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Advertising Expenditure and Consumer Prices

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Abstract

This paper studies the effect of a change in the marginal costs of advertising on advertising expenditures of firms and consumer prices across industries. It makes use of a unique policy change that caused a decrease of the taxation on advertising expenditures in parts of Austria and a simultaneous increase in other parts. Advertising expenditures move immediately in the opposite direction to the marginal costs of advertising. Simultaneously the price reaction to advertising is negative in some industries (food, education) and positive in other industries (alcohol, tobacco, transportation, hotels and restaurants), depending on the information content of advertising. The paper reconciles these findings using a model that contains informative and persuasive forces of advertising.

JEL Classifications: H25, M37

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1 Introduction

This paper studies the effect of a change of the marginal costs of advertising on advertising expenditures and consumer prices. It makes use of a policy change in Austria, which affected the marginal costs of advertising, and thus advertising expenditures. While previous works have estimated the impact of advertising on consumer prices for certain goods, this is the first study that investigates the effect of advertising costs on consumer prices for all major industries and representative data for an entire economy. As demonstrated below, advertising increases consumer prices in some industries, and decreases them in others.

There are at least three important reasons why advertising has been of interest to economists: First, advertising has been debated at length in the theoretical economic literature as it is closely tied to the issues of information and search, topics that have taken a prominent place in economic theory in recent decades. Advertising also features in models of entry barriers and product quality. Throughout its long debates advertising has remained a controversial topic, with contradicting policy recommendations, as discussed below. Detailed empirical evidence might be helpful to guide this debate.

Second, advertising itself is an increasingly important business activity. In the United States media advertising accounts for almost 2 percent of GDP, while in Europe typically for about half that number.¹ In Austria, on which this paper focuses, advertising accounted for a share of 0.009 of GDP in 2000. This was a substantial increase from the year 1990, where the share of advertising in GDP was only 0.0061 (see Grohall et al. 2007). Advertising is one of the main sources of revenue for the media industry and the internet but also for cultural and sporting events. Thus greater understanding of advertising is relevant for businesses in all these industries.

Third, the demonstration of the effects of taxation of advertising, which this study provides, meets a recurring policy idea, of which I mention only a few examples: While there are many cities and towns worldwide that tax local advertising, there have also been frequent attempts to introduce an advertising tax at state or national level. In 1987 the Florida legislature enacted a sales tax on a range of services that included advertising. In a heavy storm of protests the advertising tax was attacked as “unfair, unwise and unconstitutional” (Hellerstein 1988), and repealed after only six months of installation. More recently, in Pennsylvania in 2006 the senate discussed a bill (Senate Bill 854) that attempted to introduce a six percent sales tax on advertising in that state, but was not enacted (see Philadelphia Business Journal 2006). In Europe, the Slovak Republic charged a tax on all advertising expenditure which was eliminated

¹The US data counts for the years 2001 to 2004 and was taken from Arkolakis (2008), while European numbers come from Kosmelj and Zabkar (2008).

when Slovakia entered the European Union in 2004. In 2008 the French president discussed the taxation of advertising revenues of private television stations.² Hence despite few actual observations of taxations of advertising at state or national level, it remains a recurring and important political subject, and an idea that is periodically discussed. Almost all countries have laws that ban advertising of certain products like cigarettes or health related products. The introduction of a ban on advertising of certain products may have a similar effect to a substantial increase of an advertising tax.

For this investigation I make use of a policy change in Austria in 2000 that harmonized the regional taxation on advertising expenditure, thus simultaneously increasing it in some parts of the country while reducing it in others. A comparison of advertising expenditures of firms in these two parts shows a strong and sudden impact of the change in advertising costs on advertising expenditures, that is similar in magnitude across products from different industries. To investigate the change of consumer prices I complement this data on advertising expenditures with regional price indexes, and show that also consumer prices were immediately affected, but differently across industries.

Throughout the debate advertising has remained a controversial topic: Some economists have argued that there are excessive amounts of advertising, which therefore may be a good target for taxation, while others have suggested that underprovision of advertising might provide a case for a subsidy.³ The main cause of this different advice has been identified to be that advertising can be seen as *persuasive* or as *informative* (see Bagwell 2007). Butters (1977) defines these two views as “advertising as a set of psychological ploys which induce consumers to buy products or brands that they otherwise would not buy”, or as “a provision of information which allows consumers to make more discriminating choices within the framework of a fixed set of preferences.” This distinction, however, goes further back at least to the work of Alfred Marshall (1919) who defined similar categories with the names of combative and constructive advertising. The persuasive view of advertising typically sees changes in preferences in the form of an outward shift of demand, a decrease of elasticities of substitution between products, or increased monopoly power of firms, and thus increasing market prices, while the informative view sees increased information for consumers, stronger competition and thus lower market prices. A closely related distinction was brought forward by Johnson and Myatt (2006), who call the two types of advertising hype and real information.

²See the article *Sarkozy's vision of a 'BBC' for France* by Ben Hall in the Financial Times of January 8, 2008.

³Some examples of viewpoints among many others: Pigou suggested a tax on advertising in 1929, in addition Dixit and Norman (1978) have argued for the possible presence of excessive amounts of advertising. Stivers and Tremblay (2005) present the case for a subsidy. Meurer and Stahl (1994) and Stegeman (1991) present models that can have both outcomes.

An extreme example of the persuasive view was sketched by Pigou (1929) who wrote: “It may happen that the expenditures on advertisement made by competing monopolists simply neutralise one another, and leave the industrial position exactly as it would have been if neither had expended anything. For clearly, if each of two rivals makes equal efforts to attract the favor of the public away from the other, the total result is the same as it would have been if neither had made any effort.” This view might have been what Marshall had in mind when naming persuasive advertising ‘combative advertising’. Similar views on advertising have been expressed by Kaldor (1950) who asserts a harmful effect of advertising and suggests the introduction of a tax on advertising. Further, Sutton (1974) makes the distinction between generated sales from advertising and diverting sales from advertising, where the described case would be encountered if there were only diverted and no generated sales. Finally, Gasmi et al. (1992) suggest that the advertising game between Pepsi and Coca Cola is a predatory competition that hardly serves to generate sales.

By the other view, advertising might serve as a transporter of information. This idea has been formalized in models closely linked to the large literature on consumer search, but rather than consumers searching for products, firms search for consumers via advertising. Here advertising provides useful information to consumers such as the existence, the quality, or the price of a good, see for example Butters (1977), Stahl (1989), or Grossman and Shapiro (1984). In these models advertising expenditure has a marginal effect on a firm’s demand that will correspond to the marginal advertising cost it faces. Therefore a change of the cost function will likely change advertising expenditure, and thus demand. It follows that in these models the taxation of advertising has in general a clear effect on firm variables. More advertising increases competition and thus lowers prices. As demonstrated by Stahl (1989), in these models a subsidy for advertising might be desirable.⁴ A model of this class is provided below.

In this article I show that both these effects, the informative and the persuasive effect of advertising, are present in some industries to a varying degree. This variation may help to distinguish different working mechanisms of advertising.⁵ In the theoretical part I show that many existing theories of advertising are not consistent with the empirical observations. However, I create a model by adding a persuasive element to an existing model of information that is consistent with the observations. If both forces (persuasion and information) are present in a single model, the effect of a cost reduction of advertising on consumer prices is not clear, and depends on which effect dominates. This model can explain why an increase of the marginal cost of adver-

⁴Grossman and Shapiro (1984) argue however that in the case of differentiated products advertising can lead to an inflation of the number of firms, which would not suggest the case for subsidy.

⁵Akerberg (2001) argues that advertising that provides product information can be distinguished, as it should only attract consumers that are inexperienced with the brand. This is however a different definition of informational advertising as used in the mentioned model, which solely concerns price information.

tising causes prices to increase in industries with more informative advertising, and to decrease otherwise.

This paper proceeds as follows: Section 2 describes the data and empirical strategy used to estimate the effects of a change in marginal advertising costs on advertising expenditures and consumer prices, Section 3 presents the main empirical results, Section 4 shows that most current models of advertising are not consistent with the presented observations, and develops a model that is by combining the informative and persuasive views on advertising. Section 5 concludes.

2 Empirical strategy and data

The empirical investigation relies on a policy change of the tax on advertising in Austria in 2000. Austria is one of the few countries in the world, and the only OECD country that collects a nationwide tax on advertising. The tax is officially called ‘Werbeabgabe’, and locally referred to as ‘Werbesteuer’. It covers advertising for goods and services from all industries. A constant fraction of advertising expenditure that a firm pays to the media has to be paid by the advertising firm to the authorities as advertising tax. There are only few companies or publications that are excused from paying the tax, such as advertising expenditure for content in student run school magazines or the advertising of churches and benevolent non-profit organizations. The tax includes all television and radio spots, advertisements in newspapers and magazines, and expenditure for all other publicly displayed advertisements (for more details see Grohall et al. 2007).

The advertising tax was introduced in 1927, and has remained in existence ever since without interruption. Until the year 2000 it was collected at regional level with different tax systems in different regions, whereby the location of the publication in which the advertising appears determines the payable tax. The states Tirol and Burgenland⁶ did not collect any advertising tax. The amount payable in the other provinces was typically ten percent of advertising expenditure. In the state of Salzburg the tax was only collected in the city of Salzburg, and the state Vorarlberg had a tax of only five percent (see Bundesgesetzblatt 2000 and VÖZ (1995)). At the national level, at which the large majority of firms operate and most advertisements are made, the tax was ten percent.

After a change of the law, which took effect on June 1st 2000, the tax has been collected at the national level, with an overall tax of 5 percent (WKO 2002) for national, regional and local

⁶Throughout I refer to the nine regional units of Austria as states. In other publications they may be referred to as provinces or regions. I use the original German names of these States.

advertisers alike. Hence the year 2000 brought about an increase of the advertising tax on local advertisements from zero to five percent for local advertisers in the states of Tirol and Burgenland, while most of the other states and for nation-wide advertisers the tax rate dropped from ten to five percent. For a more detailed legal description of the tax before and after the policy change see the legal description, Bundesgesetzblatt (2000). The map in Figure 1 shows a map of Austria and highlights the tax changes. In the following empirical analysis I omit the states Vorarlberg and Salzburg to get two sets of groups with the same treatment for each element.

Two common sets of critiques of differences-in-differences estimates relate to possible endogeneity of selection of the treated group and the timing of the shock. First, since in the present case the policy was of a unifying nature, the difference between the treatment and control group emerges from the prior decisions of Tirol and Burgenland not to install a tax on advertising. This difference, and thus the treatment group selection, dates back to the year 1927 when these states considered the matter differently from the rest of the country. Between the years 1927 and 2000, the First Republic under which the law was established was replaced with a home made dictatorship, then under German rule, after which the country was occupied by the allies after whose return the current Second Republic was installed. In addition the country experienced the great depression, the Second World War, several changes of currency and membership of the European Union. Hence there is reason to assume that the economic differences that influenced the political process asymmetrically then, such as for example a more influential lobby of the media in some regions, are not present in the same way today.

Secondly it may be argued that the control and treatment group in the presented experiment are not comparable, since they lived under different tax regimes prior to the policy change and might have selected themselves into the more suitable one. There are several answers to this: (a) the tax studied concerns a small fraction of firm expenditures, and the tax difference between Tirol and the other states itself concerns only a fraction of that fraction. Hence this factor is probably a minor consideration for many firms facing their location decision; (b) in the regressions concerning advertising expenditure the sample is restricted to businesses that advertise in one state only. Since Austrian states are small (the median populated state Tirol had less than 700,000 inhabitants in 2000) a regression that only involves local advertisers concerns for the most part small local businesses whose location decision often goes back to the birthplace of its founder; (c) I provide a robustness check of within firm reallocation of advertising expenditures, which controls for firm differences. In this specification the treatment and control groups consist of the same firms, and thus do not allow for a selection bias. Further, Austrian states are small in international comparison and less important policy makers than states in other countries. For example, states do not collect income taxes and receive most of

their budget and policies from the Austrian national government.

The timing of the policy would invalidate the estimation if it were chosen with considerations that favor one of the two groups, or if it was anticipated. The report of the finance committee of the Austrian parliament, which drafted the law and suggested the change, lists the following reasons for its decision to harmonize the taxation of advertising across states (see *Bundesgesetzblatt* 2000): They refer to the lengthy debate about the usefulness of such a tax in the country, they list administrative complications for trans-state businesses due to the different tax regimes, and call for a general harmonization of taxes to avoid tax competition (although they do not see any signs of such a tax competition taking place, in fact there has been remarkably little adjustment). The minutes of the discussion of the corresponding parliamentary subgroup show that there was a less general, and quite particular cause for the timing of the initiative: A decision of the constitutional court of Austria from the year 1998 ruled that each local authority may only tax the advertising value generated on its territory, even in the case of radio stations. As apparent from the minutes, this decision made the collection of the tax practically impossible. In turn parliament felt that the law had to be adjusted. None of these reasons suggests that the timing of the harmonization was chosen in a way that would benefit a particular state. Before the harmonization there was a recurring demand from the chamber of commerce and some journalists to abolish the tax altogether, but no political party or representative took the matter into their program. Thus there was no reason to anticipate the harmonization for the year stated.

Another circumstance that would invalidate the natural experiment would be if Tirol and Burgenland were simultaneously effected by an important other shock that drives or biases the results. I check the archives of several national and international newspapers to see if Tirol or Burgenland were mentioned significantly more often in 2000 than in the other years of the sample. This was not the case in the archives of the *Economist*, the *New York Times* (which has been used in economic studies before to indicate importance of events, see Kuziemko, Werker 2006), the *Wirtschaftsblatt*, the only Austrian daily that is primarily interested in economic matters, and *Die Zeit*, a German newspaper that reports frequently on Austrian events. Similar tables for the control group states also do not show an unusual frequency of mentioning of either state in the year 2000. Similarly, incomes were comparable between treatment and control group: with a GDP per capita of 26,300 Euro, Tirol was the fourth richest state in Austria in 2000, a position it had in all prior years of the sample (ie. back to 1995), and much smaller Burgenland was the poorest state.⁷ Estimations along the lines of equation 1 did not suggest that any state experienced a break in its time trend of income in 2000.

The data on advertising expenditures comes from “FOCUS Research & Consulting Austria” (see

⁷Source of regional GDP data: Statistik Austria online database.

Focus 2008). This company measures square centimeters and seconds of advertisements in TV and radio stations as well as newspapers and magazines. Using the advertising price lists of these publications, they can estimate the advertising expenditures of firms. The company supplied me with their complete dataset from 1995 to 2005, which records advertising expenditure per firm, year, medium and industry. Further they provided the area where the publication in question is available, and an industry classification for the advertising company.

This dataset does not include all publications available in Austria, but with over 400 news providers all major ones and a wide range of small local magazines. Table 1 reports by state the number of regional advertisements recorded, the number of regional media (typically local newspapers, here only shown if they are exclusive to one state), the log average cost of an advertisement and the number of firms advertising in each of these mediums. In total, the dataset contains about 700,000 advertisements for the period considered. Table 1 shows that in terms of firms per medium and average advertising expenditures the values for the treatment state Tirol do not differ widely from the other states. In terms of the number of advertisements and regional media the treatment state Tirol is at the top of the distribution, together with Steiermark. The relatively high number of regional media in Tirol in this sample is most likely due to geographical reasons. Since Tirol shares only a small fraction of its border with other Austrian states, other states have more trans-state advertisers. Burgenland has less firms per publication, and comes last in terms of GDP per capita. I verify that qualitatively all the results provided are robust to the exclusion of Burgenland from the sample.

One of the disadvantages of the data is that it contains little information on each of the advertising firms and hence does not allow for the inclusion of many control variables. I could not find a useful data source with information on small Austrian firms that I could match. Further the restrictions of the available data led me to analyze the effect on advertising expenditures and consumer prices in separate datasets, and not a unified two stage regression. In its broad collection of advertisements that include small local businesses from all kinds of industries comparable over a long period of time, the FOCUS dataset is unique in Austria.

The analysis of consumer prices relies on two different datasets provided by the Austrian statistical office (Statistik Austria). They provide price indexes for twelve different industries and their subcategories, classified by the COICOP (Classification of Individual Consumption According to Purpose) system of classification from the UN, on a state level and over the period from 1997 to 2003. The disadvantage of this classification is that it is not fine enough to distinguish individual products, and only informs about four digit product groups. Its advantage is that it spans the complete universe of consumer products in Austria, and is perfectly comparable across states in different years. It is the finest aggregation of products for which the Statistik Austria was willing to share its complete data. In addition, Statistik Austria provided

me with a selection of 40 randomly selected individual products at the most detailed level in different states in the same panel.

Figure 3 displays prices of goods for the main COICOP groups for Tirol and Burgenland and the mean price for that good for the remaining six states in Austria, with Salzburg and Vorarlberg omitted. There is no state-level variation in the prices for communication (COICOP two-digit item 8), which does not vary at state level, as the national mail and the phone companies all operate nation wide with the same prices. This category is excluded from the estimation. Typically I estimate a differences-in-differences equation of the following type:

$$y_{it} = Post_t\beta_1 + Treat_i\beta_2 + Post_t * Treat_i * \beta_3 + \epsilon_{it}. \quad (1)$$

In this equation, *Post* is a variable that takes a value of one for the year of 2003 and a value of zero in the year 1997, *Treat* is a dummy variable that indicates the firms advertising in the states of Tirol and Burgenland, and the interaction *Post * Treat* gives the differences-in-differences coefficient of interest. In the regressions robust standard errors are clustered by state. Although the used data is a panel with many time dimensions, I typically focus on the year three years before and the year three years after the treatment (the years 1997 and 2003) to avoid correlation of errors in the regression, which is a concern in differences-in-differences estimations with repeated time periods (see Bertrand et al. (2004)). Some robustness checks with more complete panels and other years are provided.

3 Results

Effect on advertising expenditures

First I analyze how the growth rate of advertising expenditures reacted to the introduction of the tax. Given that the treatment differs at state level, I only use local advertisers, defined as firms that advertise in one state only. Since most advertising in Austria is at the national level or across more than one state, this restriction reduces the number of observations in the dataset to less than ten percent. In addition I only use firms that have positive advertising expenditures in all eleven years of the panel from 1995 to 2005 to obtain a balanced panel. The resulting dataset consists of 877 observations in the provinces of Tirol and Burgenland and 1,120 in the other provinces, and includes a complete panel of total advertising expenditure for each of these firms and each year. The data reports the expenditures as they arrive at the publications, and thus reports the expenditure net of taxes.

In order to normalize advertising expenditures I compute the growth rates of advertising ex-

penditure for each of the remaining firms. Figure 2 shows the mean growth rates of advertising expenditure for the two subsamples of Tirol and Burgenland where the tax increased and other states where the tax decreased, and the 95 percent confidence intervals of these mean growth rates. These are estimated using information on the coefficients from a regression of advertising expenditure on year fixed effects using robust standard errors clustered by industry. To limit the influence of outliers, the one percent highest and lowest growth are excluded from the graph.

Figure 2 shows a higher growth rate of advertising expenditures outside of Tirol and Burgenland in the year 2000, which is the year in which the tax was implemented. In all other years the mean growth rates of advertising expenditures are not significantly different at five percent level of significance. Table 2 provides p-values from a two sided test of the equality of these growth rates. As in the graph, the test only suggests a difference in the year 2000 with a p-value of 0.03 in the two sided test, while in all other years the p-values of a simple test of differences of means are above 0.05 and also above 0.1. The jump of growth rate in 2000 is the largest change of growth rate visible in the graph, the second biggest does not reach half its magnitude. These results provide evidence that the change in advertising costs led to an immediate strong increase of advertising expenditures in the states where advertising became less costly on average.

As a placebo test to this simple difference of means, I replace the treatment state with each of the other six states of Austria (absent Salzburg and Vorarlberg), and rerun the exercise for all these eight states and nine years, omitting in addition Tirol and Burgenland. These p-values from a test for the difference of means are reported in the right panel of Table 2. In the placebo table there is no difference significance at one percent level, and two that are significant at five percent level. Forty p-values from random data are expected to deliver two values below 0.05.

Figure 2 suggests that the difference of growth rates of advertising expenditures as received by the media between states is 25 percent. This difference is the largest mean difference between the two groups observed in all the data. If firm expenditures are estimated this difference is less, since those firms that increased their expenditures also had to pay fewer taxes. If the 9.5 percent⁸ tax difference is accounted for, a 9.5 percent cost difference resulted in a 15.5 percent difference of advertising expenditures. Thus on average the estimates suggest that a one percent increase of advertising costs results in a 1.6 percent reduction of advertising expenditure, conditional on firms not exiting from the advertising markets. This is the estimate of the elasticity of advertising expenditures with respect to marginal advertising costs.

One concern is that despite the selection of surviving firms only in the previous exercise, they

⁸Tirol and Burgenland experienced a five percent increase of costs from one to 1.05, and the other states a decrease of 4.5 percent from 1.1 to 1.05.

might be affected differently by the unequal exit of other firms. Exit from advertising is an extreme form of advertising reduction. However, the presented results are robust qualitatively and quantitatively when the sample is restricted to those industries in which I do not find significant evidence for increased exit of firms. Again the only significant difference of mean growth rates is observed in the year 2000, and in this reduced panel it is 26 percent. The table that indicates the exit probabilities across industries is available on request.

To see how the effect differs across industries I provide estimates from a differences-in-differences regression as described in equation 1 in the upper part of Table 3. I focus on one year three years before and the one three years after the treatment (the years 1997 and 2003), which is the most conservative strategy to address the problem of auto-correlation of errors in the regression (see Bertrand et al. 2004). I use only firms that are present with positive advertising expenditure in both these years. Further I use only advertisers that advertise in a single state in order to compare small local firms. The industry classification is taken from the advertising expenditure dataset and similar to the one constructed by its supplier. I only provide results for industries with at least 30 overall observations. I include state fixed effects in all regressions. There is evidence for a significant reduction of advertising expenditures in Tirol and Burgenland for some industries. All coefficients that differ significantly from zero at a ten percent level of significance show a negative coefficient in the interaction of post and treat, and also the overall mean effect is negative and significantly different from zero.

Additional evidence comes from the analysis of within firm reallocation. For this exercise I again observe only firms that have positive advertising expenditures in both the years 1997 and 2003 in Tirol or Burgenland and at least one other state. For each firm I aggregate all advertising in states outside Tirol and Burgenland. Thus for the regression there remains a sample with four advertising expenditure observations per firm (within and outside of Tirol in the years 1997 and 2003). This estimation strategy can provide robustness with respect to a possible selection effect, since in this specification the treatment and the control group consist of different advertising expenditures of the same firms. In addition, this estimation provides typically more observations since most of the firms in Austria advertise in more than one state. Using this sample I estimate in OLS a differences-in-differences regression using again robust standard errors, and in this exercise firm fixed effects. The results are reported in the second part of Table 3. There is stronger evidence for a reduction of advertising expenditures in Tirol within firms overall, and for all industries except tourism, coefficients do not vary strongly across industries. In this part of the panel I can not cluster standard errors by state, since I pool different states for each remaining firm.

In addition I verify if these expenditures correlate with advertising intensity of industries, but find no evidence for such a correlation. A related question is if the relative number of newspapers

declined with the advertising tax. The answer is that the number of publications remained very stable in treatment and control states alike, and I did not find any evidence for a differential effect. All these results are available on request.

Taken together, these results suggest that the increase of advertising costs indeed caused a decrease of advertising expenditures across almost all industries, and to the opposite effect in no industry. Many of the views on advertising described in the literature section of this article would not predict such an adjustment of expenditures. The within-firm results give similar coefficients for different industries, and suggest that the reallocation is of similar magnitude in different industries.

Prices

In the literature there exists some evidence of how advertising affects prices. In particular, several studies make use of bans of advertising in certain areas for particular goods. They found that advertising seems to decrease prices for eyeglasses (Kwoka 1984), children's breakfast cereal (Clark 2007), and drugs (Cody 1976), among others. Milyo and Waldfogel (1999) present evidence that advertising decreases the price of advertised goods in liquor stores, while it increases the price of non advertised goods in the same stores. On the other hand, Gallet and Euzenet (2002) suggest that advertising to sales ratios have a positive effect on the supply price in the brewing industry.⁹

Again the estimation follows the common differences-in-differences approach, following equation 1. To avoid autocorrelation in the errors I use one observation per time period and unit, the mean price for each state and industry for the years 1997 to 1999 for the pre-treatment effect, and the mean for 2001 to 2003 for the post-treatment measure. Table 4 reports the estimates for all COICOP class 1 industries, except communication which does not vary at state level. To increase the number of observations I use the most disaggregated level for which I can access price information (typically this is on COICOP class 3 level), so that sub categories for industries are used. In these regressions I apply state fixed effects and cluster robust standard errors by state. This table confirms what is observable in graph 3: There is evidence that prices increased in the industries food and education, while they decreased for alcohol and tobacco, transport, hotels and restaurants.

The overall effect is estimated in Table 5. Again these estimates suggest an increase of prices in Tirol and Burgenland, however with a possible delay. The differential coefficient is positive, but not significant when the years 1999-2001 are compared. It remains at a similar magnitude for the years 1999-2002, 1999-2003 and 1999-2004, but increases in significance. Columns six and seven provide two placebo estimates for the periods before and after the treatment (1995-1997

⁹In a related earlier study Gisser (1999) found no significant relationship in the same industry.

and 2003-2005) and show no differential treatment effect.

The differential treatment effect that I study appears strictly at regional level. Advertising at the national level experienced a reduction of the tax on advertising from 10 to 5 percent. This reduction however is similar for national advertisers in the treatment and control states. The treatment is thus stronger in industries in which the share of local advertising is higher, and price effects can be expected to be larger as well. I compute the share of local advertising for each industry from the Focus data, and plot it against the marginal price effects in figure 5. The left panel shows the absolute value of the differential coefficients from table 4, and the right panel shows COICOP category 2 prices for which I found matching industries in the Focus data. See Appendix 2 for details on the match. In both panels there is a strong positive correlation between the share of local advertisers, and the price response.

One concern is that the prices at industry level, which are aggregations, may be too broad to cover the true effects. Statistics Austria generally does not give access to its data on prices of individual goods, but they agreed to provide me with a small random sample to perform a robustness check. I asked for prices that are comparable across states, from products that may be sold by small local businesses. They provided me with 40 such prices at the most disaggregated available level. Examples of these units are *beefsteak in a restaurant*, an *hour of a car mechanic* or a *car wash*. Some of these panel series are incomplete, with missing states or missing years. I drop these products, and in table 6 I reproduce the same regressions as on industry level using these detailed prices. As is apparent, the tables give the same signs as prices at industry level on the differential effect. However, the number of observations is lower, which sometimes may be the reason for lower statistical significance. This robustness check gives some evidence that the aggregate price indices behave similar to the goods that they consist of in this exercise.

Persuasive and informative advertising industries

The observed differences of the behavior of consumer prices across industries points to possible differences of the parameters across industries. Consumers may be more easily persuaded to buy certain products such as alcohol and tobacco than to buy certain food. In an industry in which persuasion is not easy, advertising content focuses on the informative aspect of advertising, while industries with persuasive potential will make efforts to put additional elements into their advertisings.

As discussed in the introduction and as illustrated in the model section below, the model predicts a positive relationship between industries in which advertising leads to a price increase, and the persuasive content of advertising. To test this prediction I rely on a study from the marketing literature that provides a meta-analysis of the information intensity in advertisings

from different industries (Abernethy and Franke 1996, Table 2). In their article they summarize the findings from 60 studies that measure information content of advertising. Using the methodology developed by Resnik and Stern (1977), which relies on the count of well defined *information cues*, they give estimates of the information share across industries. I merge their industry with the COICOP industries from the Statistic Austria as far as this was possible with confidence (see Appendix 2). Graph 4 shows a clear positive correlation between the price response to advertising suggested by my estimates in Table 4 and the information content reported by this meta-study. The correlation between the two series is 74 percent, a regression with robust standard errors yields a slope that is significantly different from zero at five percent level of confidence. The slope coefficient of the displayed line is 0.02 with a robust standard error of 0.0077. This suggests that the informative effect of advertising is observed in industries with high information content in advertising.

Summary and magnitudes

These results show a significant relative reduction of advertising expenditures or a more frequent exit from advertising markets in the states of Tirol and Burgenland after they experienced a relative increase of the overall advertising tax and for the large majority of industries. Further, the results highlight a within-firm reallocation of advertising expenditure out of Tirol. While the advertising expenditures react consistently across industries, consumer prices increase for some and decrease for other industries. In particular, there is evidence that prices increased in the industries food, transportation, education and tourism while they decrease for alcohol and tobacco, health, leisure and house and garden.

To find the magnitude of the overall price change, I use the weights for each of the COICOP one digit groups provided by Statistics Austria (2010). The weighted differential growth rates from Table 4 suggest that mean prices in Tirol were about 1 percent higher than in the other states after the introduction of the tax. This suggests that the 9.5 percent difference in marginal advertising costs, or the 25.5 percent difference of advertising expenditures arriving at media, or the 16 percent difference of firm expenditures on advertising resulted in a one percent difference of consumer prices. Note that this mean price is an average of positive and negative growth rates. The effects for certain industries or products can be much higher or lower as apparent from Table 4.

4 Implications for theory

Many existing models of advertising are not consistent with these findings. In this section I will review some of these before modifying an existing model to arrive at a new model that is

consistent with the empirical results.

In the literature there is a class of models of advertising based on the view that advertising expenditure itself may serve as a quality signal. This idea was developed by Nelson (1970, 1974, 1978) and later formalized by Kihlstrom and Riordan (1984) and Milgrom and Roberts (1986). In these models advertising expenditure can serve as a costly signal for quality that can lead to a separating equilibrium of high and low quality firms. By this account, the content or form of advertising is irrelevant. Milgrom and Roberts write: “this type of advertising corresponds to a public burning of money”. This type of model is in contradiction one of the key findings of this paper, the finding that marginal advertising costs influence advertising expenditure. If advertising is equal to public burning of money, the optimal amount of advertising expenditure would remain the same if as a consequence of a tax part of the money is submitted to the government rather than to the flames. This holds true as long as the public is aware of that tax.

Similarly, to view advertising as a prisoner dilemma, or a Bertrand game sketched in the introduction, does not predict that advertising expenditures of firms react with the marginal cost of advertising. By this view, the firm that advertises an amount ϵ more than its competitors captures all or a large share of the consumers. In this model, firms invest in advertising to the limit of their resources. A tax on advertising that affects all firms in the same way does again not change the total advertising expenditure of firms. Hence in this model, like in the quality-signal model, a taxation of advertising generates public revenue without hurting the firms or the consumers.

Schmalensee (1974) derives equilibria in a Cournot model in which advertising serves as an entry barrier (see also Bain 1968 or Cubbin 1981 for papers that consider advertising as entry barrier). This model, which has surprisingly complex and counterintuitive predictions, distinguishes several cases such that a change of the marginal advertising costs may increase or decrease advertising expenditures, and increase or decrease market prices. Thus it is not possible to say anything on the consistency of the presented data with this model, as Schmalensee provides no prediction of advertising expenditures and prices that can be estimated with the data at hand.

The information models of informative advertising (see for example Stahl 1994) typically predict that advertising expenditure decreases with the marginal cost of advertising. However, since they only consider the informative aspect of advertising, they predict that advertising lowers consumer prices. Thus the models can not predict the finding that advertising increases in some industries with low information content in advertising. In these models, a subsidy for advertising would increase welfare.

As shown below, if I extend such a model by a persuasive element I arrive at a model that has both effects, the informative and the persuasive effect of advertising, which is consistent with all the findings from the data. The extension of an informative model with persuasion also addresses another important aspect of these models. In these models advertising solely serves to inform consumers of market prices. In practice however advertising contains much more than just price information. If a persuasive element is added to the model, this criticism is also addressed.¹⁰

Consider a market with $n \geq 2$ firms that produce a good that for the same level of advertising is a perfect substitute with production costs equal to zero. Firms compete by simultaneously choosing prices p_i and advertising expenditures a_i for firm i , taking the behavior from the other firms as given. The measure of advertising expenditure a_i denotes the probability that a given consumer will receive an advertisement of firm i . Therefore by definition $0 \leq a_i \leq 1$. Firms do not know how many advertisements from competitors reach a consumer, thus each consumer has the same probability to receive an advertisement from firm i . The costs of advertising level a_i are given by the cost function $c(a_i)$, which is assumed to be positive for all values $a_i > 0$ and monotonically increasing in a_i . Further I assume that $\lim_{a \rightarrow 0} c'(a) = 0$ and $\lim_{a \rightarrow 1} c'(a) = \infty$ to ensure uniqueness. This assumption plausibly requires that it is nearly costless to inform a very small number of consumers, but very costly to reach every single consumer with advertising.

On the demand side of the market, there is a mass of consumers who wish to purchase one unit of the good at most. The mass of consumers is normalized to one without loss of generality. Consumers receive advertisements which indicate the price at which the advertising firm sells the product. A consumer who does not receive an advertisement does not buy the product, consumers who receive more or equal to one advertisement buy at the lowest price they observe, given this price is below their marginal willingness to pay. This is the information component of advertising as developed by Butters (1977).

To introduce the persuasive element of advertising I built upon the work of Stigler and Becker (1977) who propose to model persuasive advertising by making a distinction between the price as firms see it and the price as it appears to households.¹¹ If firm i charges price p_i for the good and advertises with advertising intensity a_i , consumers will respond to this price subjectively as if it was $\rho_i = p_i/g(a_i)$, where ρ_i is the subjective price as it appears to the household in question and $g(a_i)$ is a monotonically increasing function of the advertising intensity of firm i . The function $g(a)$ maps non-negative advertising expenditures into linear transformations of

¹⁰For empirical evidence on the amount of information in advertising see Anderson and Renault (2006), Abernethy and Butler (1992), Abernethy and Franke (1996).

¹¹Among others, Becker and Murphy (1993) argue that persuasive advertising may serve to shift demand.

prices. Further I assume that the first derivative $g'(a)$ is strictly greater than zero, such that an increase of advertising expenditure makes the subjective price appear smaller to the persuaded consumers. Thus advertising makes consumers more willing to buy the product at a certain price.

It should be noted that in the model derived such an increase of $g(a_i)$ can be interpreted as a higher willingness to pay for the good by a given number of consumers, but also such that the number of potential consumers increases with an increase of a_i . In these models both these views are possible, since in practice a higher level of advertising for a given price leads to an increased demand for the advertised good.

The maximum willingness to pay for each consumer is assumed to be equal to a subjective price of v . If consumers receives no advertisement, or only advertisements suggesting prices $\rho > v$ they do not buy the product. If they receive at least one advertisement that suggests a subjective price ρ smaller or equal to v they buy from the firm with the lowest price.

A similar envelope theorem argument as developed by Stahl (1994) can be applied in the present case to show that in the situation analyzed in equilibrium, the optimal advertising expenditure of a firm will be independent of the consumer price it charges.¹² The convexity assumptions concerning costs ensure that for a firm a unique optimal level of advertising expenditure exists.¹³ This level is similar for all other firms, since they are ex ante identical. I will denote the constant equilibrium advertising expenditure of firms by a . Apart from this ex-ante proposition on the constancy of advertising expenditures, it can be verified ex post that firms do not have an incentive to change their advertising levels if all the other firms advertise the amount a . Equilibrium profits in equation 4 denote the profits for a firm given that all its rivals use advertising amount a and prices from the equilibrium distribution. Since this equation is independent of prices, this equation is maximized with respect to a_i by firm i , and hence firm i will also choose the equilibrium level a of advertising. The equilibrium price distribution is denoted with $F(p)$ which indicates the probability that a firm charges a price lower than p .

The number of goods that firm i can expect to sell is in the case of two firms given by the demand function $D_i = a_i[1 - a + a(1 - F(p_i))]$, in Nash equilibrium it must hold that $a_i = a$ (provided a unique solution for a exists). The terms of this demand function count the consumers that receive advertising from firm i (by definition this is equal to a_i) and not from the rival $(1 - a)$ plus those consumers that receive advertising from both firms, provided that the price of firm

¹²In particular, if the profit function is expressed in terms of ρ instead of p , its form is a special case of the general form analyzed by Stahl. Some empirical evidence on this finding was presented by Caves and Greene (1999) who found that advertising does not serve as an indicator of quality.

¹³Note from equation 2 that maximization with respect to a_i gives the equilibrium condition that marginal costs of advertising equal a constant.

i is lower. In the case of n firms this demand can be generalized and is characterized by the polynomial $D_i = a_i[1 - aF(p_i)]^{n-1}$. Then expected profits of firm i , denoted by $E(\Pi_i)$ are given by:

$$E[\Pi_i(p_i, a_i)] = a_i E([1 - aF(p_i)]^{n-1})p_i - c(a_i) \quad (2)$$

At any point of the equilibrium price distribution of consumer prices the expected profits must be the same. In equilibrium the upper bound of the price distribution is the marginal willingness of consumers to pay $vg(a)$ (see Varian 1980). The price distribution must be continuous since any breakpoint could be profitably undercut. At a price at the upper bound of the distribution the probability of another price being lower $F(p)$ must be one. Expected equilibrium profits at this point can be derived straight forwardly and are given in equation 4.

The equilibrium price distribution $F(p)$ is then derived from equating the profit function of the upper bound with expected profits. Equating profits at the upper bound of the price distribution with expected profits while setting $F(p_i) = 0$ (since at the lower bound prices can't be undercut) yields the lower bound of the equilibrium price distribution. Thus the equilibrium price distribution is given by:

$$F(p) = \begin{cases} 1 & \text{if } p \geq vg(a) \\ \frac{1}{a} \left[1 - (1 - a) \left(\frac{vg(a)}{p} \right)^{\frac{1}{n-1}} \right] & \text{if } (1 - a)^{n-1}vg(a) < p < vg(a) \\ 0 & \text{if } p \leq (1 - a)^{n-1}vg(a) \end{cases} \quad (3)$$

The expected equilibrium profits of each firm are:

$$E(\Pi_i) = E(a_i(1 - a)^{n-1}vg(a_i) - c(a_i)), \quad (4)$$

Given symmetry, in equilibrium it holds that $a_i = a$. The main difference with respect to the model of Butters (1977) and Stahl (1994) (apart from the explicit functional form on demand I assume) is the introduction of the persuasive element $vg(a)$. Thus also the results so far are largely similar; without the inclusion of the persuasive element the equation would be the same. Equilibrium advertising expenditures as derived in equation 4 are indeed independent of consumer prices. The expected value of prices is given by:

$$E(p) = \frac{(1 - a)vg(a)}{(n - 2)a} (1 - (1 - a)^{n-2}). \quad (5)$$

Consider the introduction of an advertising tax which transforms the cost function of firms from $c(a)$ to $c(a^t)(1+t)$, where a^t denotes advertising expenditures under taxation. The advertising tax considered in the empirical analysis in this paper works in a similar fashion, since it is calculated as a constant share of all advertising expenditure of a firm.

- *Proposition 1: In equilibrium $\partial a/\partial t < 0$. The introduction of a proportional tax on advertising expenditure decreases advertising expenditure. See appendix 1 for a proof.*

Proposition 1 holds in the extended model that includes the persuasive $g(a)$ term, but it is also observed in previous models which do not incorporate a persuasive element. A difference between these models emerges however when prices are considered:

- *Proposition 2: In equilibrium $\partial p/\partial a$ may be positive or negative depending on the parameters and the location on the price distribution. Advertising will increase market prices in industries where persuasive forces dominate, and decrease them where informative forces dominate. While the upper end of the price distribution increases with an increase of the equilibrium advertising expenditure a , the lower end of the price distribution and the expected value of prices may increase or decrease.*

Proof: First consider the model that does not have the persuasive element represented by the $g(a)$ term. In this version the derivative of the price distribution with respect to a is given by:

$$\frac{\partial F(p)}{\partial a} = \frac{1}{a^2} \left[-1 + \left(\frac{v}{p} \right)^{\frac{1}{n-1}} \right].$$

Since in this model v is the maximum willingness to pay and hence the maximum observed consumer price, it will hold that $p \leq v$. The derivative above must be greater or equal to zero. $F(p)$ denotes the probability to observe a price lower than p , hence if $F(p)$ increases for a given value of p , this suggests a decrease of prices. Higher advertising expenditure increases competition and thus decreases prices in this purely informational model. In the model extended by $g(a)$ however the partial derivative becomes:

$$\frac{\partial F(p)}{\partial a} = \frac{1}{a^2} \left[-1 + \left(\frac{vg(a)}{p} \right)^{\frac{1}{n-1}} \left[1 - \frac{a(1-a)g'(a)}{(n-1)g(a)} \right] \right].$$

The term $(vg(a)/p)^{\frac{1}{n-1}}$ is greater or equal to one since $p \leq v(g(a))$, the term $[1 - a(1-a)g'(a)/[(n-1)g(a)]]$ is smaller than one since all the components of its second term are positive. Note that at the upper bound of the price distribution where $p = vg(a)$ this partial derivative

is negative. Hence the upper bound of the price distribution increases with higher advertising expenditures for all parameters of the model. This is due to the persuasive element that increases the maximum willingness of consumers to pay with advertising.

Prices at the lower bound of the price distribution where $p = (1 - a)^{n-1}vg(a)$ will increase if $(n - 1)g(a) < g'(a)(1 - a)$, and decrease or remain the same otherwise. Hence at the lower bound prices are more likely to decrease for a large number of firms n , or a small opportunity to persuade consumers (small $g'(a)$). In these markets the price distribution widens with advertising. An example of a price distribution in this case is demonstrated in figure 6, which shows price distributions for simulated data with varying equilibrium advertising expenditures. Markets are parametrically possible where all prices increase (in the sense that the values on the cumulative density function of prices becomes less or equal at all feasible prices).

From equation 5 follows that the expected value of prices will increase in the equilibrium advertising expenditure a if and only if:

$$a(1 - a) \left[\frac{g'(a)}{g(a)} (1 - (1 - a)^{n-2}) + (n - 2)(1 - a)^{n-3} \right] > 1 - (1 - a)^{n-2}. \quad (6)$$

For a level of advertising expenditure close to zero this inequality will not hold, and an increase of advertising expenditure will decrease the expected value of prices. Note that even in the case of a large number of firms the expected value of prices may increase or decrease; given a large number of firms it will increase if

$$a(1 - a)g'(a) > g(a). \quad (7)$$

This suggests that in markets with a large number of competitors and either very low or very high initial equilibrium levels of advertising, an increase of advertising expenditures decreases consumer prices. At intermediate levels of advertising the $g(a)$ function determines if prices increase or decrease with advertising expenditures. If persuasion is strongly possible (represented by a large $g'(a)/g(a)$) prices are likely to increase with advertising expenditures. This provides another testable implication: Industries with a large ratio of $g'(a)/g(a)$ are expected to have more persuasive elements in their advertising (since industries in which persuasion does not work focus on information), and also to have a stronger positive reaction of prices. Below I will show that such a relationship indeed exists in the data.

Given that this model uses changing preferences, it is not straight forward to analyze welfare generally. Profits decrease in equilibrium with an increase of equilibrium advertising, which follows straight forwardly from the first derivative of equation 4 in combination with Appendix

1.

This model provides a unified framework to study both forces of advertising (information and persuasion) simultaneously at work. It is consistent with the empirical findings in four respects. (1) An increase of the marginal costs of advertising leads to a decrease of advertising expenditures. (2) Consumer prices may increase or decrease with advertising. (3) Industries where consumer prices increase with advertising are industries in which advertising has a large persuasive function, and (4) it has an informative function otherwise. This suggests that the information content of advertising should be correlated with the marginal price reaction, as shown in the previous section.

5 Conclusion

A policy which involved a change of the taxation of advertising is used to estimate across industries how advertising costs affect advertising expenditure and consumer prices. The data suggests that the proportional taxation of advertising expenditure is an effective policy to reduce advertising; I estimate that a one percent increase of the marginal tax of advertising decreases advertising expenditure by 1.6 percent, and there is significant evidence of reduction across all industries.

On the basis of a theoretical model I show that in principle prices may increase or decrease with advertising, depending on whether persuasive or informative forces dominate in an industry. The estimation results suggest that informative forces, which decrease prices with advertising, dominate in the industries food and education; while persuasive forces that increase consumer prices with advertising seem to dominate in the industries of alcohol and tobacco, transportation, hotels and restaurants.

Thus there is a case to restrict advertising in these latter industries – and in fact many countries already restrict advertisements for alcohol and tobacco. As shown, a proportional tax on advertising expenditure is a useful policy tool to achieve that goal. Overall however, the informative forces seem to dominate. I estimate that a ten percent increase of advertising tax leads to a 0.5 percent increase across consumer prices. Thus a complete abolition of the five percent advertising tax in Austria would lead to an overall increase in competition and lower consumer prices by about 0.25 percentage points. This effect however would differ across industries as described.

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Appendix 1

Proof of Proposition 1:

For a single firm it is straight forward to show that given the advertising expenditures of its competitors an increase of advertising costs decreases its advertising expenditures. This is less trivial for the equilibrium a in Nash equilibrium. Note first that if a solution to the optimal amount of advertising exists, it can't be the boundary solution of $a = 1$, since from equation 4 all firms would make losses at this level of a . Thus if an equilibrium solution with $a > 0$ exists, it must be an interior solution, and fulfill the following first and second order equilibrium conditions:

$$FOC = 0 \Leftrightarrow v(1-a)^{n-1}(ag(a))' = c'(a)(1+t)$$

$$SOC \leq 0 \Leftrightarrow v(1-a)^{n-1}(ag(a))'' \leq c''(a)(1+t)$$

The term $(1+t)$ on the right hand side denotes the tax on advertising. Let us consider the introduction of a marginal tax on advertising, an increase of t from 0 to ϵ . Rewriting the first order condition:

$$\frac{v(1-a^t)^{n-1}(a^t g(a^t))'}{c'(a^t)} = (1+t).$$

Before the introduction of the tax, the numerator and denominator on the left hand side have the same value. Proposition 1 states that a decrease of a would increase the left hand side to make the equation hold in the new equilibrium for an increased right hand side. To show is that in equilibrium the partial derivative of the left hand side of the equation above with respect to a is smaller than zero. This condition to be proven is:

$$\frac{[v(1-a^t)^{n-1}(a^t g(a^t))']' c'(a) - v(1-a^t)^{n-1}(a^t g(a^t))' c''(a)}{(c'(a))^2} < 0$$

From the first order condition, and given that we analyze the case where t is shifted from 0 to ϵ close to zero, follows that $c'(a) = v(1-a^t)^{n-1}(a^t g(a^t))'$ in the neighborhood of $t = 0$. This simplifies the condition above to:

$$(1-a)^{n-1}(ag(a))''v - (n-1)(1-a)^{n-2}(ag(a))'v < c''(a).$$

The term $(1 - a)^{n-1}(ag(a))''v$ must be smaller or equal to $c''(a)$ by the second order condition. The term $-(n - 1)(1 - a)^{n-2}(ag(a))'v$ is less than zero since all its components are positive. Thus the equation above must hold for all feasible equilibria, the left hand side decreases in a , thus a decrease in a is needed to balance the increase of taxes on the right hand side, and hence an increase of the marginal costs of advertising decreases the equilibrium advertising expenditure.

Appendix 2

In this appendix I provide details of how I link the industries in the COICOP classification from the Statistics Austria with the industries from Abernethy and Franke (1996) (from here on abbreviated as AF), Table 2 on page 10. Since the AF industries do not follow a standard classification, I have to link them based on the name. COICOP subgroup levels are matched with the most fitting industry. Then I compute for each industry a weighted mean of information values, the weights were taken from the price index baskets provided by Statistics Austria (2010). The categories of *food* and *alcohol and tobacco* are omitted in this match, since they yield opposite price predictions, but are inseparably pooled in AF. For the table the estimates from the 1997-2003 differences-in-differences estimates were compared with the *percent informative* measures provided by AF in Table 2 on page 10.

The COICOP subgroups were merged as follows (the following paragraph shows in **bold** the main COICOP industry, in *italics* the COICOP two digit sub-industry, then in unformatted text the matched AF industry): **Health**: *Medical products and equipment*: Medicine, medical products; *Out-patient services*: Services; *Hospital services*: Personal care; **Clothing**: *Clothing*: Clothing; *Footwear*: Clothing; **Hotels, Restaurants**: *Catering services*: Financial, transportation, travel; *Accommodation services*: Financial, transportation, travel; **Transport**: *Purchase of vehicles*: Cars, *Operation of personal transport equipment*: Financial, transportation, travel, *Transport services*: Financial, transportation, travel; **House, water, electr., gas**: *Actual rentals for housing*: Laundry and household; *Maintenance and repair of the dwelling*: Laundry and household; *Water supply and miscellaneous services*: Services; *Electricity, gas, and other fuels*: Laundry and household; **Durable goods**: *Furniture and furnishing, carpets, floor coverings*: Furniture, home furnishes, appliances; *Household textiles*: Household, lawn, garden; *Household appliances*: Electronics; *Glassware, tableware, and household utensils*: Household, lawn, garden; *Tools and equipment for house and garden*: Furniture, home furnishes, appliances; *Goods and services for routine household maintenance*: Services **Recreation, culture**: *Audi visual processing equipment*: Hobbies, toy, transportation; *Other major durables*: Hobbies, toy, transportation; *Other recreational items and equipment*: Hobbies, toy, trans-

portation; *Recreation and cultural services*: Services; *Newspapers books and stationary*: Toys, leisure, entertainment; *Package holidays*: Services; **Miscellaneous**: *Personal care*; Personal care; *Personal effects*; Hobbies, toy, transportation; *Social protection*; Institutional; *Insurance*; Financial, transportation, travel; *Financial services*; Financial, transportation, travel; *Other services*; Services **Food** Food.

The match for figure 4 was done as follows (COICOP 2 for price data in italics followed by normal text for the advertising data): *Gas and fuel*, fuel; *medical products*, pharmaceutical and cosmetic products; *shoes (including repair)*, shoes; *food*, food; *hotel services*, hotels; *leisure and culture*, touristic; *household appliances*, electronic appliances; *water supply*, water supply; *transportation*, transportation; *alcohol*, alcohol; *furniture*, furniture (trade); *tools for house and garden*, garden tools; *fotography*, optic trade; *transportation services*, services.

Table 1: Descriptive statistics

	Area <i>km</i> ²	Population 2008 (in 1,000)	GDP/cap. 2007	Number of advertisements	Number of publications	Log mean expenditure	Number of firms per publication
Burgenland	3,965	282	21,600	12,925	12	12.06	140.5
Kärnten	9,536	561	27,800	30,467	15	12.4	275.4
Niederösterreich	19,178	1,601	26,600	34,678	19	12.54	250.3
Oberösterreich	11,982	1,409	31,800	47,737	14	12.94	399.5
Salzburg	7,154	528	37,300	38,540	15	12.57	305.3
Steiermark	16,392	1,206	28,200	42,881	22	13.12	251.1
Tirol	12,648	702	34,200	58,501	22	12.36	298.4
Vorarlberg	2,601	367	34,000	24,886	11	12.58	270.2
Wien	415	1,680	43,300	27,049	18	13.49	186.9

Note: Summary statistics for the nine states of Austria. The last four columns consider only regional advertisements, defined as those that are published in publications that appear in only one state. The last four columns show numbers for the full panel from 1995-2005.

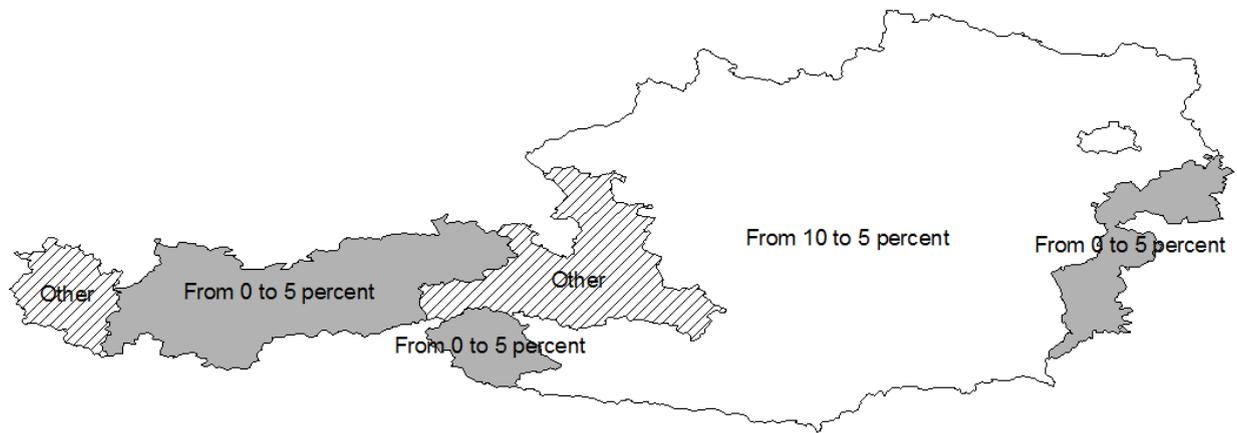


Figure 1: This map shows the heterogeneous changes of advertising taxes in Austria in 2000. In most parts of the country the tax was reduced from ten to five percent. In Tyrol and Burgenland it went in the other direction, from zero to five percent. Vorarlberg and Salzburg had mixed tax regimes in state subdivisions.

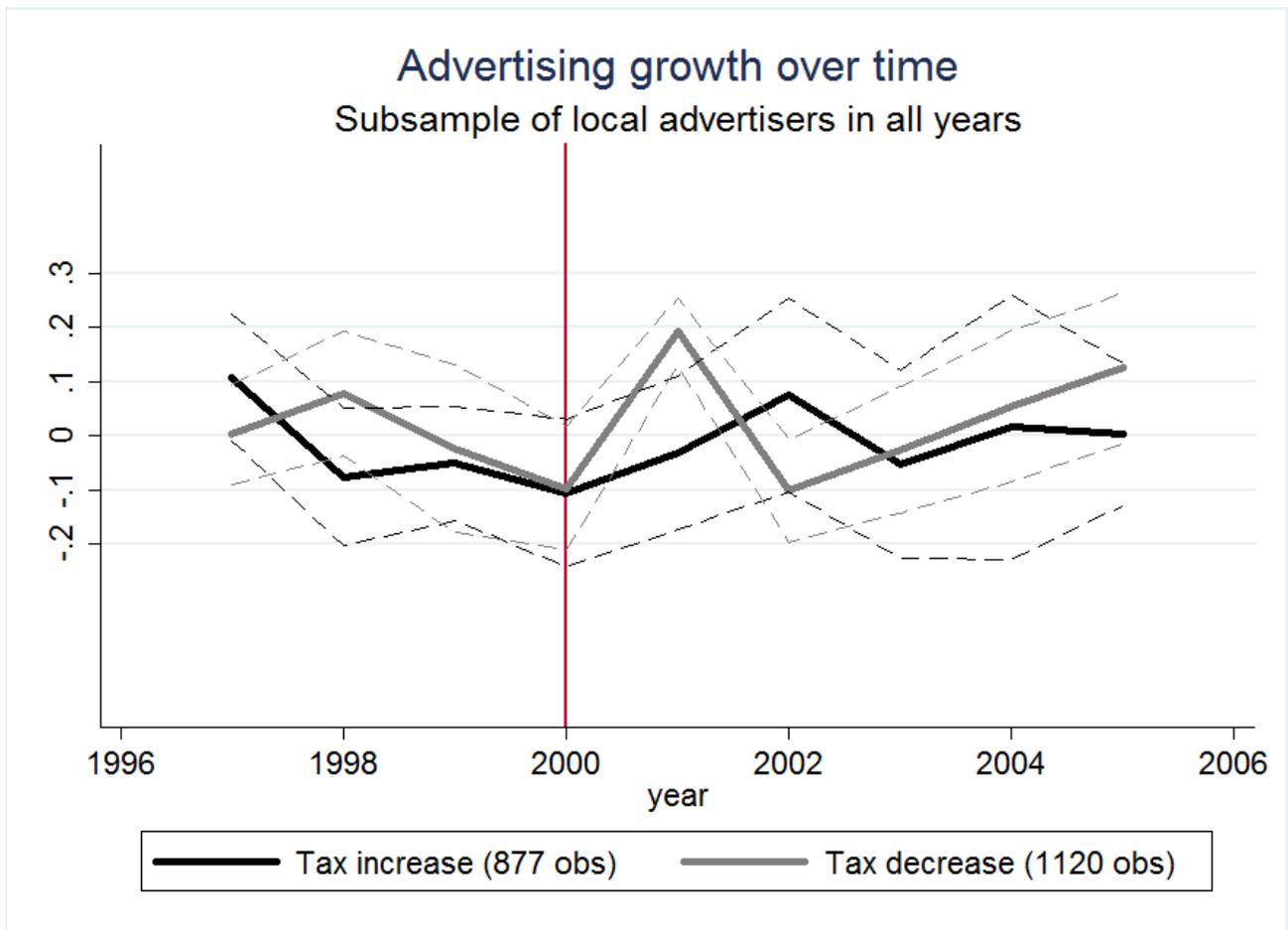


Figure 2: Growth rates of advertising expenditures for regional Austrian advertising firms with positive advertising expenditures in all the years from 1997 to 2005. For the computation of the displayed 95 percent confidence intervals, advertising expenditure are regressed on time fixed effects. The one percent highest and lowest growth rates are excluded. Salzburg and Vorarlberg are excluded, Tirol and Burgenland experienced a tax increase, while the other states experienced a tax decrease. Robust standard errors are clustered by industry.

Table 2: Differences of advertising expenditure growth rates

	Tirol+Burgenland		Kärnten	Niederö.	Oberö.	Steiermark	Wien
	$t_u - t_d$	p	p	p	p	p	p
1997	0.13	0.349	0.683	0.798	0.231	0.871	0.157
1998	0.10	0.422	0.167	0.083	0.882	0.358	0.912
1999	-0.004	0.978	0.574	0.033	0.723	0.099	0.847
2000	0.25	0.033	0.469	0.294	0.74	0.761	0.744
2001	-0.19	0.123	0.066	0.525	0.036	0.2	0.25
2002	0.01	0.941	0.219	0.527	0.53	0.315	0.634
2003	-0.001	0.993	0.543	0.484	0.739	0.315	0.937
2004	0.14	0.228	0.07	0.211	0.643	0.545	0.786

Note: The left part of this table provides results of tests for differences of mean growth rates of advertising expenditures between states with increasing and decreasing marginal tax rates for advertising ($t_u - t_d$) and the p-value from a two-sided test of the difference of the coefficients. The right side of the table provides the p-values of corresponding placebo exercises with each state of the sample with tax decreases tested against the others. The states Salzburg and Vorarlberg are omitted from all calculations.

Table 3: Differences in differences of advertising expenditures across industries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All	Audio	Construction	Services	Leisure	Retail Trade	House Garden	Automotive	Clothing	Tourism
Advertising expenditures: Differences between local advertisers										
Post	0.0778	-0.105	0.296	-0.0160	0.0536	-0.114	0.0958	0.343**	-0.352	-0.110
	(0.0971)	(0.167)	(0.327)	(0.200)	(0.654)	(0.557)	(0.0974)	(0.132)	(0.223)	(0.228)
Post x Treat	-0.307**	-0.283	-0.860*	-0.170	0.0245	-0.494	-0.270**	-0.287*	-0.372	0.184
	(0.0966)	(0.167)	(0.327)	(0.200)	(0.654)	(0.557)	(0.0974)	(0.132)	(0.223)	(0.228)
Constant	13.14***	13.00***	12.86***	13.12***	12.60***	14.04***	13.00***	12.60***	13.30***	12.99***
	(0.202)	(0.125)	(0.0663)	(0.341)	(1.059)	(0.803)	(0.306)	(0.122)	(0.503)	(0.351)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1064	56	101	123	30	43	114	326	113	85
With tax increase	428	23	48	44	22	21	52	100	51	40
Advertising expenditures: Within firm reallocation										
Post	0.117***	0.178***	0.109***	0.157***	0.072	0.061	0.127***	0.129**	0.022	0.040
	(0.106)	(0.412)	(0.346)	(0.246)	(0.525)	(0.398)	(0.270)	(0.531)	(0.350)	(0.496)
Post x Treat	-0.191***	-0.186***	-0.184***	-0.224***	-0.206***	-0.199***	-0.209***	-0.207***	-0.136***	-0.830
	(0.011)	(0.045)	(0.034)	(0.027)	(0.050)	(0.037)	(0.024)	(0.044)	(0.035)	(0.626)
Constant	14.40***	14.31***	14.29***	14.31***	15.65***	14.40***	15.21***	14.41***	14.49***	13.88***
	(0.813)	(0.261)	(0.215)	(0.178)	(0.350)	(0.263)	(0.181)	(0.439)	(0.265)	(0.215)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,048	64	124	174	56	88	108	28	68	40

Note: Both parts of the table report diff-in-diff estimates of advertising expenditures for the years 1997 and 2003. The first panel considers local advertisers; the second panel considers within firm reallocations for cross-state advertisers. Robust standard errors in parentheses, in the upper panel they are clustered by state. Salzburg and Vorarlberg are omitted from all calculations.

Prices in Austrian states

Black: Tax increase, Gray: Tax decrease

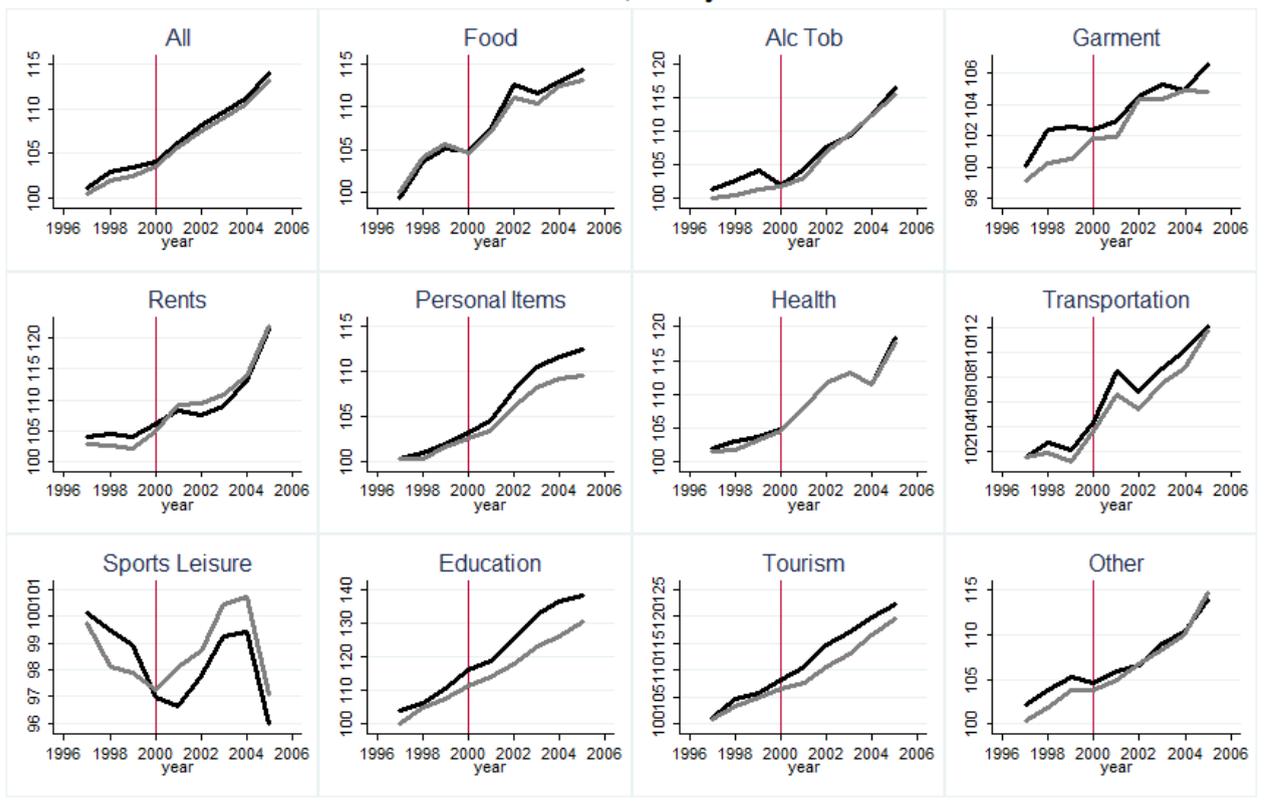


Figure 3: Prices

Note: State price index for states with increasing and decreasing marginal costs for advertising. All COICOP 2 categories listed, except for the prices of *Mail and Telecommunications*, which do not vary at state level. The states Salzburg and Vorarlberg are omitted from the figure.

Table 4: Prices, main industry groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Food	Alc Tob	Garment	Housing	Furnishing	Health	Transport	Recreation	Education	Hotels	Other
Post	0.0203** (0.00554)	0.0656*** (0.00424)	0.0101 (0.0115)	0.0493*** (0.00707)	0.0398*** (0.00662)	0.0885*** (0.00393)	0.0709*** (0.00336)	-0.0239*** (0.00440)	0.252*** (0.0357)	0.0738*** (0.00376)	0.0601*** (0.00465)
Treat	-0.00698 (0.00437)	0.0101* (0.00436)	0.0119 (0.0137)	0.00983 (0.00511)	0.0107* (0.00480)	0.00282 (0.00530)	0.0195* (0.00901)	-0.00400 (0.0139)	-0.00465 (0.0346)	0.0110* (0.00536)	0.0166** (0.00524)
Post × Treat	0.0367*** (0.00310)	-0.0122*** (0.00269)	0.0100 (0.00721)	-0.00345 (0.00566)	-0.000850 (0.00638)	0.00819 (0.00503)	-0.0226** (0.00808)	0.0223 (0.0126)	0.104** (0.0284)	-0.0128* (0.00622)	0.0155*** (0.00402)
Const	4.635*** (0.00433)	4.628*** (0.00337)	4.594*** (0.0123)	4.633*** (0.00221)	4.605*** (0.00280)	4.626*** (0.00353)	4.618*** (0.00370)	4.603*** (0.00618)	4.678*** (0.0396)	4.638*** (0.00218)	4.627*** (0.00374)
Obs	42	42	42	56	98	56	56	56	14	42	70

Note: Diff-in-diff estimates of prices, for all pooled prices and for COICOP-2 industries (except *mail and telecommunication* which does not vary at state level). I use the most disaggregated prices available for each COICOP-2. The treatment group consists of the states where advertising taxes increased (Tirol and Burgenland). Salzburg and Vorarlberg are omitted from the estimation. The pre period uses collapsed prices from 1997 to 1999, the post period from 2001 to 2003. The coefficient on *Post × Treat* reports the differential effect. Robust standard errors clustered by state.

Table 5: Placebo

	(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)
	Pool 3 years	Pool, weights	1999-2001	1999-2002	1999-2003	1999-2004	1995-1997	2003-2005
Post	0.052*** (0.002)	0.044*** (0.002)	0.0218*** (0.00202)	0.0446*** (0.00174)	0.0614*** (0.00158)	0.0724*** (0.00203)	-0.235*** (0.00473)	0.0334*** (0.00145)
Treat	0.008** (0.002)	0.008*** (0.002)	0.00866** (0.00322)	0.00961** (0.00291)	0.0109*** (0.00277)	0.0111*** (0.00297)	-0.00394 (0.00429)	0.00998* (0.00465)
Post \times Treat	0.006*** (0.001)	0.0034** (0.001)	0.00446 (0.00258)	0.00439* (0.00208)	0.00472** (0.00152)	0.00439** (0.00165)	0.00489 (0.00334)	0.00290 (0.00252)
Constant	4.624*** (0.002)	4.622*** (0.001)	4.633*** (0.00234)	4.633*** (0.00224)	4.632*** (0.00221)	4.632*** (0.00227)	4.849*** (0.00296)	4.695*** (0.00373)
Observations	602	602	602	602	602	602	602	602

Note: Diff-in-diff estimates of pooled prices. Most disaggregated prices available are used. The treatment group consists of the states where advertising taxes increased (Tirol and Burgenland). Salzburg and Vorarlberg are omitted from the estimation. The coefficient on $Post \times Treat$ reports the differential effect. Robust standard errors clustered by state.

	(1) Beer	(2) Wine	(3) Food	(4) Non alcoholic drinks	(5) Food in restaurants	(6) Services
Post	-0.00211 (0.00933)	0.154 (0.149)	-0.00332 (0.00344)	0.0237*** (0.0055)	0.303** (0.0937)	5.846*** (0.419)
Treat	0.114*** (0.0247)	-0.12 (0.0971)	-0.0491*** (0.00852)	-0.0313** (0.0085)	1.285** (0.382)	1.268 (23.91)
Post × Treat	-0.0312** (0.00933)	0.211 (0.149)	0.0553*** (0.00344)	0.0772*** (0.0055)	-0.175 (0.104)	-0.839 (4.054)
Observations	14	14	132	84	126	28

Table 6: Diff-in-diff estimation for detailed prices. The treatment group consists of the states where advertising taxes increased (Tirol and Burgenland). Salzburg and Vorarlberg are omitted from the estimation. The coefficient on $Post \times Treat$ reports the differential effect. Robust standard errors clustered by state.

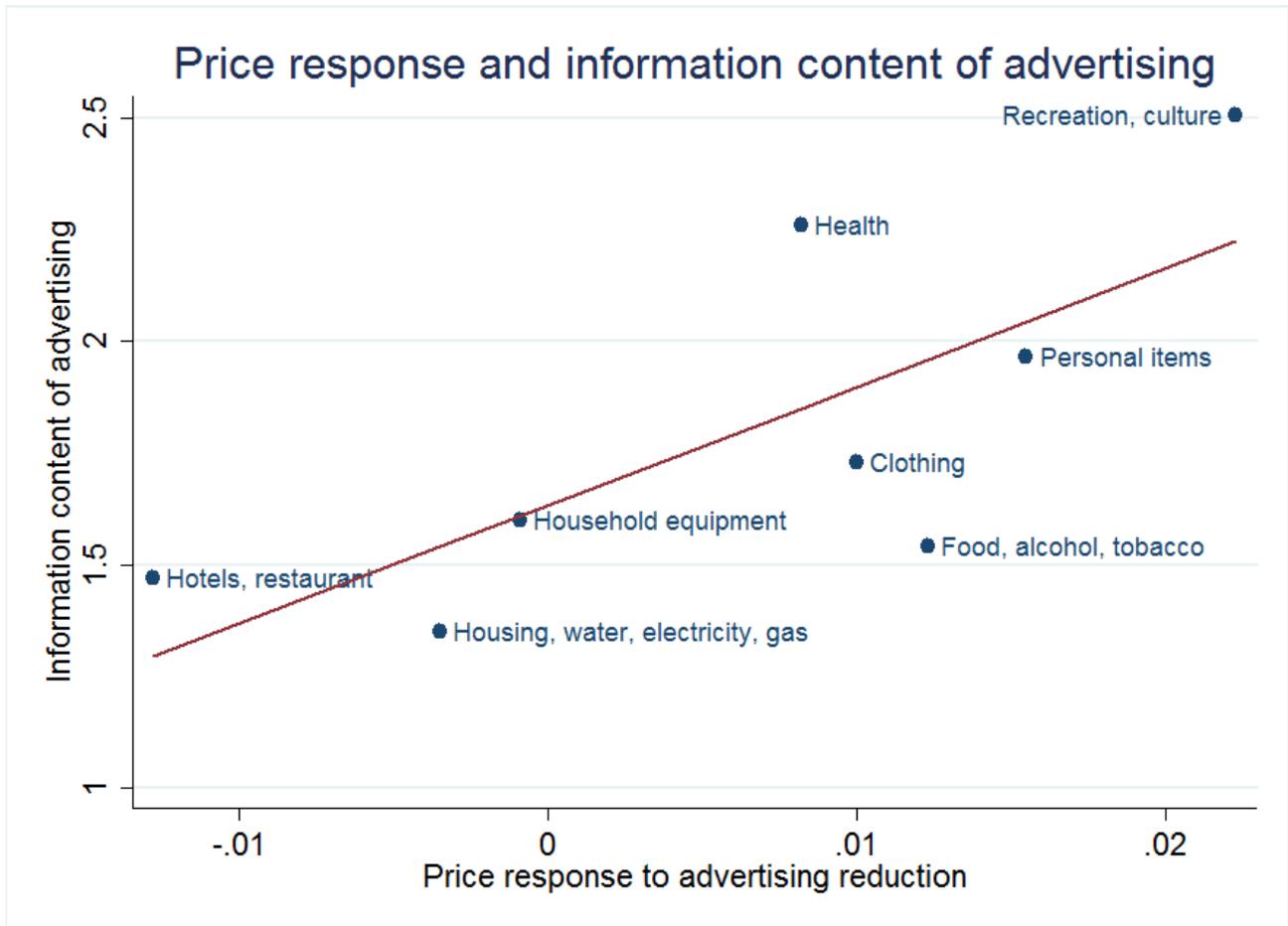


Figure 4: Price response and information

Note: This figure shows the marginal average price response by industry as estimated in table 4 against information content of advertising in industries as reported in the meta study by Abernathy and Franke (1996).

Absolute price response and local advertising

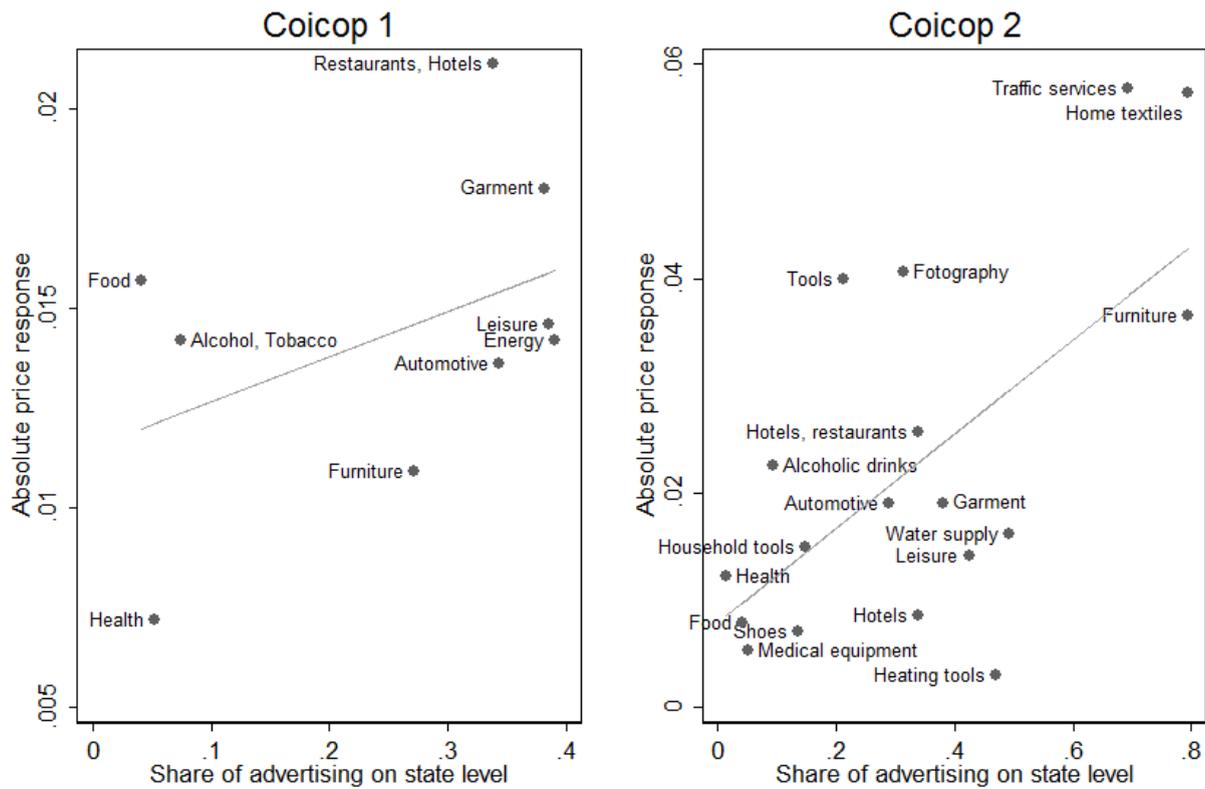


Figure 5: Absolute price response by industry

Note: This figure shows the marginal absolute price response at level of industry classification coicop 1 and coicop 2 against the share of advertising on state level in advertising on state and national level from Focus data.

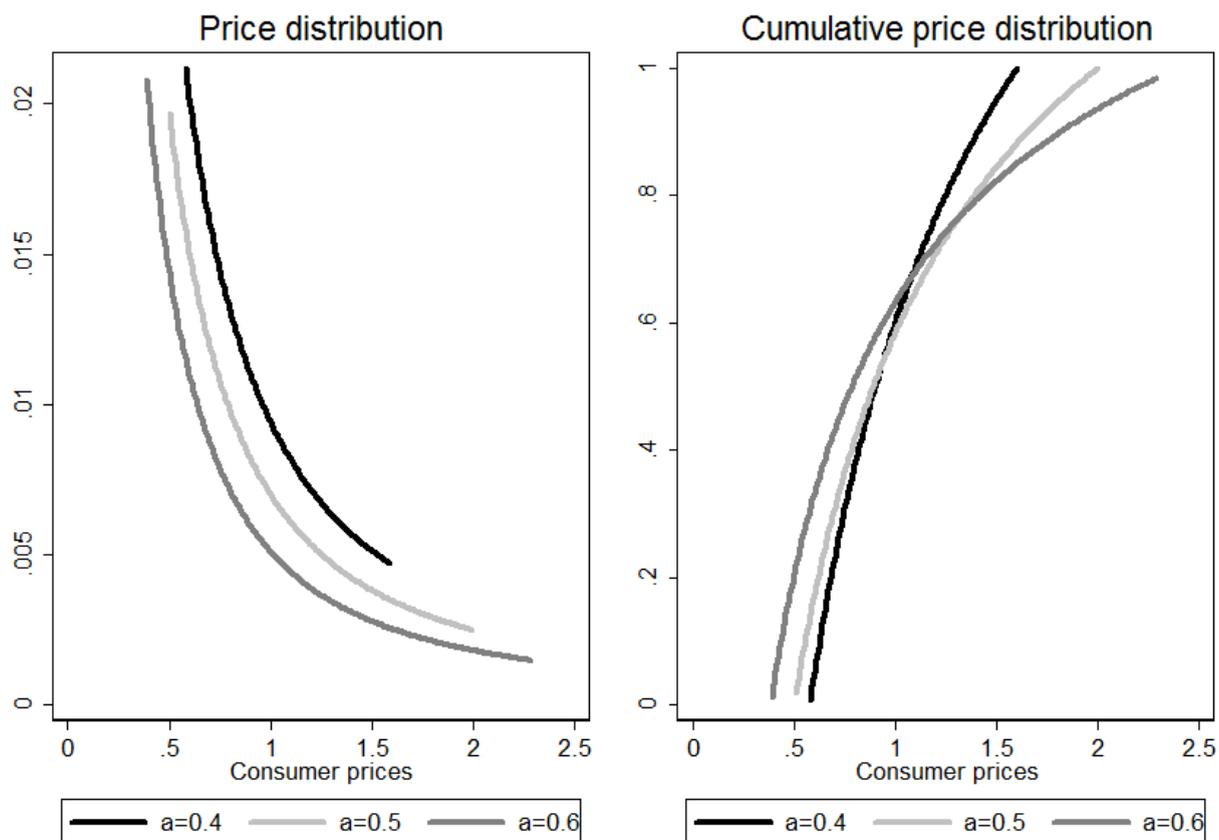


Figure 6: Simulated prices

Note: This figure shows the price distribution and the cumulative price distribution from a simulation of the model for different values of equilibrium advertising expenditure a . The following parameters are assumed: $v = 1$, $n = 3$, $g(a) = 4a$.

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