

Does market power allow firms to pass on more of the tax burden to consumers? Evidence from gasoline tax reforms in Austria

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Abstract

This paper explores how the intensity of competition in output markets affects the shifting of taxes to consumers. According to a popular view firms with market power are able to react to tax increases by passing on the burden to consumers while firms which face intense competition in output markets are unable to do so. In contrast, standard economic theory of tax shifting argues that the link between market power and tax incidence is ambiguous. We use data from the Austrian gasoline retail market to study this issue empirically. We find that the share of the tax shifted to consumers increases significantly with the market power of the suppliers. We find that the difference in the tax induced price increase between stations with the lowest and the highest degree of competition is equal to roughly 50 per cent of the overall tax increase.

1. Introduction

The question of who bears the economic burden of taxation is of primary importance for tax policy. Thus is not only because tax incidence has distributional implications. Tax incidence is also important for the impact of tax reforms on employment or investment. For instance, if firms cannot shift taxes to consumers they may be forced to cut wages or shut down. It is one of the key results of standard tax theory that the obligation to pay a tax may say little about the distribution of the economic burden of the tax because tax changes lead to changes in prices and quantities traded in markets. To what extent tax changes lead to changes in prices depends on various aspects of the market environment. One important aspect is the degree of competition. In public debates it is often stated that companies exposed to high competitive pressure on output markets are not able to pass on taxes to consumers. From a theoretical viewpoint the link between the degree of competition and the extent of pass-through is, however, ambiguous.¹ For instance, a perfectly price discriminating monopolist will inevitably bear the full burden of taxation because extreme monopoly power is used to capture the entire surplus generated by the market.

This article provides empirical evidence from the Austrian gasoline market about the relation between tax incidence and the degree of competition. We consider two gasoline tax reforms and we exploit the fact that our data includes information about the competitive situation of individual gasoline stations. The gasoline sector is ideal for the analysis of the link between market structure and tax incidence. Firstly, this sector is characterized by a multi-level value chain consisting of exploration and production, transport, refinement, and retailing, but is nevertheless comparably simple. Secondly, a multitude of

¹ See e.g. the overview in RBB (2014) or the unifying article Weyl and Fabinger (2013).

local markets with similar conditions allow the identification of how the intensity of competition affects tax pass-through. In the cross section dimension, local markets differ mainly in size with mostly stationary supply structure regarding the number of stations. In the time series dimension, demand fluctuates mostly during daytime and between different days, but remains mostly constant between different weeks (cf. demand profiles of traffic counts as in Austria or Germany). There may be some variation with regard to school holidays. In sum, this is a good basis for empirical analysis.

2. The Literature

Empirical studies investigating the relation between competitive pressure and incidence are rare. The three papers most closely related to our analysis are Delipalla and O'Donnell (2001), Marion and Muehlegger (2011) and Kopczuk et al (2013). Delipalla and O'Donnell (2001) analyze the incidence of tobacco tax at the national level in a number of European countries. Since this is a market with special features (addictive potential of consumers, high government intervention levels), and given the small sample size of twelve countries, this paper has various drawbacks with respect to the precision and the generalizability of their results as the authors state themselves.² Their primary motivation, however, is to compare ad valorem to specific taxes. Second, Marion and Muehlegger (2011) investigate the fuel market in the US. They also only implicitly test the degree of competition impact on tax incidence. They are not able to distinguish between exercise of market power and just low levels of supply elasticity.

Other authors investigate the pass-through of taxes in single markets, but then cannot relate this explicitly to competitive regimes such as Fabra and Reguant (2014) for CO₂-taxes in electricity.

Kim and Cotterill (2008) build on structural estimation methods hypothesizing the mode of competition and—without knowing marginal cost—inferring on the possible pass-through-cost-combination from observed prices and quantities in the processed cheese industry. Thereby, they derive pass-through of 0.21 to 0.31 for collusion and 0.73 to 1.03 for differentiated Bertrand competition.

Harding et al. (2012) and Bergman and Hansen (2013) investigate tax pass-through dependent on distance to the boarder for US cigarettes and alcoholic beverages respectively. The former find a significant effect reducing pass-through by nearly half, whereas the latter find no significant effect.

In a strategic context, there is some work analyzing vertical restraints. These are investigated e.g. by Bonnet et al. (2013) and Bonnet and Réquillart (2013). They find strategic pricing to lead to a price increase of 10% due to a tax on soft drinks.

Finally, there is an abundant literature on pass-through of costs other than taxes. Some of this work builds on firm-specific micro-data, but the majority by large is based on aggregate data. Several aspects such as input substitution, exchange rate pass-through, or more general input price pass-through have been investigated.³ Mostly, these studies derive pass-through of less than one. Nevertheless, depending especially on the curvature of demand, higher pass-through rates are possible, but do not occur often. More specifically, two studies also try to estimate the effect of retail competition on cost pass-through. Besanko et al. (2005) show pass-through elasticities to vary widely for 78 retail product prices when wholesale rebates are granted. They then estimated the influence of the rivals' distances. Ashenfelter et al. (1998) estimated the influence of the presence of Office Depot on Staples pricing. Both found no change in pass-through dependent on competitors' presence. Whereas Borenstein et al. (1997) are amongst the first to estimate asymmetric cost pass-through in gasoline, Verlinda (2008) is the most relevant work in this branch of literature for this study. The author investigates the impact of local competition on asymmetric pass-through of petroleum prices. Asymmetric pricing decreases with

² They derive pass-through values of 0.32 to 7.00. Furthermore, Reny et al. (2012) have shown a formal mistake in equilibria derivation with regard to the asymmetric nature of competition.

³ See for example Peltzman (2000) or Eckert (2013) for fuel and gasoline.

additional competitors and lower distance to the nearest rival. This is indirect evidence, because the author’s analysis refers more to the asymmetry than to the level. Nevertheless, it suggests more cost-based pricing with increasing competition, which would translate into higher pass-through. However, Verlinda does not investigate the impact of tax increases on retail prices.

3.Theory

to be added

4. Data and Industry Background

4.1. Austrian Fuel Tax Reforms

The gasoline market in Austria is ideally suited for studying how the intensity of output market competition affects tax pass-through. There were various changes in the gasoline tax in the period covered by our data, which is the period between January 1st 2007 and 31st of December 2009. In this time span two tax reforms took place. The following table lists tax levels for gasoline and diesel.

Sprit/ab Datum	31.12.2004	01.10.2005	01.07.2007	01.10.2007
Super (2710 11 ..)	417€1000l =41,7 c/l	%	447€1000l =44,7 c/l	475€1000l =47,5 c/l
Diesel (2710 19 ..)	302€1000l =30,2 c/l	325€1000l =32,5 c/l	375€1000l =37,5 c/l	%

The tax changes are significant. The gasoline tax was raised in two steps, from 41.7 cents per litre to 44.7 cents per litre in July 2007 and then to 47.5 cents per litre in October. This corresponds to 3 and 2.8 cents per litre increases summing up to 5.8 cents per litre in total. The diesel tax was increased in a one-off adjustment of 5 cents per litre together with the first of the gasoline tax increases.

A graphical representation of the tax in relation to other retail price components such as the petroleum price or the refinery price index is in Figure 1.

4.2. Austrian Gasoline Sector

Our retail price data includes data of the ÖAMTC, the Austrian automobile association.⁴ The ÖAMTC data consists of station level price data for gasoline and diesel from 1st of January 2007 to 31st of December 2009, which is collected by staff or hired assistants and drivers. The sample contains 2,300 stations. The data is collected at daily to weekly frequency with some blanks for some stations. We decided to use the 300 stations with not more than one weekly price per year missing.

Figure 1 shows the price time series for Brent, the corresponding petroleum product acting as an input for refinement, and a refinery price index for gasoline, called “super” (95 octane), and the gasoline tax development. Moreover, the sum of the last two series, “super+steuer”, as well as the three average retail price time series for monopolists, high competition stations consisting of an equal number of stations with the highest number of competitors, and all stations.

⁴ This is the “Österreichischer Automobil-, Motorrad- und Touring Club” (ÖAMTC). URL: www.oeamtc.at.

Figure 1 shows that monopoly stations have substantially higher prices than average as well as high competition stations. For clarification the difference between the first and the latter is added to the diagram. From visual inspection an increase of the gap between stations of different competitive intensity can be identified. In some of the phases characterized by decreasing input prices a similar effect of increasing price differences between monopoly and high competition stations is observable.

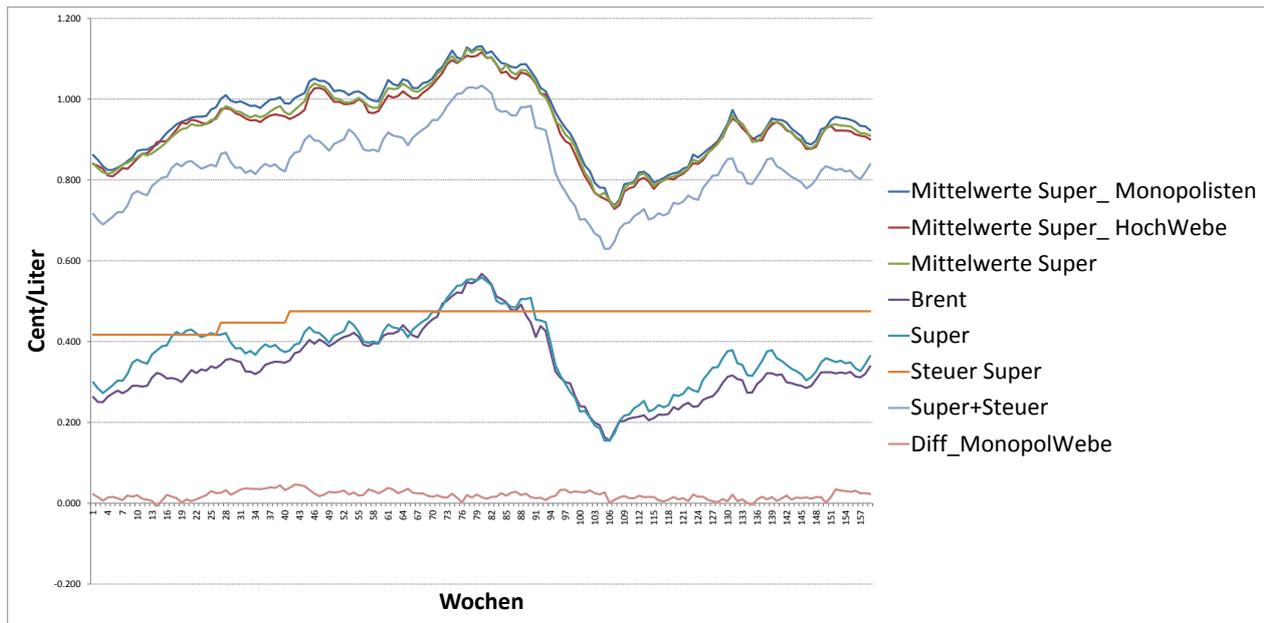


Figure 1: Petroleum prices (Brent), refinery price index (Super), retail prices (average, monopolists and high competition counterparts), specific tax on gasoline; sources: Reuters, Bloomberg, Austrian legislation

4.3. Local Market Definition and Brand Identity

The local markets are defined according to opportunity cost considerations. Average wages per hour in combination with average driving speed on urban and country roads are used to calculate distances a searcher would want to drive to save 5 to 10 cents per litre. For different assumptions a conservative measure would result in radii of 2 and 6 kilometers for urban and rural areas. We also performed sensitivity analysis assuming 0.5 and 1 kilometer (urban/rural) less and more leading to similar results. Moreover, we excluded competitors in rural areas when they belong to the 2 to 6 kilometer circle around the station mirroring that drivers typically do not enter a city after having driven a considerable distance over land only for refueling. Having defined a local market for each of the gasoline stations, the number of competitors can be determined. This approach clearly neglects the endogeneity in the market definition process stemming from customer adaptation to expected gain from search and simultaneous adaptation of stations' price setting. However, the necessary assumption in our context is stationarity of the drivers' and stations' behavior with respect to the one week horizon. We assume this to be reasonable.

(brand identity to be added)

5. The Impact of Competition Intensity on Incidence

The starting point of this empirical study is the impact of competition on average tax incidence. Taxes are supposed to increase prices, but the tax increase is assumed to depend on the degree of competition in the local market. The idea therefore is to simply estimate the impact price rise in different periods of the input and retail price time series.

The analysis of the underlying single price time series involves the estimation of models in first differences due to the non-stationarity of retail gasoline as well fuel input prices and refinery price indices. Moreover, the equilibrium relationship between retail and input prices requires the estimation of error correction models. The estimation of OLS models would therefore lead to biased and inefficient estimates. The according analysis building on an error correction model is performed in the Appendix, whereas the analysis of this section analogously extended for the estimation with asymmetric pass-through is performed in section 5.

Simply taking the difference between prices of stations in markets with low competitive intensity and those with fierce competition will solve the non-stationarity and equilibrium problems and allows estimating the simple OLS model. In addition, this has the advantage of obtaining a very intuitive model. Taking the difference R_t^D between monopoly price R_t^M and competitive price R_t^W and the identical input refinery price index directly enables us to interpret equality $R_t^D = R_t^M - R_t^W$ as a margin difference.

The simple regression equation then is

$$R_t^D = c + tax1 + tax2 + post_tax2 + \varepsilon_t$$

with c as the constant, $tax1$ and $tax2$ as indicators of the two tax periods defined as the three month period between the first and the second tax reform on 1st of July and 1st of October for $tax1$ and the following three months for the second tax reform for $tax2$. $post_tax2$ defines the period after the second tax increase period. The error term is as usual ε_t . The tax reform indicators therefore measure the markup gasoline stations set in low competition local markets compared to high competition local markets.

In a first regression we define monopoly companies to represent the low competition segment. An equivalent number of firms is chosen from local markets with the highest number of firms. Subsequently, averages of their weekly prices are taken for the regression. The second regression instead uses a more moderate approach to distinguishing the two groups. It includes a low and high competition segment by taking simply the 25 stations with the lowest and highest number of stations respectively in their corresponding local market. Both are estimated with White's robust standard errors.

The monopoly regression shows the clear result of substantial and significant increases in markups in monopoly markets. Monopolist stations have an average markup increase of 2.1 cents per litre over the more competitive ones during the first tax increase period. During the second period this effect decreases, but is still substantial at a level of 1.8 cents per litre.

Table 1: Regression results on difference “monopoly vs. high intensive competition”

Number of obs	=	159
F(3,155)	=	39.24
Prob>F	=	0
R-squared	=	0.3338
Root MSE	=	0.00875

diff_super ^o	Robust Coef.	Std.Err.	t	P> t	[95% Conf. Interv.]
tax1	0.0209	0.0023	9.24	0	0.0164 0.0253
tax2	0.0180	0.0028	6.42	0	0.0125 0.0236
post_tax2	0.0048	0.0018	2.72	0.007	0.0013 0.0083
_cons	0.0131	0.0015	8.52	0	0.0100 0.0161

The more moderate definition of low and high competition segments also shows more moderate regression results. Nevertheless, the margin markups show substantial increases of 1.58 and 1.55 cents per litre during the first and second tax reform period respectively.

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