CESifo WORKING PAPERS

Who Carries the Burden of the Value-Added Tax? Evidence from Germany

Samina Sultan

CESifo

Who Carries the Burden of the Value-Added Tax? Evidence from Germany

Abstract

The value-added tax is one of the most important tax revenue sources in many countries. However, it is sometimes considered unfair as it ultimately hits consumption, and poorer households spend a greater share of their income on consumption. But this depends on whether, and to what degree, the value-added tax is actually passed on to consumers. Exploiting an exogenous value-added tax reform in Germany, I use an event study and a differences-in-differences approach to investigate the pass-through to consumers for a wide range of commodities. On average, I find a modestly positive but statistically insignificant effect on prices. However, there are differences in tax incidence between commodity groups and anticipatory price effects well in advance of the actual implementation of the value-added tax reform.

JEL-Codes: E310, H250, H220, H310.

Keywords: consumer price index, value-added tax, tax incidence, fiscal policy.

Samina Sultan
Center for Economic Studies
University of Munich
Schackstr. 4
Germany – 80539 Munich
samina.sultan@econ.lmu.de

1   Introduction

The value-added tax is one of the most important tax revenue sources in many countries. For instance, it accounts for roughly 30% of overall tax revenue in Germany. As indirect tax it has the advantage of being hard to avoid, which makes it an efficient tax instrument in terms of revenue collection (Keen and Lockwood, 2010). Another advantage is that, in contrast to the income tax, it supposedly does not distort labor-market decisions. Yet, the value-added tax (VAT) is sometimes considered unfair, as it ultimately hits consumption, and less wealthy households spend a greater share of their income on consumption.[1] Also in that vein, a number of countries have recently announced or implemented cuts to the VAT rate in order to stimulate consumption during the covid-19 pandemic.[2] But all of this hinges on the assumption that the VAT is fully passed through to the consumer. However, this assumption is hardly so straightforward. Depending on, for instance, demand elasticities and industry competition, theory predicts that the burden of the VAT might be shared with the producer (Stern, 1987; Besley, 1989; Weyl and Fabinger, 2013). How the tax burden is actually distributed has important policy implications as the progressivity of the tax system is, in part, determined by this question[3] and also its actual impact on the labor-market. This is where this paper aims to make a contribution by exploiting a VAT reform in Germany in 2007. Using detailed price data, I employ an event study and differences-in-differences (DiD) approach to investigate the incidence of the VAT for a wide range of commodity groups. French prices for the same product groups serve as control group. Thereby, I avoid potential general equilibrium effects that could arise with using goods in the same country, not affected by the reform, as control group instead (Benedek et al., 2019).[4]

I find that on average the 2007 VAT reform in Germany had a modestly positive but statistically insignificant effect on prices. Therefore, I cannot reject the hypothesis that the increase in the VAT has not been passed on to consumers. However, there are differences between individual commodity groups, ranging from negative price effects to an over-shifting of the tax burden. Moreover, I observe anticipatory price effects well in advance of the actual implementation of the reform. Possible explanations for the rather low average effects are discussed. In particular, I focus on a simultaneous reduction in social security contributions in Germany. Employers could have used this reduction in non-wage labor costs to lower prices, particularly in labor-intensive sectors. I explore this possibility by comparing the price effects in 2007 to a VAT reform in 1998, which was not accompanied by a reduction in social security contributions. I indeed find that the magnitude of price effects is noticeably higher in 1998, suggesting that

---

[1]Keen (2007) provides as overview of recent criticism and threats to the VAT.

[2]For instance, the German government has implemented a temporary decrease to the standard VAT rate by 3 percentage points and by 2 percentage points to the reduced VAT rate. Moreover, restaurants are temporarily subject to the reduced rate instead of the standard rate. Similarly, the UK has announced a VAT decrease for hospitality, hotel accommodation, and admissions to certain attractions.

[3]Saez and Zucman (2019) find that the consumption taxes make the US tax system overall regressive.

[4]Note that there was no change to the VAT rates in France during the considered period.

the reduction in social security contributions absorbed some effect of the VAT increase in 2007. However, even in 1998, the price increase is on average statistically insignificant. While this should not be interpreted as proof for no price effect, these results at least provide no clear evidence that modest increase in the VAT are necessarily passed on to consumers. Therefore they question the hypothesis that the VAT is incontrovertibly a regressive tax on consumption. This means that the VAT could also be carried by producers, ultimately hitting either wages or profits. If the former applies, the VAT would after all cause distortions on the labor-market, which would have important policy implications.

I contribute to the literature in several ways. So far a sizeable fraction of the literature on the VAT incidence has concentrated on relatively large reforms that only applied to very particular sectors. For instance, Kosonen (2015) and Benzarti et al. (2020) both study a VAT reform to the Finnish hairdressing sector, where the VAT was decreased from 22% to 8% in 2007 and subsequently increased to its former level again in 2012. Kosonen (2015) studies only the VAT reduction and shows that hairdressers adjusted prices by half of what full pass-through would imply. Consequently, hairdressers were able to increase their profits significantly. Benzarti et al. (2020) focus on the asymmetric price reaction to the decrease compared to the increase in the VAT rate. In particular, they find that prices react twice as much to the increase than to the decrease. Similarly, Benzarti and Carloni (2019) exploit a decrease in the VAT on French sit-down restaurants from 19.6% to 5.5% in 2009 to study the impact on workers, firm owners, consumers, and suppliers. They find that firm owners profited the most from the tax cut as there is a large increase in their profits, while consumers benefited least as prices only decreased slightly.[5] Carbonnier (2007) studies two large VAT reforms in France that took place in 1987 for car sales and in 1999 for housing repair services. While taxes are under-shifted on prices in both markets, the degree of under-shifting is significantly lower in the housing repair service market compared to the car market. Carbonnier (2007) argues that this might reflect that market competition is higher in the housing repair service market. Gaarder (2018) exploits a significant drop in the VAT on food in Norway from 24% to 12% to study both incidence and distributional effects of the reform. Using a regression discontinuity model, Gaarder (2018) finds that food prices fully adjust to the 12% decrease in the VAT. Moreover the reform lowers inequality in consumer welfare, partly because the income share that poor households spend on food items is higher and partly due to shifting expenditure patterns after the price changes.[6] However, as these studies focus on comparatively large VAT rate reforms in very particular sectors, their external validity is limited. In contrast, the German reform I study was modest and applied to a wide range of commodities.

---

[5] Falkenhall et al. (2018) also exploit a significant drop in the VAT on restaurants and catering services from 25% to 12% in Sweden. Using a synthetic control approach, they show that the restaurant industry performed better after the reform on a number of indicators, such as higher profit margins and employment, but they do not study price effects.

[6] Mariscal and Werner (2018) also look at incidence and welfare effects of the VAT by exploiting two reforms in Mexico, which only applied to certain cities.

Other studies such as Benedek et al. (2019) or the second part of Benzarti et al. (2020) focus on a cross-country comparison by pooling all VAT reforms in the European Union over approximately 20 years. Among other things, Benedek et al. (2019) study the difference in the pass-through depending on whether the VAT reform concerned the standard rate or the reduced rate. They find that prices are only fully adjusted to changes in the standard VAT rate. Benzarti et al. (2020) confirm their previous finding of asymmetric price reactions to VAT decreases compared to increases also for the pooled European dataset, while Benedek et al. (2019) cannot confirm that. Buettner and Madzharova (2017) also conduct a cross-country comparison of 22 European countries but focus on the pre-announcement effect of VAT tax reforms on sales and prices of durable goods. Their results support the assumption that the incidence of the VAT is fully borne by the consumer but also that most of the price adjustments already take place before the implementation on the reform. Moreover, they find intertemporal shifts in consumption and purchases due to the tax reforms.

This paper also contributes to the literature studying the consequences of the 2007 VAT reform in Germany. Most related, Danninger and Carare (2008) study its effect on core inflation in Germany by comparing VAT and reduced-VAT items. They find that core inflation did not rise much after the implementation of the reform, as there had already been anticipatory effects during 2006. However, the suitability of their comparison group is highly questionable, as the group of reduced-VAT items mostly consists of food. Due to the World food crisis of 2006 to 2008, food prices rose dramatically during that time period. Also, Danninger and Carare (2008) do not provide any evidence that the common trends assumption of their differences-in-differences approach is fulfilled.[7] Buchheim and Link (2017) use the VAT reform to study the effect of new information on expectations. They compare German durable and non-durable goods retailers, arguing that the former had more reliable information about future demand due to the reform. Buchheim and Link (2017) find that durable goods retailers indeed become more forward-looking. Comparing German households during the VAT reform to those in other European countries, D'Acunto et al. (2016) observe an increase in German households' inflation expectations and willingness to buy durable goods. I extend this literature by studying the incidence of the 2007 VAT reform.

More generally this paper is related to the growing literature on tax incidence, such as of the corporate tax (Fuest, Peichl and Siegloch, 2018), the real estate transfer tax (Fuest et al., 2019), the property tax (Löffler and Siegloch, 2018), or energy taxes (Stolper, 2017; Fuest, Schober and Woll, 2018). These studies reveal that tax incidence does not follow straightforward assumptions and needs to be validated empirically.

Finally, by also discussing the implications of a simultaneous decrease in non-wage labor costs on commodity prices, this paper contributes to the literature on fiscal devaluations. Fiscal devaluations describe tax reforms that intend to shift the burden of taxation from income

---

[7]See Section 4 for a more detailed discussion of reduced-VAT items as suitable control group for the 2007 VAT reform in Germany.

to consumption, with the aim of increasing competitiveness. Such reforms were for instance frequently proposed during the Euro crisis to make the Southern European countries more competitive.[8] The literature studying fiscal devaluations has so far mostly concentrated on the effects on trade (see, for instance, Holzner et al. (2018) or Ivens (2018)), while I consider the possible effects on prices.

The remainder of this paper is structured as follows. Section 2 describes the institutional setting of the VAT system in Germany and the 2007 reform. In Section 3, I introduce and describe the datasets. The empirical model is presented in Section 4. The main results on tax incidence are presented and discussed in Section 5. A number of robustness tests are conducted in Section 6. Section 7 concludes.

2 The 2007 VAT Reform in Germany

The current value-added tax system in Germany was introduced in 1968.[9] It broadly consists of a standard and a reduced rate.[10] The reduced rate applies to basic needs of everyday life such as most food products, cultural and educational goods and services, and a range of medical products. The standard rate applies to most other commodities. Figure 1 shows the development of both rates from 1968 to 2019. The standard VAT rate was set to 10% in January 1968. Over the course of the years, it increased successively by 1 percentage point in July 1968, January 1978, July 1979, July 1983, January 1993, and April 1998 to reach 16%. But the biggest increase took place in January 2007, when it increased by 3 percentage points from 16% to 19%. The reduced VAT rate was initially set to equal half of the standard rate. Thus, in January 1968 it amounted to 5%. Until 1983, it increased together with the standard rate to reach 7%. However, it has not been altered since then.

The 2007 VAT reform was already part of the coalition agreement between the Social Democrats and the Conservatives, which was passed in mid-November 2005.[11] The aim was to raise tax revenue in order to consolidate the budget. Germany needed to cut its debt, as it had violated the 3% deficit-to-GDP rule, part the EU Maastricht Treaty, since 2001. The EU Commission had already opened a deficit procedure. Germany therefore needed to announce credible plans to cut its deficit in order to avoid potential fines. D'Acunto et al. (2016) therefore argue that the 2007 VAT reform in Germany can be considered as independent of future economic conditions and as an exogenous policy shock. In May 2006, the German Federal Parliament (*Bundestag*) agreed on the supplemental budget law, which included the VAT reform. Another important part of the supplemental budget law was a decrease in the unemployment insurance contributions by 2.3 percentage points to 4.2%. While the effect of this on households' dis-

---

[8]Fiscal devaluations were for instance implemented by Spain in 2010 and France in 2014.

[9]The previous system did not include an input tax deduction.

[10]There are certain goods and services that are entirely exempt from the VAT, for example most medical treatments. Moreover, for agricultural businesses there is a special VAT regime with rates of 10.7% and 5.5%.

[11]The coalition agreement also already included the exact increase in the VAT rate by 3 percentage points.

Figure 1: Development of the Standard and Reduced Value-Added Tax Rate in Germany
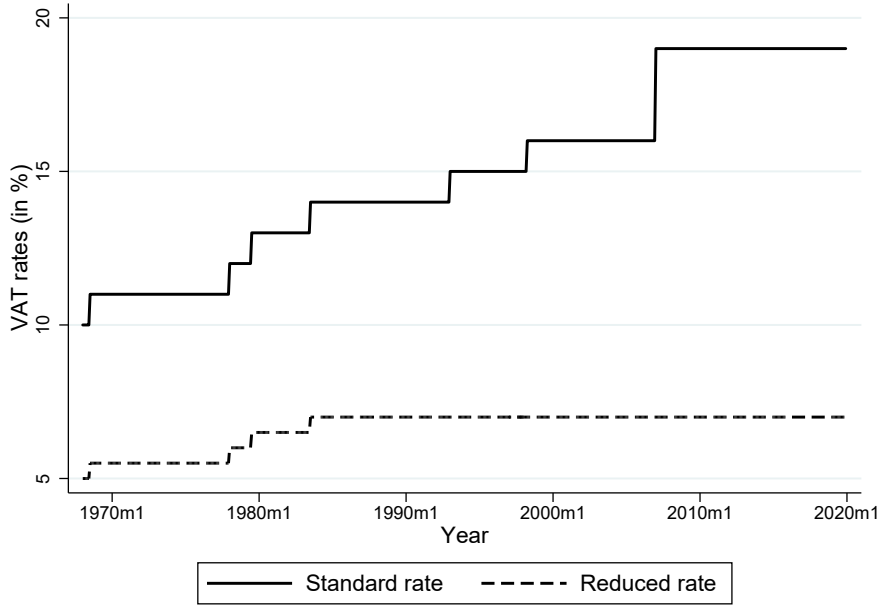
Notes: This figure shows the development of the standard and reduced value-added tax rate in Germany from 1968 to 2019 in %.

posable income is modest[12] and any effect on prices through the demand side should therefore be limited, there might be an effect on prices through the supply side, as employers might use this reduction in non-wage labor costs in Germany to lower prices. This might particularly be the case in labor-intensive sectors. I will discuss this in more detail in Section 5.3. The VAT reform took its final legislative hurdle when the German Federal Council (*Bundesrat*) approved the respective law in mid-June 2006. There had been some controversy on whether the Federal Council would approve the law. Only a compromise regarding the federal contributions to public transport ensured its timely implementation.[13] Now it was legally certain that the standard VAT rate in Germany would be raised from 16% to 19% on January 1st, 2007. This is why June 2006 is chosen as reference period relative to which price changes are measured in the empirical strategy as will be explained in Section 4. The reform was then implemented with the change of the year. It seems to have reached its goal: revenue from the VAT jumped from €111 billion in 2006 to €128 billion in 2007 and has since then steadily increased to €175 billion in 2018 (Statista, 2019). Moreover, in 2007, Germany was able to comply with the 3% deficit-to-GDP rule, again.

---

[12]Considering that contributions to the pension and health insurance increased at the same time and also that lower contribution payments increase the income tax base, the decrease in unemployment insurance contributions does not amount to a significant increase in disposable income. Taking the mean income in West Germany and assuming a single household, a back-of-the-envelope calculation results in an increase in the disposable income by €16.1 per month.

[13]See, for instance, Sueddeutsche Zeitung (2006) for media coverage on the decision by the Federal Council in June 2006.

3   Data and Descriptive Statistics

Table 1: Descriptive Statistics for Price Data

Commodity group	Part A: German Price Index			Part B: French Price Index		
	Mean	Standard dev	N	Mean	Standard dev	N
Alcoholic beverages	102.80	2.74	160	101.93	2.30	48
Audiovisual equipment	91.67	12.07	400	88.26	14.26	144
Clothing	100.71	2.39	640	100.70	1.14	80
Footwear	101.10	2.49	112	100.82	1.10	48
Furniture, carpets, home-textiles	100.74	2.97	432	101.02	2.03	128
Glass- & tableware, household utensils	101.56	2.44	176	102.22	2.32	48
Household appliances	99.54	3.26	272	96.73	3.40	144
Household maintenance	101.83	2.86	224	102.05	2.05	32
Non-alcoholic beverages	106.14	8.94	128	103.31	3.29	48
Personal care	101.41	3.07	448	100.94	2.39	64
Personal items	101.58	2.07	224	101.60	1.88	64
Recreational items	99.27	4.62	368	99.64	4.20	80
Recreational activities	102.95	5.70	80	103.72	2.83	16
Restaurants & hotels	102.88	2.60	320	104.69	4.12	64
Service & repair	103.16	3.56	256	104.89	4.07	144
Stationary	102.10	2.93	144	102.92	2.53	32
Tobacco	106.63	5.17	48	103.35	4.41	48
Tools & equipment	102.19	3.63	240	102.20	3.03	48
Vehicles purchase	103.53	3.66	208	102.45	5.02	112
Total	100.80	5.72	4880	100.23	7.20	1392

Notes: The table shows the mean, the standard deviation, and the number of observations (N) for both the German and the French seasonally adjusted price index by commodity groups.

In order to measure the incidence of the VAT, detailed price data is needed. For Germany, this data is provided by the German Federal Statistical Office. The data is recorded on the most disaggregated 10-digit level based on the *Classification of Individual Consumption According to Purpose* (COICOP). The data is available on a monthly basis from 1991 to 2015. For the given analysis, I restrict the sample to two years before and after the VAT reform, thus, to the years 2005 to 2009.[14] Moreover, I only consider those goods that are subject to the standard VAT rate in the sample period according to the German VAT tax law (*Umsatzsteuergesetz*).[15]

This leads to a balanced panel of 305 different commodities, which I categorize into 19 commodity groups. These roughly correspond to the 3-digit level according to the COICOP classification.[16] Note that I deviate from the COICOP classification by grouping all service

---

[14]Benedek et al. (2019) show that noticeable price effects due to a VAT reform take place within a one-year frame before and after the respective reform. Thus, considering a two-year window is a conservative approach. Moreover, considering a longer time window would increase the risk that other events, which also affect prices, take place.

[15]§12 of the German VAT tax law regulates which commodities are subject to what VAT rate. Moreover, the European Commission publishes an annual report on the VAT rate applied to commodities in its member states. See *https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp* for the public documents repository on the VAT rates applied in the EU member states.

[16]Table A1 in the Appendix shows how individual commodities are mapped in the commodity groups according to the COICOP classification. Note that jewelery is removed from the category of personal items, as prices for jewelery increase abnormally in France.

and repair commodities into a separate category. I also remove fuel and energy commodities, as their prices are not entirely market-driven and even partly state-regulated in Germany.[17]

Figure 2: Development of the Price Index for All Commodities
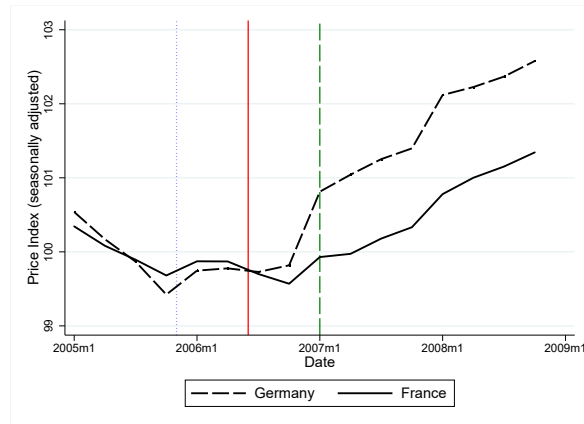
Notes: This figure shows how the seasonally adjusted price index for commodities subject to the standard VAT rate developed in Germany and France from 2005 to 2009 on average. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

I complement the German price data with French data for the same time period.[18] It is retrieved from Eurostat's Harmonized Indices of Consumer Prices (HICP), which is also available on a monthly basis. However, it is on a 5-digit level according to the COICOP classification. Thus, it is less disaggregated than the German data so that I am left with a balanced panel of 87 commodities, which are then also categorized into the 19 commodity groups.[19] To illustrate what the different aggregation levels imply, I will detail it for the clothes sector: the German data contains prices for different kinds of women's clothes, such as dresses or shirts. The French data, meanwhile, only has prices for women's clothes on average, without any further differentiation. The same is true for men's and children's clothing. For both French and German data, all types of clothes are then categorized into the commodity group *Clothing*.

As the base year for the German price index is 2010 while it is 2005 for the French price data, I furthermore recalculate the base year of the German data to match the French base

---

[17]To be precise, for example the electricity price is made up of three components: procurement, sales, margin (22%), network usage fees (24%), duties and taxes (54%). Since 2007 the network usage fees are state-regulated in Germany. The regulation initially led to a decrease of the network usage fees. On the total sum of the first two components and all other duties and taxes, the value added tax is levied. That means it is not simply levied on the wholesale price. Moreover, one should note that the given data contains consumer prices. Hence, it also includes the basic charge for electricity and potential bonuses. Thus, the given data is only to a limited degree suitable to study the VAT pass-through in the electricity sector, as there might be simultaneous developments for example to the network usage fees or the basic charge that also affect the electricity price. Previous studies such as Benedek et al. (2019) have similarly dropped the sector due to the fact that the price is not market-driven. Nevertheless, in unreported regressions, I also look at the VAT incidence for fuel and energy commodities. I find that the point estimates for the price effect are close to zero for both groups and statistically insignificant at the 10%-level. However, given the previous explanation, these results should be interpreted with caution.

[18]A detailed discussion of why French prices are chosen as control group follows in Section 4.

[19]Note that I code the commodity groups as country specific to account for the fact that the same commodity group in the two countries might be subject to different trends.

Figure 3: Relative Development of the Price Index for All Commodities
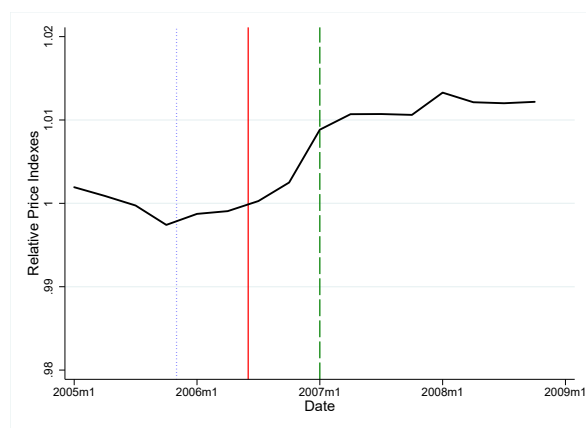
year.[20] Finally, to remove some of the volatility and seasonality in the data, the price index is first averaged on a quarterly basis for each commodity and, secondly, annually repeating patterns are accounted for. Table 1 provides descriptive statistics by commodity group and the overall price index for both Germany and France.

Figure 2 shows how the price index for the selected sample of commodities developed in Germany and France from 2005 to 2009. The dotted blue vertical line marks the passing of the coalition agreement in November 2005, the solid red vertical line marks the final legal decision on the VAT reform in June 2006, and the dashed green vertical line highlights its implementation in January 2007. Prices in both countries first contract and then stagnate. This development is very similar in both countries until the decision on the VAT reform in Germany, which provides first graphical evidence that the French price index is a suitable control group for the German price index, as they follow parallel trends throughout the year and a half before the decision on the reform. Then the trends for the two indices start to differ. While both increase, the increase is steeper for German prices until January 2007, the implementation of the VAT reform. Afterwards, German and French prices follow a similar increasing trend. Figure 2 therefore seems to suggest that the effect on prices due to the increase in the VAT took place before the actual implementation of the reform, at the time of its final legal decision. Moreover, the effect seems rather modest. These findings are corroborated by Figure 3, which shows the relative development of the German to the French price index. It oscillates around the value 1 until mid-2006 and then jumps to 1.01.

While Figures 2 and 3 show the average trend for all commodities, the question is whether the development for the individual commodity groups differs. Figure 4 therefore shows the

---

[20]Note that the German Federal Statistical Office is currently revising the consumer price index data. The new base year will be 2015 and the data with base year 2010 is no longer available. However, the data I use remains valid, as the current revision does not affect data before 2015.
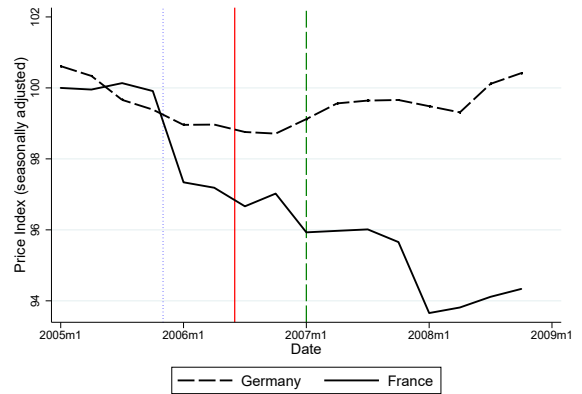
development of the German and French price index for selected commodity groups.

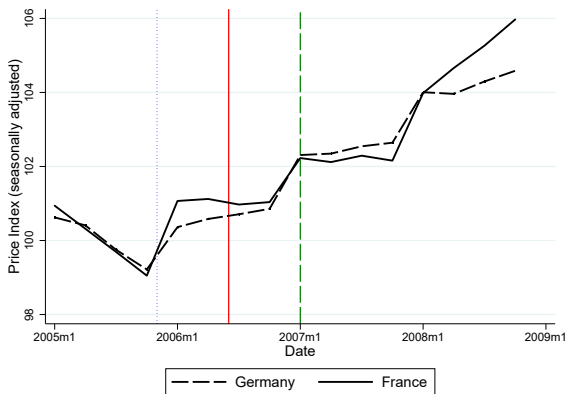**Figure 4:** Development of the Price Index for Selected Commodity Groups
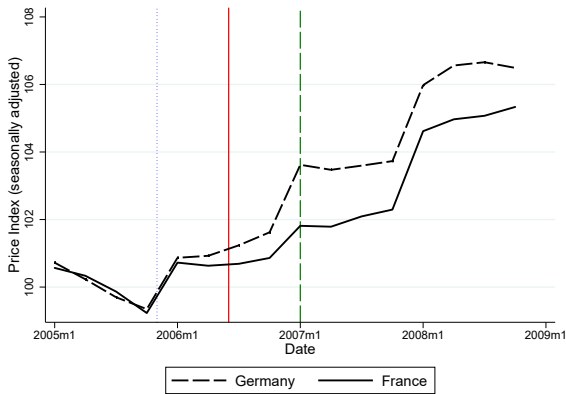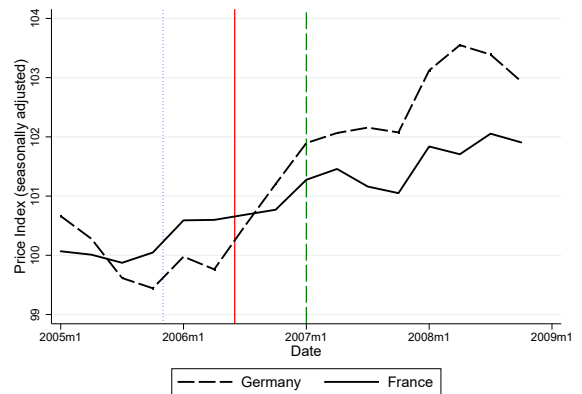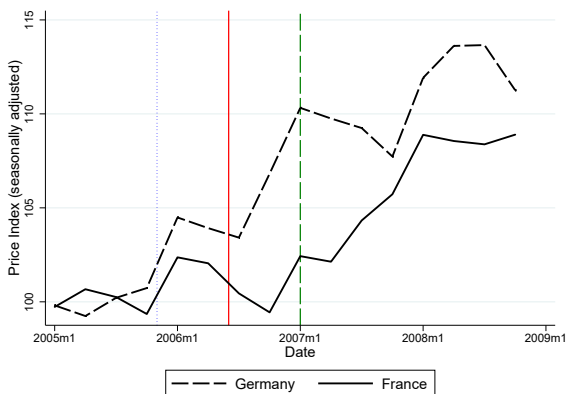

(a) Alcoholic Beverages

(b) Household Appliances
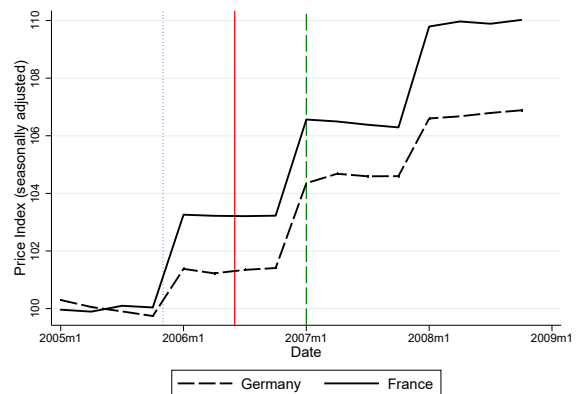
(c) Household Maintenance

(d) Personal Care

(e) Tobacco

(f) Service & Repair

Notes: This figure shows how the seasonally adjusted price index for selected commodity groups developed in Germany and France from 2005 to 2009. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

Figure 4a compares the development of the price indices for the commodity group of alcoholic beverages only. Again, before the decision on the VAT reform in Germany, the two indices follow parallel trends. Then there is a marked and steady increase in both indices but the increase

10

is steeper for German prices. This seems to suggest that prices for alcoholic beverages in Germany did react to the VAT reform, albeit to a modest degree, and that this reaction again took place before the actual implementation of the reform. Figure 4b shows that prices for household appliances developed similarly negative in France and Germany until the beginning of 2006. In France, the negative trend continues, while prices stabilize in Germany at around the time of the VAT reform and even increase slightly in 2007. Thus, for the interpretation of the following regression results it is important to note that prices for household appliances in Germany and France do not follow parallel trends from around 2006 onwards and that French prices decrease sharply.[21] In Germany, prices for personal care items, such as hygiene products, increase noticeably around the time the VAT reform was decided on as Figure 4d shows. The same is true for tobacco products (see Figure 4e).

Thus, also for these commodity groups the VAT increase seems to affect prices before the actual implementation of the reform. However, there are also commodity groups for which this is not true. For instance, Figure 4c shows that prices for household maintenance commodities develop very similarly in Germany and France throughout the sample period. The same is true for the commodity groups *Glass-& tableware and household utensils* or *Personal items*.[22]

Finally, Figure 4f shows the price development for service and repair commodities. This, for example, includes prices for domestic services by paid staff, repair of household appliances, or hairdressing. In both countries prices increase stepwise with the turn of the year. This suggests that prices for these commodities are sticky, as there might be costs to changing them, for example, printing new signboards in a hair salon. However, the increases are less strong in Germany. This price pattern also holds for the commodity group *Restaurants & hotels*. It is interesting to note that both of these commodity groups are particularly labor-intensive. Thus, the less pronounced price increase in Germany could reflect the decreasing non-wage labor costs due to the decrease in social security contributions, which was another part of the supplemental budget law (see Section 2). This will be discussed in more detail in Section 5.3. It is important to note, though, that for these two commodity groups, the parallel trends assumption seems to hold less well, as prices in Germany and France already follow different trends before the decision on the VAT reform.

In summary, the average price development in Figure 2 only partly provides an accurate depiction of the development for the individual commodity groups.

---

[21]Note that the development for French prices is not driven by a one specific commodity within that group. Instead, prices for all commodities in that commodity group decrease sharply.

[22]The development for the remaining commodity groups is depicted in Figures A6 and A7 in the Appendix.

4 Estimation Strategy

I use two different methods to estimate the price effects of the 2007 VAT reform in Germany. First, I implement an event study design to assess the dynamic impact of the VAT reform on the consumer price index. As it provides quarterly estimates of the price effect, the event study design, in contrast to a DiD approach, enables to more precisely locate the timing of any effect. Moreover, the event study design provides an illustration of common pre-trends in commodity prices in Germany and France, which is the key identifying assumption. Second, I estimate the average treatment effect of the VAT reform with a generalized DiD model.

4.1 Event Study

The following baseline event study model is used to estimate the average quarterly VAT incidence for all commodities:

$$ln(p)_{itc} = \sum_{j=-5}^{10} \beta_j(D^{treat} * I_{t+j}) + \alpha_{ic} + \gamma_t + \epsilon_{itc}. \tag{1}$$

The dependent variable is the log of the price index for commodity i in quarter t and country c. D^{treat} is a treatment dummy indicating whether the commodity was affected by the VAT reform or not. I_{t+j} is an indicator for the event window which runs from 5 quarters prior to the decision on the VAT reform to 11 quarters after the decision on the reform.[23] β_j is therefore the coefficient of interest, as it measures the treatment effect, which is the price change for commodities that were exposed to the VAT reform which exceeds the change in the control group in a given quarter.

As reference period relative to which the change in prices is measured, I choose the final legal decision on the VAT reform in June 2006, that is, the second quarter 2006. As explained in Section 2, from this point in time there was legal certainty that the reform was going to be implemented in January 2007. Thus, anticipatory price effects seem likely. These would be missed if the reference period is set to the implementation date instead. Figures 2 or 4a, for example, show that prices did, indeed, already react in June 2006. Moreover, Benedek et al. (2019) find that for increases in the standard VAT rate, anticipation effects are likely. As a robustness test, I alternatively choose November 2005, the date when the coalition agreement was passed, and January 2007, the implementation date of the reform, as base periods. The results can be found in Section 6.3.

I include country-specific commodity fixed effects, $\alpha_{i,c}$, to account for time-invariant characteristics by country and commodity that affect the development of the price index. γ_t controls for time fixed effects to capture general quarterly price level trends.

---

[23]The event window runs until quarter 10, as the reference month is coded as 0.

4.2 Differences-in-Differences

Besides the quarterly event study estimates of the price increase, I estimate the average treatment effect of the VAT reform using the following generalized DiD model:

$$ln(p)_{itc} = \beta_0 + \beta_1 D^{treat} + \beta_2 Post + \beta_3(D^{treat} * Post) + \alpha_{ic} + \gamma_t + \epsilon_{itc}, \tag{2}$$

where the dependent variable is again the log of the price index for commodity i in quarter t and country c. D^{treat} is a treatment dummy indicating whether the commodity was affected by the VAT reform or not. $Post$ is a binary indicator for the treatment period, which takes on the value 1 for observations after the decision on the VAT reform in June 2006, that is, after the second quarter 2006. β_3 is therefore the coefficient of interest, as it measures the treatment effect. Country-specific commodity fixed effects, α_{ic}, and time fixed effects, γ_t, are again controlled for in all specifications.

4.3 Statistical Inference

An important issue in the design of the empirical strategy are assumptions regarding the structure of the error term. The first important assumption regards homoskedasticity. Figure A5 in the Appendix shows that the variance is greater for more extreme values of the dependent variable. Accordingly, using a Breusch-Pagan test, the assumption of homoskedasticity is rejected. I correct for this by using heteroskedasticity-robust standard errors.

The second assumption concerns the correlation of errors within clusters. As shocks might be correlated within a commodity across time, standard ordinary least squares (OLS) would underestimate standard errors (Donald and Lang, 2007; Moulton, 1986). This is corroborated by a test for cross-sectional dependence described in Pesaran (2004) and Pesaran (2015). Thus, clustering standard errors at least at the level of the identifying variation, commodity i, is necessary. To be even more prudent, I follow Angrist and Pischke (2008) in clustering standard errors at a higher level in the baseline specification, namely, the commodity group level. However, this reduces the number of clusters to 38. As few clusters might lead to an underestimation of the correlation, I follow Cameron et al. (2008) and Cameron and Miller (2015) and use the wild cluster bootstrap method to correct for this in my baseline specification.

As robustness tests, I also report the main specification with heteroskedasticity-robust standard errors, clustered standard errors, pairs cluster bootstrapped standard errors, and wild cluster bootstrapped standard errors at the commodity level, instead of the commodity group level (see Table 4 in Section 6.1). Only when not accounting for intraclass correlation, the null hypothesis of no price effect can be rejected at the 1%-level.

Equations 1 and 2 are the baseline models to estimate the price effect across all commodities. I also estimate the price effect for specific commodity groups in a slightly adjusted version. Specifically, errors are now wild cluster bootstrapped at the individual commodity level i,

rather than at the level of the commodity group.

Finally, Abadie et al. (2017) have recently questioned the common practice to report clustered standard errors. In case of fixed effects regressions they argue that clustering is only necessary when there is heterogeneity in the treatment effect. As this is true here and, moreover, there is also clustering in the assignment because only German commodity prices are treated, clustering standard errors seems necessary even from this perspective.

4.4 Identification

The parallel-trends assumption is the necessary condition for causal interpretation in the given setting. It requires that the price indices in Germany and France follow similar trends before and after the VAT reform, if the reform would not have happened. Figures 2 and 4 provide first graphical evidence that prior to the reform the development in the price indices is very similar, both for all commodities on average and most of the different commodity groups.[24] It therefore seems valid to assume that prices would have behaved similarly in Germany and France absent the policy shock, which makes French prices a suitable control group. Nevertheless, the decision to choose France as control group requires some explanation.

The most obvious control group seem to be commodities subject to the reduced VAT rate in Germany, because that rate did not change in 2007 (see Section 2). This group mostly consists of food items, though. That means that their prices were affected by the World food crisis 2006 to 2008.[25] Thus, exactly at the time of the reform to the standard VAT, the commodities subject to the reduced rate were also exposed to a price shock, albeit unrelated to their taxation. Figure A1 in the Appendix shows the development of prices for commodities subject to the reduced VAT rate in Germany. The price shock due to the food crisis is clearly visible. Thus, these items cannot serve as control group to estimate the price effect of the VAT reform. Moreover, Benedek et al. (2019) criticize the use of goods in the same country, not affected by a VAT reform, as control group due to potential general equilibrium effects.

With the disqualification of the reduced VAT items as suitable control group, an alternative are prices in other Euro countries for the same commodities as in Germany but that did not experience a VAT reform during the period 2005 to 2009.[26] A further restriction is the availability of price data at a sufficiently disaggregated level. Although Eurostat makes price indices available for all European countries, the level of detail of the data varies. Thus, the two criteria mean that four countries are left as possible control group: Belgium, France, Lithuania, and Slovenia. Due to the great difference in economic development compared to Germany, the latter two countries do not seem like natural control groups, whereas Belgium and France

---

[24]The statistical evidence will be provided in Section 5.1.

[25]For a number of reasons, global food prices rose substantially during the period 2006 to 2008. For a more complete discussion see, for instance, Headey and Fan (2010).

[26]To avoid complications due to the exchange rate, only countries which use the Euro as currency are considered in the search for potential control groups. This condition precludes, for instance, the United Kingdom.

seem like viable options. As outlined above, French prices do indeed seem to fulfill the parallel-trends assumption. Belgian prices, however, seem to be more cyclical than German ones, as Figure A2 in the Appendix shows. The price development before the VAT reform is less similar comparing Germany and Belgium than it is comparing Germany and France. Furthermore, the risk of potential price spill-overs is higher for Belgium than for France due to their relative size compared to Germany. Hence, France fulfills the condition for causal interpretation best, which motivates its choice as control group.[27] D'Acunto et al. (2016) likewise conclude that the similarity of pre-shock trends is most pronounced when they only use France as control group. Moreover, Montag et al. (2020) use France as a control group in a differences-in-differences approach to measure the impact of the temporary VAT reduction in Germany in 2020 on fuel prices, arguing that the two countries are very similar in various of dimensions.

Moreover, Figure A3 in the Appendix shows that for a number of macroeconomic indicators, such as inflation, unemployment, or GDP growth, Germany and France show relatively similar trends compared to the other potential control countries. As mentioned above, there was no reform to the VAT rates during the time frame 2005 to 2009 in France. The most recent amendments to the standard VAT rate are a reduction from 20.6% to 19.6% in 2000 and an increase to 20% in 2014. One of the few tax reforms that took place during the sample years in France concerned the taxation of donations and gifts. This was part of a bigger fiscal package by the Fillon administration in 2007, which aimed to liberalize the labor-market, ease the fiscal burden on businesses, and stimulate investment, for instance, by exempting overtime hours from the income and payroll taxes. Another tax reform was a modification to the wealth tax for non-resident French citizens in the summer of 2008. It is unlikely that either of these reforms had a significant impact on commodity prices in France. Besides fiscal reforms, the French administration tried to implement new youth employment laws in 2006 but this legislation had to be scrapped due to ongoing protests. Furthermore, plans to reform the pension benefits system triggered widespread protests in late 2007. Thus, no significant reform was successfully implemented during the sample years in France.

Finally, the German data follows the national definitions of the consumer price index (CPI), whereas the French data follows the definition of the harmonized index of consumer prices (HICP). One might argue that this difference in definition distorts the results. However, as Figure A4 in the Appendix shows, the development of the German price index is very similar whether following the national or the harmonized definition. Thus, any conclusions based on the CPI data should also hold for the HICP data.[28]

---

[27]Note that as a robustness test I furthermore control for potential pre-treatment trends in prices. The results remain very similar even with these "detrended" prices. Thus, diverging pre-treatment trends in German and French prices do not seem to drive the results (see Column (1) in Table 5 in Section 6.2).

[28]I prefer the CPI over the HICP data, as the level of disaggregation is greater for the CPI data.

5 Results

5.1 Event Study

Figure 5: Event Study Estimates for All Commodities
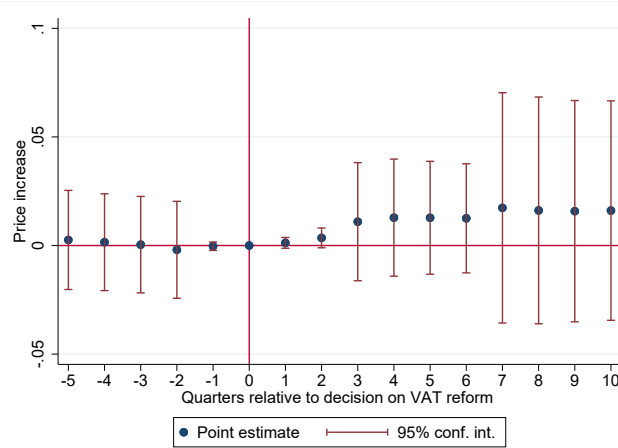
This figure plots quarterly event study estimates and corresponding 95% confidence bands for the baseline event study specification Equation 1. The dependent variable is the log of the price index for commodity i in quarter t and country c. Commodity and time fixed effects are included. Standard errors are clustered at the commodity group level. The red vertical line marks the final legal decision on the VAT reform in June 2006. The number of observations can be found in Table 2.

In this section, I will first report the results from Equation 1. Thus, Figure 5 displays quarterly event study estimates of the price increase across all commodities. It corroborates the descriptive findings from Figure 2. First, I observe flat pre-trend in prices, which provides statistical evidence that French prices are a suitable control group. Second, the point estimates become modestly positive around three quarter after the decision on the VAT reform. These anticipatory price effects would have been missed if the reference period would have been set back to the implementation of the reform. Therefore, the decision date seems like a suitable choice as reference period. The annual pattern in point estimates and confidence intervals is due to sticky prices for commodities in some industries and an increasing variance for observations further away from the reference period.[29] Given that the VAT increases by 3 percentage points from 16% to 19%, the reform would imply an increase in prices by 2.58% if the VAT burden is fully shifted to the consumer.[30] The values of the point estimates in Figure 5 display a price increase by around 1.5%. This would imply a pass-through of around 60%, which is below the average pass-through of 79% that Benedek et al. (2019) estimate for reforms to the standard VAT in the EU. The lower pass-through could be due to the fact the VAT reform

---

[29]Sticky prices mean that prices for these commodities do not adjust immediately but only at fixed points in time, for example, because it is costly to change prices. For a given time period, the individual prices remain stable but within a commodity group there is still fluctuation. Together with the growing variance for observations further away form the reference period, this leads to the step-like pattern for point estimates and confidence intervals observed in Figure 5. Furthermore, it is reinforced by the method used to control for quarterly seasonality.

[30]For the calculation: (119/116 * 100 -100) = 2.58.

in Germany affected more than 50% of the consumption basket. This is important because Benedek et al. (2019) also show that for VAT reforms with a broad scope the pass-through to consumers is lower.

However, the effects are not statistically significant at the 5%-level. The relatively broad confidence intervals include under- to over-shifting. Thus, it is difficult to draw any precise conclusions with regards to the incidence. But at least it is valid to conclude that Figure 5 lends no straightforward evidence that VAT increases are on average necessarily (fully) passed on to the consumer. In so far, I cannot lend support to the notion that the VAT is incontrovertibly a regressive tax on consumption. The question is now whether this also holds for the individual commodity groups.

Figure 6 shows quarterly event study estimates of the price increase for a number of different commodity groups. Figure 6a shows that prices for alcoholic beverages in Germany did initially increase statistically significant by around 1.5% after the decision on the VAT reform relative to French prices. The immediate reaction in alcohol prices already before the implementation of the VAT reform is in-line with results by Young and Kwapisz (2001), who find that there is no lag in the response of prices to the excise tax on alcohol in the US.

German prices for household appliances also increase statistically significant by around 2% three quarters after the decision on the VAT reform and continue to increase by as much as 4% in comparison to the base period and relative to French prices as Figure 6b shows. This would even imply an over-shifting of the VAT increase to consumers by around 50%. This corroborates results by Buettner and Madzharova (2017), who use a dataset of major domestic appliances. They that the period after the 2007 VAT reform in Germany is characterized by substantially higher prices for these goods. Similarly, D'Acunto et al. (2016) find that the 2007 VAT reform led to an increase in households' willingness to buy durable goods. This could have induced producers to increase prices. Moreover, a further explanation for the price increase might be the fact that most household appliances in Germany are imported and, therefore, could not profit from the lower labor costs due to the decrease in social security contributions, while fully bearing the increased VAT rate. However, it also needs to be stressed that the change is measured relative to prices for household appliances in France, where prices decrease sharply. The large positive point estimates for the price effect for this commodity group therefore are also a reflection of this *relatively* positive development.

A similarly large price increase can be observed for tobacco products for three quarters following the decision on the VAT reform (see Figure 6e). As the tobacco industry can be described as monopolistic, the observed over-shifting is possible from a theoretical viewpoint due to imperfect competition (Stern, 1987; Weyl and Fabinger, 2013). However, the effect fades out over time. Meanwhile, the price effect for personal care items remains relatively consistent at around 2% as depicted in Figure 6d but it becomes statistically insignificant seven quarters after the reference period. The statistically significant positive price effects for alcohol, personal care items, and tobacco might well be explained by low demand elasticities

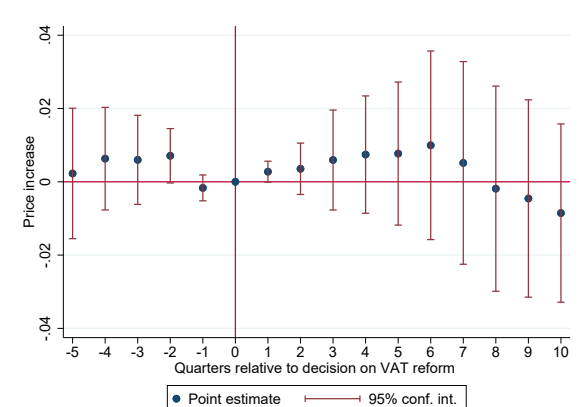**Figure 6:** Event Study Estimates for Selected Commodity Groups
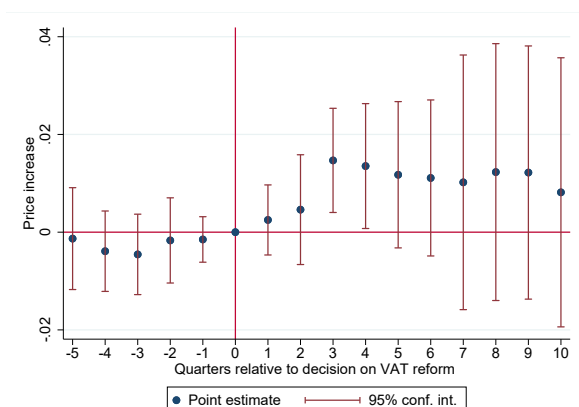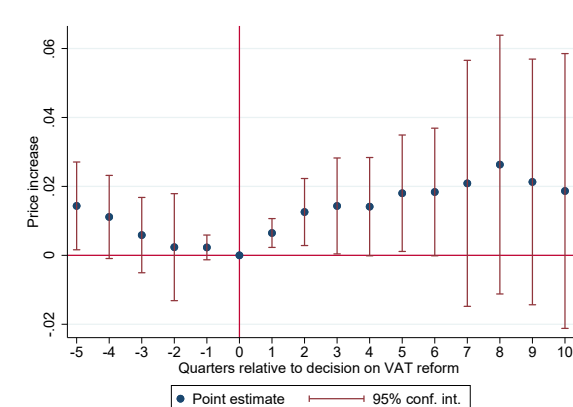
(a) Alcoholic Beverages
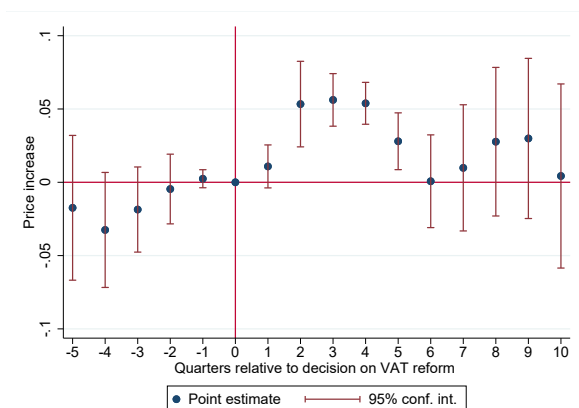

(b) Household Appliances
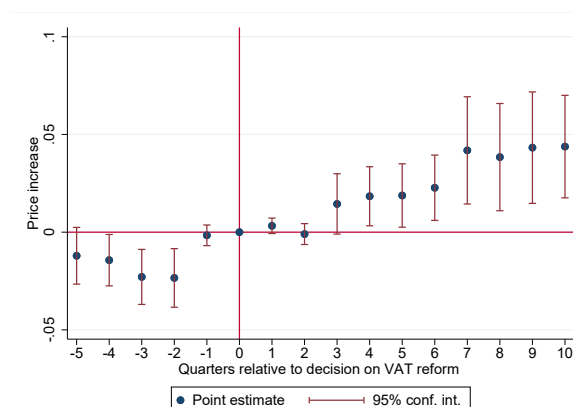
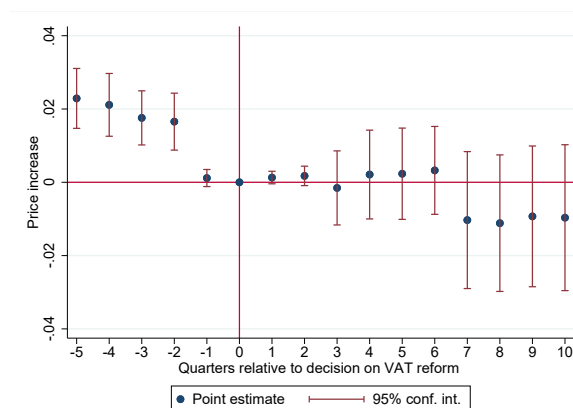**(c)** Household Maintenance

(d) Personal Care

(e) Tobacco

(f) Service & Repair

Notes: This figure plots quarterly event study estimates and corresponding 95% confidence bands. The dependent variable is the log of the price index for commodity i in quarter t and country c. Commodity and time fixed effects are included. Standard errors are clustered at the commodity level. The red vertical line marks the final legal decision on the VAT reform in June 2006. The number of observations can be found in Table 2.

for these commodity groups. Thus, producers know that they can shift at least part of the tax burden to the consumer, without hurting demand too much.

At the same time, for the commodity group *Household maintenance* no statistically signifi-cant price effects can be observed (see Figure 6c). This commodity group includes items such

18

as detergents or cleaning agents. As competition might be tight in this sector and costumer loyalty low, producers might be reluctant to pass through any VAT increases in order not to hurt demand.

Finally, Figure 6f shows the price effects for service and repair commodities. Following the decision on the VAT reform, the point estimates hover around zero and seven quarters after the reference period even turn negative. An explanation for this unexpected pattern might be the decrease in the social security contributions, which lowers labor costs in Germany. Thus, in the medium-run an indirect effect on commodity prices, especially in labor-intensive sectors, cannot be ruled out. I will discuss this in more detail in Section 5.3. However, it also needs to be noted that Figure 6f reveals significant pre-trends for this commodity group, suggesting that service and repair prices in Germany and France did not follow parallel trends prior to the VAT reform.[31] Thus, any conclusions based on such a comparison need to be regarded with caution. This similarly applies to the labor-intensive commodity group *Restaurants & hotels*.

Figures A8 and A8 in the Appendix show the event study estimates for the remaining commodity groups. Similar to the average price effect in Figure 5, the confidence intervals for many of the individual commodity groups tend to be quite large.

5.2 Differences-in-Differences

Table 2: DiD Estimates: Main Specification

	(1) All commodities	(2) Alcoholic beverages	(3) Household appliances	(4) Household maintenance	(5) Personal care	(6) Tobacco	(7) Service & repair
Treatment	0.0116	0.0123	0.0368**	-0.000583	0.0111	0.0392*	-0.0163
	(0.0248)	(0.0083)	(0.0129)	(0.0078)	(0.0128)	(0.0152)	(0.0083)
95% CI	[-0.0350, 0.0644]	[-0.0056, 0.0313]	[0.0102, 0.0632]	[-0.0614, 0.0605]	[-0.0183, 0.0481]	[0.0007, 0.0707]	[-0.0331, 0.0006]
Commodity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6272	208	416	256	512	96	400
Within R^2	0.0301	0.892	0.271	0.569	0.320	0.834	0.828

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses.

While the event study estimates enable the detection of any dynamic effects and a visualization of the parallel trends assumption, I estimate the magnitude of the average price effect of the VAT reform using a generalized DiD model. The main regression results from Equation 2 are shown in Table 2. Column (1) shows the average treatment effect for all commodities and Columns (2) to (7) focus on individual commodity groups.[32] In-line with the event study estimates, the average treatment effect for all commodities is positive but statistically insignificant. This holds also for the individual commodity groups, except for household appliances (see Column (3)) and tobacco (see Column (6)), for which the positive effects are statistically significant at the 5-% level and 10-% level, respectively. The coefficient implies an average price increase of household appliances by 3.7%, which translates into an average over-shifting of the

---

[31]This was already visible in Figure 4f.

[32]Results for the remaining 13 commodity groups can be found in Tables A2 and A3 in the Appendix.

tax burden by 40% for this commodity group. While the positive sign of the point estimates seems reasonable, the magnitude of the implied effect should be considered with caution due to the fact that the parallel trends assumption for this commodity group does not hold well and that the prices in the control decrease sharply. The effect for tobacco is of similar magnitude and implies an over-shifting by 50%. This is most likely due to the low demand elasticity, which enables producers to shift the tax burden to consumers. A noticeable deviation from the average effect can also be observed for the commodity group *Service & repair* in Column (7). The coefficient is negative but statistically insignificant at the 10%- level. This corroborates the findings in Figure 6f.

In summary, whether using an event study or a DiD approach, there is a lack of statistically significant evidence that the burden of the VAT is on average shifted to consumers. It is important, though, to stress that this should not be interpreted as evidence for no price effect. All this means is that the with the given data and approach, I cannot reject the null hypothesis of no price effect. This at least challenges the assumption that the VAT is necessarily carried by consumers. If it is instead carried by firms, it could either hit wages or profits.[33] The former would cast doubt on the hypothesis that the value-added tax causes no distortions on the labor-market and is therefore advantageous in comparison to other taxes, such as the income tax.

Previous literature for VAT *decreases* has found that prices do not fully adjust and that firm owners are able to increase their profits (Kosonen, 2015; Benzarti and Carloni, 2019). For VAT *increases*, this, in turn, would imply that consumers do not necessarily need to carry the entire VAT burden as it is shared with producers, which would be in-line with my results for the 2007 VAT reform in Germany. But this would assume that there is a symmetric reaction to VAT decreases and increases. However, Benzarti et al. (2020) find that this is not the case, as prices seem to react more to increases than to decreases in the VAT rate. It is therefore problematic to base predictions on the effect for producers on the previous literature for VAT decreases. Instead, it would be necessary to extend that research also to VAT increases in order to allow for more precise statements regarding the actual effects on wages and profits and, hence, potentially the labor-market.

Moreover, both the event study and the DiD estimates reveal that the price effect varies between commodity groups. Carbonnier (2007) similarly finds that the consumer share of the VAT burden differs between sectors in France. Simply relying on the average incidence would therefore be misleading and could mask potential distributional consequences. Using representative household data on spending in Germany from the income and consumption survey (*Einkommens- und Verbrauchsstichprobe* EVS) for the year 2003, Figures A10, A11, A12, and A13 in the Appendix show that spending on the 19 previously defined commodity

---

[33]To be more precise, it would affect *pure* profits, that is, profits beyond those provided by the normal return to capital. It would be similar to a cash-flow tax. As investments are fully deductible, they would not be distorted.

groups does differ between net household income quartiles.[34] For instance, one can observe that the share of spending on tobacco products is almost 5% for the lowest net household income quartile, while it is only 1.3% for the highest income quartile.[35] As I show that there is an over-shifting of the tax burden for tobacco (see Column (6) in Table 2), this implies that lower income groups are relatively more affected by this price increase.[36] This demonstrates how differences in tax incidence and consumption patterns can entail distributional consequences to VAT reforms. Policy makers should consider this when reforming the VAT rate.

Beyond that, the event study estimates show that prices already start to react at the time of the final legal decision on the reform, six months prior to its actual implementation. This corroborates previous research on anticipatory price effects of VAT reforms.

5.3   Comparison to the 1998 Value-Added Tax Reform

Both the event study and the DiD estimates presented above revealed only a modest and statistically insignificant average price effect for the 2007 VAT reform. As explained in Section 2, the increase in the VAT from 16% to 19% in 2007 was accompanied by a decrease in the unemployment insurance contributions by 2.3 percentage points. These are part of non-wage labor costs and the reduction therefore could in the medium-run have translated into lower prices, especially in labor-intensive sectors. Thus, the modest price reaction in 2007 might in part be explained by the joint implementation of a VAT increase and a decrease in social security contributions, a so-called *fiscal devaluation*.

While it can be argued that particularly any anticipatory price effects are probably due to the VAT reform, because the effect on prices through the labor-market are more likely to show in the medium-run, it is difficult to precisely disentangle the effect of the two reforms. Therefore, I compare the effects of the 2007 VAT reform to those of a VAT reform in Germany which took place in 1998. During that reform the standard VAT rate was increased by 1 percentage point from 15% to 16%, which is a third of the increase in 2007. Importantly, in contrast to the 2007 VAT reform, the 1998 VAT reform was not accompanied by a change in social security contributions and may therefore provide a benchmark of the "pure" VAT price effect. The 1998 VAT reform was decided on by the German Federal Council in December 1997 and implemented in April 1998. Analogously to the approach described in Section 4, I therefore choose December

---

[34]The EVS is provided by the Statistical Offices of the German States. It is conducted every five years. The year of interest for the analysis is 2003, that is, the closest year available before the VAT reform. The EVS contains detailed information on income, wealth, debt, and consumption expenditures of private households in Germany. It is send out to 60,000 households from all social backgrounds, so that the survey provides a representative sample. However, the participation in the survey is not mandatory.

[35]Spending on the 19 previously defined commodity groups equals 34% of average net household income for the lowest income quartile and 28% for the highest income quartile. For the lowest quartile, quarterly average net household income is €4045.98 and for the highest quartile quarterly average, quarterly average net household income is €18,880.3. In absolute numbers this means that the lowest and the highest net household income quartile spend around €69 on tobacco products in a given quarter.

[36]Note that there is a related literature looking at the regressivity of so-called sin taxes on commodities such as alcohol, tobacco, or sugar (Dubois et al., 2020; Griffith et al., 2017).

Figure 7: Development of the Price Index for All Commodities - 1998
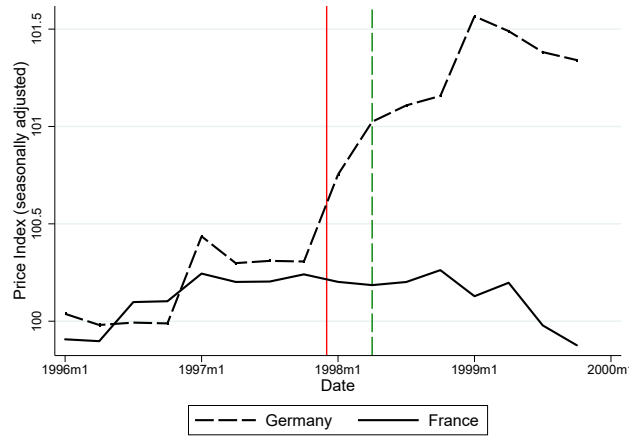
1997, that is, the last quarter of that year, as reference period relative to which price changes are measured. I construct a sample from 1996 to 2000 again comparing German and French prices.[37]

Figure 7 compares the development of German and French prices for the period 1996 to 2000 across all commodities. While the two indices follow very similar trends from 1996 to the end of 1997, verifying that French prices represent a suitable control group also during this time frame, there is a noticeable jump in German prices right at the time the VAT reform was decided on and a further increase after its implementation in April 1998. In comparison to the development from 2005 to 2009 shown in Figure 2, the price effect does seem more pronounced in 1998, although the increase in the VAT rate in 1998 is only a third of the increase in 2007. This provides first graphical evidence that the price effects in 2007 might indeed be partly absorbed by the simultaneous reduction in social security contributions.

As the reduction in social security contributions is most likely to translate into price effects in labor-intensive sectors, Figure 8 shows the development of the price index for the two commodity groups *Service & repair* and *Restaurants & hotels*, which are particularly labor-intensive and which had peculiar point estimates for the 2007 VAT reform. In comparison to Figures 4f and A7d, it first of all needs to be noted that the assumption of flat pre-trends seems to be fulfilled much better for the 1998 VAT reform for both of these commodity groups. Moreover, for service and repair commodities the reform in 1998 seems to have no price effect, as the development continues to be very similar to that of French prices even after the VAT reform was decided on. Both follow a similarly large stepwise increase over the sample period. In contrast, from 2005 to 2009, French and German prices in that sector seem to follow different trends. Given that this is a labor-intensive sector, this development might have been an implication of a number

---

[37]Note that there was no VAT reform in France during that time period.

Figure 8: Development of the Price Index for Selected Commodity Groups - 1998

(a) Service & Repair - 1998
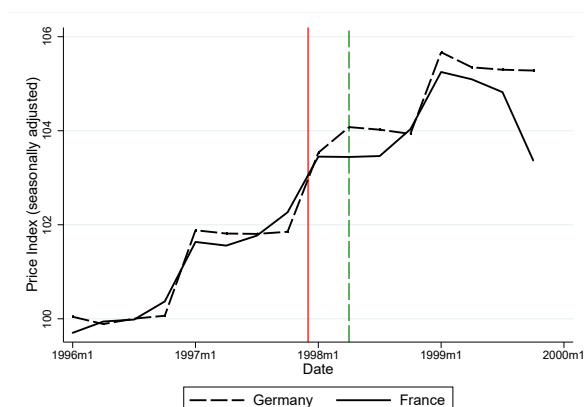
(b) Restaurants & Hotels - 1998
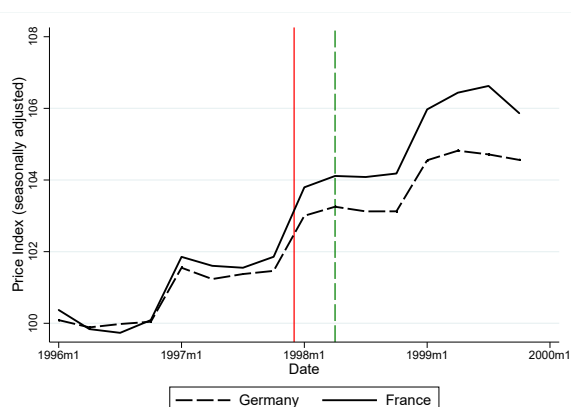
Notes: This figure shows how the seasonally adjusted price index for commodities subject to the standard VAT rate developed in Germany and France from 1996 to 2000 on average. The solid red vertical line marks the final legal decision on the VAT reform in December 1997. The dashed green vertical line marks the implementation of the VAT reform in April 1998.

of reforms which sought to make the German labor-market more competitive, most notably the 2004 Hartz reforms. The reduction in unemployment insurance contributions can also be counted towards these measures.

However, contrary to expectation, the increase in prices for restaurants and hotels in 1998 is less pronounced for German than for French prices. This is likely due to the 1998 World Cup, which took place in France and is found to impact prices for tourist hotels and restaurants in that year (Dauncey and Hare, 2014).

Analogously to the estimation strategies explained in Sections 4.1 and 4.2, I will now present event study and DiD estimates for the 1998 VAT reform for all commodities and the two commodity groups *Service & repair* and *Restaurants & hotels*.

Figure 9 again serves to illustrate the parallel trends assumption and to show the dynamic impact of the 1998 VAT reform on prices for all commodities. There is an increase of around 1% to 2% following the decision on the reform. This is surprisingly large given that the VAT rate only increased by 1 percentage point from 15% to 16%, which would imply a price increase by 0.87% if the VAT increase is fully shifted to the consumer. These findings are corroborated when estimating the average treatment effect. In Column (1) of Table 3 DiD estimates for all commodities are presented. The coefficient is positive and would imply an average price increase by 1.28%. Thus, the magnitude of the price effect for the 1998 VAT reform is substantially higher than for the 2007 VAT reform if one considers that the VAT increase in 1998 was only a third of the increase in 2007. This could be an implication of the simultaneous decrease in social security contributions in 2007. However, even in 1998 the price effect remains statistically insignificant in the preferred specification.

23

Figure 9: Event Study Estimates for All Commodities - 1998
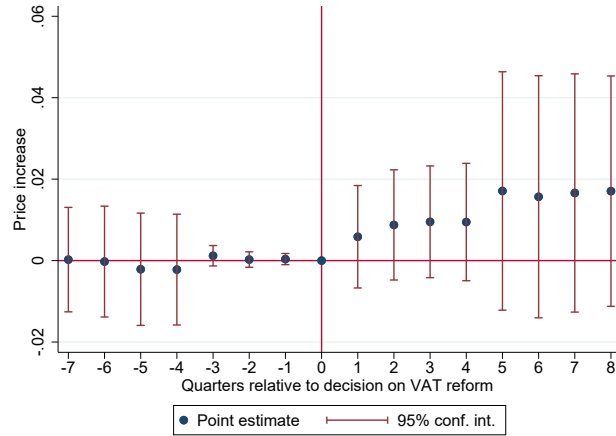
Figures 10a and 10b show quarterly event study estimates for the two labor-intensive commodity groups *Service & repair* and *Restaurants & hotels*. First, it can indeed be confirmed that the parallel trends assumption holds for both groups this time. Moreover, for service and repair commodities the quarterly price effects are positive in 1998. This is also true for the average treatment effect for this commodity group shown in Column (2) of Table 3. This is in contrast to the negative effects found in 2007 for this commodity group (see Figure 4f). The difference in effects could be an impact of the reduction in social security contributions in 2007, which made labor in Germany cheaper right at the time when the VAT was increased. However, the effect is also statistically insignificant in 1998.

Table 3: DiD Estimates: Main Specification - 1998

	(1) All commodities	(2) Service & repair	(3) Restaurants & hotels
Treatment	0.0128	0.00485	-0.0105
	(0.0147)	(0.0071)	(0.0060)
95% CI	[-0.0147, 0.0438]	[-0.0095, 0.0190]	[-0.0247, 0.0055]
Commodity FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
N	5456	336	368
Within R^2	0.0343	0.758	0.730

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses.

As expected, the price effects for restaurants and hotels are negative, which is likely to be due the 1998 World Cup in France. But they are also statistically insignificant both for the dynamic effects (see Figure 10b) and the average treatment effect (see Column (3) of Table 3), while they are statistically significant and negative for the 2007 VAT reform.

In conclusion, a comparison between the 2007 and the 1998 VAT reform in Germany does

Figure 10: Event Study Estimates for Selected Commodity Groups - 1998
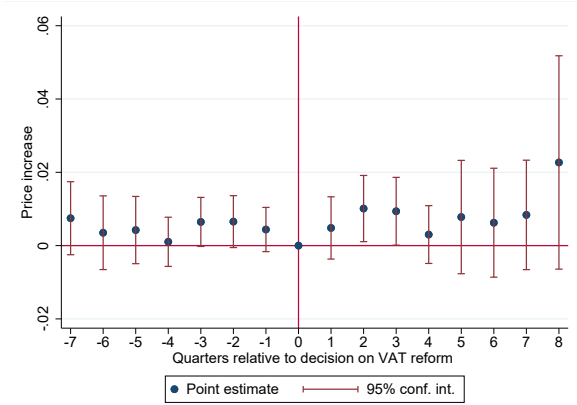
(a) Service & repair - 1998

(b) Restaurants & hotels - 1998

indicate that the effects in 2007 were muted in magnitude by the simultaneous reduction in social security contributions. This would imply that beyond affecting trade, fiscal devaluations also feedback on prices. However, for both reforms the price effects are statistically insignificant. For neither reform there is therefore statistically significant evidence that the burden of the VAT increase is shifted to consumers.

6 Robustness Tests

I carry out a number of tests in order to verify the robustness of my results. In Section 6.1, I change the assumptions regarding the error structure, I control for pre-trends and winsorize the data in Section 6.2, and in Section 6.3, I change the reference period relative to which price changes are measured in the event study approach.

Table 4: DiD Estimates: Robustness - Statistical Inference

	(1) **All commodities**	(2) **All commodities**	(3) **All commodities**	(4) **All commodities**	(5) **All commodities**
Treatment	0.0116*** (0.0028)	0.0116*** (0.0033)	0.0116 (0.0239)	0.0116 (0.0238)	0.0116 (0.0102)
95% CI	[0.0061, 0.0170]	[0.0051, 0.0180]	[-0.0369, 0.0600]	[-0.0318, 0.0607]	[-0.0078, 0.0311]
Error term	No controls	Heteroskedasticity robust	Heteroskedasticity robust & cluster	Heteroskedasticity robust & pairs cluster bootstrap	Heteroskedasticity robust & wild cluster bootstrap at commodity level
Commodity FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
N	6272	6272	6272	6272	6272
Within R^2	0.0301	0.6130	0.0301	0.0301	0.0301

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses in Columns (5) and (6). Within R^2 is reported for Columns (1), (3), (4), (5), and (6). Normal R^2 is reported for Column (2).

6.1 Statistical Inference

In Table 4, I rerun the baseline DiD equation (see Equation 2) with a number of different assumptions regarding the error structure. I continue to control for commodity and time fixed effects in all specifications. In Column (1), I neither control for heteroskedasticity nor correlation of the error terms, while I do control for the former in Column (2). Only for these two specifications the treatment effect is highly statistically significant. This suggests that neglecting the presence of correlation within a commodity group leads to an underestimation of the probability to reject the null hypothesis of no treatment effect. In the remaining specifications intraclass correlation is controlled for but the methods differ. Precisely, in Column (3) errors are clustered at the commodity group level but I do not bootstrap. In Column (4), pairs cluster bootstrapped standard errors at the commodity group are reported. The results are very similar to the main specification in Column (1) of Table 2 with wild cluster bootstrapped standard errors, which according to Cameron et al. (2008) and Cameron and Miller (2015) is the preferred method with few clusters. Finally, Column (5) reports wild cluster bootstrapped standard errors at the individual commodity level. This leads to a smaller standard error and narrows the confidence interval in comparison to the main specification. This is likely due to the fact that the number of clusters is now higher. However, it is also the less cautious approach as Angrist and Pischke (2008) recommend to cluster at a higher level, when in doubt.

Table 5: DiD Estimates: Robustness - Detrending and Winsorizing Data

	(1) **All commodities Detrended**	(2) **All commodities Winsor 1%**	(3) **All commodities Winsor 2%**
Treatment	0.0119	0.0116	0.00515
	(0.0255)	(0.0248)	(0.0145)
95% CI	[-0.0362, 0.0666]	[-0.0351, 0.0642]	[-0.0253, 0.0360]
Commodity FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
N	6272	6272	6272
Within R^2	0.0239	0.0301	0.148

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses.

6.2 Detrending and Winsorizing Data

The price data is cleaned of a linear pre-treatment trend in Column (1) of Table 5. This is done to ensure that results are not biased by different trends in the pre-treatment period for German and French prices. The results remain very similar to the main specification, suggesting that different pre-treatment trends between German and French prices are not a major issue on average.[38]

---

[38]Note that I specifically control for the linear *pre*-treatment trend only and not the linear trend in the entire sample period, as that would potentially absorb part of the treatment effect. This is particularly problematic in case of dynamic treatment effects (Wolfers, 2006).

Moreover, to verify that the results are not driven by outliers in the data, I report winsorized results at the 1%- and 2%-level in Columns (2) and (3) of Table 5, respectively. Again, the results are very robust, especially when winsorizing at the 1%-level.

6.3 Event Study: Reference Period

As robustness test to the event study approach, I choose two alternative base periods relative to which the price changes are measured. On the one hand, one could argue that there might already be anticipatory price effects when the coalition agreement, which contained the decision on the VAT reform, was passed in November 2005. Figure 11a therefore plots the quarterly event study estimates for this case. The point estimates remain close to zero for three quarters following the reference period now. This suggests that there were no anticipatory price effects immediately following the passing of the coalition agreement but that price reactions only set in after another few quarters. Thus, one would miss no relevant anticipatory price effects by setting the reference period back two quarters, which is exactly the time of the final legal decision on the reform. This is the approach followed in the baseline specification (see Figure 5).

On the other hand, if one presumes that there are no anticipatory price effects, the reference period should be set to the implementation date of the VAT reform. Therefore, Figure 11b alternatively plots the event study estimates for the situation where January 2007, the implementation date, is chosen as reference period. As expected, the treatment effects are now smaller, as one ignores the anticipatory price effects. This suggests that June 2006 is the preferable reference period relative to which price effects are measured. Thus, the baseline specification seems to follow the most appropriate approach.

Figure 11: Event Study Estimates for All Commodities - Robustness
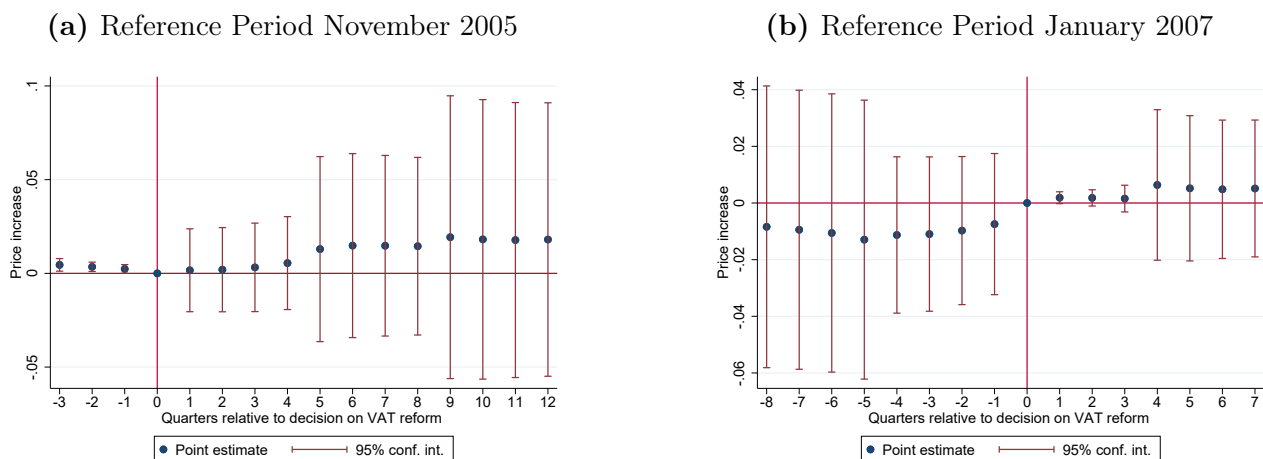
(a) Reference Period November 2005   **(b)** Reference Period January 2007

Notes: This figure plots quarterly event study estimates and corresponding 95% confidence bands for the baseline event study specification Equation 1. The dependent variable is the log of the price index for commodity i in quarter t and country c. Commodity and time fixed effects are included. Standard errors are clustered at the commodity group level. In the left panel the red vertical line marks the implementation of the VAT reform in January 2007. In the right panel the red vertical line marks the implementation of the VAT reform in January 2007.

7 Conclusion

The value-added tax is one of the most important tax revenue sources in many countries. It is efficient in terms of revenue collection and is assumed to cause only relatively low distortions on the labor-market. However, it is also often referred to as regressive tax, as it supposedly ultimately hits consumption, and lower income groups spend a greater share of their income on consumption. It is also for this reason that a number of governments have recently implemented VAT cuts in order to revive consumption during the covid-19 pandemic. These attributions and measures all contain inexplicit assumptions about the tax incidence of the VAT, namely that it is necessarily passed on to consumers. However, previous literature has shown that tax incidence often does not follow straightforward assumptions. It is therefore essential to provide empirical evidence of who actually carries the burden of the VAT, also for modest and broad reforms, which have so far received little attention in the literature.

This is where this paper aims to make a contribution by exploiting an exogenous VAT reform in Germany in 2007. Using detailed price data, I implement an event study and DiD approach to investigate the incidence of the VAT for a wide range of commodity groups.

I find that on average the 2007 VAT reform in Germany had a modestly positive but statistically insignificant effect on prices. I can therefore not reject the hypothesis that on average the VAT increase has not been passed through to consumers. However, there are differences between individual commodity groups, ranging from negative price effects to an over-shifting of the tax burden. Simply relying on the average incidence would therefore be misleading. Policy makers should consider this when reforming the VAT rate. Particularly as the consumption of certain commodities seems to differ between income groups in the population, VAT reforms could have unintended distributional effects. Moreover, I observe anticipatory price effects well in advance of the actual implementation of the reform.

A possible explanation for the low average effect in 2007 could be a simultaneous reduction in social security contributions in Germany. Employers could have used this reduction in non-wage labor costs to lower prices, particularly in labor-intensive sectors. I explore this possibility by comparing the price effects in 2007 with those a VAT reform in 1998 in Germany, which was not accompanied by a reduction in social security contributions. I indeed find that the magnitude of price effects is noticeably higher in 1998, suggesting that the reduction in social security contributions in 2007 absorbed some effect of the VAT increase. This would imply that fiscal devaluations also feedback on prices.

However, for both VAT reforms the price increase is on average statistically insignificant. Therefore, I cannot reject the null hypothesis of no price effect. While one needs to be careful not to interpret this as proof for no price effect, this result at least provides no clear evidence that modest increases are necessarily passed through to consumers and thereby casts doubt on the hypothesis that the VAT is incontrovertibly a regressive tax on consumption. In turn, if the VAT should indeed not be shifted to consumers, it would be carried by producers, ultimately

hitting either wages or profits. If the former applies, the VAT would after all cause distortions on the labor-market. This would have important policy implications.

Particularly as the given setting and empirical approach do not allow to draw more precise conclusions on the incidence of the value-added tax for broad and modest reforms, there is scope for future research.

Finally, it is difficult to directly compare the 2007 VAT reform and its effects to the recently implemented VAT reforms in the wake of the covid-19 pandemic for a number of reasons. First, the 2007 VAT reform implied an increase to the standard VAT rate, while the recent reforms are VAT reductions. This is an important difference as Benzarti et al. (2020) show that the price reaction to increases and decreases in the VAT is not symmetric. Second, some of the recent VAT reforms target very particular sectors, for example hospitality and hotel accommodation in the UK, while the 2007 reform in Germany had a broad scope. Benedek et al. (2019) find that the price effects are smaller for broader reforms. Third, the 2007 VAT reform was announced as permanent increase, while most of the recent VAT reforms are announced as temporary. One could argue that sticky prices and menu costs will mean that prices are less likely to adjust to temporary modifications. Moreover, firms face additional bureaucratic costs when the VAT is reformed and the scope to decrease prices in the short-run might therefore be limited.[39] A final important difference between the current situation and the one in 2007 is that we are facing an unprecedented recession in many countries. This means that firms compete more fiercely in many markets, that consumers are likely to be more price sensitive, and that the level of uncertainty is higher.[40] Altogether this implies that making predictions for the price reactions in 2020 based on those for the 2007 VAT reform in Germany is problematic.

---

[39]At the same time, one could argue that the primary policy aim of temporary consumer tax reductions is an increase in consumer spending, irrespective of the actual price effects. For instance, the UK government introduced a temporary VAT reduction in 2008 as fiscal stimulus during the recession following the financial crisis. Crossley et al. (2014) show that the volume of retail sales did indeed increase as consumers brought forward their purchases. However, firms only initially passed-through the reduction in the VAT by lowering prices. After a few months the price cuts were partly reversed. Thus, the increase in sales was due to intertemporal substitution rather than an income effect. Similarly, Agarwal et al. (2017) show that for temporary sales tax holidays in the US, spending on the covered goods increases substantially. For the very short-run, Montag et al. (2020) show that the pass-through due to the temporary VAT reduction in Germany in 2020 on retail fuel prices was fast, substantial, but incomplete, with pass-through rates depending on the competitiveness of the relevant market.

[40]Balleer et al. (2020), for instance, look at how supply and demand forces affect planned price adjustments in the early stage of the covid-19 pandemic in Germany (at the time the temporary VAT reductions were not yet in place). They find that demand deficiencies dominate, which could be due to an expected income risk and higher economic uncertainty. This shows that under the current circumstances there are many factors at play that affect prices.

References

Abadie, A., Athey, S., Imbens, G. W. and Wooldridge, J. (2017). When Should You Adjust Standard Errors for Clustering?, *NBER Working Paper No. 24003* .

Agarwal, S., Marwell, N. and McGranahan, L. (2017). Consumption responses to temporary tax incentives: Evidence from state sales tax holidays, *American Economic Journal: Economic Policy* **9**(4): 1–27.

Angrist, J. and Pischke, J. (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton, NJ: Princeton University Press.

Balleer, A., Link, S., Menkhoff, M. and Zorn, P. (2020). Demand or Supply? Price Adjustment During the Covid-19 Pandemic, *CEPR Discussion Paper No. 14907* .

Benedek, D., Mooij, R., Keen, M. and Wingender, P. (2019). Varieties of VAT pass through, *International Tax and Public Finance* **27**: 890–930.

Benzarti, Y. and Carloni, D. (2019). Who Really Benefits from Consumption Tax Cuts? Evidence from a Large VAT Reform in France, *American Economic Journal: Economic Policy* **11**(1): 38–63.

Benzarti, Y., Carloni, D., Harju, J. and Kosonen, T. (2020). What Goes Up May Not Come Down: Asymmetric Incidence of Value-Added Taxes, *Journal of Political Economy (forthcoming)* .

Besley, T. (1989). Commodity taxation and imperfect competition: A note on the effects of entry, *Journal of Public Economics* **40**(3): 359–367.

Buchheim, L. and Link, S. (2017). The Effect of Disaggregate Information on the Expectation Formation of Firms, *CESifo Working Paper Series No. 6768* .

Buettner, T. and Madzharova, B. (2017). The Effects of Pre-announced Consumption Tax Reforms on the Sales and Prices of Consumer Durables, number G17-V3 in *Beiträge zur Jahrestagung des Vereins für Socialpolitik 2017: Alternative Geld- und Finanzarchitekturen - Session: Fiscal Policy*, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Vienna.

Cameron, A. C., Gelbach, J. B. and Miller, D. L. (2008). Bootstrap-based improvements for inference with clustered errors, *The Review of Economics and Statistics* **90**(3): 414–427.

Cameron, A. and Miller, D. (2015). A practitioner's guide to cluster-robust inference, *Journal of Human Resources* **50**(2): 317–372.

Carbonnier, C. (2007). Who pays sales taxes? Evidence from French VAT reforms, 1987–1999, *Journal of Public Economics* **91**(5): 1219–1229.

Crossley, T., Low, H. and Sleeman, C. (2014). Using a Temporary Indirect Tax Cut as a Fiscal Stimulus: Evidence from the UK, *IFS Working Paper No. W14/16* .

D'Acunto, F., Hoang, D. and Weber, M. (2016). The Effect of Unconventional Fiscal Policy on Consumption Expenditure, *NBER Working Paper No. 22563* .

Danninger, S. and Carare, A. (2008). Inflation Smoothing and the Modest Effect of VAT in Germany, *IMF Working Paper No. 08/175* .

Dauncey, H. and Hare, G. (2014). *France and the 1998 World Cup: The National Impact of a World Sporting Event*, London, UK: Taylor & Francis.

Donald, S. G. and Lang, K. (2007). Inference with Difference-in-Differences and Other Panel Data, *The Review of Economics and Statistics* **89**(2): 221–233.

Dubois, P., Griffith, R. and O'Connell, M. (2020). How well targeted are soda taxes?, *TSE Working Paper No. 17-868* .

Falkenhall, B., Mansson, J. and Tano, S. (2018). Impact of VAT Reform on Swedish Restaurants: A Synthetic Control Group Approach, *The Scandinavian Journal of Economics* **122**: 824–850.

Fuest, C., Dolls, M., Krolage, C. and Neumeier, F. (2019). Who Bears the Burden of Real Estate Transfer Taxes? Evidence from the German Housing Market, *ifo Working Paper No. 308* .

Fuest, C., Peichl, A. and Siegloch, S. (2018). Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany, *American Economic Review* **108**(2): 393–418.

Fuest, C., Schober, D. and Woll, O. (2018). Tax Incidence and Competition – The Case of Gasoline Retail Taxation, *Working Paper* .

Gaarder, I. (2018). Incidence and Distributional Effects of Value Added Taxes, *The Economic Journal* **129**: 853–876.

Griffith, R., O'Connell, M. and Smith, K. (2017). Design of optimal corrective taxes in the alcohol market, *IFS Working Paper No. W17/02* .

Headey, D. and Fan, S. (2010). Reflections on the global food crisis: How did it happen? How has it hurt? And how can we prevent the next one?, *Research Report No. 165, International Food Policy Research Institute* .

Holzner, M., Tkalec, M., Vizek, M. and Vuksic, G. (2018). Fiscal devaluations: Evidence using bilateral trade balance data, *Review of World Economics* **154**(2): 247–275.

Ivens, A. (2018). Fiscal devaluation in the Euro area: The role of rigidities, non-tradables, and social security contributions, *Journal of International Money and Finance* **87**: 62–81.

Keen, M. (2007). VAT attacks!, *International Tax and Public Finance* **14**: 365–381.

Keen, M. and Lockwood, B. (2010). The value added tax: Its causes and consequences, *Journal of Development Economics* **92**(2): 138–151.

Kosonen, T. (2015). More and cheaper haircuts after VAT cut? On the efficiency and incidence of service sector consumption taxes, *Journal of Public Economics* **131**: 87–100.

Löffler, M. and Siegloch, S. (2018). Property taxation, housing, and local labor markets: Evidence from German municipalities, *Working Paper* .

Mariscal, R. and Werner, A. (2018). The Price and Welfare Effects of The Value-Added Tax: Evidence from Mexico, *IMF Staff Papers* **18**.

Montag, F., Sagimuldina, A. and Schnitzer, M. (2020). Are temporary value-added tax reductions passed on to consumers? Evidence from Germany's stimulus, *Working Paper, Ludwig-Maximilians-University, Munich* .

Moulton, B. R. (1986). Random group effects and the precision of regression estimates, *Journal of Econometrics* **32**(3): 385–397.

Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels, *CESifo Working Paper No. 1229* .

Pesaran, M. H. (2015). Testing Weak Cross-Sectional Dependence in Large Panels, *Econometric Reviews* **34**(6-10): 1089–1117.

Saez, E. and Zucman, G. (2019). *The Triumph of Injustice: How the Rich Dodge Taxes and How to Make Them Pay*, New York, NY: W. W. Norton & Company.

Statista (2019). Steuereinnahmen aus der Umsatzsteuer in Deutschland von 2004 bis 2018, https://de.statista.com/statistik/daten/studie/235794/umfrage/einnahmen-aus-der-umsatzsteuer/. Accessed February 14, 2020.

Stern, N. (1987). The effects of taxation, price control and government contracts in oligopoly and monopolistic competition, *Journal of Public Economics* **32**(2): 133–158.

Stolper, S. (2017). Who Bears the Burden of Energy Taxes? The Role of Local Pass-Through, *Working Paper* .

Sueddeutsche Zeitung (2006). Bundesrat stimmt Mehrwertsteuererhöhung zu, https://www.sueddeutsche.de/wirtschaft/finanzen-bundesrat-stimmt-mehrwertsteuererhoehung-zu-1.905577. Accessed March 4, 2020.

UK Office for National Statistics (2016). Coverage differences between the Harmonised Index of Consumer Prices and national Consumer Prices Indices, https://www.ons.gov.uk/economy/inflationandpriceindices/articles/coveragedifferencesbetween theharmonisedindexofconsumerpricesandnational consumerpricesindices/2016-05-23. Accessed March 27, 2020.

Weyl, E. G. and Fabinger, M. (2013). Pass-Through as an Economic Tool: Principles of Incidence under Imperfect Competition, *Journal of Political Economy* **121**(3): 528–583.

Wolfers, J. (2006). Did Unilateral Divorce Laws Raise Divorce Rates? A Reconciliation and New Results, *American Economic Review* **96**(5): 1802–1820.

Young, D. and Kwapisz, A. (2001). Alcohol Taxes and Beverage Prices, *National Tax Journal* **55**(1): 57–73.

Appendix

A   Additional Figures and Tables

Table A1: Definition of Commodity Groups

Commodity group	Commodities
Alcoholic beverages	Brandy, cognac or similar, grain or double grain, liqueur, whiskey, rum, vodka or similar, white wine, red wine or rose wine, sparkling wine, prosecco, champagne, beer, non-alcoholic beer, mixed beer drink, wine spritzer or similar
Audiovisual equipment	MP3 players or the like, loudspeakers or headphones, TV, DVD recorder, DVD player or Blu-ray player, home cinema system, satellite system, digital camera, digital camcorder, zoom lens, binoculars, desktop PC, portable computer, monitor, printer, scanner, joystick, gamepad or similar for PC, organizer or mobile navigation device, calculator or desktop calculator, operating system or other PC application software, unrecorded data carriers, pre-recorded data carriers or music downloads, photo album
Clothing	Fabrics for outerwear, men's suit, men's leather jacket, blazer or jacket for men, men's pants, men's coat, pullover or cardigan for men, sports or work clothing for men, men's shirt, men's T-shirt, men's pajamas, men's underwear, stockings or socks for men, costume, dress or pants suit for women, women's skirt, women's trousers, women's blouse, women's jacket, women's coat, sweater, cardigan or twin set for women, sports and workwear for women, bra, women's shirt, nightgown or pajamas for women, women's underwear, women's tights, children's jacket, children's pants, costume, dress, skirt or pants suit for girls, sportswear for children, shirt or blouse for children, children's shirt, pajamas or nightgown for children, children's underwear, stockings, socks or tights for children, romper suit or two-piece suit for infants, cap or hat, cycling helmet, gloves, tie, scarf or other clothing accessories, knitting wool or other ere haberdashery
Footwear	Classic shoes or casual shoes for men, men's slippers, men's sports shoes, pumps or casual shoes for women, women's slippers, women's sports shoes, children's shoes, toddler shoes, children's slippers, shoelaces or insoles
Furniture, carpets, and home-textiles	Chair or corner bench, cupboard element for fitted kitchen, kitchenette or fitted kitchen, wardrobe, bed, slatted frame or spring frame, mattress, sofa bed, upholstered furniture, living room table or dining table, living room cabinet, desk, computer table or desk chair, bathroom furniture, wardrobe furniture, garden furniture or camping furniture, shelf, wall lamp or ceiling lamp, table lamp or floor lamp, Berber carpet, oriental carpet or the like, carpeting, carpet tile or the like, laminate, finished parquet, linoleum or the like, woolen blanket, duvet, bedspread or the like, duvet cover set or bed sheet, curtain, interior blind or similar, bathroom carpet or bathroom furniture, towel, tablecloth, table runner or similar, garden umbrella
Glass- & tableware and household utensils	Drinking glasses, tableware made of porcelain, baking dish, cutlery, kitchen knife or the like, kitchen scales, mixing spoons, pounders or the like, frying pan, casserole or saucepan, tableware made of metal, plastic or wood, laundry basket or folding box made of plastic, storage container made of plastic, ironing board, baby bottle or the like
Household appliances	Refrigerator, fridge-freezer combination, freezer or freezer, washing machine, dryer, dishwasher, stove, oven or microwave, fireplace, extractor hood, fan or similar, vacuum cleaner, sewing machine, toaster, waffle iron or similar, coffee machine or tea maker, kettle, egg cooker or the like, fully automatic coffee machine, pod machine or the like, electric mixer or blender, iron
Household maintenance	Heavy duty detergent, mild detergent or special detergent, fabric softener, starch or similar, dishwashing detergent, sanitary cleaner, shoe polish or other shoe care product, metal care product or other care product, all-purpose cleaner or other cleaning agent, aluminum foil, transparent film or the like, filter paper, paper cups or the like, nails, screws or the like, brushes, brooms or other cleaning articles, candles, glue, matches or the like
Non-alcoholic beverages	Cola drink, caffeine-free lemonade, apple juice or similar fruit juice, orange juice or similar fruit juice, multivitamin juice, diet fruit juice, vegetable juice

Table A1: Definition of Commodity Groups

Commodity group	Commodities
Personal care	Hair dryer or other hair care device, electric, razor, electric toothbrush, hairbrush, comb or hair clip, bathroom scales, toothbrush, non-electric, wet razor, razor blades or the like, Eau de toilette or perfume, hair shampoo, Hairspray, hair gel or the like, hair color or tint, hand cream, day cream or night cream, children's cream, toothpaste, mouthwash, dental floss or the like, aftershave, shaving cream or the like, lipstick or lip balm, nail polish, make-up, kohl pencil or mascara, fine soap, shower gel, shower bath or bath additive, deodorant spray or deodorant roller, toilet paper, tissue, diapers for babies or toddlers, tampons, facial tissues or other hygiene products
Personal items	Wristwatch or pocket watch, wall clock, alarm clock, stopwatch or the like, battery change for a wristwatch, women's handbag, briefcase, satchel or backpack, suitcase, travel bag or the like, purse, ID bag or the like, disposable lighter, stroller, child car seat, umbrella, sunglasses, weather station
Recreational items	Motorhome, caravan, musical instruments, including accessories, board game, game console, game for game console, electric model train or accessories, construction kit, experiment kit or model kit, tricycle, scooter or other children's sports vehicle, doll, teddy bear or other soft toy, toy car, toy shop or other toy, decorative items for parties, soccer or other sports balls, skis, snowboards or other winter sports items, tennis rackets, table tennis rackets or the like, fitness equipment, inline skates, ice skates or roller skates, football shoes or other special sports shoes, paddling pool, diving goggles or the like, sleeping bag, tent or other camping items, flower pot or planter, flower fertilizer, potting soil, bark mulch, peat or the like
Recreational activities	Visit to an amusement park, services from photo laboratories or similar, ride with cable car or ski lift, fishing permit or similar, fee for gym
Restaurants & hotels	Consumption of meat dishes, consumption of fish dishes, consumption of pasta, pizza, omelets or similar, consumption of soups or stews, consumption of ice cream or other dessert, consumption of other dishes, food for consumption on public transport, consumption of coffee, tea or the like, consumption of fruit juice or vegetable juice, consumption of mineral water, consumption of lemonade or the like, consumption of spirits, consumption of beer, consumption of wine or sparkling wine, drink for consumption on public transport, consumption of food in canteen or cafeteria, overnight stay, overnight stay in youth hostels, rent for holiday apartment or holiday home, campsite fee
Service & repair	Repair of consumer electronics, laying and fixing floor coverings, sanding and sealing parquet flooring, repair on large household appliances, domestic help services, cosmetic repairs and other repairs, hairdresser for men, hairdresser for children, hairdresser for women, fee for tanning salon, cosmetic treatment or the like, painting of a fender, car inspection, car repair, car wash, bicycle repair
Stationary	Calendar, postcard or greeting card, pen, fountain pen or similar, file folder, stamp or other office supplies, envelopes, letter pad or stationery, exercise book, drawing pad, printer paper, pencil, colored pencil, ink box or similar, printer cartridge
Tobacco	Cigarettes, cigars and cigarillos, tobacco
Tools & equipment	Motor lawn mower, hammer drill, cordless screwdriver or drill, garden tools, hammer, screwdriver or similar, paintbrush or paint roller, locks, keys or fittings, halogen lamp, energy-saving lamp or similar, socket, plug, cable or similar, alarm detector or motion detector, batteries, wallpaper, paints or varnishes, wallpaper paste, thinner or the like, building materials, doors, windows and the like
Vehicles purchase	New cars, vans, used cars, motorcycles, bicycles, car tires, car battery or spark plugs, accessories or spare parts for motor vehicles, car trailers, car wax, paint care products or the like, tires or inner tubes for bicycles, accessories or spare parts for bicycles

Table A2: DiD Estimates for Selected Commodity Groups: Main Specification I
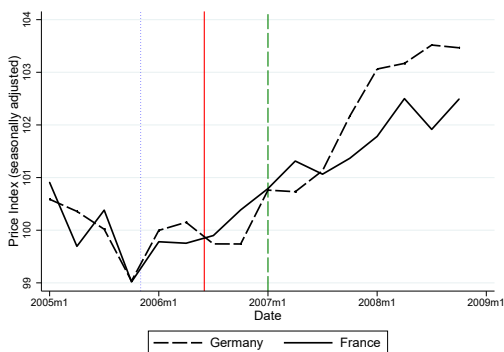
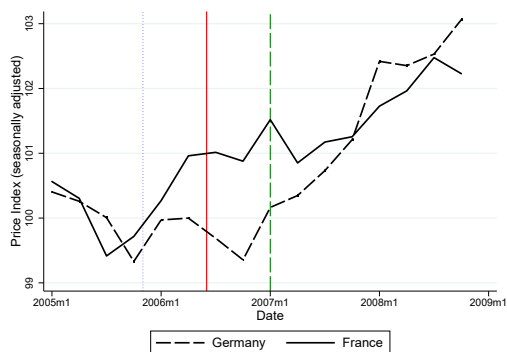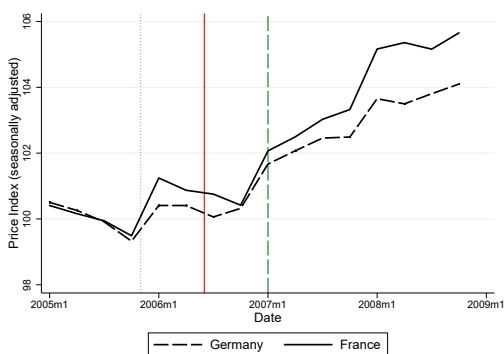|	(1) Audiovisual equipment	(2) Clothing	(3) Footwear	(4) Furniture, carpets & hometextiles	(5) Glass-&tableware, household utensils	(6) Nonalcoholic beverages
Treatment	0.0581	0.00151	0.00256	-0.00149	-0.00701	0.0322
	(0.0058)	(0.0076)	(0.0087)	(0.007)	(0.0246)	(0.0064)
95% CI	[-0.0772, 0.1938]	[-0.0197, 0.0127]	[-0.0203, 0.0227]	[-0.0196, 0.0169]	[-0.0291, 0.0134]	[-0.0479, 0.0996]
Commodity FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
N	544	720	160	560	224	176
Within R^2	0.459	0.274	0.543	0.256	0.647	0.636

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses.

Table A3: DiD Estimates for Selected Commodity Groups: Main Specification II

	(1) Recreational items	(2) Personal items	(3) Recreational activities	(4) Restaurants & hotels	(5) Stationary	(6) Tools & equipment	(7) Vehicle purchase
Treatment	0.0008	-0.000270	-0.00193	-0.0198*	-0.00527	0.00457	0.0137
	(0.0614)	(0.0237)	(0.0282)	(0.0089)	(0.0078)	(0.0162)	(0.0186)
95% CI	[-0.0191, 0.0135]	[-0.0512, 0.0703]	[-0.3679, 0.4023]	[-0.0383, 0.0015]	[-0.0562, 0.0460]	[-0.0351, 0.0470]	[-0.0319, 0.0537]
Commodity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	288	448	96	384	176	288	320
Within R^2	0.722	0.0401	0.436	0.891	0.735	0.589	0.624

Notes: Commodity and quarter fixed effects in all estimations. Wild cluster bootstrapped standard errors are reported (10,000 repetitions) in parentheses.

Figure A1: Development of the Price Index for Commodities Subject to the Reduced VAT
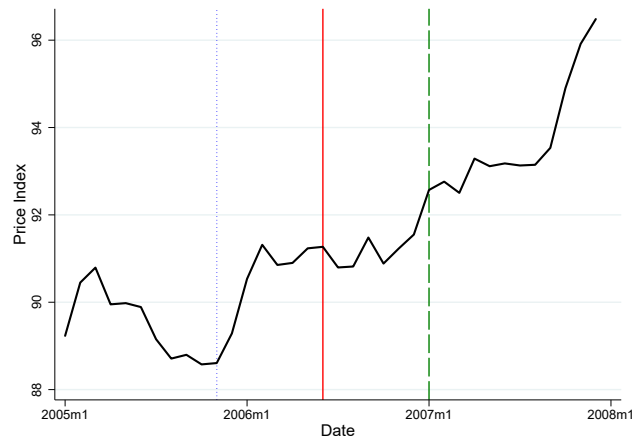
Notes: This figure shows the development of the price index for commodities subject to the reduced VAT in Germany from 2005 to 2009. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

**Figure A2:** Development of the Price Index for All Commodities: German and Belgian Prices
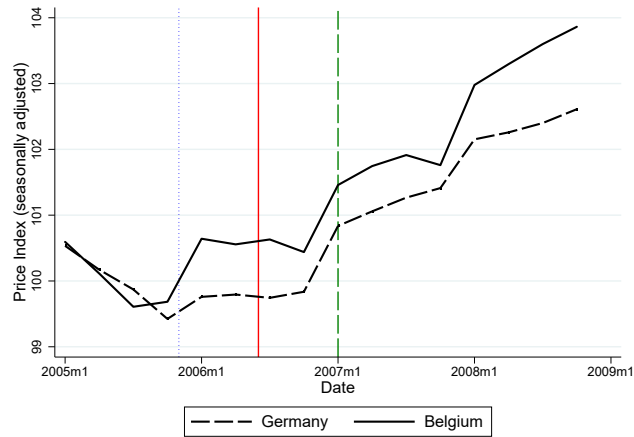
Notes: This figure shows how the seasonally adjusted price index for commodities subject to the standard VAT rate developed in Germany and Belgium from 2005 to 2009 on average. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

Figure A3: Macroeconomic Trends

(a) Inflation
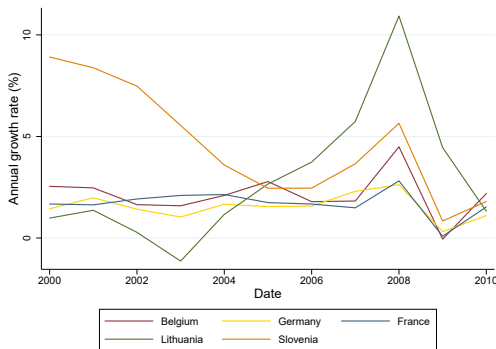
(b) Real GDP Growth
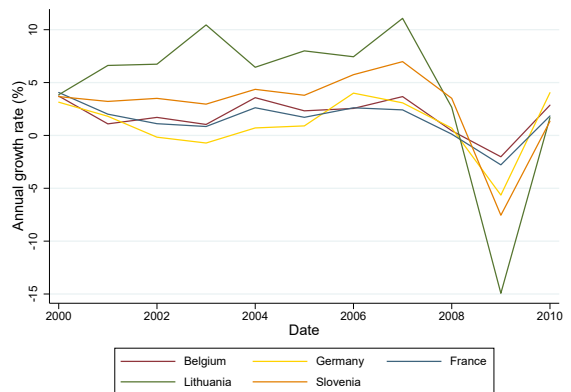
(c) GDP per Capita
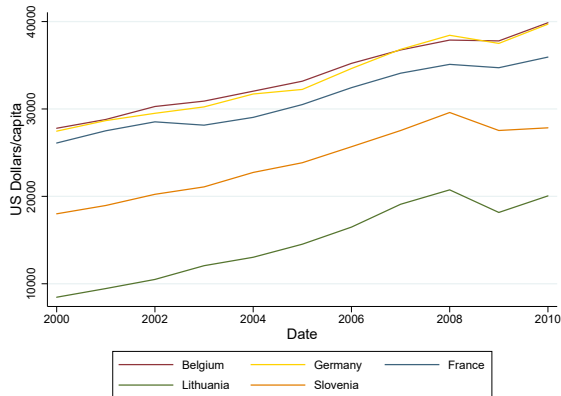
(d) Harmonized Unemployment Rate
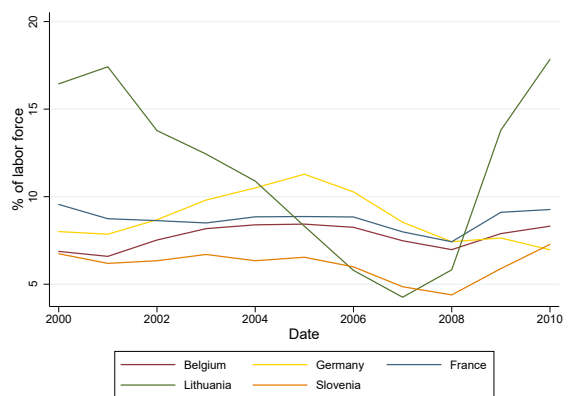
Notes: This figure shows macroeconomic trends for a selection of European countries for 2000 to 2010. Source: OECD.

viii

Figure A4: Development of the German Price Index Following the National (CPI) and the Harmonized (HICP) Definition
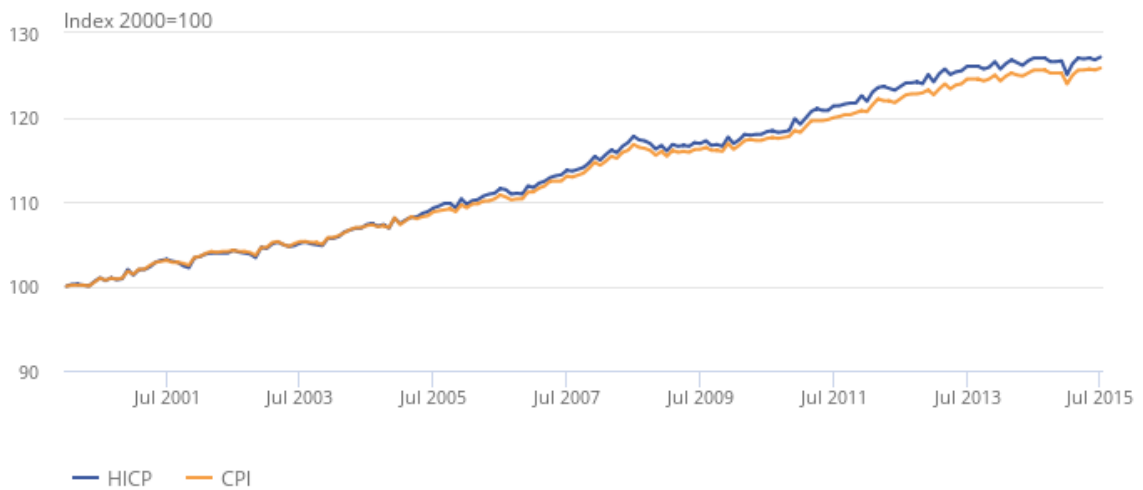
Index 2000=100

Figure A5: Residuals
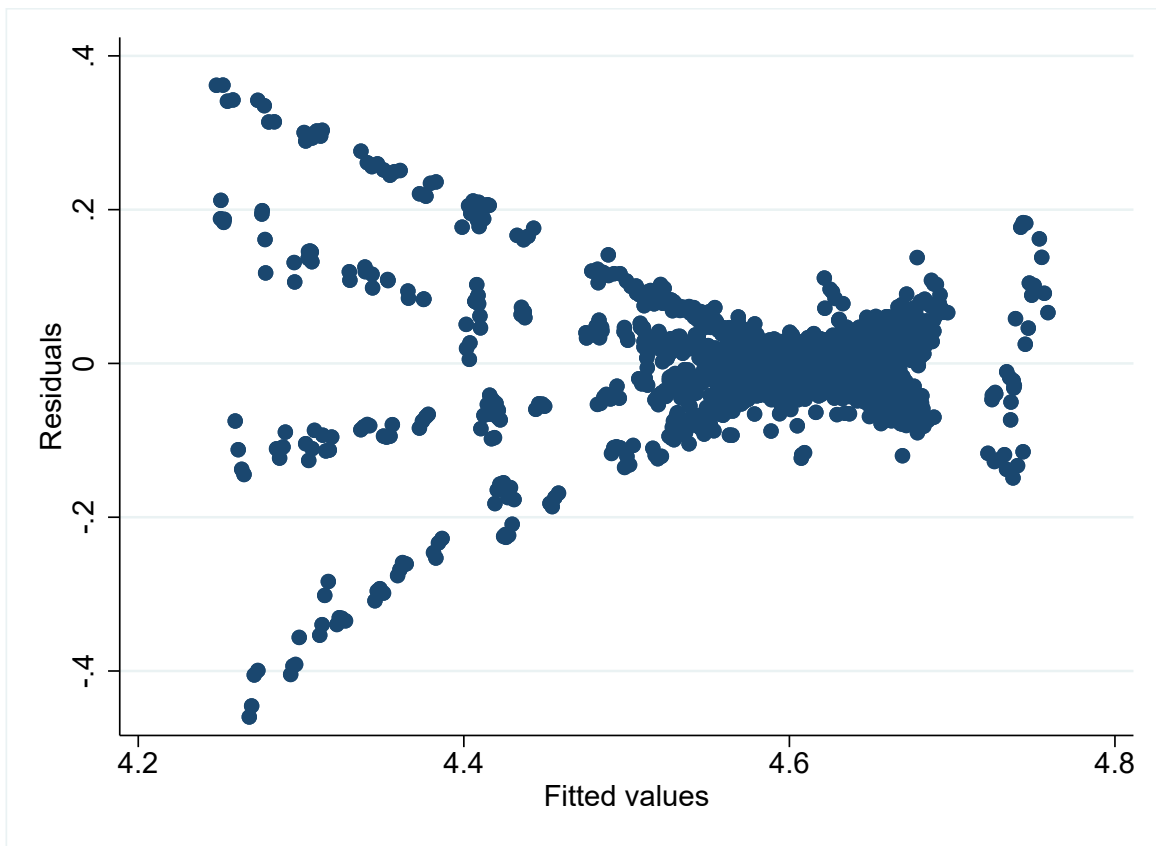
Notes: This figure shows the distribution of residuals with the log of prices as dependent variable.

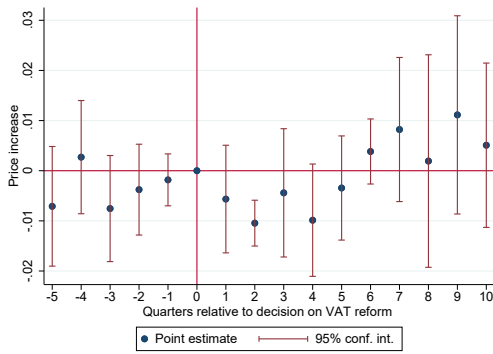**Figure A6:** Development of the Price Index for Selected Commodity Groups I
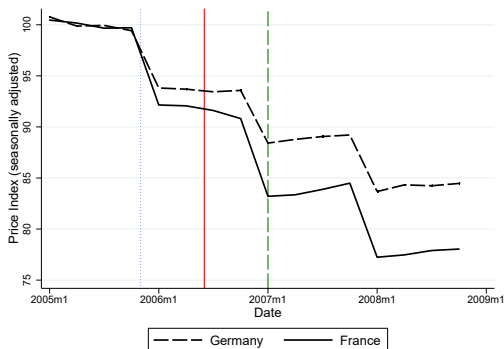
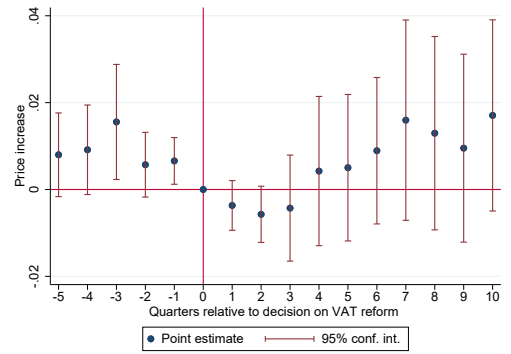**(a)** Audiovisual Equipment
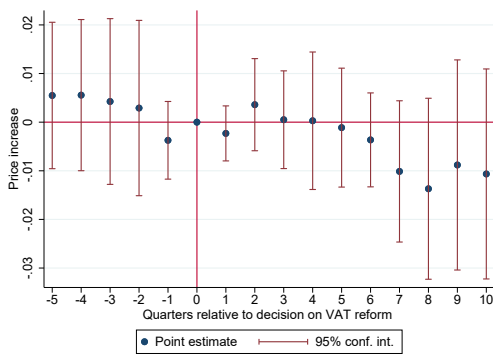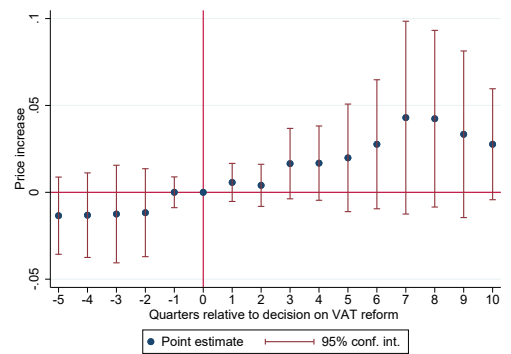

(b) Clothing

(c) Footwear

(d) Furniture, Carpets & Hometextiles

(e) Glass-& Tableware, Household Utensils

(f) Non-Alcoholic Beverages


Notes: This figure shows how the seasonally adjusted price index for selected commodity groups developed in Germany and France from 2005 to 2009. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

Figure A7: Development of the Price Index for Selected Commodity Groups II
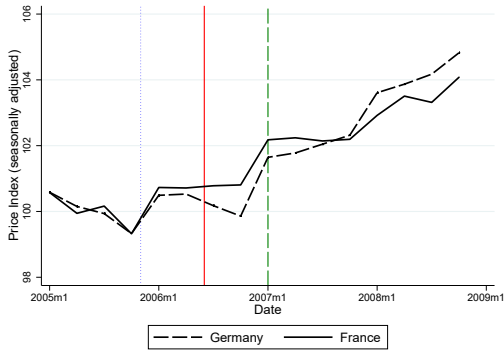
(a) Personal Items

(b) Recreational Items
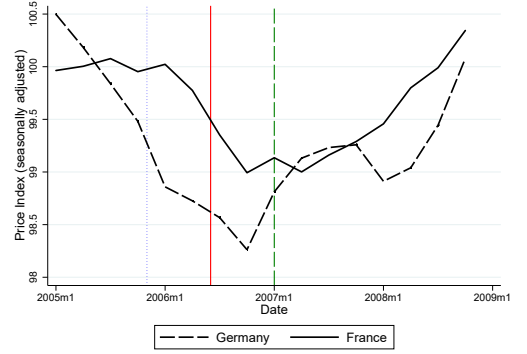
(c) Recreational Services
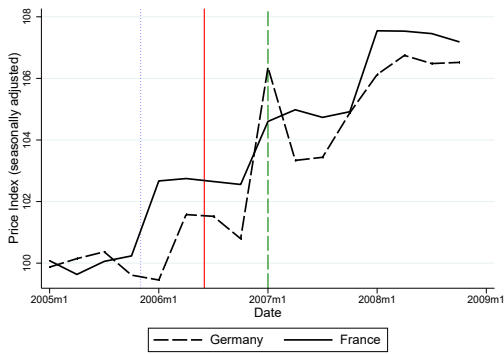
(d) Restaurants & Hotels
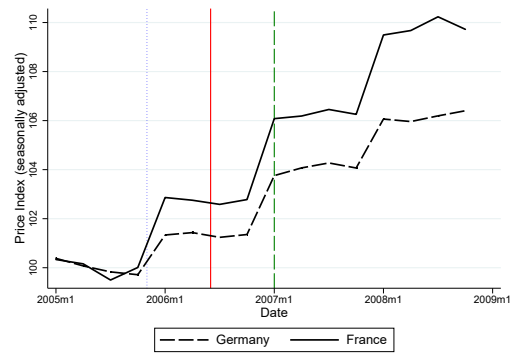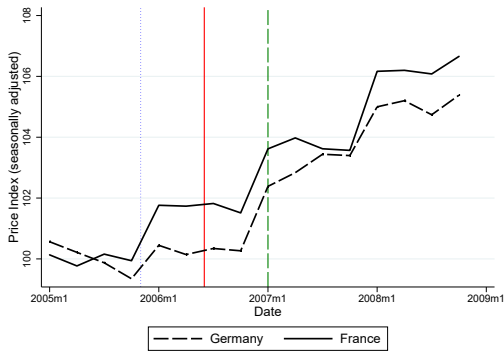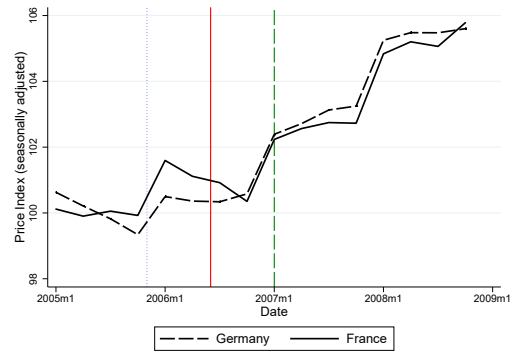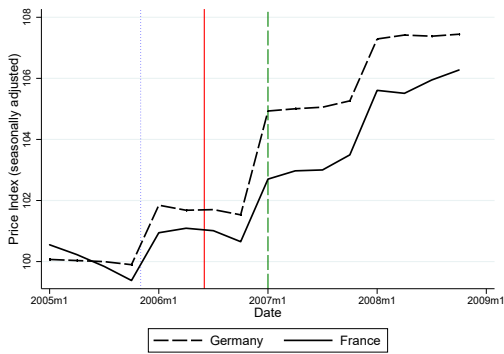
(e) Stationary

(f) Tools & Equipment

(g) Vehicle Purchase

Notes: This figure shows how the seasonally adjusted price index for selected commodity groups developed in Germany and France from 2005 to 2009. The dotted blue vertical line marks the passing of the coalition agreement in November 2005. The solid red vertical line marks the final legal decision on the reform to the standard VAT rate in June 2006. The dashed green vertical line marks the implementation of the respective VAT reform in January 2007.

Figure A8: Event Study Estimates for Selected Commodity Groups I
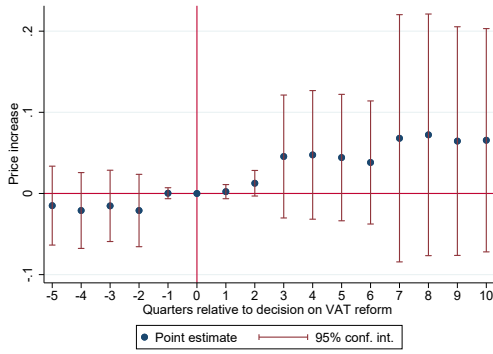
(a) Audiovisual Equipment

(b) Clothing

(c) Footwear

(d) Furniture, Carpets & Home Textiles

(e) Glass-& Tableware, Household Utensils

(f) Non-Alcoholic Beverages

Notes: This figure plots monthly event study estimates and corresponding 95% confidence bands. The dependent variable is the log of the price index for commodity i in month t and country. Commodity, time and country fixed effects are included. Standard errors are clustered at the commodity group level. The red vertical line marks the final legal decision on the VAT reform in June 2006. The number of observations can be found in Table A2.

Figure A9: Event Study Estimates for Selected Commodity Groups II
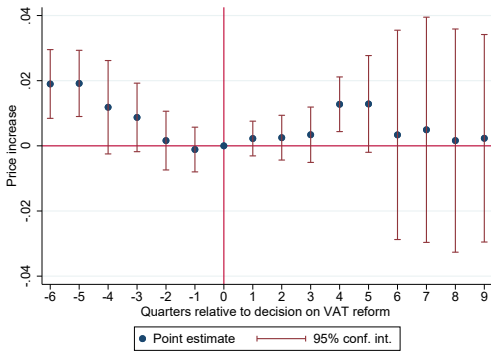
(a) Personal Items
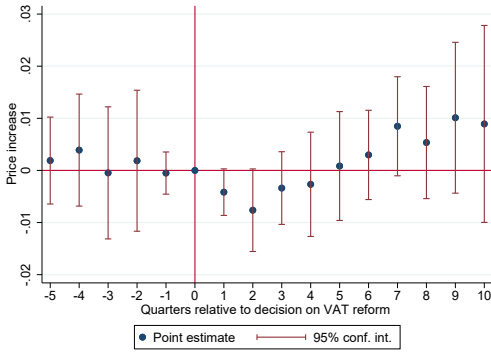
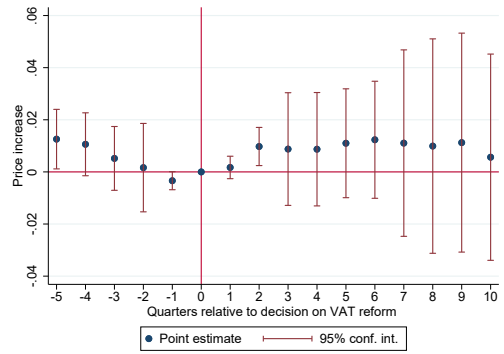**(b)** Recreational Items
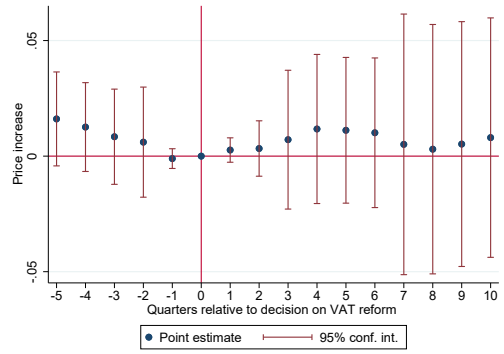
(c) Recreational Activities
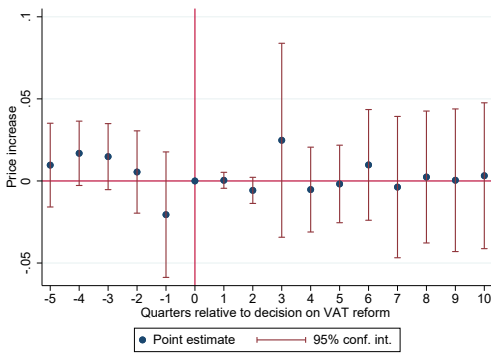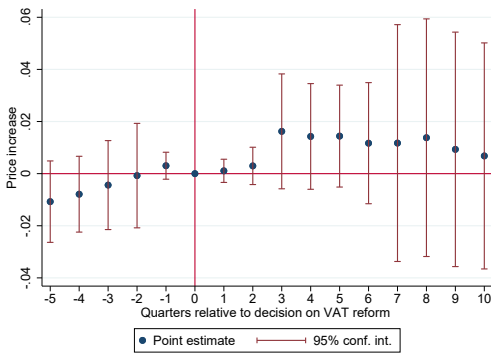
(d) Restaurants & Hotels
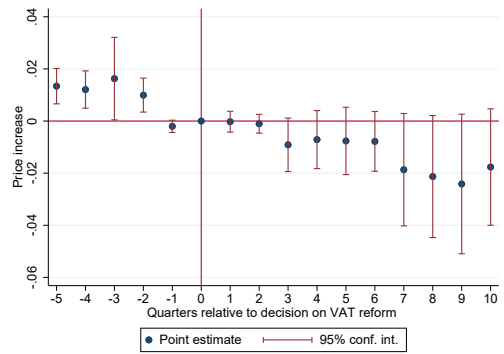
(e) Stationary

(f) Tools & Equipment

(g) Vehicle Purchase

Notes: This figure plots monthly event study estimates and corresponding 95% confidence bands. The dependent variable is the log of the price index for commodity i in month t and country. Commodity, time and country fixed effects are included. Standard errors are clustered at the commodity group level. The red vertical line marks the final legal decision on the VAT reform in June 2006. The number of observations can be found in Table A3.

Figure A10: 1st Net Household Income Quartile: Consumption Shares (%)
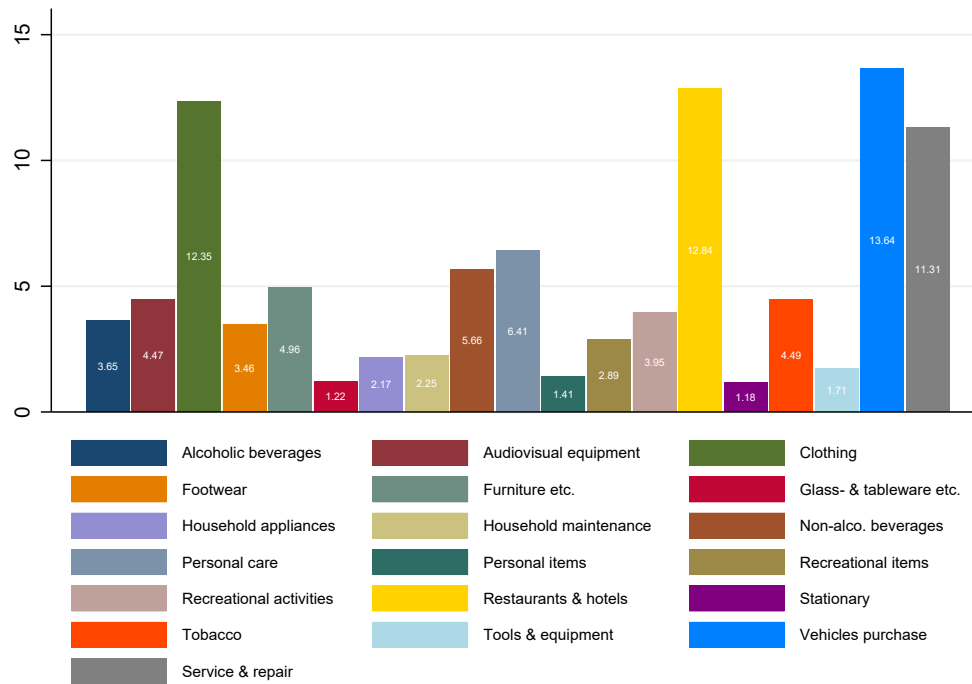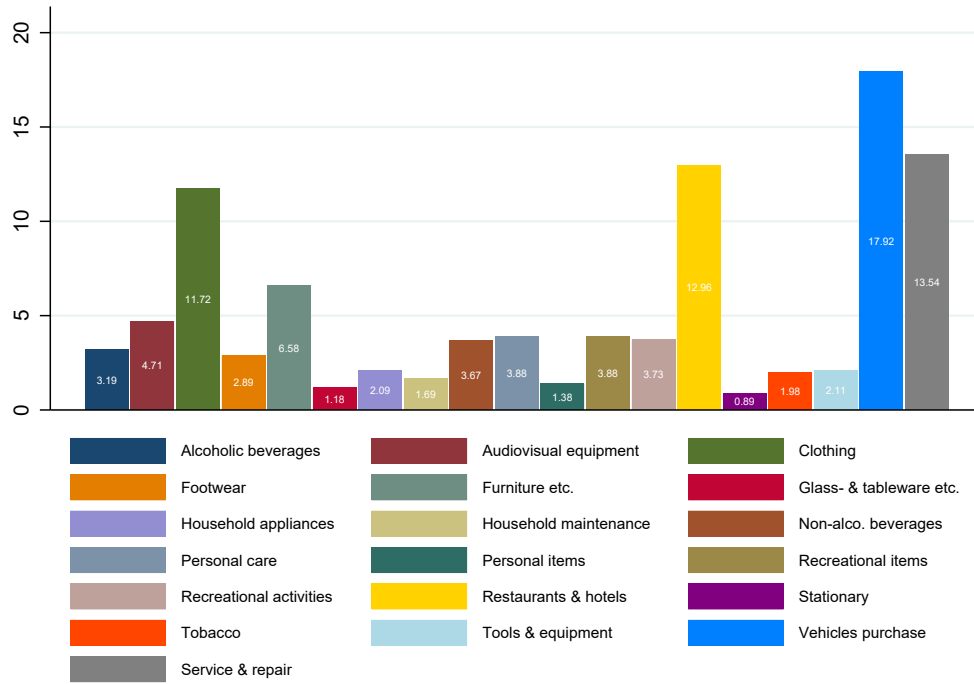

This figure shows consumption shares for 19 previously defined commodity groups for the first net household income quartile in %. This figure is based on data from the income and consumption survey (*Einkommens- und Verbrauchsstichprobe*, EVS) for the year 2003.

Figure A11: 2nd Net Household Income Quartile: Consumption Shares (%)
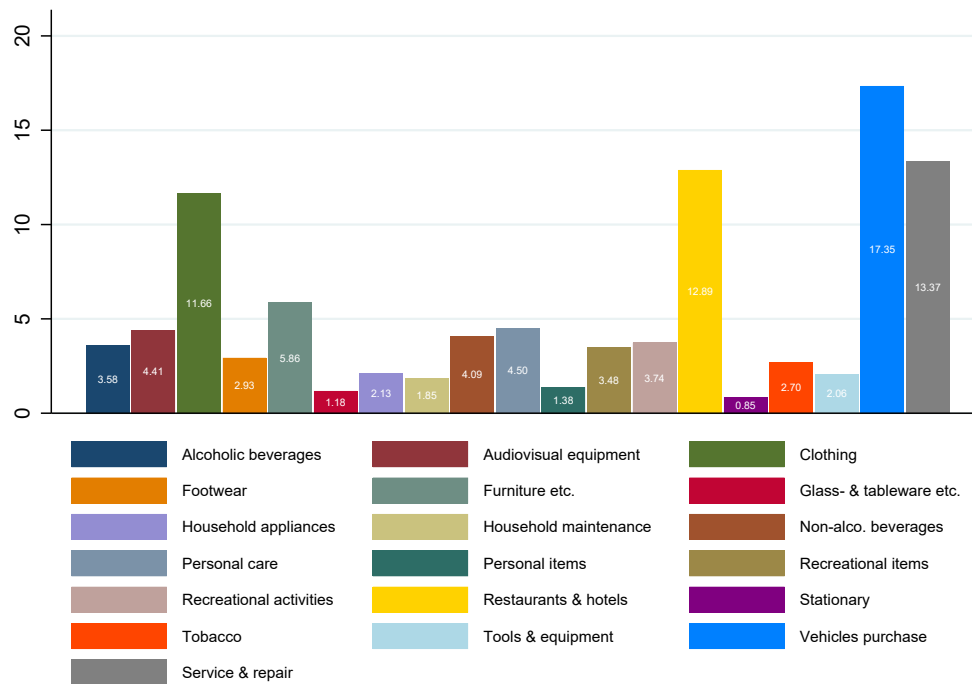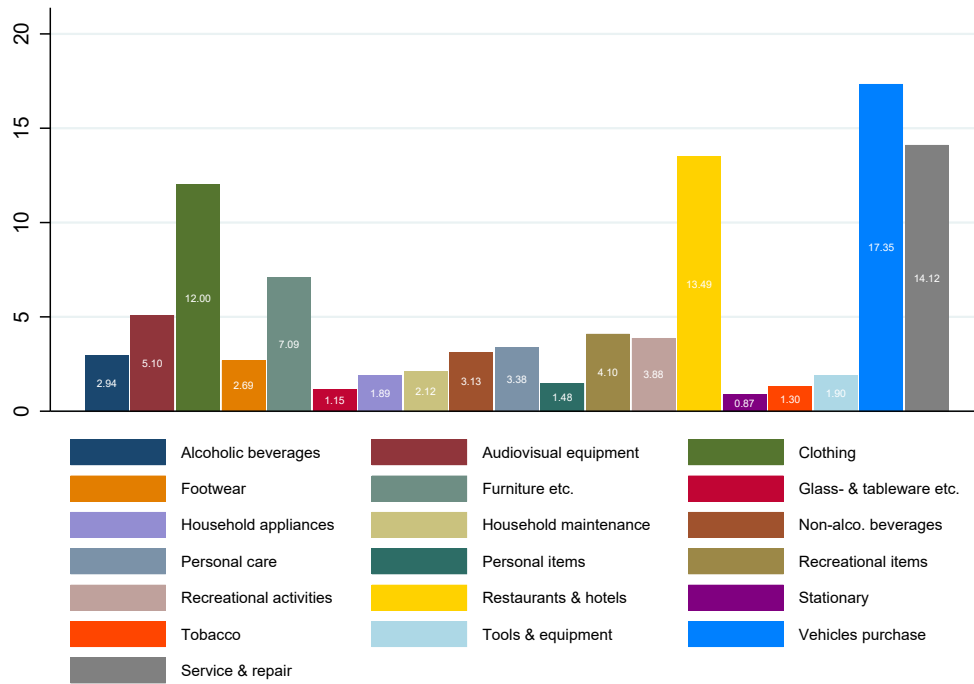

This figure shows consumption shares for the 19 previously defined commodity groups for the second net household income quartile in %. This figure is based on data from the income and consumption survey (*Einkommens- und Verbrauchsstichprobe*, EVS) for the year 2003.

Figure A12: 3rd Net Household Income Quartile: Consumption Shares (%)

This figure shows consumption shares for the 19 previously defined commodity groups for the third net household income quartile in %. This figure is based on data from the income and consumption survey (*Einkommens- und Verbrauchsstichprobe*, EVS) for the year 2003.

Figure A13: 4th Net Household Income Quartile: Consumption Shares (%)

This figure shows consumption shares for the 19 previously defined commodity groups for the fourth net household income quartile in %. This figure is based on data from the income and consumption survey (*Einkommens- und Verbrauchsstichprobe*, EVS) for the year 2003.