The impact of the temporary VAT reduction in Germany: A study on price effects in online grocery retail with a focus on differences between manufacturer and retailer brands

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Abstract

This paper investigates the impact of the temporary reduction in the German value-added tax (VAT) in July 2020 on online grocery prices, focusing on both traditional manufacturer brands and private labels. Using a fixed-effects estimation and daily price data from a major German online grocery retailer, we examine price effects for four key product categories and tracking the entry into the VAT reduction period. Our analysis reveals a significant initial price decrease during the first week of the VAT cut, maintaining a lower level throughout the reduction period but experiencing a slight rise by the end of August. On average, the pass-through rate is around 80 %. Notably, differences emerge among product categories, and private labels exhibit a more than complete pass-through rate of 152%, while manufacturer brands only pass on 63% of the VAT change. An incomplete transfer is below the expectations of politicians and the announcements of the retailers. At the same time, a more than complete transfer contradicts the expectations for private labels. The study can provide evidence to assess the effect in future measures.

Keywords Temporary VAT reduction, online grocery retail, private labels

JEL code H25, L81

1. Introduction

In July 2020, the German government lowered the VAT rate for six months from 19% to 16%, and the reduced VAT rate from 7 % to 5 % in order to stimulate private consumption and support the economy, which had been weakened by the coronavirus pandemic.

After income tax, VAT is the most important source of income for the German state (Statistisches Bundesamt (German Federal Statistical Office) 2022). Approximately one third of government revenue is generated by it (Bundesregierung 2020). The government (2020) calculated that the reduction would reduce tax revenue by €19.6 billion in 2020. At the same time, a temporary VAT reduction is a relatively new instrument of tax policy and, as a result, there is little evidence of its effectiveness (Fuest, Neumeier and Stöhlker 2021). There are only a few studies on the topic. The most extensive temporary VAT reduction so far took place in the UK. In December 2008, the government there reduced the VAT rate by 2.5 percentage points for 13 months with the aim of stimulating consumer spending after the financial crisis (Barrell and Weale 2009; Blundell 2009; Crossley, Low and Wakefield 2009; Crossley, Low and Sleeman 2014). In addition to this, there were further VAT reductions, although the rate was only reduced in individual sectors rather than in general. Belgium, for example, reduced the VAT rate

for electricity from 21 to 6 % between 2014 and 2015 (Hindriks and Serse 2021). In Finland, VAT on hairdressing services was reduced for five years in 2007 (Benzarti et al. 2020). Both VAT reductions were subsequently temporary, but were initially introduced as permanent tax cuts.

The aim of this study is to analyse the impact of the VAT reduction on food prices in Germany. The study supplements the existing analyses of the temporary VAT reduction by taking a comprehensive look at brand types, manufacturer brands and private labels in online grocery retailing. In addition to the average transmission rate, the course over time is also analysed. For this purpose, extensive price data for a large number of individual products from different categories of the e-retailer Rewe are analysed. On the one hand, the analysis is relevant, among other things, because shopping behaviour has changed significantly towards online retail during the pandemic (Busch, Bayer and Spiller 2021; Engels 2020). Since then, everyday products have increasingly been purchased online (Engels 2020). Online grocery sales rose by 89.4 per cent in the second quarter of 2020 (bevh 2020). Reasons for this included protection against infection and sold-out products at local retailers (Busch et al. 2021; Dannenberg et al. 2020; Engels 2020). It can also be assumed that online grocery retail will continue to grow in importance in the future (bevh 2020). The IFH (2020) assumes that online sales will account for 5 to 9 per cent of the total food trade in Germany by 2030. In 2019, the share was still 1.4 per cent (HDE 2021). On the other hand, it is interesting to take a closer look at the differences between manufacturer brands and private labels. Private labels have been an important part of the food retail industry for decades. Initially, they were introduced to keep up with the cheap products from the new discounters (Jonas and Roosen 2005). They are generally significantly cheaper than manufacturer brands (Bittmann and Scharnhop 2021), and are purchased by lower income groups in particular, which is why they are especially important during economic downturns (Lamey et al. 2007).

The paper is organised as follows: Firstly, an overview of the theory and results of previous studies on temporary VAT reductions is provided. This is followed by a description of the data and the methodology. Next, the results of the model estimates are presented and discussed. Finally, the main findings of the article are summarised.

2. Background / Literature

A temporary tax reduction has an income effect. If prices fall as a result of the reduced VAT, the real income of consumers increases (Blundell 2009; Crossley et al. 2009; Dullien and Gechert 2020). As a result, consumers are incentivised to increase their demand (Dullien and Gechert 2020) or they are relieved by lower costs for the same bundle of goods (Crossley et al. 2009; Crossley et al. 2014). A reduction in value-added tax (VAT) will provide relief for the lower- and middle-income groups in particular, as they bear the relatively highest VAT burden in terms of income (Bach, Isaak and Banal-Estanol 2017; Schaefer 2013). As income rises, relative consumer spending decreases and therefore the relative burden of VAT also falls (Bach et al. 2017; Schaefer 2013). In addition to the initiated price reduction, the size of the income effect depends on the consumer's planning horizon (Crossley et al.

2009): If the planned consumption is after the period of the temporary tax cut, the income effect is reduced. The expectation of what costs will be incurred by the consumer in the future (e.g. through increased taxes) to finance the measure plays a role here (Crossley et al. 2009).

Furthermore, the measure can work via the intertemporal substitution effect. If VAT rates and therefore prices fall for a limited period of time, it is advantageous for consumers to bring forward future purchases (Blundell 2009; Crossley et al. 2009; Dullien and Gechert 2020). This effect could also occur if prices do not fall at all, e.g. if consumers expect prices to rise after the end of the measure (Dullien and Gechert 2020). If the purchase of storable goods in particular is preferred, this is referred to as an arbitrage effect (Barrell and Weale 2009; Crossley et al. 2009; Crossley et al. 2014).

In order for the VAT reduction to lead to an increase in expenditure or a reduction in the burden on consumers, it must be passed on in the form of lower prices. The federal government has urged companies to pass on the VAT reduction to consumers (Bundesregierung 2020). If this is not the case, they can increase their margins and profits (Dullien and Gechert 2020). However, this cannot be assumed, as the food retail sector is highly concentrated, but there is fierce price competition between companies (Hoffmann and Loy 2010). Some of the largest food retail companies in Germany, including Rewe, Edeka and Lidl, had already announced in advance that they would pass on the VAT reduction in full (EDEKA 2020; Hofmann 2020; Lidl Deutschland 2020). However, if we look at consumer expectations, a different picture emerges. In a survey by Behringer, Dullien and Gechert (2021), a majority of respondents expected the VAT reduction to be passed on only partially, a small proportion expected it to be passed on in full and around a third did not expect it to be passed on at all.

Due to the great importance of transmission, the studies presented in the introduction deal with whether and to what extent the VAT reduction will be passed on by companies to consumers (see Benzarti et al. 2020; Blundell 2009; Crossley et al. 2009; Crossley et al. 2014; Hindriks and Serse 2021). The 2020 VAT reduction in Germany was also analysed with regard to this point. Montag, Sagimuldina and Schnitzer (2020) analyse the passing on of the VAT reduction for petrol and diesel prices. They come to the conclusion that the reduction was passed on quickly after it came into force, but only 40 to 83 %, depending on the type of fuel. They attribute differences between petrol and diesel to different consumer purchasing behaviour and competitive pressure on the markets (Montag et al. 2020). Targeted application to markets with high competitive pressure can therefore increase the cost efficiency of such a measure (Montag et al. 2020).

Beck et al. (2021) analyse how the prices of fast-moving consumer goods (FMCG), which include food, and slow-moving consumer goods (SMCG), which include electronic goods, behave. Using scanner data, they determine a transmission rate of 76 % for FMCG and 96 % for SMCG and conclude that the measure led to rapid relief for households (Beck et al. 2021). The study by Fuest et al. (2021) looks at

everyday consumer goods. To this end, the prices in Rewe's online shop are analysed. The transmission rate for the entire product range is 70 %; for food and non-alcoholic beverages, the transmission rate is as high as 80 % (Fuest et al. 2021). Fuest et al. (2021) also come to the conclusion that the competitive situation is decisive for the pass-through rate.

3. Data

This study uses a panel data set consisting of daily price observations for 2,644 products from the food range of large online shop in Germany. The data set is based on the data from Fedoseeva (2023). Fedoseeva and van Droogenbroeck (2023) use the same data basis for their study and describe in detail the process of data collection through web scraping. We distinguish between two types of brands: manufacturer brands and private labels. Allocation to one of the two categories is based on the brand name of the products. Rewe is a great candidate because it offers a wide range of manufacturer brands as well as established private labels. In addition to product prices, information on promotional offers and product categories is also used. The data set ranges from 1 May to 30 August 2020 and thus covers the entry period of the temporary VAT reduction in Germany in 2020. The period two months before and after the change in the VAT rate is considered. The product categories considered are based on the categories used to calculate the German consumer price index (Statistisches Bundesamt 2019).

The following categories, which are based on standard retail definitions categories and are used to calculate the German consumer price index (Statistisches Bundesamt 2019), are analysed: Bakery products, meat products, eggs and dairy products as well as coffee and tea. All of the categories considered are everyday products and the reduced VAT rate of 7 per cent before and 5 per cent after the VAT reduction in July 2020 applies. Measured in terms of consumer spending by the German population, these categories account for around 44.5 per cent of spending on food and non-alcoholic beverages (Statistisches Bundesamt 2019).

Table 1 shows some descriptive statistics for the price data differentiated by brand type. The dataset contains prices of 2,644 different products with a total of 292,966 observations. All products for which data is available for less than 75 per cent of the days in the period under review have been removed for reasons of comparability. This is also to ensure that the data set represents the retailers' standard product range. In addition, Table 1 contains the average prices, the median and the minimum and maximum price of a product category for each brand type. For this purpose, the average price for the respective product was first calculated and then summarised for the respective category. The proportion of observations that are on promotion is also shown.

Table 1: Descriptive statistics by brand type

	Number of Products	Price in Euro per Unit				Share of Promotions
		Mean	Median	Min	Max	
Manufacturer brands	**2,237**	**5.88**	**3.99**	**0.33**	**105.27**	**0.8%**
bakery products	196	2.54	2.19	0.69	5.69	1.1%
meat products	164	4.08	2.19	1.03	105.27	1.0%
eggs and dairy products	442	2.10	1.66	0.33	25.35	0.9%
coffee and tea	1,435	7.70	5.90	1.49	86.69	0.7%
Private Labels	**407**	**2.38**	**1.78**	**0.28**	**16.50**	**0.3%**
bakery products	30	1.38	1.13	0.68	2.96	0.0%
meat products	208	3.06	2.19	0.88	16.50	0.2%
eggs and dairy products	131	1.22	0.88	0.28	3.95	0.2%
coffee and tea	38	3.42	2.45	0.58	13.36	1.2%
Total	**2,644**	**5.34**	**3.60**	**0.28**	**105.27**	**0.7%**

Source: Own calculations with Stata version 18 based on data from Fedoseeva (2023)

2,237 products can be classified as manufacturer brands. The average price of manufacturer brands across all categories is 5.88 euro, with 0.8 % of the observations being a special offer. The majority of products of this brand type come from the coffee and tea category, which is also the most expensive with an average price of 7.70 euros. In contrast, products from the eggs and dairy products category are the cheapest with an average price of €2.10. The bakery products and meat products categories are in between at €2.54 and €4.08 respectively. Most of the special offers are for meat products with a share of 1.1 % of the observations.

In contrast, only 407 products can be classified as private labels, which, with an average price across all categories of €2.38, are also significantly cheaper and, with a share of 0.3%, also have significantly fewer promotional observations. Most products for this brand type come from the meat products category. As with the manufacturer brands, the cheapest category is eggs and dairy products with an average price of 1.22 euros. With a share of 1.2 %, the most offer observations come from the coffee and tea category, which is also the most expensive category with an average price of 3.42 euros.

4. Method

A fixed-effect model estimation is used to quantify the price changes caused by the VAT reduction. The procedure is similar to the event study method, which can be categorised as the difference-in-differences approach (DiD approach) (Schmidheiny and Siegloch 2023). A general problem with such studies is predicting prices without the intervention. Assumptions must be made in this regard. In the DiD approach, this problem is solved by using a control group (Gertler et al. 2016). This allows the influence of the intervention to be analysed independently of other factors that cause price changes. The DiD approach is widespread and frequently used in the field of VAT changes (see e.g. Beck et al.

2021; Benedek et al. 2020; Benzarti et al. 2020; Crossley, Low and Sleeman 2014; Fuest, Neumeier and Stöhlker 2021; Montag, Sagimuldina and Schnitzer 2020).

As there is no such control group for the question here, a simplifying assumption must be made with regard to price development without intervention. We assume that the price changes that occur after the VAT reduction are mainly due to the intervention. Consequently, there are no other factors that have systematically influenced prices during this period or that have changed during this period. The assumption can be justified as this is a relatively short period and other studies have found no effects in the control group.

For example, in studies that also examined the effects of the 2020 VAT reduction in Germany, prices from neighbouring countries where there was no change in the VAT rate were used as a control group. Fuest et al. (2021) use online prices from an Austrian food retailer whose average prices hardly changed from June to the end of August 2020 (see Fuest et al. 2021 Fig. 3). The development of the Austrian consumer price index (CPI) for food underlines this observation (Europäische Zentralbank 2022), Beck et al. (2021) also analyse the short-term change in VAT and use prices from the Netherlands as a control group. They come to the conclusion that no significant price changes can be identified in the Netherlands in 2020. As the price structures in Austria and the Netherlands are very comparable to Germany, the assumption that no price changes would have taken place without a VAT reduction can be justified (Beck et al. 2021; Fuest et al. 2021).

This article follows the model proposed by Schmidheiny and Siegloch (2023), which is also used by Fuest et al. (2021), among others. It is adjusted accordingly due to the lack of a control group.

In the following model, gross prices in food retail are modelled in a panel structure. The main explanatory factors are time dummy variables, which consist of dummy variables for each day of the observation period. This allows the temporal development of the price effect of the VAT reduction to be visualised. In addition, a promotion dummy variable and individual effects are included in the model (see equation 1).

(1)

$$\ln(Price_{\mathrm{it}}) = \sum_{t=1}^{T} \beta_t \, d_t + \gamma \, Promotion_{it} + \mu_{\mathrm{i}} + \epsilon_{\mathrm{it}}$$

The natural logarithm of the price of product *i* on day *t* serves as the dependent variable. We perform separate estimations for each category of the two brand types, resulting in a total of 8 estimations. $\mathrm{d_t}$ is a dummy variable that takes the value 1 on the respective day of the observation period and 0 otherwise. To ensure that the period directly before the announcement of the reduction can also be

mapped graphically, the first day included is 1 May 2020 (t=1). In total, the period T=131 days, the last day included is 31 August 2020. The coefficients β_t are the coefficients of the day dummies, which are to be interpreted as the average price difference of a day *t* to the reference day. The reference day is 3 June 2020 (t=34), the day on which the temporary VAT reduction was announced by the government. The corresponding coefficient is set to 0. $\mathrm{Promotion}_{\mathrm{it}}$ is a dummy variable that takes the value 1 if a product is on offer and 0 otherwise. γ shows the average effect of a special offer on the price. In addition, individual effects of the products (μ_i) are estimated and ϵ_{it} denotes the error term. Due to tests for heteroscedasticity and serial correlation in advance, cluster-robust standard errors are used, whereby the different products *i* are clustered together. In addition, the programme developed by Schaffer and Stillman (2006) examines for all models that a fixed-effect estimate is suitable for each model.

In order to obtain an average price effect for the period of the VAT reduction (event period), the individual days from 1 July on are grouped in a single dummy variable for a second estimation. In addition, a dummy variable is created for the period from 3 June to 1 July (announcement period) in order to capture a potential announcement effect. A study by Benedek et al. (2020) found that prices reacted to announced VAT rate changes in advance. Similar to the findings of Lan, Lloyd and Morgan (2015) for special offers in English supermarkets, it is also conceivable here that shops increase prices in advance so that the effect of the VAT reduction appears greater.

This results in a total of two estimates, one for each brand type:

(2)

$$\ln(\mathrm{Price}_{\mathrm{it}}) = \sum_{\mathrm{z}=1}^{2} \beta_{\mathrm{z}1}\, Period_{\mathrm{z}} + \sum_{\mathrm{z}=1}^{2}\sum_{\mathrm{k}=2}^{4} \beta_{\mathrm{zk}}\ \mathrm{Period}_{\mathrm{z}} \times \mathrm{Category}_{\mathrm{k}} + \gamma_1\, \mathrm{Promotion}_{\mathrm{it}} + \sum_{\mathrm{k}=2}^{4} \gamma_{\mathrm{k}}\, \mathrm{Promotion}_{\mathrm{it}} \times \mathrm{Category}_{\mathrm{k}} + \mu_{\mathrm{i}} + \epsilon_{\mathrm{it}}$$

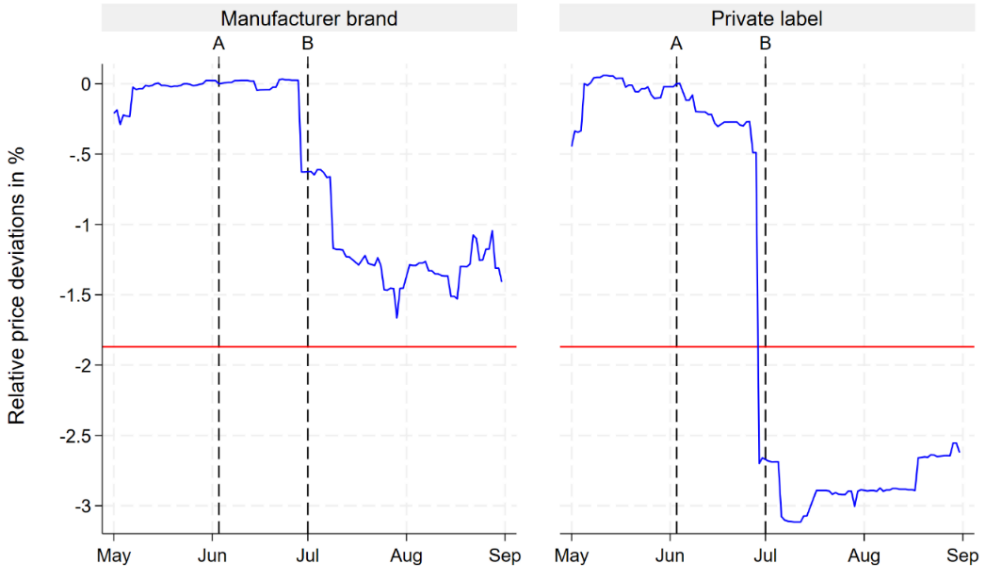
The natural logarithm of the price of the respective product *i* on day *t* again serves as the dependent variable in Equation 2. $\mathrm{Period}_{\mathrm{z}}$ denotes the two time periods. β_{z1} is to be interpreted as the average price difference of the bakery products category in period z compared to the period before the VAT was announced. In addition, the dummy variables $\mathrm{Period}_{\mathrm{z}}$ are interacted with categories 2 to 4, β_{zk} indicates the difference to the reference. The promotion dummy variable $\mathrm{Promotion}_{\mathrm{it}}$ is again included in the model as a control variable. As only one estimation is performed per brand type compared to Model 1, it is also interacted with the vector $\mathrm{Category}_{\mathrm{k}}$, γ_k denotes the corresponding coefficients. By interacting with the categories, the overall effect of an offer and a time period is determined separately for each product category. This addresses the problem that product categories with more observations are weighted more heavily in the estimation.

Linear combinations of the coefficients of the base category with the coefficients of the other categories, which represent the differences compared to the base, give the effect of a particular category on the product price for the respective variable. As the model is a semi-log model, a conversion of the coefficients using the formula 100*(e^β-1) allows an interpretation as a percentage change (Halvorsen and Palmquist 1980).

The overall effect of a brand type in the different periods are determined using linear combinations of the effects of the categories. For this purpose, a weighted average of the individual effects of the product categories is calculated using the weights[1] of the consumer price index (Statistisches Bundesamt 2019). This can then also be used to determine the extent to which the VAT reduction was passed on to the consumer by the respective shops. As the reduced VAT rate was reduced by two percentage points, it is passed on in full if prices fall by 1.87 percentage points during the event period.

5. Results

The estimated price effects of the individual days from Model 1 are shown graphically in Figure 1. For this purpose, a weighted average of the coefficients of the four categories is formed for each day, separate by brand type. The time course of the VAT reduction can thus be visualised on a daily basis. In addition, Table 3 in the appendix provides the regression results of the individual estimations for Model 1.



Legend: Blue line: relative average price deviations in per cent compared to day of announcement of VAT reduction for respective retailer. A: Day of announcement of the VAT reduction; B: Day the VAT reduction came into effect. Red line: simulated percentage price deviation for a full transmission of the tax reduction. Own results and representation based on data from Fedoseeva (2023).

Figure 1: Estimated average price changes over time by brand type

[1] Bakery products: 6.27; meat products: 18.6; eggs and dairy products: 14.19; coffee and tea: 3.19.

Table 2: Linear combinations: Individual and total effect of announcement and reduction period by brand type

	Manufacturer Brand	Private Labels
Effect in announcement period		
Bakery products	0.01	0.14
	(0.001)	(0.004)
Meat products	-0.07	-0.65***
	(0.001)	(0.002)
Eggs and dairy products	0.11	-0.28***
	(0.001)	(0.001)
Coffee and tea	-0.05***	-0.38***
	(0)	(0.001)
Weighted average	0.01	-0.39***
	(0)	(0.001)
Effect in event period		
Bakery products	-0.51**	-2.92***
	(0.002)	(0.007)
Meat products	-1.73***	-2.05***
	(0.003)	(0.003)
Eggs and dairy products	-0.79***	-4.18***
	(0.001)	(0.004)
Coffee and tea	-1.02***	-1.3***
	(0.001)	(0.004)
Weighted average	-1.18***	-2.84***
	(0.001)	(0.002)
Observations	247,257	45,709
R-squared	0.57	0.29
Number of IDs	2,238	407
Cluster-robust standard errors in brackets, coefficients can be interpreted as percentage change compared to the base (Halvorsen-Palmquist correction), overall effect is calculated from the weighted average of the individual effects. *** p<0.01, ** p<0.05, * p<0.1		

Source: Own calculations with Stata version 18 based on data from Fedoseeva (2023)

The linear combinations, which represent the individual and overall effects of the product categories of the brand types, are shown in Table 2. They are derived from the estimated coefficients for Model 2, which determine the effect of the VAT reduction on the prices of a category (individual effect) or a brand type (overall effect). Detailed regression results for Model 2 can be found in Table 4 in the appendix.

The quality of the single estimations of Model 1 and 2 varies between the two brand types and between the different categories (see Table 2 and 3). For model 2, the proportion of variance that can be explained by the model is 57 % for manufacturer brands and 29 % for private labels. In addition, the influence of a promotional offer on the product price is significant but heterogeneous for all categories of a brand type. For the bakery products category, there are no observations of special offers for private labels, which is why no coefficient is calculated.

For the manufacturer brands, there is a slight increase in the price level at the beginning of May (see Figure 1). Prices then remain largely constant, even after the announcement date (marked as A in Figure 1). Only a few days before the VAT reduction came into force (marked as B in Figure 1), on 29 June, prices jumped downwards, with average prices falling to a level of -0.63% and then again to -1.17% a few days later, on 9 July. This is followed by a heterogeneous phase in which prices repeatedly fall and rise, but around a level of -1.25 %, where they remain until the end of the observation period. While no significant price effect can be identified for the announcement phase (see Table 2), the significant price effect of the event period is -1.18 % on a weighted average across the individual categories. This corresponds to an average pass-through rate of the VAT reduction of around 63 %. It is highest for the meat products category (92.5 %) and lowest in the bakery products category (27.3 %).

The picture is different for the private labels of e-retailer Rewe. The average prices of the private labels also rise at the beginning (see Figure 1). They then remain more or less constant until the decision day and then slowly fall to a level of around -0.3 % during the announcement period. On 29 June, there is a sharp price jump down to a level of -2.7 % compared to the decision day (marked as A in Figure 1) and a few days later, on 6 July, another, smaller jump to a level of -3.1 %. The price level then gradually rises again slightly and at the end of the period under review it is back at around -2,6 %, roughly the same level as after the first price jump on 29 June. The average price effect of the announcement phase is -0.39 % compared to the date of the announcement and is significant. If we look at the average effect in the event period, the effect is bigger still. Prices fall by an average of 2.84% compared to the reference date. This corresponds to a pass-through rate of 152 %. The price changes are greatest in the eggs and dairy products category (-4.18 %) and lowest in the coffee and tea category (-1.3 %).

6. Discussion and Conclusion

In June 2020, the then German government launched a comprehensive economic stimulus package to cushion the economic impact of the coronavirus pandemic. An important component was the reduction in VAT for six months. This paper analyses the price effects of the VAT reduction for important product categories in German online grocery retail using an econometric fixed-effect model, while focusing on differences between manufacturer brands and private labels. The results show that

the VAT reduction had an impact on prices in online grocery retail. For the brand types analysed, price reductions can be observed around the time the VAT reduction came into force. The tax reduction was passed on in the form of price reductions, but the extent depends on the brand type and product category.

The pass-through rate for private labels clearly exceeds that of manufacturer brands. While 152 % of the reduction for private labels is passed on to the consumer in the form of lower prices, a more than full pass-through, the rate for manufacturer brands is just 63 %. Without knowing the exact sales shares of the individual brand types, it is difficult to determine a general level for Rewe from the values calculated. If the calculated values are weighted with the product shares of the respective brand types, a value of approximately 77% is obtained. Fuest et al. (2021) determined a value of 80 % for the Rewe online shop, but consider a significantly broader product range and the entire reduction period, but do not address differences between manufacturer and private labels. Beck et al. (2021) also determine a similarly high value of 76 % for fast-moving consumer goods. However, in addition to online shops, they primarily look at bricks-and-mortar retail (Beck et al. 2021). Montag et al. (2020) determine a higher pass-through rate for products with higher competitive pressure. And Fuest et al. (2021) also identify higher pass-through rates for products that are offered by many suppliers. The results can also be applied to these findings. Since private labels are offered exclusively by one retailer, but usually do not differ between the various retailers except for the name, they also fall into the category of widely offered products with strong competitive pressure.

As described above, private labels in the low-price segment are primarily purchased by consumers with low incomes (GfK 2020a; Lamey et al. 2007). A comprehensive passing on of the VAT reduction for these products therefore relieves the lower income groups in particular. In addition, Lamey et al. (2007) attribute particular importance to private labels during economic downturns. However, the coronavirus pandemic appears to be an exception: According to studies by GfK (2020a), it was mainly branded products that were in demand during the pandemic. They cite the loss of expenditure in other areas as the reason, which meant that more could be spent on food (GfK 2020a). The more than complete pass-through of private labels is interesting. As private labels are generally sold without a profit margin (Barsky et al. 2003), one would expect the VAT reduction to be passed on only in full.

Although there were slight price adjustments for private labels in advance, the largest adjustments were made at the same time as for manufacturer brands on 29 June, right at the beginning of the week in which 1 July, the day on which the VAT reduction was implemented, falls. The early adjustments for private labels and the slightly premature significant reduction for both types of brand show that the online retailer's pricing policy certainly seems to play a role in this issue. The direct reduction in prices when the measure comes into effect is in line with the results of Beck et al. (2021).

Menu costs, the costs associated with a price change, can be a reason why a VAT reduction is not passed on in full. This applies in particular to temporary measures where prices have to be adjusted twice in a short period of time (Crossley et al. 2009). Menu costs are all the more relevant the smaller the price changes are (Anderson, Jaimovich and Simester 2015). In the online retail sector considered here, the actual menu costs are probably less relevant than in bricks-and-mortar stores (Aparicio, Metzman and Rigobon 2021). And in bricks-and-mortar stores, they are also continuing to decrease due to electronic price tags (Stamatopoulos, Bassamboo and Moreno 2021). This should therefore not be a major reason for the tax reduction not being passed on in full. In addition, psychological prices, i.e. prices that end in 9, for example, can play a role in price adjustment (Egner 2021). Such pricing is also widespread in online retail (Hillen 2021). A 1:1 passing on of the reduction would therefore result in unattractive prices. However, studies by the Statistical State Office of Saxony show that such prices did occur during the period of the reduction (Statistisches Landesamt des Freistaates Sachsen 2021).

As the data set only contains price data, this study cannot determine the extent to which the quantities consumed or consumer spending have changed as a result of the VAT reduction. However, other studies show that consumers' propensity to buy has increased significantly (GfK 2020b). This also applies to everyday consumer goods (GfK 2020a). Clemens et al. (2021) come to the conclusion that demand for consumer goods has increased by two percentage points. The impact of the tax cut on consumer spending in online grocery retail is an interesting subject of investigation. In addition, further analyses of individual prices are needed to determine the impact on income for different consumer groups.

This study looks at the first two months of the six-month VAT reduction. The average pass-through rates determined therefore relate to the first third of the reduction period. Crossley et al. (2014) found that in England the VAT reduction was only passed on at the beginning. Whether the passing on of the reduction remains constant over the entire period would be interesting to investigate for the German online grocery trade. Whether prices return to their original level at the end of the measure is also an interesting question.

The use of temporary tax cuts is currently the subject of widespread political debate. Germany is currently discussing the abolition of VAT on healthy food, while Spain has temporarily reduced VAT on basic foodstuffs to 0% in order to ease the current economic burden. The instrument has also been used in other individual sectors in recent years. A three-month fuel discount ended in August 2022. Furthermore, from October 2022 to March 2024, the VAT on gas has temporarily been reduced. These and other studies cited on temporary VAT reductions show that a temporary reduction in VAT is largely, but never fully, passed on. In contrast, it is essential that the reduction is passed on in full in

order to achieve the objectives of the measure. This is because a VAT reduction is a relatively expensive measure. This finding should be taken into account by policymakers in order to better assess the impact of future measures in advance.

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Appendix

Table 3: Regression results model 1

	(1) MB, Cat 1		(2) MB, Cat2		(3) MB, Cat3		(4) MB, Cat4		(5) PL, Cat1		(6) PL, Cat2		(7) PL, Cat3		(8) PL, Cat4	
ln(Price)	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.	Coef.	St. Err.
Promotion	-0.1905***	(0.0153)	-0.2830***	(0.0268)	-0.4011***	(0.0184)	-0.2238***	(0.0126)			-0.1943***	(0.0088)	-0.2483***	(0.0120)	-0.1128***	(0.0148)
1-May	-0.0003	(0.0013)	-0.0053	(0.0045)	0.0012	(0.0019)			-0.0095**	(0.0039)	-0.0007	(0.0017)	-0.0072**	(0.0028)		
2-May	0.0001	(0.0008)	-0.0053	(0.0045)	0.0008	(0.0015)	0.0014**	(0.0006)	-0.0146	(0.0086)	-0.0002	(0.0016)	-0.0047*	(0.0024)	0.0045**	(0.0021)
3-May	0.0001	(0.0009)	-0.0060	(0.0044)	-0.0014*	(0.0008)	0.0015**	(0.0006)	-0.0148	(0.0090)	-0.0003	(0.0016)	-0.0047*	(0.0024)	0.0045**	(0.0021)
4-May	0.0004	(0.0008)	-0.0045	(0.0044)	-0.0014*	(0.0008)	0.0014**	(0.0005)	-0.0148	(0.0090)	-0.0001	(0.0015)	-0.0047*	(0.0024)	0.0045**	(0.0021)
5-May	0.0004	(0.0008)	-0.0045	(0.0044)	-0.0016**	(0.0008)	0.0014**	(0.0005)	-0.0040	(0.0057)	-0.0001	(0.0015)	0.0007	(0.0015)	0.0044**	(0.0022)
6-May	-0.0003	(0.0004)	-0.0045	(0.0044)	-0.0014*	(0.0008)	0.0013**	(0.0005)	-0.0046	(0.0051)	-0.0000	(0.0015)	0.0005	(0.0015)	0.0044**	(0.0022)
7-May	0.0002	(0.0007)	-0.0001	(0.0003)	-0.0012	(0.0008)	0.0015***	(0.0005)	-0.0043	(0.0055)	-0.0002	(0.0015)	0.0011	(0.0015)	0.0045**	(0.0021)
8-May	-0.0002	(0.0004)	-0.0001	(0.0003)	-0.0013	(0.0008)	0.0015***	(0.0005)	-0.0044	(0.0053)	0.0010*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
9-May	-0.0002	(0.0004)	-0.0001	(0.0003)	-0.0013	(0.0008)	0.0020***	(0.0006)	-0.0044	(0.0053)	0.0011*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
10-May	-0.0002	(0.0004)	-0.0001	(0.0003)	-0.0013	(0.0008)	0.0020***	(0.0006)	-0.0044	(0.0053)	0.0011*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
11-May	-0.0002	(0.0004)	-0.0002	(0.0004)	-0.0006	(0.0007)	0.0021***	(0.0006)	-0.0035	(0.0059)	0.0011*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
12-May	-0.0002	(0.0004)	-0.0002	(0.0004)	-0.0007	(0.0007)	0.0021***	(0.0006)	-0.0035	(0.0059)	0.0011*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
13-May	-0.0002	(0.0004)	-0.0001	(0.0001)	-0.0007	(0.0007)	0.0020***	(0.0006)	-0.0040	(0.0055)	0.0011*	(0.0006)	0.0007	(0.0014)	0.0045**	(0.0021)
14-May	0.0007	(0.0007)	-0.0001	(0.0002)	-0.0006	(0.0007)	0.0020***	(0.0006)	-0.0042	(0.0053)	0.0011*	(0.0006)	0.0008	(0.0015)	0.0045**	(0.0021)
15-May	0.0007	(0.0007)	0.0001	(0.0001)	-0.0008	(0.0007)	0.0020***	(0.0006)	-0.0049	(0.0049)	0.0010*	(0.0006)	0.0006	(0.0014)	0.0045**	(0.0021)
16-May	-0.0000	(0.0000)	0.0000	(0.0001)	-0.0008	(0.0007)	0.0017***	(0.0005)	-0.0057	(0.0050)	0.0014*	(0.0008)	0.0006	(0.0014)	0.0045**	(0.0021)
17-May	-0.0000	(0.0000)	0.0000	(0.0001)	-0.0008	(0.0007)	0.0017***	(0.0005)	-0.0057	(0.0050)	0.0014*	(0.0008)	0.0006	(0.0014)	0.0045**	(0.0021)
18-May	-0.0000	(0.0000)	0.0000	(0.0001)	-0.0008	(0.0007)	0.0013**	(0.0005)	-0.0057	(0.0050)	0.0004	(0.0005)	0.0012	(0.0012)	0.0002	(0.0002)
19-May	-0.0000	(0.0000)	-0.0001	(0.0001)	-0.0009	(0.0007)	0.0013**	(0.0005)	-0.0043	(0.0053)	0.0002	(0.0003)	0.0011	(0.0012)	0.0009	(0.0010)
20-May	-0.0000	(0.0000)	-0.0001	(0.0001)	-0.0007	(0.0007)	0.0013**	(0.0005)	-0.0043	(0.0053)	0.0002	(0.0003)	0.0013	(0.0012)	0.0002	(0.0002)
21-May	-0.0000	(0.0000)	-0.0001	(0.0001)	-0.0008	(0.0007)	0.0012**	(0.0005)	-0.0071	(0.0052)	0.0002	(0.0003)	0.0012	(0.0012)	-0.0001	(0.0004)
22-May	-0.0000	(0.0000)	-0.0001	(0.0001)	-0.0006	(0.0007)	0.0013**	(0.0005)	-0.0071	(0.0052)	0.0002	(0.0003)	0.0010	(0.0012)	0.0002	(0.0002)
23-May	0.0007	(0.0007)	-0.0001	(0.0001)	-0.0006	(0.0007)	0.0013**	(0.0006)	-0.0056	(0.0051)	0.0002	(0.0003)	0.0010	(0.0012)	0.0002	(0.0002)
24-May	0.0007	(0.0007)	-0.0001	(0.0001)	-0.0006	(0.0007)	0.0013**	(0.0006)	-0.0056	(0.0051)	0.0002	(0.0003)	0.0010	(0.0012)	0.0002	(0.0002)
25-May	0.0003	(0.0008)	-0.0001	(0.0001)	-0.0005	(0.0006)	0.0012**	(0.0006)	-0.0049	(0.0049)	0.0001	(0.0001)	0.0014	(0.0013)	-0.0000	(0.0000)
26-May	-0.0003	(0.0003)	-0.0001	(0.0001)	-0.0005	(0.0006)	0.0012**	(0.0006)	-0.0051	(0.0048)	0.0000	(0.0000)	-0.0001	(0.0002)	0.0002	(0.0002)
27-May	-0.0000	(0.0000)	0.0000	(0.0001)	-0.0006	(0.0006)	0.0012**	(0.0006)	-0.0051	(0.0048)	0.0000	(0.0000)	-0.0010	(0.0006)	0.0002	(0.0002)
29-May	0.0005	(0.0005)	0.0001	(0.0001)	-0.0006	(0.0006)	0.0012**	(0.0006)	-0.0047	(0.0051)	0.0001	(0.0001)	-0.0010	(0.0006)	-0.0000	(0.0000)
30-May	0.0011	(0.0008)	-0.0001	(0.0001)	0.0003	(0.0003)	0.0000	(0.0001)	-0.0001	(0.0005)	-0.0004	(0.0004)	-0.0001	(0.0001)	-0.0000	(0.0000)
31-May	0.0011	(0.0008)	-0.0001	(0.0001)	0.0003	(0.0003)	0.0000	(0.0001)	-0.0001	(0.0005)	-0.0004	(0.0004)	-0.0001	(0.0001)	-0.0000	(0.0000)
1-Jun	0.0011	(0.0008)	-0.0001	(0.0001)	0.0003	(0.0003)	-0.0000	(0.0000)	-0.0001	(0.0005)	-0.0004	(0.0004)	-0.0001	(0.0001)	-0.0000	(0.0000)
2-Jun	0.0011	(0.0008)	-0.0001	(0.0001)	0.0003	(0.0003)	-0.0000	(0.0000)	-0.0001	(0.0005)	-0.0004	(0.0004)	-0.0001	(0.0001)	-0.0000	(0.0000)
4-Jun	-0.0000	(0.0000)	0.0001	(0.0001)	-0.0001	(0.0001)	0.0002	(0.0002)	-0.0003	(0.0003)	0.0000	(0.0001)	0.0001	(0.0002)	0.0002	(0.0002)
6-Jun	0.0000	(0.0007)	0.0001	(0.0001)	0.0001	(0.0002)	0.0001	(0.0002)	-0.0025	(0.0021)	-0.0020**	(0.0008)	0.0001	(0.0002)	0.0002	(0.0002)
7-Jun	0.0000	(0.0007)	0.0001	(0.0001)	0.0001	(0.0002)	0.0001	(0.0002)	-0.0025	(0.0021)	-0.0020**	(0.0008)	0.0001	(0.0002)	0.0002	(0.0002)
8-Jun	-0.0009	(0.0006)	0.0001	(0.0001)	0.0005	(0.0009)	0.0014***	(0.0005)	-0.0003	(0.0003)	-0.0020**	(0.0008)	0.0002	(0.0002)	0.0002	(0.0002)
9-Jun	-0.0009	(0.0006)	0.0001	(0.0001)	0.0005	(0.0009)	0.0014***	(0.0005)	-0.0003	(0.0003)	-0.0046***	(0.0017)	0.0002	(0.0002)	0.0002	(0.0002)
10-Jun	-0.0005	(0.0005)	0.0001	(0.0001)	0.0005	(0.0009)	0.0014***	(0.0005)	-0.0003	(0.0003)	-0.0046***	(0.0017)	0.0001	(0.0002)	0.0002	(0.0002)
11-Jun	-0.0005	(0.0005)	0.0001	(0.0001)	0.0005	(0.0009)	0.0014**	(0.0005)	-0.0003	(0.0003)	-0.0046***	(0.0017)	0.0001	(0.0002)	0.0000	(0.0003)
12-Jun	-0.0005	(0.0005)	0.0001	(0.0001)	0.0005	(0.0009)	0.0014**	(0.0005)	-0.0003	(0.0003)	-0.0046***	(0.0017)	0.0001	(0.0002)	0.0000	(0.0003)
13-Jun	-0.0004	(0.0003)	0.0001	(0.0001)	0.0003	(0.0009)	0.0013**	(0.0005)	-0.0006	(0.0005)	-0.0046***	(0.0017)	-0.0002	(0.0004)	0.0000	(0.0003)
14-Jun	-0.0004	(0.0003)	0.0001	(0.0001)	0.0003	(0.0009)	0.0013**	(0.0005)	-0.0006	(0.0005)	-0.0046***	(0.0017)	-0.0002	(0.0004)	0.0000	(0.0003)
15-Jun	-0.0007	(0.0005)	-0.0016**	(0.0007)	0.0006	(0.0009)	0.0013**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0002	(0.0004)	0.0000	(0.0003)

16-Jun	-0.0008	(0.0005)	-0.0016**	(0.0007)	0.0008	(0.0009)	0.0013**	(0.0005)	-0.0025	(0.0021)	-0.0061***	(0.0020)	-0.0001	(0.0004)	0.0000	(0.0003)
18-Jun	-0.0004	(0.0003)	-0.0016**	(0.0007)	0.0007	(0.0009)	0.0012**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	0.0002	(0.0002)
19-Jun	-0.0004	(0.0003)	-0.0016**	(0.0007)	0.0007	(0.0009)	0.0012**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	0.0002	(0.0002)
20-Jun	-0.0003	(0.0003)	-0.0016**	(0.0007)	0.0012	(0.0010)	0.0012**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	-0.0000	(0.0000)
21-Jun	-0.0003	(0.0003)	-0.0016**	(0.0007)	0.0012	(0.0010)	0.0012**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	-0.0000	(0.0000)
22-Jun	0.0023**	(0.0011)	-0.0018**	(0.0007)	0.0018*	(0.0010)	0.0012**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	-0.0000	(0.0000)
23-Jun	0.0023**	(0.0011)	-0.0016**	(0.0007)	0.0018*	(0.0010)	0.0011**	(0.0005)	-0.0025	(0.0021)	-0.0061***	(0.0020)	0.0001	(0.0002)	0.0002	(0.0002)
24-Jun	0.0023**	(0.0011)	-0.0018**	(0.0007)	0.0018*	(0.0010)	0.0011**	(0.0005)	-0.0025	(0.0021)	-0.0061***	(0.0020)	-0.0000	(0.0002)	0.0002	(0.0002)
25-Jun	0.0023**	(0.0011)	-0.0018**	(0.0007)	0.0018*	(0.0010)	0.0011**	(0.0005)	-0.0006	(0.0005)	-0.0061***	(0.0020)	-0.0000	(0.0002)	0.0002	(0.0002)
26-Jun	0.0023**	(0.0011)	-0.0019***	(0.0007)	0.0019*	(0.0010)	0.0011**	(0.0005)	-0.0006	(0.0005)	-0.0059***	(0.0020)	-0.0001	(0.0001)	0.0002	(0.0002)
27-Jun	0.0038***	(0.0012)	-0.0019***	(0.0007)	0.0013	(0.0010)	0.0008*	(0.0005)	-0.0044	(0.0029)	-0.0098***	(0.0034)	-0.0001	(0.0001)	0.0002	(0.0002)
28-Jun	0.0038***	(0.0012)	-0.0019***	(0.0007)	0.0013	(0.0010)	0.0008*	(0.0005)	-0.0044	(0.0029)	-0.0098***	(0.0034)	-0.0001	(0.0001)	0.0002	(0.0002)
29-Jun	-0.0017	(0.0020)	-0.0106***	(0.0020)	-0.0040***	(0.0011)	-0.0015***	(0.0006)	-0.0307***	(0.0061)	-0.0201***	(0.0036)	-0.0376***	(0.0040)	-0.0197***	(0.0003)
30-Jun	-0.0017	(0.0020)	-0.0106***	(0.0020)	-0.0040***	(0.0011)	-0.0015***	(0.0006)	-0.0307***	(0.0061)	-0.0201***	(0.0036)	-0.0363***	(0.0038)	-0.0197***	(0.0003)
2-Jul	-0.0017	(0.0020)	-0.0106***	(0.0020)	-0.0039***	(0.0011)	-0.0014**	(0.0006)	-0.0323***	(0.0067)	-0.0201***	(0.0036)	-0.0363***	(0.0038)	-0.0197***	(0.0003)
3-Jul	-0.0030	(0.0025)	-0.0102***	(0.0020)	-0.0034***	(0.0011)	-0.0056***	(0.0008)	-0.0355***	(0.0072)	-0.0201***	(0.0036)	-0.0352***	(0.0036)	-0.0197***	(0.0011)
4-Jul	-0.0025	(0.0019)	-0.0102***	(0.0020)	-0.0036***	(0.0011)	-0.0014**	(0.0006)	-0.0323***	(0.0067)	-0.0201***	(0.0036)	-0.0364***	(0.0038)	-0.0197***	(0.0003)
5-Jul	-0.0025	(0.0019)	-0.0102***	(0.0020)	-0.0036***	(0.0011)	-0.0015**	(0.0006)	-0.0323***	(0.0067)	-0.0201***	(0.0036)	-0.0364***	(0.0038)	-0.0197***	(0.0003)
6-Jul	-0.0025	(0.0019)	-0.0102***	(0.0020)	-0.0042***	(0.0012)	-0.0019***	(0.0006)	-0.0345***	(0.0067)	-0.0220***	(0.0037)	-0.0437***	(0.0039)	-0.0258***	(0.0012)
7-Jul	-0.0025	(0.0019)	-0.0111***	(0.0021)	-0.0042***	(0.0012)	-0.0019***	(0.0006)	-0.0345***	(0.0067)	-0.0226***	(0.0037)	-0.0436***	(0.0039)	-0.0261***	(0.0013)
8-Jul	-0.0021	(0.0019)	-0.0111***	(0.0021)	-0.0042***	(0.0012)	-0.0019***	(0.0006)	-0.0345***	(0.0067)	-0.0228***	(0.0037)	-0.0436***	(0.0039)	-0.0258***	(0.0012)
9-Jul	-0.0044**	(0.0022)	-0.0193***	(0.0028)	-0.0075***	(0.0014)	-0.0035***	(0.0007)	-0.0345***	(0.0067)	-0.0228***	(0.0037)	-0.0436***	(0.0039)	-0.0258***	(0.0012)
10-Jul	-0.0048**	(0.0022)	-0.0193***	(0.0028)	-0.0075***	(0.0014)	-0.0035***	(0.0007)	-0.0345***	(0.0067)	-0.0228***	(0.0037)	-0.0436***	(0.0039)	-0.0265***	(0.0013)
11-Jul	-0.0054**	(0.0024)	-0.0189***	(0.0029)	-0.0077***	(0.0014)	-0.0040***	(0.0008)	-0.0345***	(0.0067)	-0.0228***	(0.0037)	-0.0436***	(0.0039)	-0.0265***	(0.0013)
12-Jul	-0.0057**	(0.0026)	-0.0189***	(0.0029)	-0.0077***	(0.0014)	-0.0040***	(0.0008)	-0.0345***	(0.0067)	-0.0228***	(0.0037)	-0.0436***	(0.0039)	-0.0265***	(0.0013)
13-Jul	-0.0059**	(0.0027)	-0.0198***	(0.0030)	-0.0078***	(0.0014)	-0.0040***	(0.0008)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0436***	(0.0039)	-0.0265***	(0.0013)
14-Jul	-0.0058**	(0.0026)	-0.0199***	(0.0030)	-0.0078***	(0.0014)	-0.0040***	(0.0008)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0436***	(0.0039)	-0.0261***	(0.0012)
17-Jul	-0.0061**	(0.0026)	-0.0199***	(0.0030)	-0.0079***	(0.0014)	-0.0096***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0428***	(0.0038)	-0.0089**	(0.0044)
19-Jul	-0.0047*	(0.0025)	-0.0195***	(0.0031)	-0.0071***	(0.0015)	-0.0093***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0428***	(0.0038)	-0.0089**	(0.0044)
20-Jul	-0.0047*	(0.0026)	-0.0198***	(0.0031)	-0.0083***	(0.0015)	-0.0094***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0428***	(0.0038)	-0.0089**	(0.0044)
21-Jul	-0.0047*	(0.0026)	-0.0200***	(0.0030)	-0.0084***	(0.0015)	-0.0095***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0429***	(0.0038)	-0.0089**	(0.0044)
22-Jul	-0.0047*	(0.0026)	-0.0200***	(0.0030)	-0.0084***	(0.0015)	-0.0102***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0436***	(0.0039)	-0.0089**	(0.0044)
23-Jul	-0.0034	(0.0025)	-0.0197***	(0.0030)	-0.0084***	(0.0016)	-0.0072***	(0.0009)	-0.0355***	(0.0072)	-0.0213***	(0.0035)	-0.0430***	(0.0039)	-0.0103**	(0.0042)
24-Jul	-0.0047*	(0.0025)	-0.0200***	(0.0030)	-0.0084***	(0.0015)	-0.0103***	(0.0010)	-0.0345***	(0.0067)	-0.0219***	(0.0035)	-0.0434***	(0.0039)	-0.0089**	(0.0044)
25-Jul	-0.0055**	(0.0025)	-0.0235***	(0.0032)	-0.0087***	(0.0015)	-0.0103***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0434***	(0.0039)	-0.0089**	(0.0044)
26-Jul	-0.0055**	(0.0025)	-0.0235***	(0.0032)	-0.0087***	(0.0015)	-0.0103***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0434***	(0.0039)	-0.0089**	(0.0044)
27-Jul	-0.0055**	(0.0025)	-0.0235***	(0.0032)	-0.0083***	(0.0015)	-0.0103***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0434***	(0.0039)	-0.0062	(0.0045)
28-Jul	-0.0055**	(0.0025)	-0.0235***	(0.0032)	-0.0083***	(0.0015)	-0.0105***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0434***	(0.0039)	-0.0062	(0.0045)
29-Jul			-0.0233***	(0.0031)	-0.0083***	(0.0017)					-0.0215***	(0.0035)	-0.0424***	(0.0038)		
30-Jul	-0.0053**	(0.0024)	-0.0236***	(0.0032)	-0.0082***	(0.0015)	-0.0105***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0435***	(0.0039)	-0.0062	(0.0045)
31-Jul	-0.0053**	(0.0024)	-0.0235***	(0.0032)	-0.0083***	(0.0015)	-0.0107***	(0.0010)	-0.0346***	(0.0068)	-0.0220***	(0.0035)	-0.0431***	(0.0039)	-0.0062	(0.0045)
2-Aug	-0.0054**	(0.0024)	-0.0196***	(0.0030)	-0.0082***	(0.0015)	-0.0110***	(0.0010)	-0.0346***	(0.0068)	-0.0220***	(0.0035)	-0.0433***	(0.0039)	-0.0062	(0.0045)
3-Aug	-0.0054**	(0.0024)	-0.0196***	(0.0030)	-0.0082***	(0.0015)	-0.0114***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0433***	(0.0039)	-0.0062	(0.0045)
4-Aug	-0.0054**	(0.0024)	-0.0196***	(0.0030)	-0.0082***	(0.0015)	-0.0114***	(0.0010)	-0.0345***	(0.0067)	-0.0220***	(0.0035)	-0.0433***	(0.0039)	-0.0062	(0.0045)
5-Aug	-0.0062**	(0.0025)	-0.0189***	(0.0030)	-0.0082***	(0.0015)	-0.0115***	(0.0010)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0437***	(0.0039)	-0.0062	(0.0045)
6-Aug	-0.0062**	(0.0026)	-0.0189***	(0.0030)	-0.0082***	(0.0015)	-0.0115***	(0.0010)	-0.0328***	(0.0060)	-0.0218***	(0.0035)	-0.0437***	(0.0039)	-0.0062	(0.0045)
7-Aug	-0.0054**	(0.0024)	-0.0189***	(0.0030)	-0.0082***	(0.0015)	-0.0114***	(0.0011)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0437***	(0.0039)	-0.0062	(0.0045)
8-Aug	-0.0054**	(0.0024)	-0.0196***	(0.0030)	-0.0092***	(0.0018)	-0.0118***	(0.0011)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0434***	(0.0039)	-0.0062	(0.0045)
9-Aug	-0.0054**	(0.0024)	-0.0196***	(0.0030)	-0.0092***	(0.0018)	-0.0118***	(0.0011)	-0.0345***	(0.0067)	-0.0218***	(0.0035)	-0.0434***	(0.0039)	-0.0062	(0.0045)
10-Aug	-0.0054**	(0.0024)	-0.0199***	(0.0030)	-0.0095***	(0.0018)	-0.0119***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0434***	(0.0039)	-0.0062	(0.0045)
11-Aug	-0.0054**	(0.0024)	-0.0199***	(0.0030)	-0.0095***	(0.0018)	-0.0119***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0035)	-0.0434***	(0.0039)	-0.0062	(0.0045)
12-Aug	-0.0054**	(0.0024)	-0.0199***	(0.0030)	-0.0098***	(0.0018)	-0.0118***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0435***	(0.0039)	-0.0062	(0.0045)
13-Aug	-0.0053**	(0.0024)	-0.0202***	(0.0031)	-0.0096***	(0.0018)	-0.0118***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0435***	(0.0039)	-0.0062	(0.0045)
14-Aug	-0.0053**	(0.0024)	-0.0202***	(0.0031)	-0.0096***	(0.0018)	-0.0118***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0435***	(0.0039)	-0.0062	(0.0045)

15-Aug	-0.0053**	(0.0024)	-0.0212***	(0.0032)	-0.0129***	(0.0022)	-0.0116***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0436***	(0.0039)	-0.0062	(0.0045)
16-Aug	-0.0053**	(0.0024)	-0.0212***	(0.0032)	-0.0129***	(0.0022)	-0.0116***	(0.0011)	-0.0345***	(0.0067)	-0.0216***	(0.0036)	-0.0436***	(0.0039)	-0.0062	(0.0045)
17-Aug	-0.0053**	(0.0024)	-0.0212***	(0.0032)	-0.0133***	(0.0021)	-0.0116***	(0.0011)	-0.0345***	(0.0067)	-0.0218***	(0.0036)	-0.0436***	(0.0039)	-0.0062	(0.0045)
18-Aug	-0.0053**	(0.0024)	-0.0159***	(0.0049)	-0.0133***	(0.0021)	-0.0116***	(0.0011)	-0.0347***	(0.0068)	-0.0162***	(0.0053)	-0.0436***	(0.0039)	-0.0062	(0.0045)
19-Aug	-0.0053**	(0.0024)	-0.0159***	(0.0049)	-0.0133***	(0.0021)	-0.0116***	(0.0011)	-0.0345***	(0.0067)	-0.0162***	(0.0053)	-0.0436***	(0.0039)	-0.0062	(0.0045)
20-Aug	-0.0053**	(0.0024)	-0.0159***	(0.0049)	-0.0133***	(0.0021)	-0.0116***	(0.0011)	-0.0345***	(0.0067)	-0.0162***	(0.0053)	-0.0435***	(0.0039)	-0.0062	(0.0045)
21-Aug	-0.0053**	(0.0024)	-0.0159***	(0.0049)	-0.0133***	(0.0021)	-0.0095***	(0.0010)	-0.0345***	(0.0067)	-0.0162***	(0.0053)	-0.0435***	(0.0039)	-0.0065	(0.0045)
22-Aug	-0.0047*	(0.0025)	-0.0162***	(0.0047)	-0.0069***	(0.0016)	-0.0093***	(0.0012)	-0.0345***	(0.0067)	-0.0161***	(0.0054)	-0.0436***	(0.0039)	-0.0048	(0.0049)
23-Aug	-0.0047*	(0.0025)	-0.0163***	(0.0048)	-0.0075***	(0.0015)	-0.0095***	(0.0012)	-0.0345***	(0.0067)	-0.0161***	(0.0054)	-0.0436***	(0.0039)	-0.0048	(0.0049)
24-Aug	-0.0051**	(0.0026)	-0.0187***	(0.0049)	-0.0088***	(0.0016)	-0.0099***	(0.0012)	-0.0345***	(0.0067)	-0.0161***	(0.0054)	-0.0440***	(0.0040)	-0.0048	(0.0049)
25-Aug	-0.0051**	(0.0026)	-0.0186***	(0.0048)	-0.0088***	(0.0016)	-0.0099***	(0.0012)	-0.0345***	(0.0067)	-0.0161***	(0.0054)	-0.0439***	(0.0039)	-0.0048	(0.0049)
26-Aug	-0.0052**	(0.0026)	-0.0175***	(0.0049)	-0.0080***	(0.0015)	-0.0096***	(0.0012)	-0.0345***	(0.0067)	-0.0159***	(0.0054)	-0.0440***	(0.0039)	-0.0048	(0.0049)
27-Aug	-0.0052**	(0.0026)	-0.0175***	(0.0049)	-0.0080***	(0.0015)	-0.0094***	(0.0012)	-0.0347***	(0.0068)	-0.0159***	(0.0054)	-0.0439***	(0.0039)	-0.0048	(0.0049)
28-Aug	-0.0039*	(0.0022)	-0.0154***	(0.0048)	-0.0074***	(0.0015)	-0.0091***	(0.0012)	-0.0347***	(0.0068)	-0.0160***	(0.0054)	-0.0439***	(0.0039)	-0.0048	(0.0049)
29-Aug	-0.0045*	(0.0027)	-0.0187***	(0.0049)	-0.0107***	(0.0023)	-0.0101***	(0.0012)	-0.0349***	(0.0069)	-0.0161***	(0.0054)	-0.0407***	(0.0035)	-0.0048	(0.0049)
30-Aug	-0.0045*	(0.0027)	-0.0187***	(0.0049)	-0.0107***	(0.0023)	-0.0101***	(0.0012)	-0.0349***	(0.0069)	-0.0161***	(0.0054)	-0.0407***	(0.0035)	-0.0048	(0.0049)
31-Aug	-0.0049*	(0.0027)	-0.0191***	(0.0049)	-0.0131***	(0.0023)	-0.0102***	(0.0012)	-0.0400***	(0.0086)	-0.0160***	(0.0054)	-0.0407***	(0.0035)	-0.0050	(0.0049)
Constant	0.7974***	(0.0012)	1.0126***	(0.0016)	0.5057***	(0.0009)	1.8109***	(0.0006)	0.2422***	(0.0039)	0.9154***	(0.0022)	-0.0048**	(0.0020)	0.9106***	(0.0016)
Observations	21,856		18,626		49,301		157,474		3,228		23,521		14,726		4,234	
R-squared	0.503		0.520		0.789		0.414		0.385		0.151		0.521		0.491	
Number of ID	196		165		442		1,435		30		208		131		38	

cluster-robust standard errors in parentheses, MB - manufacturer brand, PL - private label, Cat1 - bakery products, Cat1 - meat products, Cat3 - eggs and dairy products, Cat4 - coffee and tea
*** p<0.01, ** p<0.05, * p<0.1

Source: Own calculations with Stata version 18 based on data from Fedoseeva (2023)

Table 4: Regression results model 2

	(1) Manufacturer brand		(2) Private label	
ln(Price)	Coef.	St. Err.	Coef.	St. Err
Promotion	-0.190***	(0.0153)	-0.106***	(0.0141)
Promotion x Cat2	-0.0955***	(0.0307)	-0.0831***	(0.0162)
Promotion x Cat3	-0.212***	(0.0239)	-0.142***	(0.0190)
Promotion x Cat4	-0.0346*	(0.0198)		
Period1	0.000120	(0.000515)	0.00138	(0.00448)
Period1 x Cat1	-0.000787	(0.00106)	-0.00787*	(0.00476)
Period1 x Cat2	0.000976	(0.000943)	-0.00415	(0.00461)
Period1 x Cat3	-0.000618	(0.000541)	-0.00521	(0.00461)
Period2	-0.00508**	(0.00233)	-0.0296***	(0.00750)
Period2 x Cat2	-0.0124***	(0.00359)	0.00892	(0.00826)
Period2 x Cat3	-0.00284	(0.00266)	-0.0131	(0.00844)
Period2 x Cat4	-0.00521**	(0.00245)	0.0166**	(0.00832)
Constant	1.402***	(0.000328)	0.571***	(0.00127)
Observations	247,257		45,709	
R-squared	0.57		0.287	
Number of id	2,238		407	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Own calculations with Stata version 18 based on data from Fedoseeva (2023)