rich local tax rate variation, we study whether corporate taxes affect consumer prices, the underlying economic forces behind the shifting of taxes to consumers, and how tax (accounting) rules and tax avoidance opportunities relate to the incidence of taxes falling on consumers.

While theory on whether firms can shift corporate taxes to consumers is mixed (e.g., Harberger 2008, Gravelle 2013), a key assumption determining tax incidence relates to how tax accounting rules define the tax base. On the one hand, many models assume the *full* deductibility of factor input costs (e.g., the cost of financing). In that case, taxes do not affect prices in the short run, because taxes do not change factor inputs, and the corporate tax is borne by owners. No existing corporate tax code, however, features full deductibility, since, for example, the cost of equity is not deductible. On the other hand, if *no* costs were deductible, the corporate tax would not tax profits, but sales (Brekke et al. 2017). In that case, consumers bear more of the tax the less elastic their demand is relative to firms' supply (e.g., Poterba 1996). Because the tax base empirically lies

[1] For example, the Congressional Budget Office assumes that 75% of the corporate tax is borne by capital owners. The remaining 25% is borne by workers through lower wages (https://www.cbo.gov/sites/default/files/cbofiles/attachments/43373-AverageTaxRates_screen.pdf, https://www.cbo.gov/system/files/2020-10/56575-Household-Income.pdf).

between these extremes, we expect the relative elasticity of demand vis-à-vis supply to remain a key determinant of whether consumers bear corporate taxes. Because other strategies reducing the tax burden and the shifting of taxes to consumers are substitutes in theory, we also expect tax avoidance opportunities and other tax shields to affect the corporate tax incidence on consumers.

We therefore test whether 1) consumers bear part of the corporate tax burden and 2) how this effect varies as a function of economic forces (i.e., the relative elasticity of demand, a concept closely related to market power) and factors relevant to tax accounting (i.e., tax rules, their enforcement, and other tax avoidance opportunities). We test these predictions in the setting of Germany's retail gasoline market because of two advantages. First, each municipality in Germany can set its own tax rate on business profits, the so-called local business tax rate. Tax rates range between 7% and 19.25% and are thus economically significant and salient (relative to the 15% federal tax). We can isolate the effect of taxing business profits on consumer prices, because other relevant taxes do not vary within Germany, and tax rates change mostly for political reasons (Foremny and Riedel 2014) and not in response to business cycle shocks (Fuest et al. 2018).

Second, we focus on the retail gasoline market, because gas stations are relatively capital intense, implying that they likely can deduct only part of their capital investments cost, because the cost of equity cannot be deducted or the tax depreciation is too low. While this would theoretically open a channel through which corporate taxes affect consumer prices, it is still unclear whether consumers would bear corporate taxes through higher prices because their demand is likely to be relatively elastic.[2] Given this tension, the German gasoline market is especially opportune, because we observe high-quality granular price data for about 15,000 gas stations selling a homogeneous good, which allows isolating whether taxes are passed on to consumers. The setting also allows us

[2] Owners exposed to higher taxes in a municipality cannot easily move their gas station to another municipality in the short run, but consumers can move to a gas station in a nearby municipality that is not subject to higher taxes.

to exploit differences across firms (e.g., stations belonging to a large brand or located on a highway) to examine theoretical predictions on the heterogeneity in tax incidence falling on consumers.

Illustrating these economic channels underlying the shifting of corporate taxes to consumers is important because it allows us to connect our results from a setting with plausibly high internal validity to other settings and variables of interest, such as how market power affects tax avoidance and other firm decisions through its effect on tax incidence. However, gas stations also differ along other dimensions that allow us to explicitly examine the role of tax accounting factors in the corporate tax incidence falling on consumers. That is, we examine how consumer incidence differs depending on whether other means to reduce the tax burden are available (e.g., debt-related tax shields and other tax avoidance opportunities) or how costly these are (e.g., tax enforcement).

Empirically, we employ a generalized difference-in-differences specification; that is, we examine how gas prices at the gas station level in a municipality respond to tax rate changes relative to the gas price trend of gas stations from nearby municipalities that are not experiencing a tax rate change. To control for variation in local economic conditions, our counterfactual gas stations are located in the same district, but in a municipality with no change in the tax rate. Since our final sample comprises about 4,500 municipalities (the level at which the tax rate varies) belonging to 400 districts with an average area of 471 square miles (1,220 square kilometers), treated and counterfactual gas stations are plausibly exposed to similar variation in local economic conditions. We also control for time-varying municipal characteristics (e.g., unemployment rate, number of cars per inhabitant, and local budget deficits) to account for differences in input prices and demand.

Our empirical results show that gas prices are sensitive to local business tax rates. We find that a 1 percentage point increase in the local business tax rate increases gas prices, on average, by 0.1 euro cent per liter. Although this magnitude appears small relative to the average gas price of 1.39 euros per liter (around $5.90 per gallon) of E5 (gasoline with 5% ethanol), it is important to note that roughly 90% of the retail gas price is fixed (e.g., through energy taxes and input prices) and margins are thin. Unfortunately, it is difficult to translate this estimate into a percentage of the tax borne by consumers, because we only observe prices and not quantities sold. However, given a likely decrease in quantity along with an increase in price, based on prior literature, our rough estimate suggests that about 60% of the corporate tax is likely borne by consumers in our case.

Our main result is robust to the inclusion or exclusion of control variables, to using a first-difference specification, and to splitting up the effect by years. Consistent with the parallel trends assumption underlying our approach, we also find that prices do not respond to future unanticipated tax rate changes. To further sharpen the identification, we exploit a unique feature of the German tax code that introduces a discontinuity in the extent to which gas stations, depending on their legal form and the tax rate, are affected by changes in local business tax rates. This system essentially splits stations into four groups (based on the legal form and the local tax rate), of which one is unaffected by the local business tax. In this setup, using a limited sample of gas stations, we find that changes in the local business tax affect prices in only the three groups that are affected based on the tax code. This analysis provides additional reassurance of a causal interpretation of our finding that prices increase with taxes, consistent with the shifting of corporate taxes to consumers.

In the next step, we explore the heterogeneity in the extent to which local business taxes result in higher prices, along with economic forces and tax accounting factors. We expect the relative elasticity of demand vis-à-vis supply to be key in driving the extent to which consumers bear corporate taxes through higher prices. Since demand elasticity is closely related to the intensity of competition or firms' market power (Lerner 1934), we exploit several conceptually related gas station characteristics. Exploiting variation *within* municipalities *across* stations, we compare 1) gas stations located on a highway, 2) well known brands of gas stations (so-called top brands; e.g., Hastings 2004), 3) gas stations open at night (i.e., 24/7), and 4) stations very close to each other (conducive to collusion) with other gas stations within a municipality. Consistent with the notion that gas stations with less elastic consumer demand, that is, more market power, are able to pass on more of the business tax to consumers, we find that the gas prices of highway, top brand, 24/7, and/or closely co-located gas stations respond significantly more to business taxes.

We next examine how factors studied in the tax accounting literature, such as tax rules, tax avoidance opportunities, and tax enforcement, drive incidence, because theory predicts these phenomena significantly affect incidence falling on stakeholders (e.g., Fuest et al. 2018, Dyreng et al. 2020). As detailed above, the definition of the corporate tax base affects whether taxes affect prices. While our setting allows isolating the tax rate effect on prices, the tax base varies only significantly with firm size. Small firms can apply cash-based rules of tax accounting, while larger firms apply accrual accounting. Fuest et al. (2018) predict that a cash flow tax (implying full deductibility) would leave investment or prices unchanged. Accordingly, we find no tax incidence falling on consumers for gas stations that (likely) apply cash-based rules of tax accounting.

Next, we exploit variation in the extent to which gas stations use debt vis-à-vis equity capital in their financing and find a lower tax incidence falling on consumers when firms use more debt capital or have greater debt capacity. This finding is consistent with two related interpretations. First, as above, because the cost of debt financing is deductible while the cost of equity financing is not, theory predicts a muted tax incidence falling on consumers for firms using more debt capital because of higher deductibility. Second, consistent with the predictions of Fuest et al. (2018) and Dyreng et al. (2020), passing on taxes to consumers appears to be a substitute for other alternatives to reduce the tax burden (e.g., a more effective use of debt tax shields or other avoidance strategies, as noted by Graham and Tucker (2006)).

To investigate this potential substitution between tax incidence falling on consumers and tax avoidance opportunities, we exploit the fact that many gas stations in our sample operate under brands belonging to groups from different countries. For example, gas stations operating under the brand Aral belong to the British oil firm BP plc, while others are part of a German or French group. The countries related to these brand gas stations differ significantly in their anti-avoidance rules, ranging from lenient (e.g., in Austria or the Netherlands) to rather strict rules (e.g., Germany, France, and Italy). We test whether gas stations belonging to groups headquartered in countries with stricter anti-avoidance rules pass on more of the corporate tax to consumers because of their limited avoidance opportunities. In line with a substitutive relation between tax avoidance and tax incidence falling on stakeholders (Dyreng et al. 2020), we find a higher tax incidence falling on consumers in gas stations belonging to firms from countries with limited avoidance opportunities.

To further corroborate the substitutive relation between tax incidence on consumers and tax avoidance, we examine the role of tax enforcement. Since prior literature finds that stricter tax enforcement limits tax avoidance (Hoopes et al. 2012), we expect to find a higher tax incidence falling on consumers under stricter tax enforcement. Using variation in tax enforcement outcomes at the regional level within Germany, we find a higher tax incidence falling on consumers when there are more local tax auditors and tax audits generate greater incremental revenue (i.e., in regions with lower tax avoidance). Overall, our findings illustrate substitution between avenues for shareholder tax reduction studied in prior literature (e.g., the use of debt tax shields and tax avoidance) and the shifting of the corporate tax incidence to non-shareholder stakeholders.

In the final step, we extend our analysis beyond tax incidence and examine firm outcomes and their tax sensitivity to the ability to pass on taxes to consumers. First, prior literature finds that tax avoidance opportunities reduce the negative effect of taxes on economic growth (Shevlin et al. 2019) and investment (e.g., Dobbins and Jacob 2016). Similarly, we find that opportunities to shift taxes to consumers (e.g., when firms face relatively inelastic consumers) reduce the tax sensitivity of gas station growth and legal form choice. Second, out of sample, where we have better data on more traditional tax avoidance outcomes, we find that firms with greater opportunities to pass on taxes to consumers engage in less tax avoidance (consistent with Dyreng et al. (2020) for the labor market). Similarly, we show that the ability to pass on taxes to consumers manifests in greater pretax performance (consistent with the theory of Gordon (1967)).

Taken together, our findings contribute to the literature in two ways. First, we show that the consumer tax incidence and other means to reduce the tax burden, such as tax avoidance, are negatively associated, consistent with the predictions of Fuest et al. (2018) and Dyreng et al. (2020). Accordingly, our findings highlight the role of tax accounting rules that are under the control of policymakers, such as tax enforcement, or the definition of the tax base—as recently changed, for example, in the Base Erosion and Profit Shifting (BEPS) Project of the OECD or the 2017 US tax reform—in determining tax incidence. Given the substitutive relation between tax incidence falling on consumers and tax avoidance, our findings add to the literature on the relation of tax avoidance with tax enforcement (e.g., Hoopes et al. 2012), tax base characteristics (e.g., Voget 2011, Buettner et al. 2012), or market power (e.g., Kubick et al. 2015). We highlight that these characteristics also affect an alternative way to reduce the tax burden, namely, passing on taxes to consumers. Further, our finding that tax incidence falling on consumers results in higher pretax profits has implications for estimating profit shifting[3] and offers a complementary explanation for the positive relation between pretax profits and statutory tax rates in the study of Markle et al. (2020).

Second, we contribute to the literature on corporate tax incidence (e.g., Fullerton and Metcalf 2002). We show that corporate taxes are also borne by consumers, and not only by shareholders, low-skilled workers, and landowners (Suárez Serrato and Zidar 2016, Fuest et al. 2018). Our results complement the concurrent work of Baker et al. (2020) by exploiting mostly tax increases (whereas Baker et al. exploit tax cuts) indicating a symmetric effect of tax increases and decreases on consumer incidence and by exploiting heterogeneity rooted in both the underlying economics and tax accounting rules, as well as avoidance opportunities. We contribute further to this literature by showing that the ability to pass on taxes to stakeholders reduces the corporate tax sensitivity of

[3] This literature (e.g., Grubert and Mutti 1991, Jacob 1996, Collins et al. 1998, Mills and Newberry 2004, Dyreng and Lindsey 2009, Klassen and Laplante 2012, De Simone 2016) often uses pretax income and/or sales when estimating profit shifting. Since the consumer tax incidence increases reported sales and, thus, pretax income, the tax incidence could result in an underestimation of profit shifting as “pre-incidence” sales or profits are lower than observed.

firms' investment decisions (e.g., Djankov et al. 2010, Giroud and Rauh 2019) and organizational form choices (e.g., Donohoe et al. 2019).

2. Institutional setting, data, and empirical strategy

2.1 German local business tax

Business taxes in Germany depend on the legal form, generating two groups that are subject to local business taxes. First, similar to C corporations in the United States, corporations are taxed on their profits, and shareholders are taxed if dividends are paid out. Corporate profits are subject to a federal tax of 15% and a local business tax. The local tax is levied at the municipality level. There are almost 11,000 municipalities in Germany. Local taxes account for roughly 40% of municipalities' total revenues. Although the tax base of the local business tax is defined at the federal level, the municipality sets a local multiplier that generates the variation we exploit. On average, the local component of a firm's tax burden is about 14% of profits, roughly half of the total tax burden.

Second, unincorporated (e.g., partnership) firms' profits are passed through directly to their owners, to be taxed at the owner level (just as the income of S corporations in the United States). These profits are, however, also subject to local business taxes. To achieve nominal tax burden equivalence between incorporated and unincorporated firms, the owners of unincorporated firms receive an income tax credit for local business taxes, up to 13.3%. Local business taxes exceeding that level will become a true tax burden for these owners. We exploit this peculiarity, sorting unincorporated firms into unaffected firms (whose business tax is less than or equal to 13.3%) and affected firms (whose business tax is greater than 13.3%) in a later test. Note that this credit is granted by the federal government as part of the personal income tax declaration.

2.2 Tax rate data and variation

We obtain local business tax rates from the Federal Statistical Office of Germany for the 16 German federal states. After merging the tax rate data with the municipality data and gas station prices described below, we arrive at a sample of 4,507 municipalities. We lose municipalities mainly because there are no gas stations in the majority of very small municipalities.[4] During our sample period, there were 1,583 changes in local business tax rates larger than or equal to 0.25 percentage points. Of those changes, 1,544 were increases, and only 39 were decreases. The average increase in the local business tax rate was 0.8 percentage points, whereas the average decrease was 0.7 percentage points. Those changes occurred across Germany and among both urban and rural municipalities. Figure 1 shows all increases (Panel A) and decreases (Panel B) of more than 0.25 percentage points and of more than 1 percentage point. Figure 2 shows a map of our sample municipalities and the quintiles of the local business tax (Panel A), as well as a map that indicates municipalities with changes in the local business tax (Panel B).

While potential endogeneity in local business tax rate changes is often an issue, the German local business tax setting is somewhat unique. Tax rate changes are mostly politically motivated and carry more weight in decision making than economic shocks (Castanheira et al. 2012). Consistent with this notion, Foremny and Riedel (2014) show that the timing of local elections at the municipality level affects local business tax changes, and Fuest et al. (2018) find no local shocks to the business cycle prior to local business tax changes in Germany.

2.3 Composition of gas prices in Germany

Our initial empirical strategy uses prices set by gas stations as a measure of consumer prices. The price of gas comprises several elements. The main price driver is crude oil. Crude oil prices are usually stated in US dollars per barrel, determined by numerous factors on spot and future markets, such as oil quality and political circumstances, that are largely exogenous to our sample gas stations. Wholesale fuel prices in Germany are mostly determined by spot market prices in

[4] The average (median) population in our sample municipalities is 16,442 (6,543) in 2017, whereas, in the dropped municipalities, the average (median) population is 1,232 (790). Put differently, municipalities without gas stations are very small and thus unlikely to host gas stations. We also lose some municipalities because of frequent mergers between municipalities in the densely populated part of the former German Democratic Republic

Amsterdam, Rotterdam, and Antwerp, plus costs for transportation and storage. Apart from spot prices, gas prices fluctuate because of local competition among gas stations. Since the 1990s, gas stations have changed prices within seconds and have responded immediately to the actions of competitors. Another major part of fuel prices consists of taxes and duties per liter: the energy tax (amounting to 47.7% of the 2017 gross gas price), the value-added tax (19%), and an oil stocking fee (0.2%). Further cost factors are transportation costs, salaries, and capital expenditures (Mineralölwirtschaftsverband 2006).

Most gas stations' sales stem from E5, diesel, and E10 gasoline.[5] Diesel is the cheapest fuel because of lower energy taxes, followed by E10 and E5. In 2017, the spread between E5 and E10 was constantly 2–3 euro cents per liter, whereas the spread between E5 and diesel was 17–24 euro cents. Relevant factors for price differences across gas stations are ex-refinery prices as key input costs, a station's location (e.g., urban, industrial area, or highway), the local competitive environment, and station-specific services and amenities, such as a car wash or a kiosk-type store (Haucap et al. 2017). Importantly, short-run fluctuations in gas prices affect the amount of fuel purchased while refueling: Ritter et al. (2016) find price elasticities between -0.25 and -0.87. Frondel et al. (2012) find elasticities of around -0.5, also for the German market. For the United States, recent short-run elasticity estimates of -0.37 are in that range as well (e.g., Coglianese et al. 2017). Similar results are obtained for the Japanese market (Knittel and Tanaka 2019).

2.4 Gas price and station data

To obtain data on consumer prices, we exploit a unique data source. In Germany, since December 2013, all gas stations have been required by law to report every price change to an entity of the Federal Cartel Office. These rich panel data comprise a census of retail prices for gasoline and diesel for all gas stations in Germany. We use data ranging back to June 2014 to avoid known startup difficulties with the data. Further, we drop negative and zero values for gas prices, as well

[5] E10 is similar to E5, but consists of 10% anhydrous ethanol in addition to 90% gasoline.

as prices in the 0.01st and 99.99th percentiles of the respective gas prices. Figure 3 presents a histogram of the gas prices by year. The retail prices are the nominal prices in euro cents per liter for the consumer, including all taxes and duties. We compute the average price per year for each gas station. We note that the annual means and medians of the daily averages are very highly correlated (with a correlation coefficient of 0.98). Hence, we use only the average gas price per year in our regression analysis. The gasoline prices are (close to) normally distributed in a given year (Figure 3).

We also show that prices are not set at the national level, and there is variation in gas prices across regions and even within regions. Figure 4 presents a histogram of daily average prices less the average gas price of stations in the same district. We find substantial variation in daily gas prices, even within very local areas. This feature is important for our approach, since local taxes would be unlikely to strongly affect prices set at national levels, as assumed by Fuest et al. (2018).

Our empirical analysis is based on annual average price information. We choose this level because the local business tax rate is set annually. Once set by the local authorities, the tax rate is effective and persistent for a full fiscal year. Therefore, prior literature on tax incidence has used annual metrics (even though higher-frequency metrics would have been available), to be consistent with the level of variation of the tax rates and many of the control variables. For example, Fuest et al. (2018) (Baker et al. (2020)) aggregate their monthly wage (product price) data into annual data.

The data also comprise names, brands, addresses, longitudes and latitudes, and unique gas station IDs. The gas station market is characterized by a few brands under which most gas stations operate. Brands can be grouped based on their brand value and vertical integration. Haucap et al. (2017) differentiate among the oligopolistic players Aral (BP), Shell, Total, Esso (ExxonMobil), and Jet (ConocoPhillips); other integrated players Star (Orlen), Agip (Eni), HEM (Tamoil), and OMV; and other independent players and brands, such as Avia and bft. A group of stations that we label top brand—comprising Aral, Shell, Esso, and Total—make up 41% of all gas stations. This grouping is also used by the Federal Cartel Office (2011).

In our data, gas prices are not only set in regional clusters, as shown above, in Figure 4, but also within regions in top brand clusters. Gas stations of the same top brand in the same region often change prices simultaneously.[6] Other brands of gas stations tend to follow these price changes with a delay of about an hour. These two features suggest that 1) top brands centrally set prices in response to local costs and demand across their local stations, making it plausible for their optimization to consider variation in business taxes, and 2) smaller gas stations with presumably less sophisticated decision makers consider local business taxes in their pricing, at least indirectly, by following the (arguably more sophisticated) prices set by their regional peer top brand stations.

To examine differences in consumer demand elasticity, we further identify 3% of the sample gas stations close to highways by utilizing Allgemeiner Deutscher Automobil-Club (ADAC) data and manual search. Using data from Google Places, we also obtain information on the opening hours for 12,121 of our sample gas stations, to examine pricing differences around the clock. For further analyses, we also obtain data on the legal form of gas stations from Creditreform. Merging these data results in 7,103 unlimited liability firms (about 47% of the full sample) and 997 limited liability firms (about 7% of the full sample). Based on address information, as well as longitudinal and latitudinal GPS coordinates, we identify the local municipalities in which the respective gas stations operate.

2.5 Sample selection and descriptive statistics

Our initial sample contains 15,551 gas stations. Since we require information on all regional control variables and we need to uniquely assign gas stations to municipalities, we obtain a final sample of 14,255 gas stations (which represents more than 91% of all German gas stations) and 54,261 unique gas station–year observations over the period 2014–2017. Table 1, Panel A, presents

[6] These results are available from the authors upon request.

summary statistics for gas prices, as well as municipality-level and gas station–level characteristics. On average, the price of a liter of regular fuel (E5) is 1.39 euros during our sample period. As mentioned above, 3% of our sample gas stations are located on a highway and 41% belong to top brand gas stations. The average local business tax rate is 13.85%, which has increased steadily from 13.71% in 2014 to 13.96% in 2017. Table 1 also presents descriptive statistics on the characteristics of the municipalities in our sample. Unemployment averages 3.2% of total population. The median municipality has a local budget deficit of about EUR 8,000 per inhabitant, while the average deficit is negative, indicating that the average municipality has a local budget surplus. In our sample, the median (average) municipality has 6,521 (16,281) inhabitants and 4,981 (10,650) registered cars.

2.6 Baseline regression

We use a generalized difference-in-differences design to identify the impact of the local business tax rate on fuel prices. We compare the prices of gas stations in municipalities that experienced a change in the local business tax to the prices of gas stations located in a municipality that did not change its local business tax rate. To obtain a suitable control group, we narrow down the counterfactuals to stations from very close but unaffected municipalities. Specifically, we exploit the fact that, on average, 17 municipalities form a district, which results in the following estimation equation:

$$Gas\ Price_{i,t} = \alpha_0 + \beta_1 LBT_{m,t} + \gamma X_{m,t} + \alpha_i + \alpha_d \times \alpha_t + \varepsilon_{m,t} \qquad (1)$$

where, for municipality *m* in year *t*, the dependent variable is *Gas Price*, the gas price of gas station *i*, and *LBT* is the local business tax rate. In our tests, we use the average price of E5 because it is normally distributed and the most important type of gas in terms of sales. In Table A.1 of the Online Appendix, we replicate our tests using the prices of diesel and E10, with similar results, and we also note that all our results hold when we use the natural logarithm of the E5 price (not tabulated).

Our main independent variable is *LBT*, which is the local business tax rate (in percentage points) in municipality *j* in year *t*. If gas stations pass on the tax burden of the local business tax to consumers, β_1 is expected to be positive. We include district–year fixed effects ($\alpha_d \times \alpha_t$) to ensure that our identification stems from changes in the local business tax and that our counterfactual gas stations are located in the same district.[7] Since districts are very small, with an average area of 1,220 square kilometers (471 square miles), treated and control gas stations are subject to very comparable local economic conditions.

In our regression analysis, we include gas station fixed effects (α_i) and multiple controls related to variations in local economic conditions and gas demand, as expressed by the vector X. The control variables include the number of cars, the number of gas stations per car, and the natural logarithm of the unemployment rate for municipality m in year t. One potential source of endogeneity is that municipalities can change tax rates due to financing needs. To control for a municipality's financing needs, we include two additional control variables. First, we control for a municipality's budget deficit (or surplus) per capita. Second, we control for the local property tax, which is another main source of funding for municipalities, also set at the municipality level. Our statistical inference is based on robust standard errors clustered at the municipality level.

Our identification strategy rests on a few assumptions, for example, that gas stations do not change prices in anticipation of tax changes. We take several steps in our empirical analysis to support our baseline model. First, we test whether gas prices respond to future tax rates, to test for parallel trends. Second, we exploit the institutional features of the German tax system, where firms, depending on their legal form and the tax rate, are either affected or unaffected by the local business tax. Third, we exploit different cross-sectional tests that exploit differences in consumer demand elasticity. In these tests, we include municipality–year fixed effects to account for variation in municipality-specific local conditions that could affect taxes and/or gas prices.

[7] With this specification, municipalities that are also districts (e.g., Berlin, Munich, Hamburg, Cologne, and Frankfurt) do not identify the coefficient. With only state–year fixed effects, these cities contribute to the identification of *LBT*.

3. Empirical results

3.1 German local business taxes and gas prices

We first examine how business taxes relate to gas prices. Table 2, Panel A, reports the regression results from estimating equation (1) without controls (Columns (1) and (3)) and with controls (Columns (2) and (4)). In Columns (1) and (2), we include district–year fixed effects, to narrow down the counterfactual gas stations to those in municipalities without a tax rate change located in the same district. Columns (3) and (4) include state–year fixed effects, so that all municipalities, including bigger cities, help identifying the *LBT* coefficient. The results show that the E5 price is positively and significantly affected by the local business tax rate. The coefficient of the local business tax rate is positive and statistically different from zero at the 5% level in all specifications, whether we include control variables or change counterfactuals.

In terms of economic significance, the estimate in Column (2) suggests that a one percentage point increase in the local business tax rate raises the E5 price by 0.108 euro cents per liter. While the average E5 price is 139 euro cents per liter, the vast majority of the E5 price is de facto fixed and, according to an industry report by bft (2018) fuel stations earn gross profits of around 10 euro cents per liter, i.e., a margin of around 7%. In addition to the margin, we must make an assumption on the price elasticity of demand in order to translate the tax-induced price increase into an estimate of the additional tax borne by consumers. As our baseline assumption, we use an estimate of -0.4 (based on Coglianese et al. (2017) and Knittel and Tanaka (2019))

With these inputs, we can estimate the tax incidence falling on owners versus consumers (see, also Suárez Serrato and Zidar 2016 and Fuest et al. 2018). To approximate the percent of how much of the additional tax owners bear, one can calculate the extent to which increased tax payments reduce their after tax profits: i.e., the after-tax profit reduction divided by tax payment increase. While this ratio captures owner incidence, subtracting this ratio from one captures customer incidence. Assuming no changes in capital and labor inputs or prices, we can calculate a range of reasonable incidence estimates based on assumptions about (1) the price elasticity and (2) the profit margin of gas stations: In our preferred back-of-the-envelope calculation using the above moderate margin of 7% and a price elasticity of -0.4 (based on the estimates in Coglianese et al. 2017 and Knittel and Tanaka 2019) consumers bear about 60% of the corporate tax.[8]

While this estimate takes mid-point estimates for both the margin and elasticity, in Table A.2 of the Online Appendix, we present a sensitivity analysis using three elasticity scenarios (no, average, or high price elasticities) and margin scenarios (low, middle, or high margins). With these scenarios, consumers bear between 59% (for the low margin and high price elasticity combination) to 69% (for the no price elasticity and high margin combination) of the corporate tax. In general, consumers would bear more of the tax in this rough calculation if the demand elasticity were lower or the margin were higher. While some industry reports refer to margins after-tax and all costs lower than 7%, it is important to note that stations sell bundled products (e.g., beverage, tobacco, or car wash services) at much higher margins and that the industry is relatively opaque on its true profitability because of antitrust investigations. In addition, some scenarios such as no (high) price elasticity and low (high) margin are unlikely because a low (high) elasticity should translate into a high (low) margin (Lerner 1934).[9]

3.2 Robustness tests

We probe the robustness of our main results by performing the following additional tests in Panel B of Table 2. First, we examine a first-difference version of equation (1). First differencing has the advantage of better facilitating multiple changes per municipality. As before, it also

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[8] Consider a gas station selling 10 units at a price of 139. This results in sales of 1,390 and a (pre-tax) gross profit of 97.30 (= 7%×1,390). The tax burden is 13.47 (= 97.30×13.84% [average tax rate]), leading to an after-tax profit of 83.83 (= 97.30 - 13.47). If the tax increases to 14.84%, our estimate implies the price increases to 139.1076. Given an elasticity of 0.4, the demanded gas quantity falls from 10 to 9.997 (= (1 - 0.4×0.1076/139) ×10). Hence, the post-tax sales are 1,390.65 (= 9.997×139.1076), leading to a pretax profit of 97.95 (= 1390.65×7%), a tax burden of 14.54 (= 14.84%×97.97), and a net profit of 83.41. Hence, of the 1.07 increase in the tax burden, 40% is borne by the firm in the form of lower after-tax profits (0.42 = 83.83 - 83.41), while the remaining 60% is borne by consumers.

[9] In the extreme and plausibly unlikely scenario of no price elasticity and low margins, there might be overpassing of corporate taxes to consumers indicating that they would bear 126% of the tax. In addition to being unlikely, there is theoretical work that shows that overpassing of taxes is possible in oligopolistic markets (e.g., Weyl and Fabinger 2013 or Dutkowsky and Sullivan 2014).

removes any firm-, state-, district-, or municipality-specific fixed effects. Column (1) in Panel B reports the regression results for *LBT* from the change model. The results are very similar to our main results and support the notion that firms pass on corporate taxes to consumers.

Second, to assess the validity of the parallel trends assumption, we test for any anticipation effects. Column (2) in Panel B of Table 2 presents the regression results of estimating the change specification from Column (1), where we add the changes in the local business tax rate from *t* to *t* + 1 (ΔLBT_{t+1}) and from *t* + 1 to t + 2 (ΔLBT_{t+2}) as independent variables. The results show no anticipation effects, since ΔLBT_{t+1} and ΔLBT_{t+2} are nonsignificant. Instead, E5 prices increase in response to a higher local business tax rate only in year *t*. This result suggests that the parallel trends assumption seems to hold in our setting.

Third, one concern about the latter analysis is that we lose many observations due to the additional two lead coefficients and the short sample period. Hence, the result in Column (2) in Panel B of Table 2 could reflect that the effect size might differ considerably over time. To assess this issue, we interact *LBT* with year dummy variables to show how the results differ over time. The results in Column (3) indicate that the effect is statistically significant in three of four years, with the effect of 2014 being nonsignificant, potentially because our data only start in June 2014.[10]

Finally, since gas stations in a municipality have the same tax rate, there is no covariance for observations from the same municipality. Our coefficient estimate thus reflects only variation across municipalities, not within municipalities. Since the number of observations in each municipality differs, our model could be misspecified (Solon et al. 2015). To address this issue, we run a WLS model with the number of observations in a municipality–year as weights (Column (4),

[10] We address further concerns that the relation between our control variables for the local economic environment and E5 prices could vary over time and across regions by interacting all control variables (i) with year fixed effects to allow the coefficients of the control variables to vary over time, (ii) with state fixed effects to allow the coefficients of the control variables to vary spatially, and (iii) combining both approaches (i) and (ii). We continue to find a positive effect of local business taxes on E5 prices, with very similar magnitudes as for the main results (Table A.3, Online Appendix).

Panel B of Table 2). We find that using WLS does not change our earlier *LBT* coefficient estimate, indicating that our main model is not misspecified.

3.3 Identification: Exploiting differences in organizational form

In the next step, we address remaining concerns that unobserved local economic conditions are driving tax rate changes and E5 prices. We exploit the unique feature of the German tax system that unincorporated firms receive a tax credit of up to 13.3%. Incorporated firms do not receive such a tax credit. This feature provides us with a subsample of gas stations from the same municipality unaffected by local business taxes. We expand equation (1) and estimate the model

$$Gas\ Price_{i,t} = \alpha_0 + \beta_1 LBT_{m,t} + \beta_2 LBT_{m,t} \times Affected_{i,t} + \beta_3 Affected_{i,t} + \boldsymbol{\gamma} X_{m,t} + \alpha_i + \alpha_d \times \alpha_t + \varepsilon_{j,t} \quad (2)$$

where all the variables are defined as in equation (1). We additionally interact *LBT* with *Affected*, which is a dummy equal to one if the gas station is either an unincorporated firm subject to a local business tax rate above 13.3% in year *t* or incorporated. The dummy *Affected* is zero for all unincorporated firms subject to a local business tax rate of 13.3% or lower in year *t*, since owners receive a credit for the full local business tax and this tax is thus irrelevant to them. These firms should not respond to local business tax changes. In our setup, β_1 captures the effect of local business taxes for these gas stations. Hence, we expect the β_1 coefficient to be nonsignificant. The β_2 coefficient captures the incremental effect for gas stations that are, according to the tax code, affected by local business tax changes. Hence, we would expect the β_2 coefficient to be positive. Further, the overall effect of the local business tax on E5 prices is captured by the sum of β_1 and β_2. We expect the sum to be positive and significantly different from zero, consistent with the notion that affected gas stations pass on business taxes to consumers. In Appendix Table A.4, we expand this analysis and show that our results are robust to the firms being split up into four subgroups.

In Column (1) of Table 3, we present estimates of equation (2) with municipality fixed effects but no gas station fixed effects. This enables us to observe the coefficient on *Affected*, which is positive and significant. This positive coefficient is consistent with the fact that, on average, these firms have higher tax burdens, which, according to our theory, should increase prices. The main effect of *LBT*—the effect of a change in *LBT* for unaffected gas stations—is small and nonsignificant. Further, the interaction of *LBT* and *Affected* is positive and significant at the 5% level, suggesting that affected gas stations' prices are sensitive to local business tax changes. The joint significance test (denoted *LBT* + *LBT*×*Affected*) is significantly positive when gas station fixed effects are included, as in Column (2). The joint coefficient is somewhat larger than in our baseline regression, but, given that this sample might not be representative of all stations, the magnitude must be interpreted with a grain of salt.

Since we can only obtain the organizational form for a smaller sample of 29,765 observations, we rerun equation (1) in this smaller sample to gauge whether the firms for which we are missing information are likely affected or unaffected by the local business tax. In Column (3) of Table 3, we find that the coefficient estimate on *LBT* is nonsignificant. This result suggests that a sizable fraction of the firms for which we have *no* information on the organizational form (i.e., the 24,496 firm–year observations dropped from this test) are likely affected by local business taxes.[11] Hence, because the firms that we need to exclude from this analysis are likely to be affected by the local business tax, we draw our main inferences from the full sample and use all available observations in all the cross-sectional tests below. The main objective of Table 3 is to corroborate the causal interpretation of our findings, exploiting information for a subsample of firms.

4. Taxes and consumer prices: The role of the relative elasticities of demand and supply

In this section, we explore heterogeneity in the extent to which local business taxes affect consumer prices. Theory suggests that the relative elasticity of demand vis-à-vis supply is driving the extent to which consumers bear the corporate tax burden. We operationalize this notion by exploiting four gas station characteristics. We expect to find evidence of a greater effect of taxes on E5 prices when consumer demand elasticity is lower relative to gas stations' supply elasticity.

[11] The *LBT* coefficient for the firms missing organizational form data is positive and significant (not tabulated).

To examine this issue, we obtain information to split gas stations into those with more versus less market power relative to their customers, in the spirit of Lerner (1934), whose index relates demand elasticity to markups and market power. For ease of presentation, we use a composite measure *Market Power*, capturing gas stations' market power over consumers, drawing from four proxies for *Market Power* that we also exploit separately.

First, gas stations located on a highway (*Highway*) face relatively inelastic consumers (Haucap et al. 2017). Highway gas stations benefit from barriers to entry, which provide them with market power over consumers (McAfee et al. 2004). Second, we exploit consumer brand loyalty (Hastings 2004). For top brand gas stations, customers tend to be loyal to a particular brand, lowering their demand elasticity. Bronnenberg et al. (2012, 2015) find that consumers' brand preferences are highly persistent and that consumers pay substantial premiums. Further, due to the local coordination of gas prices across gas stations of the same brand within the same district, top brand gas stations can exert more market power. As described above, we define *Top Brands* as Aral, Shell, Esso, and Total gas stations. Third, we exploit differences in opening hours. Some gas stations close at some point during the night, temporarily providing the remaining gas stations that are always open (24/7 gas stations, denoted by *24/7*) with greater market power. Finally, we explore whether gas stations are geographically very close to each other, since these gas stations can coordinate their pricing to increase their combined market power vis-à-vis customers. Instead of competing, these gas stations tend to (at least implicitly) coordinate price adjustments, which is one concern of the Federal Cartel Office (2011).[12]

To examine whether these characteristics affect the extent to which taxes are passed on to prices, we denote the sum of these four characteristics as *Market Power*. Figure 5 presents average

[12] To validate that these four constructs capture greater market power, Panel A of Figure A.1 in the Online Appendix plots the average daily E5 prices (demeaned by the average price in the respective district) for highway versus regular gas stations. Panels B and C replicate this test for top brand and 24/7 gas stations, respectively. We find that, on average, highway gas stations charge 4.7 euro cents more per liter relative to their local competitors. Panel B (Panel C) shows that, relative to their peers in the district, top brand (24/7) gas stations, on average, charge 2.7 (1.4) euro cents more. Panel D shows that gas stations that are very close together charge 0.5 euro cents more.

gas prices across Market Power groups and shows that stations with higher market power values have higher average gas prices consistent with our measure capturing relative demand elasticity. We then define a dummy *High Power* that splits the sample at the median value of *Market Power*. We then expand equation (1) by adding *High Power*. Initially, we do not include gas station fixed effects, but only municipality fixed effects, so that the coefficient on *High Power* is identified, to determine whether stations with greater market power charge higher prices. The results are reported in Table 4, Column (1). We find that our proxy of market power (*High Power*) is related to average gas prices about 1.9–2 euro cents per liter higher. In Column (2), we include the interaction of *LBT* with *High Power*. We find that firms with greater market power can pass on more of the local business tax to consumers, as indicated by the significant interaction of *LBT* and *High Power*. This result holds when including gas station fixed effects (which absorb the *High Power* dummy), as well as municipality–year fixed effects (see Column (3)), which accounts for any variation at the municipality–year level. Hence, the *LBT* coefficient is not identified in this specification. Effectively, our regression now compares each higher market power gas station with another gas station *within* the same municipality to estimate how the local business tax translates into gas prices.

In Column (4) of Table 4, we address concerns that our results are driven by the arguably arbitrary choice of splitting the sample at the median value of *Market Power*. Using a continuous measure (Column (4)), we continue to find support for the notion that firms with greater market power can pass on more of the local business tax to consumers. In Columns (5) to (8), we validate the individual components of the composite *Market Power* measure. Specifically, we replace *High Power* with the individual variable (*Highway*, *Top Brand*, *24/7*, or *Very Close*). The positive and significant coefficients of *LBT×Highway* (Column (5)), *LBT×Top Brand* (Column (6)), *LBT×24/7* (Column (7)), and *LBT×Very Close* (Column (8)) are consistent with our prediction. We further report the difference in gas prices in the first row of the table to document that the individual characteristics are related to higher gas prices.[13] When including all characteristics at once, we find that three of the four characteristics are statistically significant.

One concern about Table 4 is that a municipality might not have gas stations whose characteristics vary within the municipality. Hence, we replicate these findings, but only including municipalities with at least one gas station in either category. The results (see Table A.5 in the Online Appendix) are very similar under this restriction. We also assess whether the effects in Table 4 are driven by affected gas stations, using the classification from Table 3. The results in Table A.6 in the Online Appendix indicate that market power only matters for passing on taxes to consumers if the gas stations are in the affected group. The interactions between *LBT* and market power are nonsignificant among unaffected gas stations. Overall, the results this section support the notion that gas stations with high market power vis-à-vis their consumers can pass on more of their business taxes to consumers.[14]

5. Taxes and consumer prices: Tax rules, tax avoidance opportunities, and tax shields

Next, we link corporate tax incidence to tax rules, tax avoidance opportunities, and tax enforcement. While Section 4 shows that the relative elasticity of demand vis-à-vis supply is a primary determinant of tax incidence, this prediction rests on the notion that the tax base definition distorts firm decisions such as investments and pricing in the first place, by limiting the deductibility of factor input costs. At the same time, theory indicates that other strategies reducing the tax burden (e.g., tax avoidance and other tax shields) that were studied in prior tax accounting literature and the shifting of taxes to consumers are substitutes. Hence, in the following section, we study how the passage of corporate taxes to consumers interacts with theory and evidence relevant to tax research in accounting.

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[13] The price difference is based on a regression as in Column (1).

[14] In the Online Appendix, we report three additional tests that examine different variants of market power. First, we examine the role of product characteristics and differentiation. We show that the ability to pass on the tax to consumers is product specific and that a greater tax incidence falls on consumers when the demand for the product is less elastic (Table A.7). Second, we examine the role of local competition (Table A.8) and find that stations facing more (less) competition pass on less (more) of the corporate tax to customers.

5.1 Exploiting tax code features: Tax accounting rules and debt-related tax shields

Theory (e.g., Fuest et al. 2018) suggests that, under full (limited) deductibility, the corporate tax incidence falls only on firm owners (and on stakeholders), because taxes do not distort factor input choices to begin with; that is, the definition of the tax base as laid out in tax accounting rules affects tax incidence. For example, making the cost of equity financing or the true economic depreciation deductible in tax codes is difficult, because both are hard to verify. Accordingly, we expect gas stations that suffer from limited deductibility to pass on more taxes to consumers. We test this notion in two ways.

First, while we cannot exploit variation in the tax base across municipalities, since the tax base is set at the federal level, the definition of the tax base varies significantly with firm size. Small firms with sales of less than EUR 600,000 can apply cash-based rules of tax accounting, while larger firms apply accrual accounting. Fuest et al. (2018) predict that moving closer to a cash flow tax would leave investment and prices somewhat unchanged. Using sales information from Creditreform for a limited sample of firms, we calculate the average sales per gas station and define a dummy variable *Simplified Accounting* if average sales are below EUR 600,000 (about 7% of the sample). For firms missing observations, we set *Simplified Accounting* to zero.[15] We then interact *Simplified Accounting* with *LBT*. The results in Table 5, Panel A, Column (1), indicate no tax incidence falling on consumers for gas stations that (likely) apply cash-based rules of tax accounting. For all other gas stations, taxes affect gas prices.

Second, we examine how the limited deductibility of cost-of-equity financing versus the deductibility of cost-of-debt financing affects corporate tax incidence. We exploit differences across firms in the deductibility of financing cost. For a very limited sample of gas stations, we are able to obtain some balance sheet information, including the debt-to-assets ratio, from Bureau van

[15] This research design choice has no impact on the *LBT*×*Simplified Accounting* coefficent but substantially increases the power of our test. Without this research design choice, the *LBT*×*Simplified Accounting* coefficient is -0.2716 and significant at the 10% level.

Dijk's Amadeus database. We then split this limited sample of about 1,100 observations into high-debt firms (with a high level of deductibility) versus low-debt firms (with a low level of deductibility), using the firms' median debt-to-asset ratio over the sample period. We then interact *LBT* with the dummy *High Debt*. In addition, as a measure of debt capacity, we exploit the magnitude of a gas station's credit line as estimated by the rating agency Creditreform for about 13,000 observations. We split the sample into firms with high and low credit lines, respectively, using the median. Firms with high credit lines form the group of firms with greater debt capacity and thus greater debt tax shield opportunities (*High Credit Limit*). We find the results to be consistent with theory (see Columns (2) and (3), Panel A of Table 5). Highly levered firms or firms with high debt capacity, that is, firms with a high level of tax deductibility, pass on less of the corporate tax burden to consumers, as indicated by the negative and significant interaction terms *LBT×High Debt* and *LBT×High Credit Limit*, respectively. This result indicates that one key feature of almost any tax code around the world, namely, the limited deductibility of investment costs, is driving the corporate tax incidence falling on consumers. This finding, however, is also consistent with an alternative interpretation: passing on taxes to consumers is a substitute for other alternatives to reduce the tax burden, such as a more effective use of debt tax shields or other avoidance strategies, as noted by Graham and Tucker (2006). We further pursue this explanation in the next two tests, exploiting differences in tax avoidance opportunities.

5.2 Exploiting tax avoidance opportunities: The role of anti-tax avoidance rules

In our second tax rule–related cross section, we test whether the corporate tax incidence on consumers is lower if firms have better tax avoidance opportunities. Theory suggests a substitutive relation between tax avoidance and tax incidence falling on stakeholders (Fuest et al. 2018, Dyreng et al. 2020). Hence, if gas stations have other tax avoidance opportunities, we should observe fewer taxes being passed on to consumers. To investigate this notion empirically, we examine tax code features that are related to profit shifting and tax avoidance (e.g., Atwood et al. 2012, Alexander et al. 2020, Joshi 2020). We exploit the fact that several gas stations operate under brands belonging to non-German parent-like companies.[16] For example, gas stations operating under the brand Aral belong to the British oil firm BP plc, Total gas stations belong to the French oil firm Total SE, and other gas stations (e.g., the brand Star) are part of a group headquartered in Germany. For the 14 most frequent brands in our sample, we locate the headquarter country and merge information on anti-tax avoidance rules obtained from Brühne et al. (2021). The countries associated with the brands under which about 73% of our gas stations are operating differ significantly in their anti-avoidance rules, ranging from very few rules (e.g., in Austria or the Netherlands) to rather strict rules (e.g., Germany, France, and Italy). We test whether gas stations belonging to groups headquartered in countries with stricter anti-avoidance rules pass on more taxes to consumers because of limited avoidance opportunities.

The results are reported in Table 5, Panel B. We use three different proxies for the strictness of anti-tax avoidance rules. First, we use the variable *Anti-Tax Avoidance Score* from Brühne et al. (2021), which is a composite measure of nine tax rules aimed at curbing tax avoidance. Second, we use a dummy variable to denote whether a country requires country-by-country reporting (*CbC Reporting*). For example, Joshi (2020) shows that country-by-country reporting reduces tax avoidance by affected firms. Finally, we use a dummy variable for the existence of general anti-avoidance rules. We find the interactions of *LBT* with each of the three anti-tax avoidance variables to be positive and significant. This result is consistent with a substitutive relation between tax avoidance and incidence on other stakeholders (see also, e.g., Dyreng et al. 2020). Specifically, we find higher consumer tax incidence among gas stations belonging to major oil firms from countries with limited avoidance opportunities.

[16] Gas stations can be direct subsidiaries or related to these groups via franchising contracts. We argue that, even in the latter case, the franchise fee likely reflects the tax avoidance opportunities of the entire group, so that a group's tax avoidance opportunities also matter in the case of franchising. Whether a gas station is directly owned or operates as a franchise is, unfortunately, unobservable to us.

5.3 Exploiting tax avoidance opportunities: The role of tax enforcement

To corroborate the substitutive relation between tax avoidance and tax incidence falling on consumers, we further exploit local variation in tax enforcement, since stricter tax enforcement is associated with less tax avoidance (e.g., Hoopes et al. 2012). In Germany, the enforcement of the local business tax is organized locally, with substantial differences in tax enforcement strength among small and medium-sized companies, such as gas stations. We obtain confidential information on additional tax revenues from tax audits for groups of different size (e.g., micro firms, small and medium-sized enterprises, and very large firms) for each state and year. We then sort state–years according to the additionally collected revenues and define a dummy variable *High Enforcement* equal to one for observations above the median, and zero otherwise. Alternatively, we use the number of total tax auditors per tax office (available for only a limited sample) as a proxy for stricter tax enforcement. We split the sample at the median to define *High Enforcement*.[17]

Consistent with a substitutive relation between tax avoidance and tax incidence, we find that firms with limited tax avoidance opportunities (because of stricter tax enforcement) pass on more of the business tax to consumers, as indicated by the positive and significant *LBT*×*High Enforcement* coefficient in Panel C, Table 5, Col. (1) and (2). For observations with less strict enforcement (*High Enforcement* = 0), that is, for firms with more tax avoidance opportunities, we find that local business taxes are not reflected in consumer prices. Finally, we run a placebo test by sorting state–years according to additionally collected tax revenues from the largest firms, which are unlikely to be gas stations. We find a significant and positive *LBT* coefficient, but a nonsignificant interaction term, because this enforcement variable is unrelated to gas stations.

Overall, Table 5 shows important interactions of the tax incidence falling on consumers with alternative debt tax shields, simplified tax accounting, anti-tax avoidance rules, and tax

[17] Alternatively, in untabulated tests, we use the distance to the local tax authority as a tax enforcement measure (Kubick et al. 2017) and find that firms with shorter distances to local tax authorities pass on more corporate taxes to consumers.

enforcement. Our findings illustrate a substitution between the avenues for shareholder tax reduction studied in prior literature (e.g., the use of debt-tax shields or tax avoidance) and shifting the tax incidence to consumers through higher consumer prices. We also note that the roles of tax avoidance and tax enforcement are robust to the inclusion of our market power proxy (not tabulated).

6. Link of tax incidence to tax avoidance and real outcomes

We pursue two additional ways to illustrate how tax incidence interacts with prior literature on tax accounting. We do so in two ways. First, we examine whether the tax incidence falling on consumers reduces the tax sensitivity of outcomes, such as firms' legal form choice (e.g., Donohoe et al. 2019) and growth, in a way that is similar to tax avoidance (e.g., Shevlin et al. 2019). Second, in out-of-sample tests, we examine whether firms that likely bear less of the corporate tax engage in less tax avoidance (e.g., Dyreng et al. 2020) and whether the tax incidence falling on other stakeholders increases pretax profitability, as predicted by Gordon (1967).

6.1 Tax incidence and legal form choice and growth

Using our gas station setting, we first examine whether the tax incidence falling on consumers affects the tax sensitivity of outcomes studied by prior literature, such as firms' legal form choice and growth, in a way that would be similar to more traditional avenues for shareholder tax reduction. Prior literature finds that taxes affect the organizational form choice (e.g., Donohoe et al. 2019), as well as growth and investment (e.g., Djankov et al. 2010, Giroud and Rauh 2019), and that tax avoidance opportunities mute the negative effect of taxes on growth and investment (e.g., Dobbins and Jacob 2016, Shevlin et al. 2019). We test whether the tax incidence falling on consumers mutes the tax sensitivity of corporate decisions such as the legal form choice and growth in a similar way.

To examine organizational form choices, we use the information on the limited sample of firms with information on their organizational form, exploited in our earlier test in Table 3. We then use the dummy variable *Incorporated* as the dependent variable. As a proxy of the ability to pass on taxes to consumers, we use our earlier composite measure *Market Power*, that is, the sum of our gas station–specific market power variables *Highway*, *Top Brand*, *24/7*, and *Very Close* and the dummy *High Power*. We interact *LBT* with *High Power* and include the main effect of *High Power* (not tabulated). The results are reported in Columns (1) and (2) of Table 6. Consistent with the tax incentives in the German tax system,[18] we find that local business taxes favor unincorporated legal forms among our sample gas stations, as indicated by the negative coefficient on *LBT*. However, in the main specification, this coefficient is not highly significant. Once we include the interaction with *High Power*, we find that gas stations' organizational form choice is associated with local business taxes. The tax effect is neutralized for gas stations whose consumers likely bear the corporate tax, as indicated by the positive and significant coefficient on *LBT*×*High Power*.

Next, we link tax incidence to the tax literature on growth and investment (e.g., Shevlin et al. 2019). Intuitively, the inability to pass on taxes to consumers increases the tax burden ultimately borne by business owners and can create going-concern issues when taxes increase. To assess this notion empirically, we run a regression at the municipality–year level with the logarithmic growth in gas stations from t - 1 to t as the dependent variable. Our prediction is that business taxes are negatively associated with growth in gas stations, but that the ability to pass on taxes to consumers can (partly) undo this negative impact on going-concern issues. Our proxy for the ability to pass on corporate taxes to consumers is the local average of gas stations' *Market Power*. Columns (3) and (4) of Table 7 present the results of this regression, where we interact *LBT* with either the dummy variable *High Power* or the continuous local average composite market power proxy (*Market Power Municipality*). Consistent with our prediction, we find that tax incidence falling on

[18] Simply stated, unincorporated businesses receive a tax credit for the local business tax, whereas corporations do not. This also holds when considering all taxes. Unincorporated businesses are subject to single taxation with personal income taxes and local business taxes, for which there is a tax credit. Distributed profits of incorporated businesses are subject to the federal corporate tax rate, the local business tax (without a tax credit), and dividend taxes. The average tax burden is usually lower for the unincorporated businesses of individuals with moderate incomes, creating an incentive to run an unincorporated business.

consumers (*High Power* = 1) dampens the tax sensitivity of growth in gas stations. Specifically, local business taxes do not reduce local station growth when station owners rather than consumers likely bear the tax. In Columns (5) and (6), we run such a test at the gas station level and use (the logarithm of) the number of employees as the firm-level investment variable. For this limited sample, using data from Creditreform, we find that local business taxes reduce employment, but when station owners rather than consumers likely bear the tax (*High Power* = 1), this negative effect is neutralized.

6.2 Out-of-sample tests: Implications for tax avoidance and profitability

Finally, we turn to a sample of international firms outside our gas station setting to provide external validity to the findings that suggest a substitutive relation between consumer tax incidence and avoidance and to document implications for profitability. In this sample, we have better firm-level financial information, but we lack the fine-grained price data and tax rate variation that is plausibly exogenous to variation in local economic conditions.

In the first step, we examine whether the same underlying product market factors shaping consumer incidence in our setting (i.e., market power) shape tax avoidance. Based on the substitutive relation discussed above, we expect that firms with high product market power that can shift taxes to consumers will engage in less tax avoidance (i.e., report higher ETRs). We explore three measures capturing firms' market power over consumers. First, we use firms' gross margin as a measure of demand elasticity and market power (e.g., Lerner 1934) and use a dummy variable (*High Margin*) indicating gross margins above the median. Second, we use market concentration in terms of sales in a country–industry in a given year. Again, we use an indicator for market concentrations above the median (*High HHI*). Note that our results (not tabulated) hold when we use continuous variables. Finally, we use the consumer protection index from the OECD, available only for a more limited sample. We argue that greater consumer protection reduces firms' market power over customers, thereby reducing the ability to pass on taxes to consumers and increasing avoidance incentives. For ease of interpretation, we multiply the consumer protection index by -1 so that higher values indicate greater market power for firms.

Using data from Compustat Global and North America for about 15,000 firms from 34 OECD countries over the period 2000–2016 and the three-year GAAP ETR (*3-year GAAP ETR*) from *t* to *t* + 2 as the dependent variable, we find that firms with high market power engage less in tax avoidance. Controlling for several firm- and country-level determinants of tax avoidance (e.g., Atwood et al. 2012, Dyreng et al. 2017, Brühne et al. 2021), our results in Columns (1) to (3) in Table 7 indicate a negative relation between market power and tax avoidance. Overall, our results are consistent with the substitutive relation between tax incidence and tax avoidance in the labor market documented by Dyreng et al. (2020).

Another implication of our result that corporate taxes are partly passed on to customers in the form of higher prices is that firms should obtain higher pretax returns (see also Gordon 1967). When taxes increase, the operating pretax profits of firms with the ability to pass on taxes to consumers should be higher than for firms without that ability. To test this, we examine whether firms with greater market power have a higher pre-tax operating income (*Operating Income*), scaled by total assets, when they face higher tax rates in the international sample above. The coefficients of interest are the statutory corporate tax rate (*Tax Rate*) and its interaction with *HHI*, our proxy for market power. While we make no predictions for the tax rate coefficient, we expect the interaction of *Tax Rate* and *HHI* to be positive, since high–market power firms are able to pass on part of the additional tax to consumers (and potentially other stakeholders), thereby increasing pretax profits. Our findings in Columns (6) and (7) in Table 7 are consistent with this result. Firms with the ability to pass on taxes to consumers have higher pretax profits relative to firms without that ability when taxes increase.

While this finding is only indicative, it implies an interesting connection between tax incidence and the interpretation of prior literature of the sensitivity of subsidiaries' profits to the tax rate as a measure of income shifting, after controlling for input such as capital, labor, or intangibles (e.g., Collins et al. 1998, Mills and Newberry 2004, De Simone 2016). A higher tax rate in the subsidiary's country would result in *lower* profits, because firms shift profits to other countries. Our results from Column (4) indicate that corporate taxes are partly passed on to stakeholders (e.g., to customers in the form of higher prices), resulting in *higher* pretax profits. Empirical studies on profit shifting thus implicitly estimate the effect of profit shifting *net* of tax incidence, implying that true profit shifting might be underestimated. One interesting avenue for future research could therefore be to tease out the role of passing on taxes to stakeholders (higher taxes increasing pretax profits) from the incentives to shift profits (higher taxes reducing pretax profits).

7. Conclusion

In this paper, we examine whether consumers bear part of the corporate tax burden in the form of higher prices and the consequences passing on taxes to consumers on firm outcomes. Using census data on the gas prices of nearly all German gas stations and local variations in business tax rates in 4,507 municipalities, we examine the effect of local business taxes on consumer prices. Our results show that higher business taxes increase consumer prices. Hence, part of the corporate tax incidence appears to fall on consumers. We further show that the effect of business taxes on gas prices increases when gas stations have greater market power and when tax avoidance opportunities or other tax shields are limited. Finally, the results in our supplemental tests further suggest that shifting taxes to consumers reduces the impact of taxes on organizational form choice and growth and might result greater pre-tax profitability.

Our results have implications not only for policymakers and the public debate, but also for the academic literature. Passing on corporate taxes to consumers is an alternative way of creating a tax shield. Hence, firm decisions on investment (e.g., Djankov et al. 2010, Giroud and Rauh 2019), capital structure (e.g., Heider and Ljungqvist 2015), and tax avoidance (e.g., Dyreng et al. 2020) are potentially affected by the ability to pass on taxes to consumers. We show that for some firm choices, such as organizational form choice, growth, or tax avoidance, the ability to pass on taxes to other stakeholders matters. However, we also note that our paper has limitations. For example, we focus on one specific market with a homogeneous good. How and whether our results are generalizable to other goods and industries are left for future research.

Bearing these limitations in mind, our findings are important for the tax policy debate. Our results suggest that increasing corporate taxes not only affects capital owners and low-skilled workers, but also consumers through higher product prices. Our results also relate to the ongoing debate surrounding the OECD BEPS Project. Several countries have introduced tax code features aimed at curbing tax avoidance (e.g., global intangible low-taxed income, or GILTI regulation, part of the 2017 Tax Cuts and Jobs Act). Such rules could result in a larger share of the corporate tax being passed on to other stakeholders. Our paper illustrates a very similar point for tax enforcement. Even if tax enforcement leads to a reduction in tax avoidance (e.g., Hoopes et al. 2012, Gupta and Lynch 2016, Kubick et al. 2016), firms will not necessarily bear all of the additional tax burden.

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Appendix: Variable definitions

	Gas station–level variables	Source
E5	The price for one liter of regular gasoline with 5% ethanol.	Tankerkönig (https://creativecommons.tankerkoenig.de)
Affected	Dummy variable that equals one if the gas station is either an incorporated company or an unincorporated firm facing a local business tax rate above 13.3%.	Federal Statistical Office of Germany (https://www.destatis.de/DE/Themen/Staat/Steuern/Steuereinnahmen/_inhalt.html#sprg245508)
Incorporated	*Incorporated* is a dummy variable equal to one if the gas station is set up as an incorporated firm (e.g., corporation or limited liability company).	Creditreform
Unincorporated	*Unincorporated* is a dummy variable equal to one if the gas station is set up as an unincorporated firm (e.g., a partnership or sole proprietorship).	Creditreform
High Power	*High Power* is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median.	Own calculations
Market Power	*Market Power* is a continuous measure, comprising the sum of *Highway*, *Top Brand*, *24/7*, and *Very Close.*	Own calculations
Highway	*Highway* is a dummy variable equal to one if the gas station is located in direct proximity to a highway.	ADAC (https://www.adac.de/_mmm/pdf/Online-Liste-Tanken-auf-Reisen-2018-07_51818.pdf)
Top Brand	*Top Brand* is a dummy variable equal to one if the gas station belongs to the brand Aral, Shell, Esso, or Total, the best-known brands in Germany.	Tankerkönig (https://creativecommons.tankerkoenig.de/)
24/7	*24/7* is a dummy variable equal to one if the gas station is open 24 hours a day and seven days a week.	Google data (www.google.com)
Very Close	*Very Close* is a dummy variable equal to one if another gas station is in immediate proximity to the respective gas station.	Federal Agency for Cartography and Geodesy (http://www.geodatenzentrum.de/geodaten/gdz_rahmen.gdz_div?gdz_spr=eng&gdz_user_id=0)
High Debt	*High Debt* is a dummy variable equal to one if the debt-to-assets ratio of the gas station is above the median.	Bureau van Dijk's Amadeus database
High Credit Limit	*High Credit Limit* is a dummy variable equal to one if the gas station's credit limit is above the median.	Creditreform
Simplified Accounting	*Simplified Accounting* is a dummy variable equal to one if the firm's average sales are below EUR 600,000.	Creditreform

	Municipality-level variables	
LBT	*LBT* is the local business tax rate.	Federal Statistical Office of Germany (https://www.destatis.de/DE/Themen/Staat/Steuern/Steuereinnahmen/_inhalt.html#sprg245508)
Cars	*Cars* is the number of registered cars per municipality.	Federal Motor Transport Authority (https://www.kba.de/DE/Statistik/statistik_node.html)
StationsPerCar	*StationsPerCar* represents the natural logarithm of the number of gas stations over the number of registered cars per municipality.	Own calculation with other data retrieved
UnemploymentRate	*Unemployment rate* is the natural logarithm of the lagged unemployment rate per municipality.	Federal Agency of Labor (https://statistik.arbeitsagentur.de)
Deficit per Inhabitant	*Deficit per Inhabitant* is the municipality's budget deficit per capita	Federal Statistical Office of Germany
Property Tax Multiplier	*Property Tax Multiplier* is the key component determining the property tax within the municipality.	Federal Statistical Office of Germany (https://www.destatis.de/DE/Themen/Staat/Steuern/Steuereinnahmen/_inhalt.html#sprg245508)
Population	*Population* is the municipality's number of inhabitants.	Federal Statistical Office of Germany
High Enforcement	*High Enforcement* is a dummy variable equal to one if additional revenues (tax auditors per tax office) are above the median.	German Federal Tax Authorities
Additional Revenue	*Additional Revenue* is the additional tax income generated from tax audits in a state.	German Federal Tax Authorities
Tax Auditors by Office	*Tax Auditors by Office* is the number of tax auditors per office in a state.	German Federal Tax Authorities
	Parent country–level variables	
Anti-TA Score	*Anti-TA Score* is a composite measure of nine rules aimed at curbing tax avoidance.	Brühne et al. (2021)
CbC Reporting	*CbC Reporting* is a dummy variable equal to one if the foreign country requires country-by-country reporting.	Brühne et al. (2021)
General Anti-Avoidance Rules	Dummy variable denoting the existence of general anti-avoidance rules	Brühne et al. (2021)

Figure 1: Distribution of local business tax changes

This figure shows the numbers of local business tax hikes (Panel A) and cuts (Panel B) larger than 0.25 percentage point and 1 percentage point.

Panel A: Increases of the local business tax **Panel B: Decreases of the local business tax**

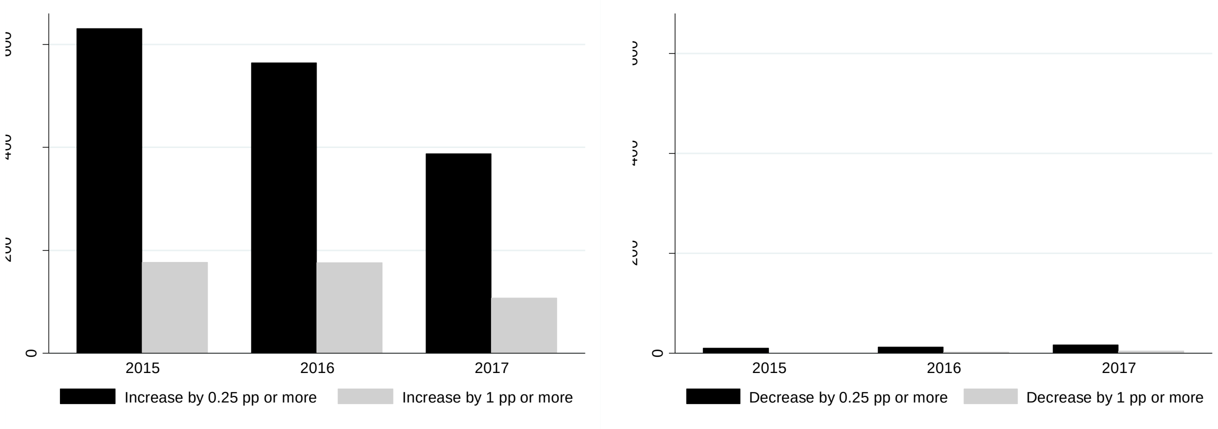


Figure 2: Local business tax in Germany

This figure depicts the local business tax landscape in Germany. Panel A presents the distribution of local business tax in Germany, where we split municipalities into quintiles. In Panel B, we depict whether a municipality has experienced one or multiple changes in local business tax rates over our sample period.

Panel A: Local business tax quintiles **Panel B: Changes in local business tax**

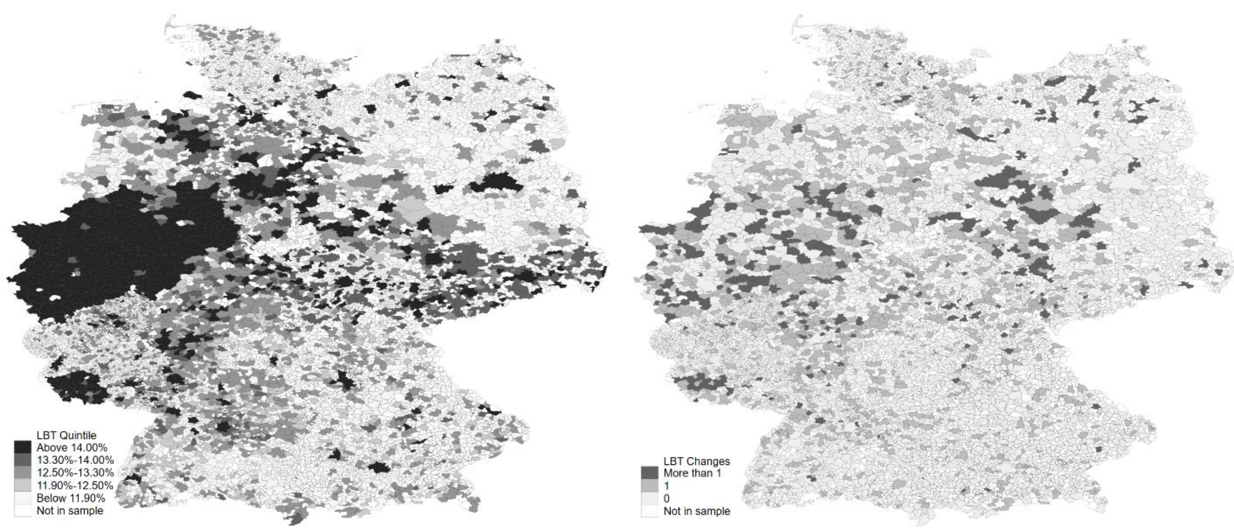


Figure 3: Distribution of gas prices by year

This figure depicts the distributions of gas prices for each sample year, after cleaning and winsorizing the data set.

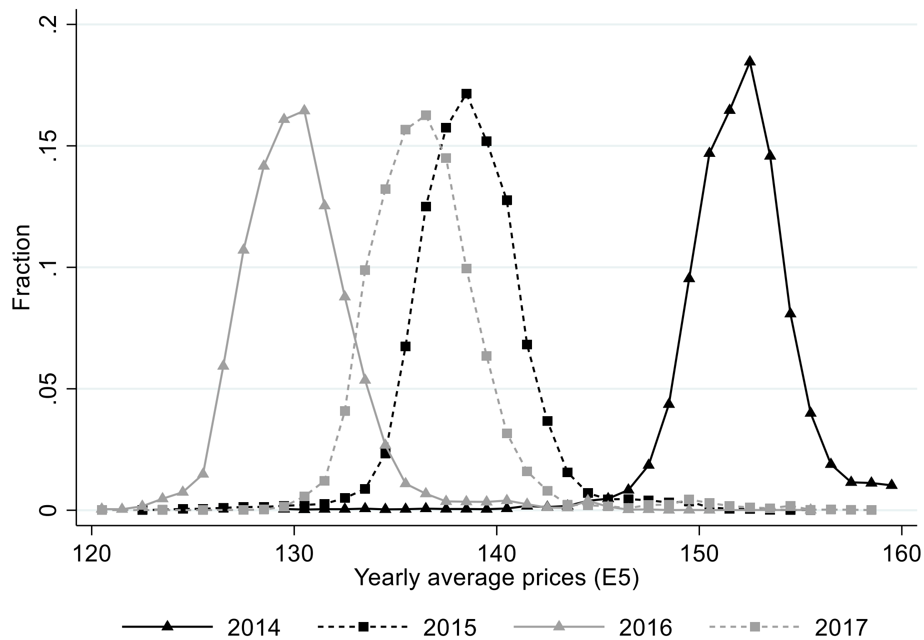


Figure 4: Daily variation in gas prices

This figure depicts the E5 price differences from the demeaned average price per liter (in euro cents). We demean the daily price at the district level.

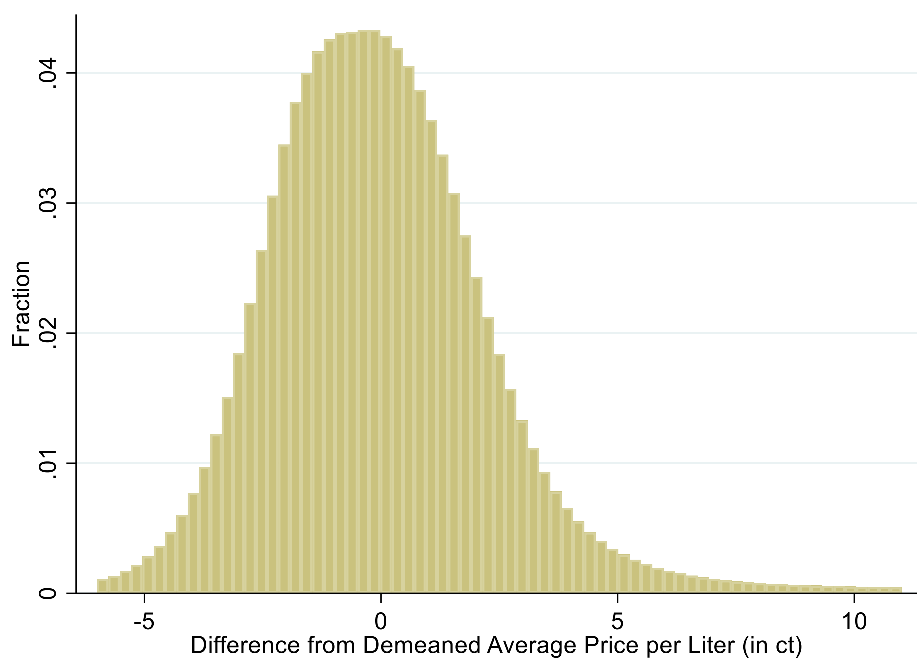


Figure 5: Average gas prices, Breakdown by *Market Power*

This figure depicts the average E5 price differences by Market Power, which takes values of 0, 1, 2, 3, and 4.

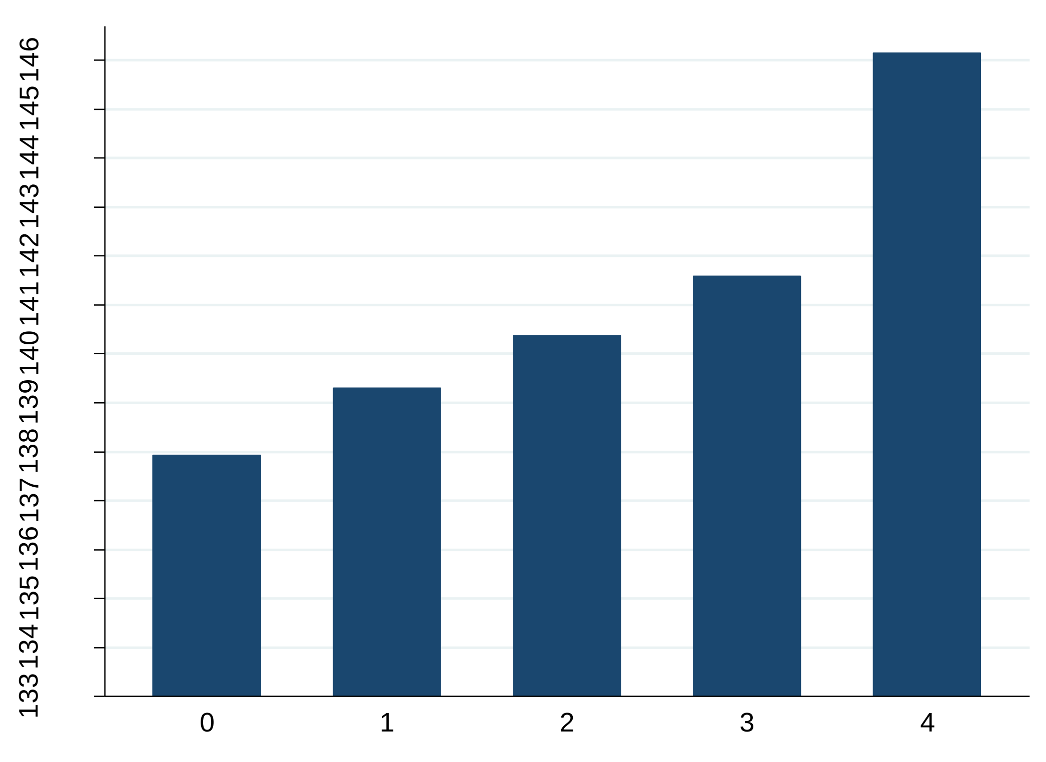


Table 1. Descriptive statistics and correlations

This table presents descriptive statistics for the main variables. Panel A shows the descriptive statistics for our main variables. The superscript + denotes variables available only for a limited sample. In Panel B, we report the correlation coefficients between the split variables. Nonsignificant correlations are reported in italics.

Panel A: Descriptive statistics

Variable	**Mean**	**Standard deviation**	**25th percentile**	**Median**	**75th percentile**
E5	139.29	8.45	133.19	137.48	145.43
Local business tax rate (%)	13.80	1.87	12.25	13.41	15.23
Affected^{+}	0.68	0.47	0.00	1.00	1.00
Unincorporated^{+}	0.12	0.33	0.00	0.00	0.00
Incorporated^{+}	0.88	0.33	1.00	1.00	1.00
High Power^{+}	0.67	0.47	0.00	1.00	1.00
Market Power^{+}	1.06	0.94	0.00	1.00	2.00
Highway	0.03	0.18	0.00	0.00	0.00
Top Brand	0.41	0.49	0.00	0.00	1.00
24/7^{+}	0.30	0.46	0.00	0.00	1.00
Very Close^{+}	0.25	0.43	0.00	0.00	0.00
Average Debt Ratio^{+}	0.64	0.24	0.48	0.66	0.85
Credit Limit over Sales^{+}	0.01	0.01	0.00	0.00	0.01
Simplified Accounting	0.02	0.14	0.00	0.00	0.00
Cars	9.75	1.52	8.72	9.63	10.71
Stations Per Car	0.00	0.00	0.00	0.00	0.00
Unemployment Rate	0.03	0.02	0.02	0.03	0.04
Deficit per Inhabitant	-24.14	329.86	-127.84	8.18	130.34
Property Tax Multiplier	428.05	106.54	360.00	400.00	480.00
Population	10.12	1.62	9.00	9.93	11.09
Anti-TA Score^{+}	0.48	0.16	0.33	0.42	0.62
CbC Reporting^{+}	0.27	0.44	0.00	0.00	1.00
GAAR^{+}	0.54	0.50	0.00	1.00	1.00
Additional Revenue^{+}	113,396.90	54,424.28	57,783.67	117,376.30	126,701.70
Tax Auditors by Office^{+}	51.72	3.72	50.46	52.80	53.09

Panel B: Correlations of cross-sectional variables

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1]	Affected	1							
[2]	High Power	0.02	1						
[3]	Market Power	0.04	0.78	1					
[3]	Highway	-0.02	0.13	0.37	1				
[4]	Top Brand	0.07	0.66	0.69	0.14	1			
[5]	24/7	0.07	0.47	0.71	0.22	0.26	1		
[6]	Very Close	-0.03	0.39	0.48	0.07	0.01	0.05	1	
[7]	High Enf. Rev	0.05	0.02	*0.00*	*-0.01*	*0.01*	*-0.01*	0.05	1
[8]	High Enf. Emp	0.05	0.03	*0.02*	*-0.01*	0.04	-0.06	0.02	-0.51

Table 2. Local business tax and gas prices: Main regression results

This table presents the main results of regressing E5 fuel prices on the local business tax rate. Controls are included in Columns (2) and (4). We include gas station and district–year fixed effects in Columns (1) and (2) of Panel A. Gas station and state–year fixed effects are included in Columns (3) and (4) of Panel A. Panel B presents the results of robustness tests. In Columns (1) and (2), we use a change specification with district–year fixed effects and controls (also in first differences). In Column (2), we additionally include changes in future tax rates. Column (3) of Panel B replicates Column (2) of Panel A, but adds interactions of *LBT* with year dummy variables. Finally, in Column (4), we replicate Column (2) of Panel A, but using weighted least squares (WLS) instead of ordinary least squares (OLS). The weights are the number of gas stations in a municipality–year. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Baseline results

	District-year Fixed Effects		**State–year Fixed Effects**	
	(1)	(2)	(3)	(4)
LBT	0.1100**	0.1076**	0.1144**	0.1140**
	(0.0440)	(0.0460)	(0.0495)	(0.0511)
Controls	No	Yes	No	Yes
Gas station FE	Yes	Yes	Yes	Yes
State–year FE	No	No	Yes	Yes
District–year FE	Yes	Yes	No	No
Observations	54,261	54,261	54,261	54,261
Adj. within R^2	0.0003	0.0004	0.0003	0.0006
Adjusted R^2	0.9697	0.9697	0.9661	0.9661

Panel B: Main regression results, with district–year fixed effects

	Change model	Pre-trends test	Breakdown by year	WLS
	(1)	(2)	(3)	(4)
ΔLBT	0.0994***	0.1353**		
	(0.0355)	(0.0610)		
ΔLBT_{t+1}		0.0137		
		(0.0953)		
ΔLBT_{t+2}		0.0967		
		(0.1145)		
LBT×2014			0.0665	
			(0.0517)	
LBT×2015			0.1150**	
			(0.0470)	
LBT×2016			0.1323***	
			(0.0476)	
LBT×2017			0.1488***	
			(0.0511)	
LBT				0.1159**
				(0.0577)
Controls	Yes	Yes	Yes	Yes
Gas station FE	No	No	Yes	Yes
District–year FE	Yes	Yes	Yes	Yes
Model	First Diff.	First Diff.	OLS	WLS
Observations	39,574	12,593	54,261	54,261
Adj. within R^2	0.0002	0.0006	0.0006	0.0004
Adjusted R^2	0.9640	0.0976	0.9698	0.9705

Table 3. Local business tax and gas prices: Identification

This table presents the identification strategy around the critical local business tax rate of 13.3% for unincorporated companies. We interact *LBT* with the dummy variable *Affected*, which is equal to one if the business is either incorporated or if the unincorporated business resides in a municipality with a local business tax rate above 13.3%. We include district–year fixed effects in all regressions. In Column (3), we run our baseline estimation from Table 2, but limit the sample to observations with non-missing information on the organizational form. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Model	**Reduced fixed effects model to identify *Affected***	**Baseline model with interaction with *Affected***	**Baseline model for the sample with non-missing org. form**
	(1)	(2)	(3)
LBT	-0.1508	-0.0406	0.0617
	(0.0952)	(0.0881)	(0.0482)
Affected	0.4664***	n.a.	
	(0.1727)	n.a.	
LBT×Affected	0.2393**	0.2212**	
	(0.1124)	(0.1072)	
Joint significance test:	*0.0885*	*0.1806****	–
LBT + LBT×Affected	*(0.0654)*	*(0.0646)*	–
Controls	Yes	Yes	Yes
Gas station FE	No	Yes	Yes
Municipality FE	Yes	No	No
District–year FE	Yes	Yes	Yes
Observations	29,765	29,765	29,765
Adj. within R^2	0.0003	0.0007	0.0004
Adjusted R^2	0.9447	0.9762	0.9762

Table 4. Local business tax, market power, and gas prices

This table presents the results of cross-sectional analyses regarding the regression of E5 fuel prices on the local business tax rate. In Columns (2) and (3), we include interactions of *LBT* with *High Power*, which is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median. Column (4) includes the continuous *Market Power* measure. The variable *Market Power* is the sum of *Highway*, *Top Brand*, *24/7*, and *Very Close*. In Column (5), we interact *LBT* with *Highway*, which is a dummy variable equal to one if the gas station is located in immediate proximity to a highway. In Column (6), we interact *LBT* with *Top Brand*, which is a dummy variable equal to one if the gas station belongs to the brand Aral, Esso, Shell, or Total, the most well-known brands in Germany. In Column (7), we interact *LBT* with *24/7*, which is a dummy variable equal to one if the gas station is regularly open 24 hours a day. In Column (8), we interact *LBT* with *Very Close*, which is dummy variable equal to one if another gas station is in immediate proximity to the respective gas station. Column (9) combines these measures. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Composite *Market Power* measure				**Breakdown by *Market Power* components**				
Price Difference	–	–	–	–	*4.2943****	*2.7013****	*1.4966****	*0.3967****	–
of split variable					*(0.2741)*	*(0.0463)*	*(0.0639)*	*(0.0906)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
High Power	1.9891***	1.9390***	n.a.	n.a.					
	(0.0486)	(0.0515)							
LBT	0.0464	-0.0129	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	(0.0498)	(0.0519)							
LBT×High Power		0.0878***	0.3790***						
		(0.0254)	(0.0751)						
LBT×Market Power				0.2994***					
				(0.0448)					
LBT×Highway					1.3546***				0.6819**
					(0.2884)				(0.2890)
LBT×Top Brand						0.5413***			0.3341***
						(0.0741)			(0.0714)
LBT×24/7							0.4432***		0.2923***
							(0.0760)		(0.0732)
LBT×Very Close								0.2126**	0.0873
								(0.0953)	(0.0872)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	No	No	No	No	No	No	No
Gas station FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District–year FE	Yes	Yes	No	No	No	No	No	No	No
Municipality–year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,329	38,329	38,329	38,329	54,261	54,261	44,351	46,695	38,329
Adjusted R^2	0.9407	0.9408	0.9768	0.9769	0.9719	0.9719	0.9748	0.9740	0.9769

Table 5. Deductibility of the cost of financing, tax shields, avoidance opportunities, tax enforcement, and corporate tax incidence

Panel A presents the results of cross-sectional analyses regarding the deductibility of costs of financing. The dependent variable is the E5 price. In Column (1), we interact *LBT* with *Simplified Accounting*, which is a dummy variable equal to one if a firm's average sales (using data from Creditreform) are below EUR 600,000. In Column (2) (Column (3)), we interact *LBT* with *High Debt* (*High Credit Limit*), which is a dummy variable equal to one if the debt-to-assets ratio (credit limit) of the gas station is above the median. Panel B presents the results from interacting *LBT* with the tax rules of the country of the headquarters of the gas station's group. We use the composite *Anti-Tax Avoidance Score* in Column (1), country-by-country reporting (*CbC Reporting*) in Column (2), and *General Anti-Avoidance Rules* from Brühne et al. (2021) in Column (3). Panel C presents the results of cross-sectional analyses regarding tax avoidance opportunities due to lax tax enforcement. We interact *LBT* with *High Enforcement*, which is a dummy variable equal to one if the additional revenues (tax auditors per tax office) in Column (1) (Column (2)) are above the median. Column (3) presents the results of a placebo test using tax revenues from the largest firms. We include gas station and district–year fixed effects in all columns. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Alternative tax shields and the role of deductibility

	(1)	(2)	(3)
LBT	0.1147**	0.8788***	0.1653**
	(0.0465)	(0.3119)	(0.0740)
LBT×Simplified Accounting	-0.3154**		
	(0.1506)		
LBT×High Debt		-0.9310**	
		(0.4454)	
LBT×High Credit Limit			-0.0701*
			(0.0380)
Controls & FE	Yes	Yes	Yes
Observations	54,261	1,149	13,227
Adjusted R-squared	0.970	0.961	0.975

Panel B: Tax avoidance opportunities (measured in the parent country)

	(1)	(2)	(3)
LBT	0.1466***	0.1216**	0.0140
	(0.0530)	(0.0530)	(0.0643)
LBT×Anti-Tax Avoidance Score	0.0392***		
	(0.0092)		
LBT×CbC Reporting		0.0810***	
		(0.0153)	
LBT×General Anti-Avoidance Rules			0.2394***
			(0.0747)
Controls & FE	Yes	Yes	Yes
Observations	39,717	39,717	39,717
Adjusted R-squared	0.972	0.972	0.972

Panel C: Breakdown by tax enforcement

Split by	Additional revenue	Auditors per tax office	Placebo, largest firms
LBT	0.0240	-0.0696	0.0906*
	(0.0599)	(0.0792)	(0.0500)
LBT×High Enforcement	0.1737**	0.3209**	0.0632
	(0.0879)	(0.1634)	(0.1072)
Controls & FE	Yes	Yes	Yes
Observations	53,887	19,073	53,887
Adjusted R-squared	0.970	0.969	0.970

Table 6. Corporate tax incidence and the tax sensitivity of firm choices

This table presents the results for the tax sensitivity of firm decisions and the ability to pass on taxes. In Columns (1) and (2), we use the subsample of gas stations with information on their organizational form. The dependent variable is *Incorporated*, which equals one if the firm is incorporated. In Column (2), we include the interaction of *LBT* with *High Power*, which is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median. The variable *Market Power* is the sum of *Highway*, *Top Brand*, *24/7*, and *Very Close*. We include control variables and state–year fixed effects in both columns. In Columns (3) and (4), we run an analysis at the municipality–year level. For each municipality, we count the number of gas stations and define *Growth in Local Gas Stations* as the logarithmic growth rate of the number of gas stations. In Column (3), we include the interaction of *LBT* with *High Power*. In Column (4), we interact *LBT* with the municipality average of gas stations' *Market Power*, which we denote *Market Power Municipality*. We include municipality-level controls, municipality fixed effects, and district–year fixed effects in both columns. In Columns (5) and (6), we use data from Creditreform on the number of employees for a limited sample of gas stations. The dependent variable, Ln*(Employees)*, is the natural logarithm of the number of employees. In Column (6), we include the interaction of *LBT* with *High Power*, which is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median. We include municipality-level controls, gas station fixed effects, and district–year fixed effects in both columns. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Incorporated*		*Growth in Local Gas Stations*		Ln*(Employees)*	
	(1)	(2)	(3)	(4)	(5)	(6)
LBT	-0.0061	-0.0117**	-0.0260	-0.0654*	-0.0596*	-0.1270***
	(0.0050)	(0.0052)	(0.0227)	(0.0351)	(0.0356)	(0.0440)
LBT×High Power		0.0118***	0.0703*			0.1448**
		(0.0042)	(0.0403)			(0.0650)
LBT×Market Power Municipality				0.0668**		
				(0.0282)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	No	No	Yes	Yes	No	No
Gas station FE	No	No	No	No	Yes	Yes
State–year FE	Yes	Yes	No	No	No	No
District–year FE	No	No	Yes	Yes	Yes	Yes
Observations	29,950	29,950	7,178	7,178	10,456	10,456
Adjusted R-squared	0.013	0.013	-0.143	-0.136	0.780	0.780

Table 7. Corporate tax incidence, tax avoidance, and profitability

This table presents the results on tax avoidance and firm-level profitability, using data on listed firms from Compustat Global and North America. In Columns (1) to (3), the dependent variable is the three-year GAAP ETR from *t* to *t* + 2. We require firm observations to have non-negative and non-missing profits over this period. The control variables include firm-level variables—size, profitability, leverage, Q ratio, cash holdings, sales growth—and country-level variables—the statutory tax rate, anti-tax avoidance, and investment score indices of Brühne et al. (2021), the gross domestic product, the gross domestic product per capita, unemployment, an indicator for an election year, trade openness, foreign direct investment, and country-level governance. Column (1) uses a dummy variable (*High Margin*) indicating gross margins above the median. In Column (2), we use an indicator for market concentration above the median (*High HHI*). Column (3) uses the OECD consumer protection index, which is a static variable with data available only for a narrower sample. For ease of interpretation, we multiply the consumer protection index by -1 so that higher values indicate greater market power for firms (*Weak Consumer Rights*). In Columns (4) and (5), the dependent variable is operating income scaled by total assets (*Operating Income*). We report the coefficient on the statutory corporate tax rate in a country (*Tax Rate*) as well as its interactions with *High HHI* in Column (4) and with the continuous Herfindahl–Hirschman index (*HHI (continuous)*) in Column (5). The control variables are the same as in columns (1) to (3), but we exclude profitability. Continuous variables are standardized to have a mean of zero and a standard deviation of one for ease of interpretation. All columns include firm and industry–year fixed effects. We report robust standard errors clustered at the firm level (Column (1)), country–industry–year level (Columns (2), (4), and (5)), and country–industry level (Column (3)) in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

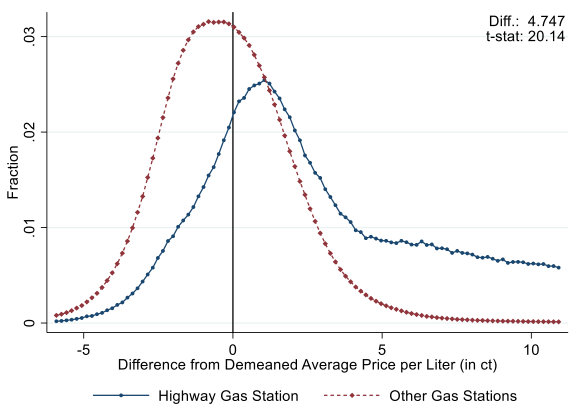
		3-year GAAP ETR			*Operating income*	
	Exp. sign	(1)	(2)	(3)	(4)	(5)
High Margin	+	0.0107***				
		(0.0032)				
High HHI	+		0.0097**		0.0044**	
			(0.0043)		(0.0021)	
Weak Consumer Rights	–			0.0029**		
				(0.0014)		
Tax Rate	?				-0.0057**	-0.0017
					(0.0023)	(0.0021)
Tax Rate×High HHI Dummy	+				0.0069***	
					(0.0016)	
Tax Rate×HHI (continuous)	+					0.0072*
						(0.0043)
HHI (continuous)						0.0000
						(0.0016)
Controls		Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes
Industry–year FE		Yes	Yes	Yes	Yes	Yes
Observations		79,965	79,696	27,905	130,971	130,971
Adjusted R-squared		0.617	0.613	0.219	0.669	0.669

Online Appendix

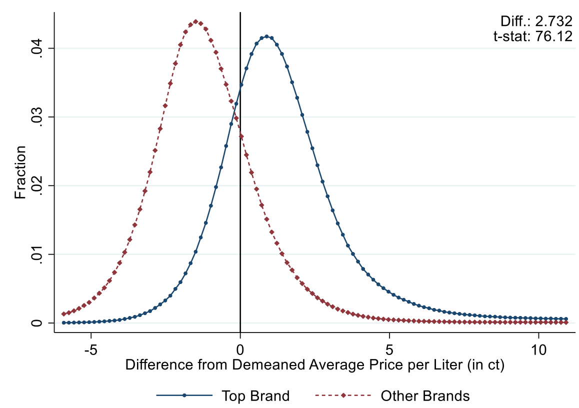
Figure A.1: Daily variation in gas prices and breakdown by demand elasticity

This figure depicts the E5 price differences from the demeaned average price per liter (in euro cents). We demean the daily price at the district level. Panel A shows the differences for highway gas stations versus other gas stations, and Panel B shows the differences between top brand and other brands of gas stations. Panel C compares gas stations that are always open (24/7 gas stations) to all the other gas stations. Panel D compares gas stations that are located within the vicinity (very close to) of all other gas stations. Differences in average demeaned prices and the *t*-statistics of the differences (based on clustered standard errors at the day–district level) are reported in each panel.

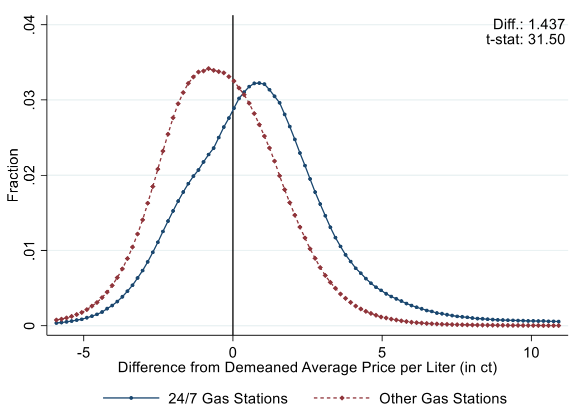
Panel A: Highway gas stations



Panel B: Top brand gas stations



Panel C: 24/7 gas stations



Panel D: Very close gas stations

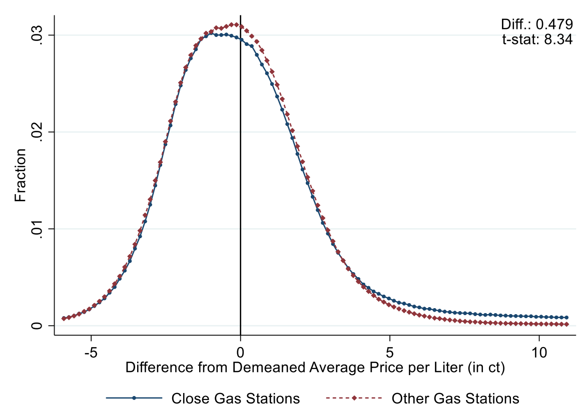


Table A.1: Local business tax and E10/diesel prices: Main regression results

This table presents the main regression results from regressing E10 fuel prices (Panel A) or diesel prices (Panel B) on the local business tax rate. The controls are included in Columns (2) and (4). We include gas station and state–year fixed effects in Columns (1) and (2). Gas station and district–year fixed effects are included in Columns (3) and (4) of Panel A. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Baseline results for E10				
	State–year FE		**District–year FE**	
	(1)	(2)	(3)	(4)
LBT	0.1099*	0.1215**	0.0927*	0.0987*
	(0.0565)	(0.0555)	(0.0541)	(0.0514)
Controls	No	Yes	No	Yes
Gas station FE	Yes	Yes	Yes	Yes
State–year FE	Yes	Yes	No	No
District–year FE	No	No	Yes	Yes
Observations	52,693	52,702	52,693	52,702
Adj. within R^2	0.0003	0.0009	0.0002	0.0002
Adjusted R^2	0.9560	0.9560	0.9606	0.9606
Panel B: Baseline results for diesel				
	State–year FE		**District–year FE**	
	(1)	(2)	(3)	(4)
LBT	0.1199***	0.1231**	0.0969**	0.1004**
	(0.0462)	(0.0486)	(0.0396)	(0.0419)
Controls	No	Yes	No	Yes
Gas station FE	Yes	Yes	Yes	Yes
State–year FE	Yes	Yes	No	No
District–year FE	No	No	Yes	Yes
Observations	54,259	55,590	54,259	55,590
Adj. within R^2	0.0005	0.0006	0.0002	0.0003
Adjusted R^2	0.9774	0.9761	0.9801	0.9788

Table A.2 Incidence falling on Consumers: Scenario Analysis

This table translates our coefficient estimate into a back-of-the-envelope estimate of the tax incidence falling on consumers. We assume that firms do not change capital and labor input and that cost of capital and wage costs remain constant. We assume a quantity Q of 10 units and a price P of 139. The tax rate is $\tau = 13.84\%$. With a margin of m, this results in a pre-tax profit of $P \times Q \times m$ and an after-tax profit of $\Pi = (1- \tau) \times P \times Q \times m$. We then calculate the reduction in the pre-tax profits and in tax payments following a tax rate increase by 1 percentage points to $\tau^* = 14.84\%$. Given our estimate of β_1, we now have a price of $P^* = P + \beta_1$. The sold quantity changes depending on the quantity elasticity ε. The new sold quantity is thus $Q^* = Q^*(1 - \beta_1/P \times \varepsilon)$. The latter term captures the percent increase in the price (β_1/P). Multiplied by ε results in the reduction in quantity. The new after-tax profit is $\Pi^* = (1- \tau^*) \times P^* \times Q^* \times m$. We now calculate the ratio of the reduction in after-tax profits ($\Delta\Pi = \Pi - \Pi^*$) following the tax increase by the increase in taxes paid due to the tax increase ($\tau \times P^* \times Q^* \times m - \tau \times P \times Q \times m$) to obtain the percent of the corporate tax borne by the firm. Taking 1 minus this ratio results in the percent of the tax borne by consumers. In our calculations, we assume different scenarios. We assume the quantity elasticity ε to be 0 ("no response"), 0.4 ("medium"), or 0.6 ("higher"). We also use three different cases of profit margins, ranging from 5% ("low") to 7% ("medium") and to 10% ("high"). Numbers in bold indicate realistic combinations of ε and m.

		Profit Margin *m*		
		Low	Medium	High
Quantity Elasticity *ε*		5%	7%	10%
No response	0.0	126%	95%	**69%**
Medium	0.4	82%	**60%**	43%
Higher	0.6	**57%**	41%	30%

Table A.3: Main results, controlling for local and time-series trends in controls

This table presents the main regression results for gas prices. The dependent variable is the gas price of E5. The main independent variable is *LBT*, the local business tax rate. In Column (1) (Column (2)), we use equation (1) and interact all the control variables except *LBT* with year (state) dummy variables. In Column (3), we use equation (1) and interact all control variables except *LBT* with year dummy variables, as well as with state dummy variables. We include gas station and district–year fixed effects in all tests. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
LBT	0.1004**	0.1196**	0.1150**
	(0.0466)	(0.0484)	(0.0492)
Controls	Yes	Yes	Yes
Controls×year dummies	Yes	No	Yes
Controls×state dummies	No	Yes	Yes
Gas station & district–year FE	Yes	Yes	Yes
Observations	54,261	54,261	54,261
Adj. within R^2	0.9698	0.9698	0.9698
Adjusted R^2	0.9698	0.9698	0.9698

In Table A.4, we expand the analysis from Table 3 and split the group of affected gas stations into 1) unincorporated gas stations with an *LBT* value above 13.3%, 2) incorporated gas stations with *LBT* below 13.3%, and 3) incorporated gas stations with *LBT* above 13.3%. We contrast these three groups with unaffected gas stations, using the approach from equation (2), but with additional interactions for the respective subgroups. In the *LBT* row, we report the (overall) effect *LBT* has on E5 prices in the respective subgroup. We also report (in italics) whether the difference in prices between groups is statistically significant. As expected, we find *LBT* has a nonsignificant effect among unaffected gas stations (Column (1)) and significantly positive results for affected gas stations (Columns (2) to (4)). Importantly, the coefficients from Column (1) (for gas stations with a local business tax rate below 13.3%) are significantly different from those for affected gas stations (Columns (2) to (4)). The remaining differences, that is, the differences between the three subgroups of affected gas stations, are not statistically significant. This result is consistent with our main prediction: when the local business tax is a burden, gas stations, irrespective of their legal form, pass on the burden to consumers in the form of higher prices.

Table A.4: Treated versus untreated gas stations: A detailed breakdown

This table presents more details of the identification strategy around the critical local business tax rate of 13.3% for unincorporated companies. In one joint regression, we split the *LBT* effect into incorporated versus unincorporated gas stations and into regions with local business rates above versus below 13.3%. We include district–year–organizational form fixed effects, as well as gas station fixed effects. We limit the sample to observations with non-missing information on organizational form. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Unincorporated gas stations		**Incorporated gas stations**	
	LBT < 13.3%	*LBT* > 13.3%	*LBT* < 13.3%	*LBT* > 13.3%
N	(N = 9,566)	(N = 16,520)	(N = 1,529)	(N = 2,150)
	(1)	(2)	(3)	(4)
LBT	**-0.0888**	**0.2835*** **	**0.4150** **	**0.3040***
	(0.0965)	**(0.0750)**	**(0.1757)**	**(0.1847)**
Difference between Cols. (1) and (2)/(3)/(4)		*0.3723*** *	*0.5038** *	*0.3297**
		(0.1222)	*(0.1971)*	*(0.2069)*
Difference between Cols. (2) and (3)/(4)			*-0.1314*	*-0.0204*
			(0.1894)	*(0.1964)*
Difference between Cols. (3) and (4)				*0.1110*
				(0.2390)
Controls			Yes	
Gas station FE			Yes	
Org. form–district year FE			Yes	
Observations			29,765	
Adj. within R^2			0.0026	
Adjusted R^2			0.9761	

Table A.5: Heterogeneity tests excluding observations without within-municipality variation in split variables

This table presents the results of cross-sectional analyses regarding the regression of E5 fuel prices on the local business tax rate. In Column (1), we include the interaction of *LBT* with *High Power*, which is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median. The variable *Market Power* is the sum of *Highway*, *Top Brand*, *24/7*, and *Very Close*. In Column (2), we interact *LBT* with *Highway*, which is a dummy variable equal to one if the gas station is located in immediate proximity to a highway. In Column (3), we interact *LBT* with *Top Brand*, which is a dummy variable equal to one if the gas station belongs to the brand Aral, Esso, Shell, or Total, the most well-known brands in Germany. In Column (4), we interact *LBT* with *24/7*, which is a dummy variable equal to one if the gas station is regularly open 24 hours a day. In Column (5), we interact *LBT* with *Very Close,* which is dummy variable equal to one if another gas station is in immediate proximity to the respective gas station. In each column, we exclude observations for which the respective cross-sectional variable does not vary within a municipality, to ensure that there is always a comparison gas station within the same municipality. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
LBT×High Power	0.3789***				
	(0.0751)				
LBT×Highway		1.3546***			
		(0.2884)			
LBT×Top Brand			0.5413***		
			(0.0741)		
LBT×24/7				0.4432***	
				(0.0760)	
LBT×Very Close					0.2126**
					(0.0954)
Controls	Yes	Yes	Yes	Yes	Yes
Gas station FE	Yes	Yes	Yes	Yes	Yes
Municipality–year FE	Yes	Yes	Yes	Yes	Yes
Observations	30,970	18,890	46,807	36,019	29,040
Adj. R^2	0.9777	0.9638	0.9732	0.9751	0.9755

Table A.6: Prices, market power, and gas prices: Breakdown by affected gas stations

This table presents the results of cross-sectional analyses regarding the regression of E5 fuel prices on the local business tax rate. In Columns (1) and (2), we include an interaction of *LBT* with *High Power*, which is a dummy variable equal to one (zero) if the gas station's *Market Power* is above (below) the median. The variable *Market Power* is the sum of *Highway*, *Top Brand*, *24/7*, and *Very Close*. In Columns (3) and (4), we interact *LBT* with *Highway*, which is a dummy variable equal to one if the gas station is located in immediate proximity to a highway. In Columns (5) and (6), we interact *LBT* with *Top Brand*, which is a dummy variable equal to one if the gas station belongs to the brand Aral, Esso, Shell, or Total, the most well-known brands in Germany. In Columns (7) and (8), we interact *LBT* with *24/7*, which is a dummy variable equal to one if the gas station is regularly open 24 hours a day. In Columns (9) and (10), we interact *LBT* with *Very Close*, which is dummy variable equal to one if another gas station is in immediate proximity to the respective gas station. In odd-numbered (even-numbered) columns, we use the subsample of gas stations that are unaffected (affected) according to the German tax code. The dummy variable *Affected* is equal to one if the business is either incorporated or if the unincorporated business resides in a municipality with a local business tax rate above 13.3%. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Affected	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LBT×High Power	-0.0874	0.5232***								
	(0.3810)	(0.1130)								
LBT×Highway			0.0139	0.9042*						
			(0.4677)	(0.4746)						
LBT×Top Brand					0.2196	0.6612***				
					(0.3024)	(0.0993)				
LBT×24/7							0.2404	0.3726***		
							(0.3048)	(0.1227)		
LBT×Very Close									0.1821	0.0853
									(0.3580)	(0.1017)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gas station FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality–year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,264	16,798	9,566	20,199	9,566	20,199	8,233	17,985	7,282	18,855
Adj. R^2	0.9501	0.9830	0.9175	0.9807	0.9176	0.9808	0.8690	0.9821	0.9577	0.9815

Table A.7 examines the role of product characteristics and differentiation. Consumers' price elasticity of demand hinges on product-specific characteristics. We argue that diesel fuel is mostly consumed by businesses (e.g., trucks, delivery vans) and other frequent drivers. These drivers are more likely to actively choose gas stations based on price. For example, logistics companies apply sophisticated route planning and algorithms to minimize costs. Since fuel is their main cost driver, they actively look for savings potential by choosing cheap gas stations or buying gas at specific times. Further, diesel vehicles are initially more expensive, but become cheaper than gas vehicles after a certain mileage. Hence, we expect diesel consumers to be more price sensitive and likely more elastic. Put differently, we expect that the effect of local business taxes is greater on gasoline prices (i.e., for E5) than on diesel prices.

The empirical test of this prediction uses the fact that we observe gas prices for E5 and diesel for each gas station. The dependent variable *Price* is then either the E5 price or the diesel price. Hence, each gas station enters the regression twice, once with its E5 price and once with its diesel price. We then run our baseline model and include a dummy variable *E5* that is equal to one if *Price* is the price of E5, as well as the interaction of *E5* with *LBT*. The results are shown in Table A.7. In Column (1) (Column (2)), we do not include controls (include all controls). We find that E5 prices significantly respond to the local tax, as indicated by the positive and significant *LBT×E5* coefficient. Consistent with the prediction that, because diesel drivers are more elastic, more of the local business tax is passed on to consumers of gasoline, we find that the difference between the diesel and E5 effects is statistically significant. The results indicate that the ability to pass on the tax to consumers is also product specific. Finally, in Columns (3) and (4), we replicate our results for affected and unaffected gas stations, respectively. Consistent with our predictions, we find that local business taxes affect E5 (and diesel, but to a lesser extent) prices when gas stations are in the *Affected* group (Column (3)), but not when gas stations are unaffected by the local business tax.

Table A.7: Prices and gas prices: Exploiting heterogeneity across products

This table presents the results of cross-sectional analyses regarding the regression of E5 fuel prices on the local business tax rate. For each gas station, we use two observations, where the dependent variable *Price* is either the gasoline price (*E5*) or the diesel price (*Diesel*). We then include the dummy variable *E5*, *LBT*, and their interaction. Column (1) replicates our main specification without control variables. Column (2) includes control variables. In Columns (3) and (4), we split the sample based on *Affected*. The dummy variable *Affected* is equal to one if the business is either incorporated or if the unincorporated business resides in a municipality with a local business tax rate above 13.3%. Column (3) (Column (4)) uses the sample of gas stations that are affected (unaffected). We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable	*Price*	*Price*	*Price*	*Price*
Sample	Full sample		Affected	Unaffected
	(1)	(2)	(3)	(4)
LBT×Diesel	0.0543	0.0587	0.1207*	-0.1263
	(0.0406)	(0.0423)	(0.0651)	(0.1019)
LBT×E5	0.1526***	0.1548***	0.2137***	-0.0151
	(0.0405)	(0.0422)	(0.0650)	(0.1024)
Difference E5 vs. Diesel	*0.0984****	*0.0961****	*0.0929****	*0.1111****
	(0.0124)	*(0.0124)*	*(0.0193)*	*(0.0265)*
Controls	No	Yes	Yes	Yes
Gas station FE	Yes	Yes	Yes	Yes
Municipality–year FE	Yes	Yes	Yes	Yes
Observations	108,520	109,851	40,517	19,198
Adj. within R^2	0.9818	0.9811	0.9878	0.9834
Adj. R^2	0.9874	0.9871	0.9911	0.9881

We next discuss the role of local competition. If gas stations face more (less) competition, we expect them to be less (more) able to pass on the corporate tax to customers. We operationalize this notion conceptually by combining proxies for low demand (proxied by the number of cars per inhabitant) and high supply (proxied by the number of gas stations per inhabitant) at the same time. Specifically, we define the dummy variable *High Competition,* which is equal to one if the municipality is characterized by low demand (i.e., the municipality is below the median in terms of the number of cars per inhabitant) and high supply (i.e., the municipality is above the median in terms of the number of gas stations per inhabitant). The combination of low demand and high supply results in high local competition. We then create a dummy variable, *Low Competition*, defined as 1 - *High Competition,* to facilitate the interpretation as high market power.

Following our approach from firm-level heterogeneity tests, we then interact *Low Competition* with *LBT* and include the main effect of *LBT*. Table A.8 presents the results. Consistent with our prediction, we find that the main effect on *LBT* is positive and significant, suggesting that, in municipalities with high competition (*High Competition* = 1 or *Low Competition* = 0), gas stations cannot pass on the tax burden to consumers. The positive interaction *Low Competition*×*LBT* shows that gas stations operating in less competitive markets are able to pass on taxes to consumers. This result also holds when we account for the *High Power* variable (see Column (2)).

In Table A.8, we also exploit cross-country differences in E5 prices. Germany shares borders with nine countries. In four of these countries (Austria, the Czech Republic, Luxembourg, and Poland), E5 is cheaper, which makes Germans and foreigners at the border more elastic than at German gas stations; that is, customers are encouraged to buy outside Germany. In contrast, in five countries (Belgium, Denmark, France, the Netherlands, and Switzerland), E5 is more expensive, making German gas stations relatively more elastic, because they do not face fierce competition from abroad. We therefore create the dummy variable *High Price Abroad* that equals one if the district shares a border with Belgium, Denmark, France, the Netherlands, or Switzerland, and zero if the district shares a border with Austria, the Czech Republic, Luxembourg, or Poland.[1] Districts without a border are excluded from this test. We then interact *High Price Abroad* with *LBT* and include controls and gas station and year fixed effects.

Column (3) of Table A.8 reports the result. The main effect of *LBT* estimates the effect in districts that share a border with a country with lower E5 prices. The nonsignificant coefficient

[1] One district shares a border with Luxembourg and France, and another shares a border with Luxembourg and Belgium. We treat these districts as having a border with a low-price environment, due to access to Luxembourg.

suggests that, in these districts—because of the local competition from abroad—German gas stations cannot pass on the local business tax. In contrast, the coefficient for *High Price Abroad*×*LBT* is positive and significant, suggesting that a higher local business tax rate results in higher E5 prices in districts that share a border with a country where E5 is more expensive than in Germany. This test corroborates our finding that gas stations pass on more of the local business tax to relatively inelastic consumers and when they have greater market power.

Table A.8: Local business tax, local market characteristics, and gas prices

This table presents the results of cross-sectional analyses regarding the regression of the E5 fuel prices on the local business tax rate. In Columns (1) and (2), we interact *LBT* with *Low Competition*, which is defined as 1 - *High Competition*, where *High Competition* is a dummy equal to one if the municipality is characterized by low demand (below-median number of cars per inhabitant) and high supply (above-median number of gas stations per inhabitant). The combination of low demand and high supply results in high local competition. In Column (2), we additionally include the interaction of *LBT* with *High Power*. In Column (3), we interact *LBT* with *High Price Abroad*, which is a dummy variable equal to one if the district shares a border with Belgium, Denmark, France, the Netherlands, or Switzerland, and zero if the district shares a border with Austria, the Czech Republic, Luxembourg, or Poland. Districts without a border are excluded from this test. We include gas station and year fixed effects. We report robust standard errors clustered at the municipality level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Low Competition	0.1333		
	(0.1722)		
LBT	-0.0297	-0.3678***	-0.3185
	(0.0726)	(0.0892)	(0.2421)
LBT×*Low Competition*	0.1819**	0.2155***	
	(0.0763)	(0.0754)	
LBT×*High Power*		0.3779***	
		(0.0727)	
LBT×*High Price Abroad*			0.8593***
			(0.3008)
Controls	Yes	Yes	Yes
Gas station FE	Yes	Yes	No
District–year FE	Yes	Yes	No
Year FE	No	No	Yes
Observations	54,261	38,329	38,329
Adj. R^2	0.9698	0.9756	0.9756