Economic Effects of Change in the Value-Added Tax Rate in Europe: Implications for the Japanese Economy*

KOMAKI Yasuyuki

Professor, Department of Economics, Osaka University of Economics

Abstract

In Europe, economic fluctuations associated with a change in the value added tax (VAT) rate are small. It has been pointed out that one reason for that is the way a VAT rate change affects prices. Many studies have been conducted on how price transfer occurs when a VAT rate changes. In Europe, there is a tendency to gradually change prices before a VAT rate change takes effect, reflecting an increase in demand. The ultimate price hike implemented at the time of a VAT rate change is equivalent to around 70% of the tax increase, and this less than full price transfer is said to be a reason for the moderate price change. However, previous studies have not made clear why a price change at the time of a VAT rate change is moderate.

The purpose of this paper is to study factors that may have kept price changes after VAT rate changes moderate in Europe. That is because price changes affect economic activity through their effects on real income (income effect). In particular, this paper's study focuses on the viewpoints of (i) the effects of the presence of multiple tax rates, including reduced rates for some particular items, and (ii) the situation of inflation in countries where VAT rates have changed.

The effects of a VAT rate change on prices identified in this paper are as follows:

1) In cases when a VAT rate was raised by one percentage point, a price transfer equivalent to only 3.6% to 76.8% of the tax increase occurred. It was confirmed that this trend becomes more pronounced when a reduced rate is raised at the same time. Changes in VAT rates are not fully transferred to prices.
2) The effects on prices before the VAT rate change takes effect are observed to a significant degree under the following conditions: (i) a high-inflation region, (ii) a tax rate hike of 2 percentage points or more, (iii) a simultaneous raising of a reduced tax rate, and (iv) application of the tax change to durable consumer goods. In other words, it may be said that the effects are significant in an environment where prices may be easily raised (a high-inflation region) or when the difference between prices of items subject to the standard tax rate and prices of other items tends not to expand (a simultaneous raising of a reduced tax rate). However, regarding durable consumer goods, prices dropped before a VAT rate change took effect in many cases.
3) Because of the presence of reduced tax rates, items subject to the standard tax rate ac-

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counted for around 65% of overall consumption items on average. This means that if a change of one percentage point in the standard tax rate causes the same level of price transfer as the one estimated from my analysis, the effects on prices are even smaller.

As shown above, the effects of a VAT rate change on prices in Europe are small presumably because (i) the real effects of a VAT rate change are mitigated by the effects of a reduced tax rate and also because (ii) tax rate changes are not fully transferred to prices. In other words, the situation in Europe is such that consumers tend to be insulated from the effects of a tax rate change.

On the other hand, at the time of a VAT rate change, retailers are supposed to set new prices in a way that fully reflects the tax rate change, as tax-inclusive pricing is applied in the case of VAT. However, given that actual price changes after past VAT rate changes were moderate, it is possible that retailers may have shouldered part of the tax increase or that the quality or quantity of goods and services may have been changed. From consumers' viewpoint, this point may not emerge as a problem if they take a price change more seriously than a quantity change. However, a more detailed analysis needs to be conducted as to why the price change at the time of a VAT rate change is small relative to the tax rate change.

Keywords: VAT, standard tax rate, reduced tax rate, price transfer, income effect
JEL Classification: H62, H31

I. Introduction

According to IMF (2008), we had −4.4% down for the Japanese economy against the past three Value Added Tax (hereafter VAT) hikes, despite −0.6% down for OECD countries on average. As a result of an estimation of several factors: 1) consumer price change before and after a VAT hike, 2) price elasticity, 3) change range of tax rate, 4) introduction of reduced rate, 5) number of media reports on VAT, and 6) ratio of households under liquidity constraints, the White paper of the Cabinet office (2019) indicates the major reason of small impacts against VAT hikes in Euro countries is a moderate change of consumer price after a VAT hike. There are many previous studies in Europe regarding the impact of VAT changes on prices based on the difference in VAT rate changes (standard rate, reduced rate and tax classification) and the difference in durable and non-durable consumer goods. However, there are not a lot of previous studies on whether the price change was small due to a VAT rate change.

The purpose of this paper is to examine why the modest price changes after the VAT change in Europe. This is because price changes affect economic activity through a substantial effect on income effect. In this paper, we consider from the viewpoints of (1) the effect of multiple VAT rates such as reduced rates on overall prices, (2) differences of inflation condition, (3) differences in goods and services, and (4) timing of a VAT rate change.

II. VAT changes and price impacts in Europe

II-1. Difference in VAT changes

In the analysis of VAT in Europe, it is necessary to classify them into (1) standard rate, (2) reduced rate, and (3) change of tax classification. Benedek et al. (2015) shows that the impact on prices before and after the VAT change varies greatly depending on the type of VAT rate change using the Harmonized Index of Consumer Prices (HICP) from 1999 to 2013.

Regarding the change in standard rate, the effect on the price has been seen from nine months ago, and the price change is 71% equivalent to the tax rate until the change date. On the day of the change, 30% of the rate change is passed on, and after that, 38% is additionally passed on to the price, and the average price change rate is 139%. As a result, the final price pass-through is less than 70%. In the case of reduced rates, there is no effect on prices in advance, and on the contrary, a 13% drop in prices can be confirmed. At the time of the change, the price was passed on by 36%, and after that, the price was passed on by 7%, and the final rate of price change was 30% on average. In the case of a change of VAT classification, the price is hardly passed on.

Carare and Danninger (2008) confirmed 24% price increase before the VAT change date for standard rate increase in Germany (implemented on January 1, 2007), and the final price pass-through is 73%. The results are similar to Benedek et al. (2015).

II-2. Differences in consumer goods

According to Benedek et al. (2015), the price of durable consumer goods changed by about 35% before a VAT rate change, and finally the price changed by 50%. In the case of non-durable consumer goods, there was no change in advance, and about 20% was passed on a VAT rate change date, and finally the price changed by about 40%. They pointed out that the reason why durable consumer goods change in price before the change is that consumers are more motivated to buy before the change in VAT and the selling price is raised in line with such consumer behavior.

Carare and Danninger (2008) confirm that consumers' willingness to buy, especially durable consumer goods, has increased, and that sellers have raised prices accordingly.

II-3. Difference between tax rate increase and reduction

Carbonnier (2005) examines the price pass-through in the case of three VAT changes in France using monthly data for 296 items: (1) standard rate hike from 18.6% to 20.6% (August 10, 1995), (2) standard rate reduction from 20.6% to 19.6% (August 1, 2000), (3) standard rate reduction for repair services from 20.6% to 5.5% (September 1, 1999). The situation is different between the reduction and increase of the tax rate, and the price pass-

through at the time of the increase is large. It is pointed out that this cause is influenced by consumer demand trends.

Benzarti et al. (2017) show that a VAT hike is twice as likely to affect prices as a VAT reduction for all VAT change cases in the EU from 1996 to 2015. This asymmetry increases the equilibrium profit and markup for businesses, and shows that companies with lower profit margins are more likely to react asymmetrically to changes in VAT. Moreover, this asymmetry will continue for several years after the VAT change, so it has a large impact on the economy.

According to Benedek et al. (2015), the price change for VAT hike is about 13% in advance, 16% on the change date, 10% after the change, and finally about 40%. In the case of a reduction, there is almost no price pass-through in advance, and the price pass-through rate is 14% on the change date and finally 24%. The price change is larger for VAT hikes. However, the Wald test for the estimation results cannot be rejected.

The effects of hike and reduction for the VAT rate are evaluated differently in previous studies. However, as in Section II-4, previous studies on the effects of tax rate changes on individual items also confirm previous studies that support the asymmetry of the effects of tax increases and reductions.

II-4. Tax rate change for individual items

In France, after the Lehman shock, the VAT of sit-down restaurants was reduced from 19.6% to 5.5% as a limited measure from July to the end of December 2009 for the purpose of bringing back people who often eat at home to restaurants and expanding employment at restaurants. After that, it was raised by 1.5% in January 2012 and by 3.0% in January 2014.

As shown in Figure 1, we can confirm that the prices at restaurants have moved in response to changes in VAT. However, although the tax rate change in July 2009 was a significant reduction, actual prices is almost remained. According to the price index including catering services[1], the price pass-through rate is only 5.6%.

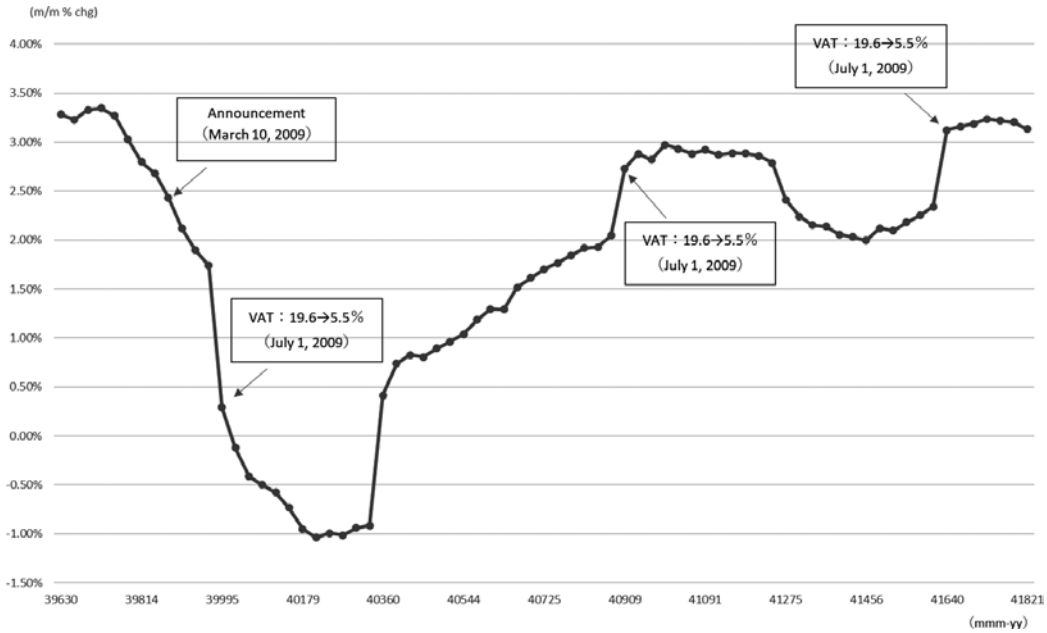
On the contrary, in the subsequent tax rate increase, the price pass-through rate is doubled or almost the same as the tax rate increase. With the reduction and increase of the VAT rate, the price pass-through rate is asymmetrical (Table 1).

The pass-through at restaurants due to VAT reduction was 9.7%, and Benzarti and Carloni (2019) pointed out that the effect of VAT reduction was limited as the growth of employment was limited and restaurant sales did not increase significantly. Temporary VAT cuts to stimulate demand have been implemented in some countries. However, the owners of the company, not the consumers, benefit from VAT reduction.

Similar to France, the VAT rate for restaurant services was reduced in Finland (22% to

[1] The target of the VAT cut here is a food served in sit-down restaurants. However, since we don't use the price index in this classification for the "Restaurants, cafés, and the Like". This index includes catering services (meals, snacks, drinks, and refreshments) provided by restaurants, cafés, buffets, bars, tea-rooms, etc.

Figure 1: Effect of VAT reduction / increase on prices in French restaurants



Note. The figure indicated the percentage change from previous year of HICP "Resraurants, cafés and the like" in France.

Table 1: Pass-through of VAT reduction / increase in French restaurants

	VAT change	Price pass-through rate	Average rate of change	Estimated value
Jul-09	Reduction	0.056	-0.66%	-11.79%
Jan-12	Increase	2.018	2.87%	1.42%
Jan-14	Increase	1.065	2.99%	2.80%

Note. The average rate of change is the 12-month average of the year-on-year rate of change after the VAT change, and the estimated value shows the effect of the tax rate change on prices.
Source. Eurostat "HICP Restaurants, cafés and the like" in France

13%) in July 2010 and in Sweden (25% to 12%) in January 2012. Both countries' support is aimed at creating jobs in the food service industry.

Compared to price change in the year before a VAT change, although the price index for restaurants has fallen to −3.15% in Finland and −2.48% in Sweden, restaurant prices change has remained positive, and no price decline can be confirmed. (Table 2).

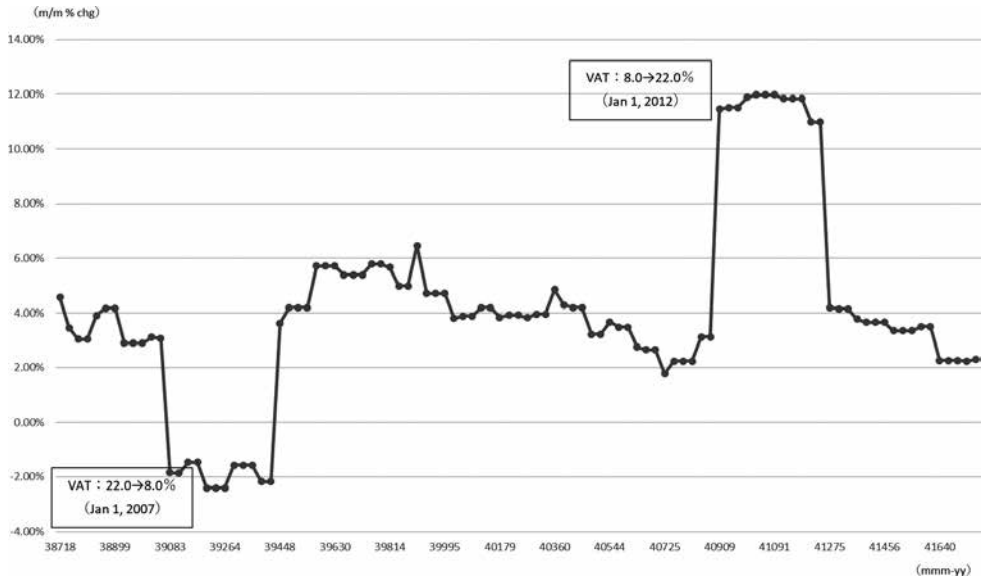
According to Harju and Kosonen (2014), the price pass-through rate of restaurants is only about 25% of the price decline (estimated value) due to a VAT reduction, and many restaurants do not reduce prices at all. These results indicate that the demand for food in restaurants is affected by low price elasticity, and that employment and wage increases in

Table 2: Pass-through of VAT reduction / increase in Finland and Sweden restaurants

	Time of tax rate change	Price pass-through rate	Average rate of change			Estimated value
			Last year	Tax rate change period	difference	
Finland	2010年7月	-0.013	3.25%	0.10%	-3.15%	-7.38%
Sweden	2012年1月	-0.042	2.91%	0.43%	-2.48%	-10.40%

Note. The average rate of change is the 12-month average of the year-on-year rate of change after the VAT change, and the estimated value shows the effect of the tax rate change on prices.
Source. Eurostat "HICP Restaurants, cafés and the like" in Finland and Sweden

Figure 2: Effect of VAT reduction / increase on prices in Finnish hairdressing services



Note. The figure indicated the percentage change from previous year of HICP "Hairdressing salons and personal grooming establishments" in Finland.

the industry have not been achieved.

Furthermore, in January 2007, the VAT of Finnish hairdressing services was reduced by 14% from 22.0% to 8.0%, and in January 2012 it was raised by 14% to return to the original level. As shown in Figure 2, the pass-through was only 16.6%, as in the case of French restaurants. On the contrary, in the subsequent tax rate increase, the price is passed on to the same extent as the VAT change range (Table 3).

Based on data on Finnish beauty services, Benzarti et al. (2017) pointed out that when VAT was reduced, 60% of beauty service stores did not change prices, and the remaining 40% did not pass on all prices. On the other hand, in the case of a VAT increase, 100% price pass-through is seen in about 50% of stores, the price is not changed in 25% stores, and

Table 3: Pass-through of VAT reduction / increase in Finnish hairdressing services

	VAT change	Price pass-through rate	Average rate of change	Estimated value
Jan-07	Reduction	0.166	-1.90%	-11.48%
Jan-12	Increase	0.898	11.65%	12.96%

Note. The average rate of change is the 12-month average of the year-on- year rate of change after the VAT change, and the estimated value shows the effect of the tax rate change on prices.
Source. Eurostat, Finnish hairdressing services

pass-through is between 0% to 80% in the remaining 25% stores.

We find asymmetric pass-through both reduces and increases VAT according to previous studies.

II-5. Impact on price before VAT increase change

As mentioned in Section II-1, in Europe, it seems that the price is gradually changed even before the change of the VAT standard rate. Carare and Danninger (2008) and Benedek et al. (2015) point out that when the tax rate change is decided, consumers' willingness to buy, especially durable consumer goods, will increase, and sellers will raise prices accordingly. Based on local hearings, Morinobu (2014) and Igarashi (2012) point out that sellers set different prices for each product according to demand so that they can secure a margin as a whole.

In this way, in Europe, prices have risen in response to demand trends even before a VAT change, and it is possible that the impact after a VAT change has been mitigated.

III. Impact of timing of VAT changes

III-1. Announcement of VAT changes

Table 4 is a list of VAT changes since 2000 whose announcement dates have been confirmed. The announcement date is based on the official statement by the authorities, Buttner and Madzharova (2019), and the news on Avalara's website.

In general, the average period from the announcement to the implementation is about six months for the change of VAT. The longest period until implementation is 568 days before in Italy (implemented on July 1, 2013) and Latvia (implemented on January 1, 2011), and the shortest is three days before in Greece (implemented on April 1, 2005).

After the global financial crisis of 2008, VAT changes have been implemented in a short period of time. In addition, there are regions such as the Baltic countries that have raised

Table 4: VAT change announcement in Europe

	Number of days from announcement to Implementation date		Announcement Date		Implementation Date	Tax change	
	Plan	Confirmation	Plan	Confirmation		Standard Rate	Reduced Rate
Japan	267	98	8-Jul-88	24-Dec-88	1-Apr-89	0%→3%	
	922	858	22-Sep-94	25-Nov-94	1-Apr-97	3%→5%	
	824	599	29-Dec-11	10-Aug-12	1-Apr-14	5%→8%	
	865		18-Nov-14		1-Apr-17		
	1217		1-Jun-16		1-Oct-19	8%→10%	8%
Autsria	281	121	26-Mar-15	2-Sep-15	1-Jan-16	-	10%→10/13%
Belgium	-	236		10-May-99	1-Jan-00		1/6/12%→6/12%
Bulgaria	65	-	26-Jan-11		1-Apr-11		7%→9%
Czech	65	-	26-Feb-04		1-May-04	22%→19%	-
	304	-	3-Mar-09		1-Jan-10	19%→20%	9%→10%
	274	28	2-Apr-12	4-Dec-12	1-Jan-13	20%→21%	14%→15%
Croatia	66	-	26-Dec-11		1-Mar-12	23%→25%	
	21	-	11-Dec-12		1-Jan-13		0/10%→5/10%
Cyprus	35	-	10-Dec-12		14-Jan-13	17%→18%	
	399	336	10-Dec-12	11-Feb-13	13-Jan-14	18%→19%	
Estnia	13	-	18-Jun-09		1-Jul-09	18%→20%	
Finland	309	79	26-Aug-09	13-Apr-10	1-Jul-10	22%→23%	8/12%→9/13%
	283	-	24-Mar-12		1-Jan-13	23%→24%	9/13%→10/14%
France	92	-	1-Oct-11		1-Jan-12		
	420	42	7-Nov-12	20-Nov-13	1-Jan-14	19.6%→20.0%	
Germany	415	61	12-Nov-05	1-Nov-06	1-Jan-07	16%→19%	
Greece	3	-	29-Mar-05		1-Apr-05	18%→19%	4/8%→4.5/9%
	11	-	4-Mar-10		15-Mar-10	19%→21%	4.5/9%→5/10%
	61	-	1-May-10		1-Jul-10	21%→23%	5/10%→5.5/11%
	42	-	20-Apr-16		1-Jun-16	23%→24%	
Hungary	246	-	30-Apr-05		1-Jan-06	25%→20%	
	135	-	16-Feb-09		1-Jul-09	20%→25%	5%→5/18%
	107	-	16-Sep-11		1-Jan-12	25%→27%	
Ireland	23	-	9-Dec-09		1-Jan-10	21.5%→21%	
	48	-	14-May-11		1-Jul-11		4.8/13.5%→4.8/9/13.5%
	26	-	6-Dec-11		1-Jan-12	21%→23%	
ITALY	10	-	7-Sep-11		17-Sep-11	20%→21%	
	568	-	11-Dec-11		1-Jul-13	21%→23%	
	263	-	11-Oct-12		1-Jul-13	21%→22%	
	96	-	27-Jun-13		1-Oct-13	21%→22%	
	363	-	3-Jan-15		1-Jan-16	22%→24%	
	61	-	1-Nov-15		1-Jan-16		
	4	-	28-Dec-15		1-Jan-16		
Latvia	23	-	9-Dec-08		1-Jan-09	18%→21%	5%→10%
	568	-	12-Jun-09		1-Jan-11	21%→22%	10%→12%
	65	-	27-Apr-12		1-Jul-12	22%→21%	
Lithuania	16	-	16-Dec-08		1-Jan-09	18%→19%	
	70	-	23-Jun-09		1-Sep-09	19%→21%	
Luxembourg	632	604	9-Apr-13	7-May-13	1-Jan-15	15%→17%	3/6%→3/8%
Malta	36	-	26-Nov-03		1-Jan-04	15%→18%	
	61	-	1-Nov-10		1-Jan-11		5%→5/7%
Netherlands	154	129	30-Apr-12	25-May-12	1-Oct-12	19%→21%	
	191	104	24-Jun-18	19-Sep-18	1-Jan-19	-	6%→9%
Poland	179	-	6-Jul-10		1-Jan-11	22%→23%	3/7%→5/8%
	-	0	1-Apr-13				
	-	0	3-Sep-13				
	177	-	8-Jul-15		1-Jan-16	23%→22%	
	828	-	25-Sep-16		1-Jan-19		
Portugal	37	-	25-May-05		1-Jul-05	19%→21%	-
	97	-	26-Mar-08		1-Jul-08	21%→20%	-
	48	-	14-May-10		1-Jul-10	20%→21%	5/12%→6/13%
	94	-	29-Sep-10		1-Jan-11	21%→23%	-
	86	-	7-Oct-14		1-Jan-15	23%→23.25%	15/1/4Cancel
Romania	56	5	6-May-10	26-Jun-10	1-Jul-10	19%→24%	-
	55	-	7-Apr-15		1-Jun-15	-	all food 24%→9%
	340	107	26-Jan-15	16-Sep-15	1-Jan-16	24%→20%	-
	473	48	16-Sep-15	14-Nov-16	1-Jan-17	20%→19%	-
Slovakia	117	86	6-Sep-10	7-Oct-10	1-Jan-11	19%→20%	6/10%→10%
Slovenia	95	53	28-Mar-13	9-May-13	1-Jul-13	20%→22%	8.5%→9.5%
Spain	275	240	29-Sep-09	3-Nov-09	1-Jul-10	16%→18%	4/7%→4/8%
	52	-	11-Jul-12		1-Sep-12	18%→21%	4/8%→4/10%
UK	7	-	24-Nov-08		1-Dec-08	17.5%→15.0%	
	403	23	24-Nov-08	9-Dec-09	1-Jan-10	15.0%→17.5%	
	197	40547	21-Jun-10		4-Jan-11	17.5%→20.0%	

Note. Rates and implementation dates are from each authirity, Buettner and Madzharova (2019) and news on Avalara's website

VAT standard rates, and there are regions such as the United Kingdom that have lowered VAT standard rates as a measure to stimulate domestic consumption.

Similarly, in order to mitigate the effects of the novel coronavirus (COVID-19) after the beginning of 2020, VAT rates have been reduced in a short period of time (Table 5). In this way, it takes a short period of time from a VAT change to implementation during an economic shock.

Table 5: Announcement of VAT change for COVID-19 in Europe

	Items subject to tax reduction	Old	New	Announcement Date	Number of days from announcement to Implementation date	Implementation date	
						Start	End
Austria	Non-Alcoholic beverages	20%	10%	11-May-20	51	1-Jul-20	31-Dec-20
	Café, restaurant and similar hospitality services	10%	5%				
	Entrance to cultural, cinema, sporting and other live venues	13%	5%	12-Jun-20	19	1-Jul-20	31-Dec-20
	Publishing	10%	5%				
Belgium	Hospitality, restaurants, cafes and publishing, not include alcholic drinks	12%	6%	21-May-20	18	8-Jun-20	31-Dec-20
Bulgaria	Hospitality, restaurants, cafes and books	21%	10%	8-May-20	54	1-Jul-20	31-Dec-20
Cyprus	Hotels, accommodation, hospitality, restaurants, cafes and public transport	9%	5%	28-May-20	34	1-Jul-20	10-Jan-21
Czech	Accommodation; sports and cultural activities	15%	10%	26-May-20	36	1-Jul-20	31-Dec-20
Germany	Standard rate	19%	16%	4-Jun-20	27	1-Jul-20	31-Dec-20
	Reduced rate	7%	5%			1-Jul-20	31-Dec-20
	catering food services (Take-away and delivered food is already liable to 7% VAT)	19%	7%	23-Apr-20	69	1-Jul-20	1-Jul-21
Greece	Public transport, taxis, ferries	24%	13%	21-May-20	11	1-Jun-20	31-Oct-20
	Transport, non-alcoholic beverages, coffee and cinema entrance	24%	13%	21-May-20	11	1-Jun-20	31-Oct-20
Ireland	Standard rate	23%	21%	23-Jul-20	40	1-Sep-20	28-Feb-21
Norway	Cinema, hotels, public transport	12%	6%	13-Mar-20	19	1-Apr-20	31-Oct-20
UK	Hospitality and tourism including restaurants; cafes; pubs (ex alcohol); hospitality; hotels; B&B's; home rental; caravan and tent sites; hot take away food; theatres; circuses; amusement parks; concerts; museums; zoos; cinemas; and exhibitions. Note: served alcoholic drinks will not benefit from the cut.	20%	5%	8-Jul-20	7	15-Jul-20	12-Jan-21

Note. Rates and implementation dates are from each authirity and news on Avalara's website

III-2. Announcement effect of VAT change

There are two effects related to VAT change: at the time of announcement and implementation.

Cashin and Unayama (2014) show that consumption decreases due to the income effect when households recognize a decrease in lifetime income at the time of announcement of a VAT change, and that the inter-temporal substitution effect increases consumption. Whether consumption increases or decreases at the time of announcement is determined by these two effects. However, it is possible that the income effect will not occur. At the same time as the VAT change, the income tax and the reduced rate of VAT may be changed, and the negative income effect may be reduced. In this case, since the inter-temporal substitution effect is stronger, the announcement effect is positive when the VAT rate is raised, and a negative ef-

fect as “consumption postponement” is expected when the VAT rate is lowered.

Carare and Danninger (2008) indicates that the effect of raising prices due to a VAT increase was suppressed as the announcement regarding the change in the standard rate in Germany, which was implemented on January 1, 2007, was early. The plan was announced on November 12, 2005, and the implementation was confirmed on November 1, 2006.

Using retail sales (Gesellschaft für Konsumforschung (GfK)) and price data from January 2004 to September 2013, Buttner and Madzharova (2019) examined the effect of the VAT change announcement. Although the VAT change is completely passed on to the price, a one-third price change equivalent to a VAT change can be confirmed before the VAT change date. In addition, if VAT is expected to change, it can be confirmed that the sales amount will change temporarily before the implementation.

IV. Impact of VAT Change

IV-1. Data

In this paper, we confirm the impact of VAT changes[2] after 2000 on consumer prices and retail sales. Panel data is created based on the HICP[3] and retail sales for 24 months (49 months in total) before and after the VAT change month. We use the production index, the output gap estimated from the production index[4], the short-term interest rate, and the unemployment rate as explanatory variables. The production index is regarded as a proxy variable for income and economic fluctuations.

This paper deals with the effects of VAT standard rates that have changed since 2000 excluding Ireland[5]. The VAT has been changed 50 times, of which 40 have been raised and 10 have been lowered (Table 6). In order to confirm the analysis in the previous study in more detail, we consider the following four points; (1) range of VAT change[6], (2) timing of announcement, (3) high and low inflation condition to clarify the economic environment in Euro countries and (4) whether or not the reduced rate is changed at the same time (Table 7).

Inflation conditions are categorized into past average inflation from 2000 to 2010 and average inflation in the 24 months immediately before the VAT change. In the past inflation

[2] In this paper, we analyze VAT changes after 2000, for which all the data of each country can be obtained.

[3] In European countries, excise tax is levied on alcohol, tobacco (alcoholic beverages, tobacco and narcotics) and energy (electricity, gas and other fuels), and the excise tax rate may be changed at the same time with VAT or individually. For example, in Greece in 2010, liquor tax and tobacco tax were raised significantly at the same time as VAT. In the case of alcohol, tobacco and energy, it is difficult to extract only the effect of VAT because of the effect of the change in excise tax. In this paper, these items are excluded from the analysis.

[4] For the output gap estimated from the output index, the gap between the trendy production variables and the actual value is regarded as the output gap. The trending production index is estimated based on the HP filter.

[5] Ireland implements VAT changes almost every year, with 10 changes since 2000. Since it is difficult to identify the effect of each VAT change, we estimate the effect excluding Ireland in this paper.

[6] Since VAT introduction in 1968, the standard tax rate for VAT has been changed 107 times (as of the end of January 2020, excluding the tax rate reduction for COVID-19). In the case of VAT increase, 1% or less is 42 cases, 2% is 31 cases, and 3% is 10 cases, and there are not many cases beyond that. In particular, the 1% increase is the highest at 37 cases. If it is less than 2%, it accounts for about half of 46 cases. In addition, when VAT is raised continuously in a short term, VAT is lifted in stages of 1% each (Czech 2010, 2013, Italy 2011, 2013, Finland 2010).

Table 6: Estimation subjects in this paper

Case number		Tax change Date	Standard Rate change	Simultaneous implementation of reduced tax rate changes = 1	Announcement Date	Period until implementation (month number display)
1	Czechia	1-May-04	-3		26-Feb-04	2
2		1-Jan-10	1	1	3-Mar-09	10
3		1-Jan-13	1	1	2-Apr-12	9
4	Germany	1-Jan-07	3		12-Nov-05	14
5	Estonia	1-Jul-09	2		18-Jun-09	0
6	Greece	1-Apr-05	1	1	29-Mar-05	0
7		15-Mar-10	2	1	4-Mar-10	0
8		1-Jul-10	2	1	1-May-10	2
9		1-Jun-16	1		20-Apr-16	1
10	Spain	1-Jul-10	2	1	29-Sep-09	9
11		1-Sep-12	3	1	11-Jul-12	2
12	France	1-Apr-00	-1			
13		1-Jan-14	0.4	1		
14	Croatia	1-Aug-09	1			
15		1-Mar-12	2		26-Dec-11	2
16	Italy	17-Sep-11	1		7-Sep-11	0
17		1-Oct-13	1		27-Jun-13	3
18	Cyprus	1-Jul-02	3			
19		1-Jan-03	2			
20		1-Mar-12	2			
21		14-Jan-13	1		10-Dec-12	1
22		13-Jan-14	1	1	10-Dec-12	13
23	Latvia	1-Jan-09	3	1	9-Dec-08	1
24		1-Jan-11	1	1	12-Jun-09	19
25		1-Jul-12	-1		27-Apr-12	2
26	Luxembourg	1-Jan-15	2	1	9-Apr-13	21
27	Hungary	1-Jan-06	-5		30-Apr-05	8
28		1-Jul-09	5	1	16-Feb-09	5
29		1-Jan-12	2		16-Sep-11	4
30	Malta	1-Jan-04	3		26-Nov-03	1
31	Netherlands	1-Oct-12	2		30-Apr-12	5
32	Poland	1-Jan-11	1	1	6-Jul-10	6
33	Portugal	1-Jun-02	2			
34		1-Jul-05	2		25-May-05	1
35		1-Jul-08	-1		26-Mar-08	3
36		1-Jul-10	1	1	14-May-10	2
37		1-Jan-11	2		29-Sep-10	3
38	Romania	1-Jul-10	5		6-May-10	2
39		1-Jan-16	-4		26-Jan-15	11
40		1-Jan-17	-1		16-Sep-15	16
41	Slovenia	1-Jan-02	1	1		
42		1-Jul-13	2	1	28-Mar-13	3
43	Slovakia	1-Jan-03	-3	1		
44		1-Jan-04	-1	1		
45		1-Jan-11	1	1	6-Sep-10	4
46	Finland	1-Jul-10	1	1	26-Aug-09	10
47		1-Jan-13	1	1	24-Mar-12	9
48	United Kingdom	1-Dec-08	-2.5		24-Nov-08	0
49		1-Jan-10	2.5		24-Nov-08	13
50		4-Jan-11	2.5		21-Jun-10	7

Note. Rates and implementation dates are from each authirity and News in Home page of Avalara.

Table 7: Estimated classification in this paper

(Classification in the form of tax rate change)

	Classification	Number of cases	Case number
1	Reduction, all cases	10	1, 12, 25, 27, 35, 39, 40, 43, 44, 48
2	1% reduction	5	12, 25, 35, 40, 44
3	2% or more reduction	5	1, 27, 39, 43, 48
4	Increase, all cases	40	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 41, 42, 45, 46, 47, 49, 50
5	Increase, Simultaneous change with reduced rate	20	2, 3, 6, 7, 8, 10, 11, 13, 22, 23, 24, 26, 28, 32, 36, 41, 42, 45, 46, 47
6	Increase, standard rate only	20	4, 5, 9, 14, 15, 16, 17, 18, 19, 20, 21, 29, 30, 31, 33, 34, 37, 38, 49, 50
7	1% increase	16	2, 3, 6, 9, 14, 16, 17, 21, 22, 24, 32, 36, 41, 45, 46, 47
8	1% increase, Simultaneous change with reduced rate	11	2, 3, 6, 22, 24, 32, 36, 41, 45, 46, 47
9	1% Increase, standard rate only	5	9, 14, 16, 17, 21
10	2% Increase	14	5, 7, 8, 10, 15, 19, 20, 26, 29, 31, 33, 34, 37, 49
11	2% or more increase	9	4, 11, 18, 23, 28, 30, 38, 49, 50

(Classification by inflation condition)

	Classification	Number of cases	Case number
1	High inflation (2000-2010 average)	19	5, 6, 7, 8, 9, 10, 11, 14, 15, 23, 24, 26, 28, 29, 32, 38, 41, 42, 45
2	1% change	7	6, 9, 14, 24, 32, 41, 45
3	2% change	8	5, 7, 8, 10, 15, 26, 29, 42,
4	Low inflation (2000-2010 average)	21	2, 3, 4, 13, 16, 17, 18, 19, 20, 21, 22, 30, 31, 33, 34, 36, 37, 46, 47, 49, 50
5	1% change	9	2, 3, 16, 17, 21, 22, 36, 46, 47
6	2% change	8	19, 20, 31, 33, 34, 37, 49, 50
7	High inflation (24 months before Tax change)	15	2, 5, 6, 7, 8, 14, 23, 28, 29, 30, 33, 34, 38, 46, 50
8	1% change	4	2, 6, 14, 46
9	2% change	7	5, 7, 8, 29, 33, 34, 50,
10	Low inflation (24 months before Tax change)	25	3, 4, 9, 10, 11, 13, 15, 16, 17, 18, 19, 20, 21, 22, 24, 26, 31, 32, 36, 37, 41, 42, 45, 47, 49
11	1% change	12	3, 9, 16, 17, 21, 22, 24, 32, 36, 41, 45, 47
12	2% change	9	10, 15, 19, 20, 26, 31, 37, 42, 49

(Classification by time and content of announcement)

	Classification	Number of cases	Case number
1	Increase, all cases	35	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 21, 22, 23, 24, 26, 28, 29, 30, 31, 32, 34, 36, 37, 38, 39, 40, 42, 45, 46, 47, 49, 50
2	Increase, 1-3 months ago	15	7, 8, 9, 11, 15, 17, 21, 23, 30, 34, 36, 37, 38, 42, 49
3	increase, 1-3 months ago, Simultaneous change with reduced rate change	6	7, 8, 11, 23, 36, 42
4	increase, 1-3 months ago, Standard rate only	9	9, 15, 17, 21, 30, 34, 37, 38, 49
5	increase, within 4 months to 1 year	12	2, 3, 4, 10, 22, 28, 29, 31, 32, 46, 47, 50
6	increase, within 4 months to 1 year, Simultaneous change with reduced rate change	8	2, 3, 10, 22, 28, 32, 46, 47
7	increase, within 4 months to 1 year, Standard rate only	4	4, 29, 31, 50
8	Reduction, all cases	6	1, 25, 35, 39, 40, 48
9	Reduction, 1-3 months ago	5	1, 25, 35, 39, 40

Note 1. Case numbers from 1 to 50 follow the case numbers in Table 6.
Note 2. Inflation levels are categorized into past average inflation from 2000 to 2010 and average inflation in the 24 months immediately before the VAT change.
Note 3. Euro countries are classified for the average inflation rate on 2.5%, and for inflation rate on 2.0% before the VAT change.

condition category, we classify by country for the average inflation rate of 2.5%. On the other hand, just before the VAT change, 40 cases of VAT change are classified based on 2.0%[7]. This is categorized on the assumption that the average inflation condition in the past influences the behavior of consumers in the region.

IV-2. Impact on prices

IV-2-1. Price trends before and after VAT change

Table 8 shows the price change (rate of change from the same month of the previous year) before and after a VAT change for the 50 cases. In Table 8, "Before change" shows the average rate of change for 12 months before a VAT change. "Before and after the change" shows the difference in the average rate of change for three months before and after the change of VAT. A positive number in the table means that the price is rising due to a VAT change.

In 40 cases of VAT increase, overall index less food etc. (overall index excluding energy, food, alcohol and tobacco) increased in 37 cases before the change and even after the change 30 cases maintained an upward trend.

However, the price index of durable goods was declining in 30 cases before the change, and the range of price changes narrowed in 32 cases after a VAT change.

In detail, we find that the price of precision equipment (audio-visual, photographic and information processing equipment) is declining before the change in all 40 cases, and the range of change narrowed in 31 of them. In 16 cases, the price of "vehicles" fell before the change, and in 31 cases, the range of price change decreased after the change.

As mentioned in II-5, in Europe, prices will rise in advance when a VAT increase is announced. However, this applies to items except durable goods, and we confirm that the prices of durable goods are on a downward trend before the change. For durable goods, it is possible that prices have fallen in order to mitigate the impact of the VAT increase.

In this regard, the price decline can be confirmed even in Japan before the VAT change (Takano et al. [2015]). In Japan, when the consumption tax rate was raised in 1997 and 2014, there was an intertemporal effect before the VAT was changed. The background to this situation is that prices have fallen just before the tax rate change one month before. We confirm this from the year-on-year change in the price excluding consumption tax using the Nikkei / University of Tokyo Daily Price Index.

IV-2-2. Final price pass-through

(1) Relationship between VAT change range and reduced tax rate

Here, we confirm the final price pass-through rate for each item using Equation (1). In this paper, we use the Evans et al. (1999) model, which estimates the price pass-through of

[7] In this paper, low-inflation countries are Czech, Germany, France, Italy, Cyprus, Malta, the Netherlands, Portugal, Finland and the United Kingdom. High-inflation countries are Estonia, Greece, Spain, Croatia, Latvia, Luxembourg, Hungary, Poland, Romania, Slovenia and Slovakia.

Table 8: Price trends before and after VAT change

<VAT Increase>

Case number	implementation	Overall index less food and etc		Durables goods		Precision equipment		Vehicles	
		Before change	Before and after change	Before change	Before and after change	Before change	Before and after change	Before change	Before and after change
2 Czech	1-Jan-10	0.36%	-0.59%	-5.64%	-2.38%	-10.42%	1.04%	-8.90%	-6.15%
3 Czech	1-Jan-13	1.54%	-0.80%	-3.15%	0.26%	-8.17%	0.22%	-3.16%	0.60%
4 Germany	1-Jan-07	0.65%	0.83%	-0.30%	1.03%	-5.98%	0.10%	1.32%	1.99%
5 Estnia	1-Jul-09	3.68%	-0.69%	-5.93%	1.58%	-14.17%	2.53%	-9.17%	2.04%
6 Greece	1-Apr-05	3.39%	-0.65%	1.47%	-0.55%	-1.33%	-0.85%	1.87%	-0.47%
7 Greece	15-Mar-10	1.94%	1.03%	-3.60%	4.04%	-4.38%	0.92%	-7.20%	6.68%
8 Greece	1-Jul-10	2.05%	0.37%	-1.56%	2.20%	-3.80%	1.09%	-3.55%	3.54%
9 Greece	1-Jun-16	0.25%	0.61%	-2.10%	0.19%	-3.78%	-1.32%	-2.22%	0.21%
10 Spain	1-Jul-10	0.41%	0.23%	-2.48%	2.14%	-8.66%	1.04%	-3.19%	3.03%
11 Spain	1-Sep-12	0.92%	1.19%	-0.06%	0.55%	-10.51%	0.28%	1.74%	0.61%
13 Spain	1-Jan-14	0.73%	0.21%	-0.48%	-0.20%	-7.69%	0.08%	1.41%	-0.03%
14 Croatia	1-Aug-09	3.33%	-0.71%	-1.85%	-0.22%	-14.84%	2.57%	-2.63%	-0.47%
15 Croatia	1-Mar-12	-0.05%	0.70%	-0.92%	1.37%	-6.14%	1.70%	-1.05%	2.02%
16 Italy	17-Sep-11	1.68%	1.26%	1.79%	0.82%	-6.38%	2.07%	2.01%	0.53%
17 Italy	1-Oct-13	1.36%	-0.05%	-0.04%	0.34%	-7.92%	4.20%	0.34%	1.24%
18 Cyprus	1-Jul-02	1.19%	0.37%	-1.28%	-3.20%	-13.23%	2.76%	-0.41%	-8.99%
19 Cyprus	1-Jan-03	1.02%	1.54%	-2.78%	-0.40%	-9.68%	-1.66%	-5.12%	-1.45%
20 Cyprus	1-Mar-12	1.11%	0.68%	-0.65%	0.39%	-6.32%	-0.31%	-0.99%	1.07%
21 Cyprus	14-Jan-13	1.67%	-0.69%	-0.73%	0.65%	-6.70%	1.98%	-0.66%	0.49%
22 Cyprus	13-Jan-14	-0.31%	0.54%	-1.37%	-1.47%	-4.31%	-1.42%	-0.07%	-1.92%
23 Latvia	1-Jan-09	9.03%	-0.77%	-1.94%	-1.50%	-13.97%	0.84%	-0.77%	-2.35%
24 Latvia	1-Jan-11	-4.03%	1.45%	-5.76%	0.41%	-8.15%	0.04%	-4.89%	0.60%
26 Luxembourg	1-Jan-15	1.28%	0.57%	0.29%	1.09%	-5.83%	1.49%	0.76%	1.59%
28 Hungary	1-Jul-09	2.76%	2.32%	-0.26%	3.73%	-10.08%	3.57%	1.92%	4.56%
29 Hungary	1-Jan-12	1.74%	1.50%	-1.27%	0.10%	-5.97%	1.16%	-1.14%	-2.06%
30 Malta	1-Jan-04	1.88%	0.09%	0.11%	2.45%	-5.11%	2.17%	1.50%	2.34%
31 Netherlands	1-Oct-12	2.03%	0.44%	-0.55%	1.05%	-5.32%	1.81%	0.31%	0.80%
32 Poland	1-Jan-11	1.29%	0.46%	-2.26%	0.73%	-7.25%	0.37%	-1.81%	0.20%
33 Portugal	1-Jun-02	3.98%	0.41%	3.36%	0.26%	-0.84%	0.03%	4.40%	0.25%
34 Portugal	1-Jul-05	2.01%	0.64%	1.63%	0.44%	-4.56%	0.96%	2.35%	0.43%
36 Portugal	1-Jul-10	0.01%	0.76%	-2.76%	2.36%	-10.74%	2.39%	-2.77%	3.05%
37 Portugal	1-Jan-11	0.32%	1.16%	-1.34%	1.40%	-7.56%	-1.49%	-1.18%	2.08%
38 Romania	1-Jul-10	4.41%	1.76%	1.53%	1.83%	-0.25%	1.43%	1.09%	3.58%
41 Slovenia	1-Jan-02	0.57%	4.73%	3.93%	1.68%	-6.59%	2.32%	4.66%	2.29%
42 Slovenia	1-Jul-13	0.69%	0.82%	-3.02%	1.19%	-4.38%	1.48%	-3.94%	1.15%
45 Slovenia	1-Jan-11	0.36%	0.74%	-6.34%	0.64%	-4.38%	-0.46%	-11.82%	1.57%
46 Finland	1-Jul-10	1.91%	-0.27%	-0.15%	0.75%	-6.36%	0.04%	-0.93%	1.32%
47 Finland	1-Jan-13	2.12%	-0.41%	-0.83%	0.21%	-8.24%	-0.78%	-0.01%	0.61%
49 UK	1-Jan-10	1.68%	0.74%	0.65%	1.43%	-10.89%	3.51%	1.38%	2.35%
50 UK	4-Jan-11	2.69%	0.40%	2.62%	0.54%	-5.38%	-2.32%	4.48%	1.68%

<VAT Reduction>

Case number	implementation	Overall index less food and etc		Durables goods		Precision equipment		Vehicles	
		Before change	Before and after change	Before change	Before and after change	Before change	Before and after change	Before change	Before and after change
1 Czech	1-May-04	0.68%	0.94%	-2.62%	-1.17%	-7.81%	0.12%	-1.46%	-2.33%
12 France	1-Apr-00	0.46%	-0.25%	-0.38%	0.16%	-6.38%	0.52%	-0.91%	-0.10%
25 Latvia	1-Jul-12	0.45%	-0.30%	-4.56%	0.44%	-10.17%	1.76%	-2.48%	0.18%
27 Hungary	1-Jan-06	3.31%	-1.82%	-2.21%	-1.42%	-6.09%	-2.30%	-0.61%	-0.86%
35 Portugal	1-Jul-08	1.81%	0.13%	-1.32%	0.27%	-7.06%	-0.35%	-2.20%	0.33%
39 Romania	1-Jan-16	1.60%	-1.24%	0.77%	-1.37%	1.54%	-1.89%	-0.05%	-1.33%
40 Romania	1-Jan-17	0.02%	0.08%	-0.51%	0.99%	-1.10%	1.28%	-0.76%	1.00%
43 Slovakia	1-Jan-03	4.32%	2.74%	-1.48%	2.66%	-4.88%	-1.33%	-0.66%	5.72%
44 Slovakia	1-Jan-04	7.02%	-0.21%	0.84%	-2.37%	-7.27%	-1.02%	4.17%	-4.38%
48 UK	1-Dec-08	1.57%	-0.70%	-2.25%	-1.50%	-13.48%	-1.09%	-1.72%	-2.48%

Note 1. Case numbers from 1 to 50 follow the case numbers in Table 6.

Note 2. These anlysis use the following price indexes (HICP). Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Durables goods: Non-energy industrial goods, durables only

Precision equipment: Audio-visual, photographic and information processing equipment Vehicles: Purchase of vehicles

Note 3. “Before” indicates average rate of change for 12 months before VAT change.

Note 4. “Before and after” shows the difference in the average rate of change for 3 months before and after the VAT change

Source. Eurostat “HICP

tobacco tax in each state of the United States.

$$\Delta price_{ict} = \beta \Delta VAT_{ict} + \Delta \lambda_c + \gamma \Delta X_{ct} + \Delta \varepsilon_{ict} \quad (1)$$

i denotes the item, c is the country, t is the period, λc is the fixed price effect factor, X is the output gap estimated from each country's production index and short-term interest rates.

Table 9 shows the estimation results regarding the impact of VAT changes on the same month of the previous year of HICP. In the case of 1% increase, pass through is as follows: all items are 30.1%, overall index less food etc. is 37.4%, durable goods are 41.7%, and non-durable goods are 76.8%. When the reduced rate is implemented at the same time, the price pass-through rate is large for all items. From these results, we can confirm that the price pass-through is almost the same as in the previous studies.

According to the difference in the VAT change method, the pass-through rate for the 1% VAT increase is 58.2%, and for the 2% increase is 40.0%. At a VAT rate of 1%, 1% VAT increase has a higher price pass-through rate, and this situation can be confirmed for other items as well. It is possible that consumers are less likely to be affected by the magnitude of tax rate changes.

By item, as in previous studies, durable consumer goods such as vehicles and precision equipment have higher pass-through rate compared to other goods.

For service items, the price change is larger when the standard rate is changed only. The reason for this is that there are few service items subject to the reduced rate.

(2) Impact of inflation condition

The analysis object is divided by the inflation condition, and the effect of VAT change on the price is estimated (Table 10). According to the results classified by the average inflation rate, the price pass-through rate is higher in the high inflation region than in the low inflation region. In the case of 1% VAT increase and durable consumer goods, price pass-through is high. On the other hand, in the case of a 2% VAT increase in low-inflation areas, the price pass-through rate for semi-durable goods, non-durable goods and services is high.

In this way, it seems that high-inflation countries are more likely to pass on prices.

IV-2-3. Impact on price before VAT change

We will confirm the effect on prices before a VAT change for each type of consumer goods. In this paper, we estimate based on Equation (2), which is based on the model of Buttner and Madzharova (2019), which estimates the announcement effect of a VAT change.

$$\Delta price_{ict} = \sum_{t=0}^{t=-6} \beta_k dummny_{ct} + \Delta \lambda_c + \gamma \Delta X_{ct} + \Delta \varepsilon_{ict} \quad (2)$$

i denotes the item, c is the country, t is the period, λc is the fixed price effect factor, X is the output gap estimated from each country's production index and short-term interest rates. In this estimation, HICP is the data for the same month of the previous year, and VAT is the data for the same month difference from the previous year. The dummy variable sets each month to 1 before and after the VAT change date. In addition, as shown in Section III-I, the announcement time of a VAT change is six months on average. We will examine the effects from six months before hand.

Table 9: (Estimation result) Impact of VAT change on prices (1)

	All Items		Overall index less food and etc		Durable goods		Semi durable goods		Non-durable goods	
All cases	0.301	(0.000)	0.268	(0.000)	0.478	(0.000)	0.232	(0.000)	0.432	(0.000)
2% or more increase	0.382	(0.000)	0.324	(0.000)	0.307	(0.000)	0.317	(0.000)	0.555	(0.000)
2% increase	0.400	(0.000)	0.283	(0.000)	0.764	(0.000)	0.288	(0.000)	0.239	(0.000)
1% increase	0.582	(0.000)	0.374	(0.000)	0.417	(0.000)	0.036	(0.775)	0.768	(0.000)
1% increase, Simultaneous change with reduced rate	0.679	(0.000)	0.386	(0.000)	0.556	(0.000)	0.100	(0.469)	0.836	(0.000)
1% Increase, standard rate only	0.060	(0.706)	0.225	(0.123)	-0.122	(0.371)	-0.685	(0.034)	0.629	(0.001)
All cases, Simultaneous change with reduced rate	0.574	(0.000)	0.473	(0.000)	0.903	(0.000)	0.146	(0.018)	0.661	(0.000)
All cases, standard rate only	0.369	(0.000)	0.238	(0.000)	0.336	(0.000)	0.288	(0.000)	0.392	(0.000)
	Clothing and footwear		Furnishings, household equipment		Precision equipment		Vehicles		Books	
All cases	0.257	(0.000)	0.159	(0.000)	0.405	(0.000)	0.575	(0.000)	0.151	(0.015)
2% or more increase	0.431	(0.000)	0.239	(0.004)	0.353	(0.000)	0.271	(0.011)	0.480	(0.002)
2% increase	0.351	(0.000)	0.187	(0.000)	0.589	(0.000)	0.971	(0.000)	0.002	(0.986)
1% increase	-0.172	(0.338)	-0.021	(0.850)	0.475	(0.005)	0.533	(0.000)	0.404	(0.007)
1% increase, Simultaneous change with reduced rate	-0.017	(0.934)	-0.061	(0.693)	0.342	(0.056)	0.656	(0.000)	0.222	(0.141)
1% Increase, standard rate only	-1.398	(0.001)	-0.152	(0.107)	0.975	(0.032)	0.000	(0.998)	1.204	(0.011)
All cases, Simultaneous change with reduced rate	0.016	(0.855)	0.207	(0.010)	0.501	(0.000)	1.289	(0.000)	0.340	(0.005)
All cases, standard rate only	0.364	(0.000)	0.252	(0.000)	0.395	(0.000)	0.221	(0.007)	0.072	(0.417)
	Services (overall index excluding goods)		Services related to recreation, including repairs and personal care		Services related to recreation and personal care, excluding package holidays and accommodation		Services related to package holidays and accommodation		Cultural services	
All cases	0.163	(0.000)	0.039	(0.330)	0.068	(0.126)	0.009	(0.886)	0.202	(0.003)
2% or more increase	0.257	(0.005)	0.187	(0.078)	0.331	(0.004)	-0.139	(0.142)	0.677	(0.000)
2% increase	0.162	(0.000)	0.063	(0.199)	0.056	(0.295)	0.222	(0.116)	0.111	(0.068)
1% increase	0.382	(0.000)	0.071	(0.477)	0.061	(0.498)	0.038	(0.866)	0.632	(0.000)
1% increase, Simultaneous change with reduced rate	0.330	(0.017)	0.008	(0.952)	-0.016	(0.889)	0.031	(0.909)	0.366	(0.039)
1% Increase, standard rate only	0.498	(0.008)	0.243	(0.218)	0.233	(0.179)	0.208	(0.693)	1.638	(0.000)
All cases, Simultaneous change with reduced rate	0.421	(0.000)	0.000	(0.000)	0.314	(0.002)	0.171	(0.134)	0.904	(0.000)
All cases, standard rate only	0.143	(0.000)	0.051	(0.226)	0.134	(0.001)	-0.047	(0.679)	0.211	(0.000)
	Communications		Restaurants, cafés and the like		Package holidays		Accommodation services			
All cases	0.480	(0.000)	0.000	(0.994)	0.060	(0.521)	-0.150	(0.080)		
2% or more increase	0.361	(0.006)	0.218	(0.045)	-0.273	(0.071)	-0.029	(0.773)		
2% increase	0.458	(0.000)	-0.010	(0.860)	-0.062	(0.708)	0.287	(0.132)		
1% increase	0.492	(0.018)	-0.021	(0.835)	1.736	(0.000)	-1.309	(0.000)		
1% increase, Simultaneous change with reduced rate	0.714	(0.004)	-0.063	(0.621)	1.912	(0.000)	-1.343	(0.000)		
1% Increase, standard rate only	-0.661	(0.020)	-0.031	(0.876)	1.844	(0.025)	-1.440	(0.033)		
All cases, Simultaneous change with reduced rate	0.830	(0.000)	0.245	(0.011)	0.483	(0.006)	-0.024	(0.861)		
All cases, standard rate only	0.179	(0.072)	0.025	(0.575)	-0.218	(0.128)	-0.083	(0.586)		

Note 1. The figure shows the estimation results regarding the impact of VAT changes on the same month of the previous year of HICP.
Note 2. Figure in parentheses is the p-value.
Note 3. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Durables goods: Non-energy industrial goods, durables only
Semi durables goods: Non-energy industrial goods, semi-durables
Non-durables goods: Non-energy industrial goods, non-durables
Precision equipment: Audio-visual, photographic and information processing equipment Vehicles: Purchase of vehicles
Note 4. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

Table 11 shows the estimation results of the dummy variables. The impact on the price can be confirmed for the entire HICP even before the VAT change. In addition, if the announcement of a VAT change is one to three months before, the effect on the price can be

Table 10: (Estimation result) Impact of VAT change on prices (2)

	All Items		Overall index less food and etc		Durable goods		Semi durable goods		Non-durable goods	
High inflation (average) , All cases	0.644	(0.000)	0.422	(0.000)	0.723	(0.000)	0.198	(0.001)	0.525	(0.000)
High inflation (average) , 1% increase	0.768	(0.000)	0.635	(0.001)	-0.029	(0.832)	0.430	(0.085)	0.449	(0.035)
High inflation (average) , 2% increase	0.585	(0.000)	0.302	(0.000)	1.252	(0.000)	0.173	(0.042)	0.080	(0.169)
Low inflation (average) , All cases	0.355	(0.000)	0.280	(0.000)	0.431	(0.000)	0.300	(0.000)	0.398	(0.000)
Low inflation (average) , 1% increase	0.556	(0.000)	0.276	(0.000)	0.676	(0.000)	-0.083	(0.558)	0.916	(0.000)
Low inflation (average) , 2% increase	0.326	(0.000)	0.276	(0.000)	0.510	(0.000)	0.216	(0.009)	0.256	(0.000)
High inflation (Before) , All cases	0.483	(0.000)	0.311	(0.000)	0.731	(0.000)	0.115	(0.057)	0.404	(0.000)
High inflation (Before) , 1% increase	-0.354	(0.022)	-0.296	(0.047)	-0.358	(0.047)	-0.691	(0.010)	0.182	(0.293)
High inflation (Before) , 2% increase	0.594	(0.000)	0.286	(0.000)	1.225	(0.000)	0.132	(0.127)	0.072	(0.274)
Low inflation (Before) , All cases	0.396	(0.000)	0.331	(0.000)	0.381	(0.000)	0.274	(0.000)	0.557	(0.000)
Low inflation (Before) , 1% increase	0.688	(0.000)	0.424	(0.000)	0.541	(0.000)	0.137	(0.365)	0.886	(0.000)
Low inflation (Before) , 2% increase	0.275	(0.000)	0.292	(0.000)	0.490	(0.000)	0.260	(0.002)	0.300	(0.000)
	Clothing and footwear		Furnishings, household equipment		Precision equipment		Purchase of vehicles		Books	
High inflation (average) , All cases	0.095	(0.232)	0.258	(0.001)	0.408	(0.000)	0.997	(0.000)	0.288	(0.017)
High inflation (average) , 1% increase	0.599	(0.078)	0.019	(0.935)	-0.703	(0.047)	0.069	(0.804)	0.669	(0.050)
High inflation (average) , 2% increase	0.039	(0.759)	0.130	(0.068)	0.744	(0.000)	1.867	(0.000)	-0.219	(0.036)
Low inflation (average) , All cases	0.367	(0.000)	0.318	(0.000)	0.513	(0.000)	0.315	(0.000)	0.178	(0.040)
Low inflation (average) , 1% increase	-0.489	(0.020)	0.101	(0.202)	1.126	(0.000)	0.731	(0.000)	0.383	(0.003)
Low inflation (average) , 2% increase	0.303	(0.017)	0.374	(0.000)	0.471	(0.000)	0.559	(0.000)	0.318	(0.061)
High inflation (Before) , All cases	0.020	(0.814)	0.162	(0.032)	0.522	(0.000)	1.033	(0.000)	0.454	(0.001)
High inflation (Before) , 1% increase	-0.998	(0.004)	-0.059	(0.715)	2.800	(0.000)	-1.464	(0.000)	0.566	(0.301)
High inflation (Before) , 2% increase	0.057	(0.676)	0.250	(0.001)	0.645	(0.000)	1.850	(0.000)	0.282	(0.052)
Low inflation (Before) , All cases	0.337	(0.000)	0.222	(0.000)	0.365	(0.000)	0.311	(0.000)	-0.126	(0.090)
Low inflation (Before) , 1% increase	-0.062	(0.776)	-0.214	(0.103)	0.007	(0.969)	0.975	(0.000)	0.239	(0.071)
Low inflation (Before) , 2% increase	0.343	(0.005)	0.281	(0.000)	0.558	(0.000)	0.487	(0.000)	-0.138	(0.333)
	Services (overall index excluding goods)		Services related to recreation, including repairs and personal cars		Services related to recreation and personal		Services related to package holidays and accommodation		Cultural services	
High inflation (average) , All cases	0.378	(0.000)	0.262	(0.003)	0.357	(0.000)	0.089	(0.420)	0.773	(0.000)
High inflation (average) , 1% increase	0.935	(0.000)	0.334	(0.125)	0.487	(0.010)	-0.043	(0.924)	0.734	(0.035)
High inflation (average) , 2% increase	0.154	(0.020)	0.064	(0.416)	0.127	(0.176)	0.116	(0.477)	0.127	(0.296)
Low inflation (average) , All cases	0.211	(0.000)	0.145	(0.000)	0.195	(0.000)	0.206	(0.082)	0.260	(0.000)
Low inflation (average) , 1% increase	0.144	(0.049)	0.025	(0.769)	-0.049	(0.522)	0.165	(0.519)	0.636	(0.000)
Low inflation (average) , 2% increase	0.237	(0.000)	0.212	(0.000)	0.111	(0.028)	0.686	(0.000)	0.293	(0.000)
High inflation (Before) , All cases	0.219	(0.009)	0.086	(0.381)	0.214	(0.046)	-0.009	(0.933)	0.482	(0.000)
High inflation (Before) , 1% increase	-0.123	(0.488)	-0.659	(0.002)	-0.738	(0.001)	-0.348	(0.417)	-0.061	(0.881)
High inflation (Before) , 2% increase	0.150	(0.036)	0.056	(0.513)	0.066	(0.498)	0.323	(0.056)	0.051	(0.611)
Low inflation (Before) , All cases	0.284	(0.000)	0.201	(0.000)	0.205	(0.000)	0.145	(0.211)	0.554	(0.000)
Low inflation (Before) , 1% increase	0.348	(0.005)	0.063	(0.570)	0.088	(0.371)	-0.066	(0.808)	0.825	(0.000)
Low inflation (Before) , 2% increase	0.247	(0.000)	0.191	(0.000)	0.141	(0.007)	0.418	(0.027)	0.351	(0.000)
	Communications		Restaurants, cafés and the like		Package holidays		Accommodation services			
High inflation (average) , All cases	0.668	(0.000)	0.293	(0.001)	0.260	(0.184)	0.080	(0.477)		
High inflation (average) , 1% increase	1.722	(0.000)	0.336	(0.078)	1.602	(0.040)	-0.568	(0.177)		
High inflation (average) , 2% increase	0.671	(0.000)	0.188	(0.032)	-0.130	(0.653)	0.323	(0.081)		
Low inflation (average) , All cases	0.107	(0.356)	0.081	(0.038)	0.017	(0.885)	0.077	(0.659)		
Low inflation (average) , 1% increase	-0.253	(0.238)	-0.090	(0.348)	1.932	(0.000)	-1.599	(0.000)		
Low inflation (average) , 2% increase	0.232	(0.031)	-0.025	(0.674)	0.197	(0.156)	0.792	(0.005)		
High inflation (Before) , All cases	0.693	(0.000)	0.149	(0.152)	-0.097	(0.576)	0.010	(0.936)		
High inflation (Before) , 1% increase	1.586	(0.000)	-1.120	(0.000)	0.746	(0.430)	-0.037	(0.938)		
High inflation (Before) , 2% increase	0.687	(0.000)	0.074	(0.434)	-0.057	(0.770)	0.450	(0.022)		
Low inflation (Before) , All cases	0.059	(0.551)	0.091	(0.019)	0.232	(0.122)	0.041	(0.798)		
Low inflation (Before) , 1% increase	0.164	(0.476)	0.052	(0.615)	1.764	(0.000)	-1.645	(0.000)		
Low inflation (Before) , 2% increase	0.277	(0.013)	0.063	(0.254)	0.262	(0.245)	0.575	(0.032)		

Note 1. The figure shows the estimation results regarding the impact of VAT changes on the same month of the previous year of HICP.
Note 2. Figure in parentheses is the p-value.
Note 3. Inflation levels are categorized into past average inflation from 2000 to 2010 and average inflation in the 24 months immediately before the VAT change.
Note 4. Euro countries are classified for the average inflation rate on 2.5%, and for inflation rate on 2.0% before the VAT change.
Note 5. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Durables goods: Non-energy industrial goods, durables only
Semi durables goods: Non-energy industrial goods, semi-durables
Non-durables goods: Non-energy industrial goods, non-durables
Precision equipment: Audio-visual, photographic and information processing equipment Vehicles: Purchase of vehicles
Note 6. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

Table 11: (Estimation result) Announcement effect on prices of VAT change (1)

	All Items							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	0.006	0.005	0.007	0.011	0.015	0.014	0.012	0.003
	(0.002)	(0.440)	(0.646)	(0.568)	(0.361)	(0.000)	(0.000)	(0.000)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.014	0.012	0.018	0.019	0.026	0.024	0.024	0.014
	(0.127)	(0.192)	(0.051)	(0.034)	(0.005)	(0.008)	(0.009)	(0.125)
Announcement, 1-3 months ago, Standard rate only	0.004	0.004	0.003	0.006	0.007	0.005	0.004	-0.005
	(0.084)	(0.214)	(0.213)	(0.172)	(0.307)	(0.539)	(0.566)	(0.984)
Announcement, 2% increase	0.006	0.007	0.007	0.009	0.012	0.008	0.007	-0.001
	(0.060)	(0.034)	(0.031)	(0.008)	(0.000)	(0.014)	(0.049)	(0.826)
Announcement, 1% increase	0.002	0.001	0.003	0.003	0.001	0.001	0.001	-0.003
	(0.516)	(0.774)	(0.396)	(0.389)	(0.633)	(0.733)	(0.632)	(0.326)
Announcement, All cases, Simultaneous change with reduced rate	0.006	0.006	0.008	0.009	0.010	0.009	0.009	0.004
	(0.120)	(0.170)	(0.053)	(0.040)	(0.021)	(0.035)	(0.038)	(0.309)
Announcement, All cases, standard rate only	0.003	0.003	0.004	0.005	0.007	0.006	0.005	-0.004
	(0.289)	(0.278)	(0.220)	(0.086)	(0.027)	(0.050)	(0.120)	(0.179)

	Overall index less food and etc							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	0.003	0.004	0.006	0.008	0.009	0.009	0.008	0.001
	(0.423)	(0.391)	(0.143)	(0.055)	(0.028)	(0.029)	(0.047)	(0.888)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.010	0.007	0.013	0.015	0.017	0.016	0.016	0.006
	(0.230)	(0.353)	(0.111)	(0.065)	(0.038)	(0.049)	(0.054)	(0.437)
Announcement, 1-3 months ago, Standard rate only	0.001	0.003	0.004	0.004	0.004	0.003	0.003	-0.004
	(0.057)	(0.133)	(0.085)	(0.072)	(0.063)	(0.245)	(0.381)	(0.716)
Announcement, 2% increase	0.004	0.007	0.007	0.008	0.009	0.007	0.006	-0.001
	(0.159)	(0.008)	(0.005)	(0.002)	(0.000)	(0.004)	(0.010)	(0.795)
Announcement, 1% increase	0.003	0.001	0.003	0.002	0.002	0.001	0.002	0.000
	(0.259)	(0.778)	(0.399)	(0.421)	(0.472)	(0.654)	(0.581)	(0.958)
Announcement, All cases, Simultaneous change with reduced rate	0.006	0.005	0.007	0.008	0.008	0.007	0.006	0.003
	(0.098)	(0.200)	(0.070)	(0.049)	(0.050)	(0.075)	(0.122)	(0.516)
Announcement, All cases, standard rate only	0.003	0.004	0.005	0.006	0.006	0.006	0.006	-0.001
	(0.159)	(0.060)	(0.026)	(0.008)	(0.005)	(0.007)	(0.006)	(0.617)

	Durable goods							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	0.015	0.015	0.017	0.021	0.021	0.019	0.016	0.006
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.204)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.025	0.025	0.029	0.034	0.031	0.025	0.020	0.008
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.011)	(0.290)
Announcement, 1-3 months ago, Standard rate only	0.011	0.012	0.013	0.014	0.015	0.017	0.017	0.007
	(0.162)	(0.104)	(0.055)	(0.021)	(0.031)	(0.061)	(0.127)	(0.632)
Announcement, 2% increase	0.020	0.021	0.022	0.025	0.024	0.021	0.019	0.010
	(0.020)	(0.021)	(0.022)	(0.025)	(0.024)	(0.021)	(0.019)	(0.010)
Announcement, 1% increase	0.000	0.000	0.002	0.004	0.004	0.005	0.003	0.002
	(0.930)	(0.881)	(0.469)	(0.231)	(0.214)	(0.125)	(0.339)	(0.588)
Announcement, All cases, Simultaneous change with reduced rate	0.010	0.010	0.013	0.015	0.015	0.013	0.010	0.005
	(0.014)	(0.009)	(0.001)	(0.000)	(0.000)	(0.001)	(0.010)	(0.167)
Announcement, All cases, standard rate only	0.007	0.006	0.007	0.009	0.009	0.009	0.009	0.004
	(0.089)	(0.139)	(0.068)	(0.018)	(0.020)	(0.025)	(0.031)	(0.373)

	Semi durable goods							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	-0.006	0.000	0.003	0.006	0.010	-0.002	0.003	0.001
	(0.287)	(0.987)	(0.580)	(0.264)	(0.074)	(0.693)	(0.573)	(0.792)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	-0.005	0.002	0.008	0.011	0.012	0.003	0.004	0.002
	(0.522)	(0.814)	(0.289)	(0.139)	(0.090)	(0.714)	(0.569)	(0.780)
Announcement, 1-3 months ago, Standard rate only	-0.006	0.002	0.003	0.004	0.009	-0.009	0.001	0.003
	(0.013)	(0.072)	(0.068)	(0.007)	(0.001)	(0.496)	(0.525)	(0.478)
Announcement, 2% increase	-0.007	0.005	0.006	0.007	0.013	0.002	-0.001	0.001
	(0.007)	(0.005)	(0.006)	(0.007)	(0.013)	(0.002)	(0.001)	(0.001)
Announcement, 1% increase	0.005	0.001	0.002	0.006	0.006	-0.007	0.000	-0.005
	(0.260)	(0.762)	(0.636)	(0.147)	(0.188)	(0.144)	(0.951)	(0.277)
Announcement, All cases, Simultaneous change with reduced rate	0.004	0.005	0.007	0.011	0.009	0.000	-0.001	0.003
	(0.270)	(0.224)	(0.074)	(0.007)	(0.027)	(0.901)	(0.756)	(0.834)
Announcement, All cases, standard rate only	0.000	0.002	0.002	0.003	0.007	0.000	0.004	-0.002
	(0.968)	(0.726)	(0.660)	(0.502)	(0.146)	(0.930)	(0.403)	(0.622)

	Non-durable goods							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	0.009	0.007	0.009	0.009	0.010	0.013	0.014	0.003
	(0.043)	(0.148)	(0.050)	(0.042)	(0.025)	(0.006)	(0.004)	(0.579)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.020	0.013	0.016	0.015	0.017	0.018	0.017	0.003
	(0.027)	(0.155)	(0.074)	(0.086)	(0.066)	(0.050)	(0.052)	(0.765)
Announcement, 1-3 months ago, Standard rate only	0.004	0.003	0.005	0.007	0.007	0.011	0.012	0.001
	(0.002)	(0.012)	(0.017)	(0.013)	(0.095)	(0.255)	(0.381)	(0.984)
Announcement, 2% increase	0.003	0.005	0.006	0.005	0.007	0.006	0.006	0.000
	(0.003)	(0.005)	(0.006)	(0.005)	(0.007)	(0.006)	(0.006)	(0.000)
Announcement, 1% increase	0.004	0.001	0.002	0.002	0.001	0.002	0.003	0.001
	(0.328)	(0.749)	(0.583)	(0.543)	(0.846)	(0.564)	(0.447)	(0.767)
Announcement, All cases, Simultaneous change with reduced rate	0.009	0.007	0.007	0.006	0.005	0.004	0.005	0.000
	(0.030)	(0.111)	(0.092)	(0.124)	(0.213)	(0.302)	(0.262)	(0.908)
Announcement, All cases, standard rate only	0.005	0.007	0.009	0.010	0.010	0.012	0.012	0.005
	(0.062)	(0.009)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.113)

	Services (overall index excluding goods)							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	-0.002	0.005	0.005	0.012	0.013	0.015	0.012	0.006
	(0.889)	(0.678)	(0.707)	(0.340)	(0.273)	(0.220)	(0.342)	(0.624)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.052	0.063	0.078	0.088	0.104	0.098	0.090	0.075
	(0.089)	(0.041)	(0.011)	(0.004)	(0.001)	(0.001)	(0.003)	(0.009)
Announcement, 1-3 months ago, Standard rate only	-0.003	0.004	0.000	0.002	-0.004	-0.004	-0.005	-0.014
	(0.739)	(0.740)	(0.740)	(0.469)	(0.434)	(0.520)	(0.377)	(0.052)
Announcement, 2% increase	-0.008	-0.006	-0.005	-0.003	-0.003	-0.003	-0.003	-0.005
	(0.198)	(0.354)	(0.405)	(0.612)	(0.576)	(0.621)	(0.671)	(0.450)
Announcement, 1% increase	0.011	0.004	0.006	0.005	0.004	0.006	0.006	0.004
	(0.038)	(0.459)	(0.242)	(0.353)	(0.449)	(0.291)	(0.293)	(0.499)
Announcement, All cases, Simultaneous change with reduced rate	0.011	0.006	0.008	0.008	0.009	0.012	0.011	0.007
	(0.128)	(0.441)	(0.291)	(0.310)	(0.211)	(0.120)	(0.148)	(0.340)
Announcement, All cases, standard rate only	-0.001	0.000	0.000	0.002	0.000	0.001	0.001	-0.002
	(0.754)	(0.956)	(0.988)	(0.597)	(0.919)	(0.819)	(0.761)	(0.641)

	Services related to recreation, including repairs and personal care							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	-0.012	-0.005	-0.002	0.006	0.007	0.015	0.009	0.008
	(0.400)	(0.715)	(0.897)	(0.661)	(0.641)	(0.281)	(0.530)	(0.592)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.042	0.046	0.063	0.073	0.093	0.112	0.093	0.077
	(0.245)	(0.201)	(0.082)	(0.045)	(0.011)	(0.002)	(0.009)	(0.030)
Announcement, 1-3 months ago, Standard rate only	-0.010	0.001	0.001	0.004	-0.007	-0.006	-0.008	-0.010
	(0.732)	(0.407)	(0.607)	(0.270)	(0.282)	(0.175)	(0.115)	(0.075)
Announcement, 2% increase	-0.011	-0.010	-0.009	-0.007	-0.007	-0.006	-0.004	-0.007
	(-0.011)	(-0.010)	(-0.009)	(-0.007)	(-0.007)	(-0.006)	(-0.004)	(-0.007)
Announcement, 1% increase	0.007	0.000	0.000	-0.003	-0.005	-0.003	-0.003	-0.002
	(0.192)	(0.983)	(0.958)	(0.533)	(0.378)	(0.573)	(0.624)	(0.728)
Announcement, All cases, Simultaneous change with reduced rate	0.007	0.001	0.002	0.000	0.002	0.006	0.005	0.003
	(0.373)	(0.952)	(0.787)	(0.958)	(0.796)	(0.474)	(0.575)	(0.691)
Announcement, All cases, standard rate only	-0.006	-0.005	-0.004	-0.002	-0.004	-0.002	-0.001	-0.002
	(0.263)	(0.340)	(0.473)	(0.714)	(0.446)	(0.716)	(0.916)	(0.683)

	Services related to recreation and personal care, excluding package holidays and accommodation							
	-6期	-5期	-4期	-3期	-2期	-1期	当期	+1期
Announcement, 1-3 months ago	-0.001	-0.002	0.002	0.012	0.022	0.029	0.023	0.015
	(0.933)	(0.878)	(0.882)	(0.432)	(0.155)	(0.060)	(0.137)	(0.321)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.055	0.061	0.081	0.101	0.122	0.134	0.112	0.089
	(0.176)	(0.136)	(0.048)	(0.014)	(0.003)	(0.001)	(0.006)	(0.026)
Announcement, 1-3 months ago, Standard rate only	0.002	0.002	0.003	0.004	0.005	0.005	0.006	-0.003
	(0.823)	(0.903)	(0.961)	(0.904)	(0.511)	(0.294)	(0.149)	(0.102)
Announcement, 2% increase	-0.007	-0.005	-0.004	-0.003	-0.001	0.000	-0.001	-0.004
	(-0.007)	(-0.005)	(-0.004)	(-0.003)	(-0.001)	(0.000)	(-0.001)	(-0.004)
Announcement, 1% increase	0.008	0.002	0.003	0.002	0.000	-0.001	-0.003	-0.002
	(0.125)	(0.687)	(0.580)	(0.753)	(0.950)	(0.787)	(0.623)	(0.766)
Announcement, All cases, Simultaneous change with reduced rate	0.009	0.004	0.007	0.008	0.010	0.011	0.008	0.006
	(0.295)	(0.631)	(0.447)	(0.376)	(0.278)	(0.237)	(0.349)	(0.490)
Announcement, All cases, standard rate only	-0.001	-0.003	-0.002	0.000	0.002	0.004	0.003	-0.001
	(0.870)	(0.587)	(0.739)	(0.955)	(0.688)	(0.534)	(0.603)	(0.926)

Note 1. The figure shows the result for the dummy variable in which each month before the change is set to "1" in order to measure the announcement effect of the VAT change.
Note 2. Figure in parentheses is the p-value.
Note 3. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Durables goods: Non-energy industrial goods, durables only
Semi durables goods: Non-energy industrial goods, semi-durables
Non-durables goods: Non-energy industrial goods, non-durables
Precision equipment: Audio-visual, photographic and information processing equipment Vehicles: Purchase of vehicles
Note 4. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

confirmed after the announcement. It shows that the announcement of VAT change by the authorities is affecting the price. In particular, if the reduced tax rate is implemented at the same time, the effect on the price can be confirmed more clearly.

In the case of a tax rate increase of 2%, the effect on the price before the tax rate change can be confirmed, but in the case of a 1% increase, the effect in advance cannot be confirmed significantly.

By type of consumer goods, food is not significant. Since most food products are subject to the reduced tax rate, price increases before the change cannot be confirmed, as in previous studies. Similar to previous studies, durable consumer goods can more clearly confirm their impact on prices before VAT changes compared to semi-durable and non-durable goods.

In terms of the impact of inflation, high-inflation countries generally have an impact on price trends even before the VAT change. Furthermore, in goods and services, goods have a

Table 12: (Estimation result) Announcement effect on prices of VAT change (2)

	All Items							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.008	0.009	0.011	0.012	0.015	0.014	0.014	0.005
	(0.068)	(0.053)	(0.012)	(0.007)	(0.001)	(0.002)	(0.002)	(0.265)
Low inflation (average) , All cases	0.003	0.002	0.002	0.003	0.003	0.002	0.002	-0.003
	(0.214)	(0.427)	(0.363)	(0.178)	(0.166)	(0.342)	(0.522)	(0.240)
High inflation (Before) , All cases	0.006	0.005	0.007	0.009	0.010	0.010	0.008	0.001
	(0.266)	(0.320)	(0.229)	(0.116)	(0.082)	(0.076)	(0.152)	(0.839)
Low inflation (Before) , All cases	0.004	0.004	0.006	0.006	0.007	0.006	0.006	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Overall index less food and etc							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.007	0.007	0.009	0.011	0.012	0.011	0.010	0.004
	(0.120)	(0.110)	(0.029)	(0.014)	(0.006)	(0.011)	(0.015)	(0.335)
Low inflation (average) , All cases	0.003	0.003	0.003	0.004	0.003	0.003	0.002	-0.002
	(0.034)	(0.078)	(0.040)	(0.025)	(0.095)	(0.099)	(0.132)	(0.288)
High inflation (Before) , All cases	0.002	0.004	0.006	0.009	0.009	0.010	0.009	0.004
	(0.649)	(0.394)	(0.191)	(0.068)	(0.059)	(0.037)	(0.066)	(0.455)
Low inflation (Before) , All cases	0.007	0.005	0.006	0.006	0.006	0.004	0.004	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Durable goods							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.010	0.011	0.013	0.016	0.016	0.014	0.010	0.003
	(0.013)	(0.007)	(0.002)	(0.000)	(0.000)	(0.001)	(0.012)	(0.477)
Low inflation (average) , All cases	0.007	0.006	0.008	0.009	0.009	0.009	0.009	0.004
	(0.076)	(0.140)	(0.043)	(0.014)	(0.022)	(0.017)	(0.022)	(0.108)
High inflation (Before) , All cases	0.010	0.011	0.013	0.018	0.018	0.015	0.011	0.004
	(0.055)	(0.026)	(0.011)	(0.000)	(0.000)	(0.003)	(0.021)	(0.203)
Low inflation (Before) , All cases	0.007	0.006	0.008	0.009	0.008	0.009	0.008	0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Semi durable goods							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.007	0.005	0.008	0.012	0.014	0.000	0.003	0.005
	(0.093)	(0.212)	(0.056)	(0.006)	(0.001)	(0.966)	(0.548)	(0.266)
Low inflation (average) , All cases	-0.001	0.002	0.002	0.003	0.002	0.000	0.001	-0.005
	(0.763)	(0.608)	(0.610)	(0.437)	(0.567)	(0.976)	(0.808)	(0.256)
High inflation (Before) , All cases	0.000	0.002	0.004	0.007	0.006	0.006	0.005	0.003
	(0.997)	(0.744)	(0.482)	(0.182)	(0.208)	(0.199)	(0.357)	(0.538)
Low inflation (Before) , All cases	0.003	0.004	0.005	0.007	0.008	-0.005	-0.001	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Non-durable goods							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.009	0.010	0.011	0.010	0.011	0.011	0.012	0.003
	(0.050)	(0.027)	(0.019)	(0.028)	(0.015)	(0.017)	(0.009)	(0.573)
Low inflation (average) , All cases	0.004	0.003	0.004	0.005	0.004	0.004	0.004	0.000
	(0.104)	(0.263)	(0.118)	(0.039)	(0.129)	(0.094)	(0.103)	(0.937)
High inflation (Before) , All cases	0.006	0.008	0.009	0.009	0.009	0.010	0.009	0.003
	(0.142)	(0.078)	(0.044)	(0.050)	(0.041)	(0.030)	(0.035)	(0.554)
Low inflation (Before) , All cases	0.008	0.007	0.008	0.008	0.007	0.007	0.008	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Services (overall index excluding goods)							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.010	0.006	0.009	0.011	0.013	0.015	0.015	0.010
	(0.217)	(0.463)	(0.246)	(0.191)	(0.122)	(0.066)	(0.060)	(0.219)
Low inflation (average) , All cases	0.002	0.002	0.001	0.001	-0.001	-0.001	-0.002	-0.004
	(0.463)	(0.574)	(0.783)	(0.673)	(0.690)	(0.750)	(0.556)	(0.262)
High inflation (Before) , All cases	-0.003	0.001	0.004	0.007	0.008	0.010	0.010	0.007
	(0.697)	(0.876)	(0.658)	(0.428)	(0.347)	(0.230)	(0.238)	(0.398)
Low inflation (Before) , All cases	0.014	0.007	0.008	0.007	0.005	0.006	0.005	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Services related to recreation, including repairs and personal care							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.007	0.002	0.004	0.005	0.006	0.012	0.012	0.009
	(0.446)	(0.838)	(0.651)	(0.601)	(0.497)	(0.187)	(0.186)	(0.298)
Low inflation (average) , All cases	-0.001	-0.002	-0.001	-0.002	-0.005	-0.005	-0.005	-0.006
	(0.829)	(0.630)	(0.869)	(0.656)	(0.262)	(0.222)	(0.235)	(0.178)
High inflation (Before) , All cases	-0.009	-0.005	-0.002	0.001	0.002	0.007	0.006	0.008
	(0.349)	(0.623)	(0.844)	(0.888)	(0.851)	(0.488)	(0.503)	(0.420)
Low inflation (Before) , All cases	0.013	0.004	0.005	0.001	0.001	0.001	0.001	-0.005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

	Services related to recreation and personal care, excluding package holidays and accommodation							
	-6	-5	-4	-3	-2	-1	0	+1
High inflation (average) , All cases	0.009	0.006	0.010	0.012	0.015	0.018	0.016	0.012
	(0.309)	(0.535)	(0.315)	(0.222)	(0.116)	(0.066)	(0.111)	(0.231)
Low inflation (average) , All cases	0.003	0.000	0.000	0.001	0.000	-0.001	-0.001	-0.003
	(0.400)	(0.990)	(0.927)	(0.884)	(0.979)	(0.731)	(0.750)	(0.405)
High inflation (Before) , All cases	-0.002	-0.001	0.002	0.006	0.011	0.014	0.012	0.010
	(0.823)	(0.909)	(0.872)	(0.576)	(0.318)	(0.201)	(0.275)	(0.335)
Low inflation (Before) , All cases	0.012	0.008	0.009	0.007	0.006	0.004	0.003	-0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note 1. The figure shows the result for the dummy variable in which each month before the change is set to "1" in order to measure the announcement effect of the VAT change.
Note 2. Figure in parentheses is the p-value.
Note 3. Inflation levels are categorized into past average inflation from 2000 to 2010 and average inflation in the 24 months immediately before the VAT change.
Note 4. Euro countries are classified for the average inflation rate on 2.5%, and for inflation rate on 2.0% before the VAT change.
Note 5. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Durables goods: Non-energy industrial goods, durables only
Semi durables goods: Non-energy industrial goods, semi-durables
Non-durables goods: Non-energy industrial goods, non-durables
Note 6. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

greater effect on prices in advance. This is an expected result according to the characteristics of services that are produced when supply and demand match (Table 12).

IV-2-4. Weighted average effect of multiple VAT rates

In Europe, many countries have adopted multiple reduced VAT rates, and for food, clothing and footwear, different tax rates are applied even within the same classification.

For this reason, it is considered that the effect of a VAT change differs between the standard tax rate, which is nominal for consumers, and the actual tax rate. Therefore, for consumers, the effect of standard VAT rates may be substantially reduced by the existence of multiple tax rates. Table 13 shows the actual VAT rate (weighted average VAT rate) and the ratio of the standard tax rate to all items based on VAT rate for each item.

The actual tax rate is an approximation[8], but it is about 5% lower than the nominal standard tax rate in almost every country. In particular, Ireland, which changes its VAT almost every year, has a relatively high standard tax rate of 23.0%, but the actual tax rate has

[8] For items with a reduced VAT rate, the item classification between the price index and the item classification in VAT do not always match. Here, we calculate using the standard VAT rate if we cannot divide into each VAT rate for each item.

Table 13: Actual VAT changes (weighted average effect)

	Standard rate (%)	Reduced rate (%)	Super-reduecd rate (%)	Actual rate		Weight of the standard rate
					Difference from standard tax rate	
Belguim	21.00	6/12		14.94	-6.06	60.23
Germany	19.00	7		15.34	-3.66	71.57
Estnia	20.00	9		18.48	-1.52	89.64
Ireland	23.00	9/13.5	4.8	15.22	-7.78	48.09
Spain	21.00	10	4	15.43	-5.57	53.75
France	20.00	5.5/10	2.1	14.25	-5.75	60.55
Italy	22.00	5/10	4	14.57	-7.43	52.19
Cyprus	19.00	5/9		14.01	-4.99	61.00
Latvia	21.00	5/12		17.70	-3.30	80.29
Lithuania	21.00	5/9		18.58	-2.42	85.69
Luxembourg	17.00	8	3	12.34	-4.66	65.22
Malta	18.00	5/7		11.93	-6.07	61.52
Netherlands	21.00	9		16.30	-4.70	64.48
Autsria	20.00	10/13		15.88	-4.12	59.97
Portugal	23.00	6/13		16.44	-6.56	63.49
Slovenia	22.00	9.5		16.41	-5.59	58.48
Slovakia	20.00	10		16.53	-3.47	70.86
Finland	24.00	10/14		18.76	-5.24	62.58
UK	20.00	5		14.59	-5.41	71.46
Average	20.63			15.67	-4.96	65.32

Note 1. Figures are calculated using standard tax rate and reduced tax rate are as of January 2020.
Note 2. The actual tax rate is the weighted average of the tax rates for each item. However, it is an approximate value because the reduced tax rates for all items are not reflected.
Note 3. The weight of the standard rate shows the ratio against a aitems.
Source. European Commission (2020) “VAT rates applied in the Member States of the European Union”,

dropped by nearly 8%.

In addition, the ratio of items subject to the standard tax rate to the total price index is 65% on average. If the standard tax rate of 1% is changed, the effect on prices will be even smaller if the price pass-through situation is as analyzed so far. Especially in Italy and Spain, the effect of changing standard VAT rate is significantly reduced.

In the United Kingdom, VAT was raised by 2.5% respectively on January 1, 2010 and January 4, 2011. The reduced tax rate has not changed. The CPI increased by 1.1% in 2010 and 1.16% in 2011[9], which is much smaller than the tax rate change. When we calculate mechanically based on the VAT rate applied to each item, the overall CPI will show by about

[9] We analyze using the difference from the average rate of change (compared to the same month of the previous year) for each 12 months before and after the tax rate change. According to a survey by the Office for National Statistics (ONS (2011)), the effects of VAT hike by 2.5% in 2010 and 2011 are estimated to be 0.40% and 0.76%, respectively.

1.46%. In this way, a 2.5% VAT increase is expected to result in a price increase close to 2%. However, in reality, price increases are suppressed by the reduced tax rate and the zero VAT rate. In addition, the effect on prices is smaller than the range of change in the tax rate due to the difference in the price pass-through rate for goods and services for each.

IV-3. Impact on consumption (retail sales)

IV-3-1. Effect of VAT increase

We examine the impact of VAT changes on retail sales using Equation (3) based on the Keynesian-type consumption function.

$$log(Consumption_{ict}) = \beta_0 log(income_{ct}) + \beta_1 \Delta(VAT - Price)_{ict} + \Delta\lambda_c + \gamma X_{ct} + \varepsilon_{ict} \quad (3)$$

Consumption are the real retail sales (seasonally adjusted index), we use the production index as a proxy variable of, *Income* VAT-Price means the difference between VAT rate and HICP change rate. *i* denotes the item, *c* is the country, *t* is the period, λc is the fixed price effect factor, *X* is the unemployment rate as a factor for other consumption.

Table 14 shows the influence in whole period to the amount of retail sale according to the same month in the previous year of VAT. We confirm −1.09% of consumption aggravation in the whole amount of retail sale. Particularly, in the case of VAT 2% increase, we find that the consumption decreases equal to a tax rate change as −2.1%. Especially in the case of consumption of overall index less food etc., we find that in the case of a 2% increase, the consumption has decreased significantly to −4.01%. However, the purchase of precision equipment has had a small impact. This is because these prices were declining before the

Table 14: (Estimation result) Impact of retail sales on VAT change

	All Items		food		Overall index less food and etc		Clothing and footwear	
All cases	-1.099	(0.000)	-0.356	(0.000)	-2.180	(0.000)	-0.681	(0.000)
2% increase	-2.103	(0.000)	-0.194	(0.072)	-4.016	(0.000)	-0.684	(0.012)
1% increase	0.048	(0.801)	0.110	(0.254)	-1.589	(0.000)	0.115	(0.683)
All cases, Simultaneous change with reduced rate	-1.601	(0.000)	-0.504	(0.000)	-2.916	(0.000)	-0.821	(0.002)
All cases, standard rate only	-0.788	(0.000)	-0.147	(0.096)	-1.692	(0.000)	0.450	(0.058)
	Medical products, appliances and equipment		Precision equipment		Restaurants, cafés and the like		Accommodation services	
All cases	0.018	(0.000)	-0.002	(0.000)	-1.576	(0.000)	-0.793	(0.000)
2% increase	0.013	(0.000)	-0.006	(0.000)	0.321	(0.726)	-0.478	(0.360)
1% increase	0.025	(0.000)	-0.001	(0.053)	-1.281	(0.000)	-1.313	(0.000)
All cases, Simultaneous change with reduced rate	0.025	(0.000)	-0.002	(0.000)	-1.551	(0.000)	-1.400	(0.000)
All cases, standard rate only	0.013	(0.000)	-0.005	(0.000)	1.253	(0.017)	-0.511	(0.278)

Note 1. The figure shows the estimation results regarding the impact of VAT changes on the same month of the previous year of HICP.
Note 2. Figure in parentheses is the p-value.
Note 3. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Precision equipment: Audio-visual, photographic and information processing equipment
Note 4. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

VAT change, and as a result, the final decline in consumption was smaller than that of other goods. In addition, the consumption suppression effect can be confirmed in the consumption of services such as restaurants and hotels. Regarding the method of changing the tax rate, the negative effect is greater when the reduced rate and standard tax rate are changed at the same time.

In this way, we find that the negative "income effect" of raising VAT can be confirmed.

IV-3-2. Announcement effect on VAT change

The effect of a VAT change announcement is estimated for the 40 cases for which information on VAT change was confirmed. We use Equation (4) in addition to the dummy variable related to the announcement of VAT change based on Equation (3).

$$log(Consumption_{ict}) = \beta_0 log(income_{ct}) + \beta_1 announcement(dummy)_{ct} + \lambda_c + \gamma X_{ct} + \varepsilon_{ict} \quad (4)$$

i denotes the item, c is the country, t is the period, λc is the fixed price effect factor, X is the unemployment rate as a factor for other consumption. In this estimation, HICP is the data for rate of change from the same month of the previous year, and *Dummy* are dummy variable sets on 1 on the date of announcement of a VAT change.

The estimation results are shown in Table 15. The announcement of a VAT change stimulates consumption when the VAT rate is raised, while the effect of suppressing consumption can be confirmed when the tax rate is decreased. If the announcement date is the latest (within one to three months) of the tax rate change, a positive effect can be confirmed for all retail sales, overall index less food etc. (overall index excluding energy, food, alcohol and tobacco), and health / health-related consumption. In case of changing only the standard rate without changing the reduced tax rate, the announcement effect can be better confirmed. Therefore, it is possible that there is room for a last-minute substitution effect in Europe as well as in Japan. However, since service consumption is related to restaurants and hotels, the impact cannot be confirmed.

On the other hand, regarding VAT reduction, if the announcement date is the latest (within one to three months) of the VAT change, a negative effect can be confirmed on all retail sales, foodstuffs, food-related consumption, and clothing-related consumption.

In other words, we can confirm the behavior of refraining from consumption before VAT is reduced.

V. VAT change and economic environment

We examine whether VAT change is implemented in relation to the economy. In particular, we check whether VAT changes are implemented regardless of economic activity.

V-1. Economic conditions and tax rate changes

Fuest et al. (2018) examine whether the changes in the German local corporate tax rate

Table 15: (Estimation result) Announcement effect of VAT change on retail sales

	All Items		food		Overall index less food and etc		Clothing and footwear	
Announcement, all cases	0.026	(0.282)	0.006	(0.736)	0.040	(0.205)	-0.020	(0.568)
Announcement, 1-3 months ago	0.051	(0.081)	0.012	(0.682)	0.085	(0.016)	0.082	(0.157)
Announcement, 1-3 months ago, Simultaneous change with reduced rate	0.046	(0.307)	0.031	(0.444)	0.068	(0.211)	0.080	(0.388)
Announcement, 1-3 months ago, Standard rate only	0.056	(0.110)	0.001	(0.972)	0.098	(0.023)	0.085	(0.214)
Reduction announce, all cases	-0.053	(0.255)	-0.066	(0.154)	-0.044	(0.428)	-0.109	(0.242)
Reduction announce, 1-3 months ago	-0.110	(0.034)	-0.104	(0.057)	-0.130	(0.031)	-0.244	(0.020)
	Medical products, appliances and equipment		Precision equipment		Restaurants, cafés and the like		Accommodation services	
Announcement, all cases	0.024	(0.185)	-0.006	(0.860)	-0.016	(0.605)	-0.043	(0.578)
Announcement, 1-3 months ago	0.063	(0.043)	0.026	(0.585)	0.024	(0.673)	-0.056	(0.715)
Announcement, 1-3 months ago, Simultane	0.036	(0.484)	0.053	(0.439)	0.056	(0.408)	0.099	(0.542)
Announcement, 1-3 months ago, Standard	0.087	(0.017)	0.025	(0.673)	-0.013	(0.877)	-0.159	(0.508)
Reduction announce, all cases	0.064	(0.169)	-0.103	(0.172)	-0.060	(0.322)	-0.024	(0.819)
Reduction announce, 1-3 months ago	-0.038	(0.373)	-0.197	(0.030)	-0.103	(0.146)	-0.034	(0.782)

Note 1. The figure shows the result for the dummy variable in which each month before the change is set to "1" in order to measure the announcement effect of the VAT change.
Note 2. Figure in parentheses is the p-value.
Note 3. These anlysis use the following price indexes (HICP).
Overall index less food and etc: Overall index excluding energy, food, alcohol and tobacco Precision equipment: Audio-visual, photographic and information processing equipment
Note 4. Author's estimation based on Eurostat "HICP", "Retail sales index", etc.

from 1993 to 2012 are affected by the shock of the business cycle using GDP and the unemployment rate. They estimate the effect of economic variables at the time of VAT change and point out that the tax rate change is implemented without being affected by the business cycle.

Benzarti et al. (2017) analyzes whether VAT changes from 1996 to 2005 are affected by the economic environment, using the same model as Faouzi et al. (2018) for VAT changes. The estimation period is separate for all samples, VAT-hike and VAT-reduction periods. Like Fuest et al. (2018), they point out that business cycles do not affect VAT rate changes, whether VAT are raised or lowered.

V-2. Economic environment at the time of VAT change

Following Benzarti et al. (2017), we estimate the relation between the change of VAT change and economic condition by Equation (5) using same classification of VAT change as before.

$$Reform_{ict} = \sum_{t=-24}^{t=-1} \beta_t log(IP_{ct}) + \sum_{t=-24}^{t=-1} \gamma_t \Delta log(UR_{ct}) + \lambda_t + \Delta\varepsilon_{ict} \quad (5)$$

i denotes the item, *c* is the country, *t* is the period, λ*c* is the fixed price effect factor, *X* is the unemployment rate as a factor for other consumption. In this estimation, *Reform* is VAT change for item *i, IP* is industrial index, *UR* is unemployment rate.

Table 16 shows the estimation results. Regarding VAT increase, even if the economy deteriorates five months beforehand, VAT increase has been implemented, and there are situations where it is not affected by the business cycle. As mentioned above, the impact of VAT changes on the economy is small, and it is possible to change VAT independently of economic fluctuations

However, when VAT rate was reduced, the unemployment rate showed that the economy had deteriorated. Three or four months before, it indicates that VAT needs to be reduced. This coincides with the actual announcement of VAT reduction and indicates that VAT reduction has been implemented immediately in response to the economic downturn.

VI. Background of price changes being small due to VAT changes

Similar to the previous study, in Europe, a price increase of 3.6 to 76.8% can be confirmed by raising VAT rate by 1%. Not all VAT changes are passed on to retail prices. In particular, in terms of tax rate change range, the price pass-through rate is larger at 1% than at 2%, and in the case of a 2% increase, it can be judged that there is no significant difference between the 1% increase and the price change.

Furthermore, due to reduced VAT rate, the actual VAT rate is about 5% lower than the standard tax rate in almost every country. In addition, the ratio of items subject to the standard tax rate to the total price index is 65% on average, and we find that the change in the standard rate of 1% is small.

In this way, the impact of VAT changes on prices in Europe is as follows: (1) The effect of changes in standard VAT is mitigated by the reduced tax rate, and (2) not all VAT changes are passed on to prices. In other words, as a result, consumers are less likely to be affected by tax rate changes.

In addition, in the following four cases, the influence on the price before VAT change becomes stronger; (1) high inflation areas, (2) VAT increase of 2%, (3) reduced VAT at the same time, and (4) durable consumer goods can be confirmed more clearly.

However, the prices of durable consumer goods before the change in VAT have fallen year-on-year, and the rate of decline is shrinking.

Therefore, it is not only the price change due to the expansion of demand of the item as pointed out by the previous research, but also the environment where it is easy to raise the price (high inflation area), and the items subject to the standard tax rate and others are affected in advance. It may be because the price difference with the items in the above is difficult to widen (when the reduced tax rate is simultaneous).

Furthermore, it can be confirmed that the impact of VAT increase in Europe has offset a

Table 16: (Estimation result) Relation between VAT change and economic environment

		-1		-2		-3		-4	
All cases	IIP	-0.036	0.094	0.014	0.523	0.017	0.449	0.024	0.318
	UP	0.001	0.952	0.013	0.268	0.014	0.222	0.016	0.194
1% reduction	IIP	0.008	0.825	0.034	0.335	0.008	0.825	-0.012	0.747
	UP	0.029	0.264	0.037	0.162	0.053	0.051	0.049	0.085
2% reduction	IIP	0.007	0.909	0.053	0.414	0.002	0.972	-0.034	0.625
	UP	0.062	0.228	0.074	0.165	0.115	0.035	0.108	0.054
2% or more increase	IIP	-0.024	0.502	-0.012	0.745	-0.002	0.949	0.024	0.539
	UP	0.002	0.914	0.003	0.829	0.006	0.675	0.013	0.418
2% increase	IIP	-0.016	0.668	-0.011	0.778	-0.007	0.867	0.005	0.905
	UP	0.005	0.742	0.005	0.721	0.007	0.656	0.010	0.555
1% increase	IIP	-0.062	0.096	0.029	0.451	0.038	0.344	0.050	0.219
	UP	-0.009	0.743	0.020	0.451	0.015	0.583	0.024	0.403
1% increase, Simultaneous change with reduced rate	IIP	-0.019	0.723	0.038	0.479	0.031	0.568	0.049	0.390
	UP	0.059	0.107	0.082	0.029	0.059	0.123	0.062	0.115
1% Increase, standard rate only	IIP	0.000	0.999	-0.039	0.448	-0.010	0.862	0.006	0.913
	UP	-0.024	0.445	-0.036	0.256	-0.021	0.527	-0.011	0.753
All increase cases, Simultaneous change with reduced rate	IIP	-0.018	0.661	0.010	0.806	0.032	0.450	0.054	0.211
	UP	0.015	0.436	0.020	0.309	0.017	0.393	0.019	0.363
All increase cases, standard rate only	IIP	-0.062	0.055	0.007	0.835	0.005	0.888	0.022	0.542
	UP	-0.017	0.278	-0.001	0.961	0.004	0.796	0.014	0.407

		-5		-6		-7	
All cases	IIP	-0.102	0.000	-0.034	0.169	-0.008	0.738
	UP	-0.012	0.341	-0.001	0.910	-0.007	0.597
1% reduction	IIP	-0.037	0.343	0.013	0.745	0.018	0.654
	UP	0.039	0.181	0.049	0.111	0.050	0.122
2% reduction	IIP	-0.080	0.265	0.010	0.889	0.020	0.796
	UP	0.092	0.114	0.100	0.096	0.098	0.114
2% or more increase	IIP	-0.141	0.000	-0.074	0.074	-0.046	0.275
	UP	-0.022	0.183	-0.013	0.450	-0.017	0.324
2% increase	IIP	-0.098	0.018	-0.063	0.144	-0.036	0.419
	UP	-0.013	0.446	-0.008	0.646	-0.009	0.617
1% increase	IIP	-0.099	0.018	-0.031	0.473	0.005	0.901
	UP	-0.006	0.841	0.007	0.808	-0.006	0.841
1% increase, Simultaneous change with reduced rate	IIP	-0.121	0.037	-0.084	0.160	0.040	0.513
	UP	0.031	0.433	0.025	0.544	0.005	0.910
1% Increase, standard rate only	IIP	0.007	0.909	-0.059	0.316	-0.112	0.059
	UP	-0.005	0.898	-0.024	0.501	-0.045	0.222
All increase cases, Simultaneous change with reduced rate	IIP	-0.183	0.000	-0.081	0.075	-0.015	0.739
	UP	-0.033	0.123	-0.019	0.377	-0.023	0.314
All increase cases, standard rate only	IIP	-0.065	0.076	-0.028	0.453	-0.024	0.525
	UP	-0.002	0.928	0.005	0.767	-0.002	0.907

Note 1. The figure shows the estimation results regarding the impact of VAT changes on Industrial product index (IIP) and unemployment rate.
Note 2. Figure in parentheses is the p-value.
Note 3. Author's estimation based on Eurostat "HICP", "Industrial Product index", etc.

large part of the price increase due to the standard rate increase due to the existence of multiple tax rates, and there may be a price increase before a VAT change. In addition, it is possible that the impact on prices and consumption is suppressed.

VII. Conclusion

In Europe, price changes due to VAT changes are small, and the impact on the economy is fairly limited. However, it is an issue to be considered that not all VAT changes are passed on to the selling price.

For VAT, the selling price is the total price including tax. At retail stores, the selling price is set by 100% pass-through on all the tax rate changes. Figure 3 is a receipt for a grocery retail store (supermarket) in the United Kingdom. Figure 4 shows the receipt of a Belgian grocery store (supermarket). In the case of the United Kingdom, some food products are subject to standard tax rate items (indicated by a tax portion on the right side of the item amount on the receipt), but most are zero tax rates. There are four types of tax rates for food in Belgium: tax-exemption items, two types of reduced tax rates and a standard tax rate. In both cases, the taxable portion should be clearly displayed on the receipt[10].

However, the price change after VAT change is smaller than the amount equivalent to the tax rate change. This indicates that the retail store may be partially responsible for the tax rate change, or that the quantity and quality of consumer goods and services may have changed.

It has been pointed out that in the United Kingdom, shrinkflation may have occurred in which the prices of retail products remain unchanged in size and capacity. ONS (2017) analyzes the impact of VAT changes on prices from the consumer price index since 2012 and shows the possibility of shrinkflation. In addition, ONS (2019) points out that in 2016, 361 products out of 37,400 samples of food and drink were confirmed to be reduced in size, and the prices of the products were not changed in many cases from before the size change.

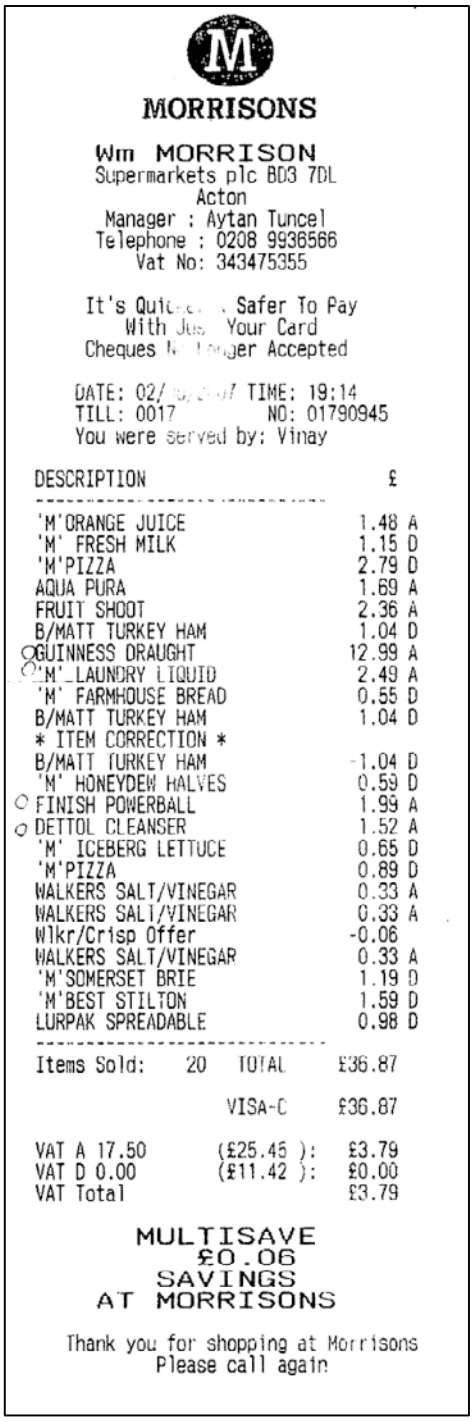
According to the author's interview survey with small and medium-sized stores in the United Kingdom (September 2019), it was pointed out that the size and capacity were reduced when the VAT rate was raised in 2010 and 2011. For consumers, the selling price is more important than the size and capacity when they decide to expenditure. Therefore, even if the VAT rate is raised, if the selling price is the same level, consumers are less likely to be aware of VAT changes.

A more detailed analysis is needed to determine that price changes through VAT changes are smaller than VAT changes. This point will be an issue for the future.

[10] The taxable portion is not displayed on the receipts of many retail stores. According to the author's survey (September-October 2019), in the case of major British supermarkets, it is not displayed in TESCO, Sainsbury's and ASDA. Morrisons shown in Figure 3 is also not displayed at this time. In addition, information on VAT is not displayed even in the price display at the store.

Figure 3: Retail store receipts in UK

2 Aug 2007
With a tax portion display



MORRISONS

Wm MORRISON
Supermarkets plc BD3 7DL
Acton
Manager : Aytan Tuncel
Telephone : 0208 9936566
Vat No: 343475355

It's Quicker & Safer To Pay
With Just Your Card
Cheques No Longer Accepted

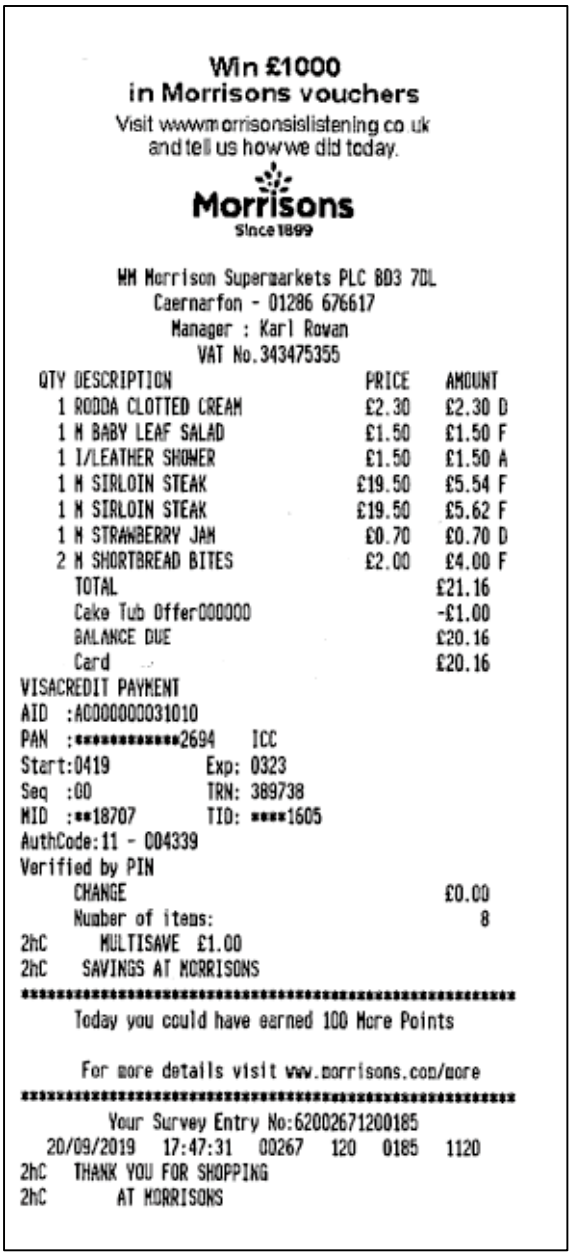
DATE: 02/08/2007 TIME: 19:14
TILL: 0017 NO: 01790945
You were served by: Vinay

DESCRIPTION	£	
'M'ORANGE JUICE	1.48	A
'M' FRESH MILK	1.15	D
'M'PIZZA	2.79	D
AQUA PURA	1.69	A
FRUIT SHOOT	2.36	A
B/MATT TURKEY HAM	1.04	D
GUINNESS DRAUGHT	12.99	A
'M' LAUNDRY LIQUID	2.49	A
'M' FARMHOUSE BREAD	0.55	D
B/MATT TURKEY HAM	1.04	D
* ITEM CORRECTION *		
B/MATT TURKEY HAM	-1.04	D
'M' HONEYDEW HALVES	0.59	D
FINISH POWERBALL	1.99	A
DETTOL CLEANSER	1.52	A
'M' ICEBERG LETTUCE	0.65	D
'M'PIZZA	0.89	D
WALKERS SALT/VINEGAR	0.33	A
WALKERS SALT/VINEGAR	0.33	A
Wlkr/Crisp Offer	-0.06	
WALKERS SALT/VINEGAR	0.33	A
'M'SOMERSET BRIE	1.19	D
'M'BEST STILTON	1.59	D
LURPAK SPREADABLE	0.98	D
Items Sold: 20 TOTAL	£36.87	
VISA-C	£36.87	
VAT A 17.50 (£25.45):	£3.79	
VAT D 0.00 (£11.42):	£0.00	
VAT Total	£3.79	

MULTISAVE
£0.06
SAVINGS
AT MORRISONS

Thank you for shopping at Morrisons
Please call again

20 Sept 2019
Without a tax portion display



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in Morrisons vouchers
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and tell us how we did today.

Morrisons
Since 1899

WM Morrison Supermarkets PLC BD3 7DL
Caernarfon - 01286 676617
Manager : Karl Rowan
VAT No.343475355

QTY	DESCRIPTION	PRICE	AMOUNT
1	RODDA CLOTTED CREAM	£2.30	£2.30 D
1	M BABY LEAF SALAD	£1.50	£1.50 F
1	I/LEATHER SHOWER	£1.50	£1.50 A
1	M SIRLOIN STEAK	£19.50	£5.54 F
1	M SIRLOIN STEAK	£19.50	£5.62 F
1	M STRAWBERRY JAM	£0.70	£0.70 D
2	M SHORTBREAD BITES	£2.00	£4.00 F
	TOTAL		£21.16
	Cake Tub Offer000000		-£1.00
	BALANCE DUE		£20.16
	Card		£20.16

VISACREDIT PAYMENT
AID :A0000000031010
PAN :**********2694 ICC
Start:0419 Exp: 0323
Seq :00 TRN: 389738
MID :**18707 TID: ****1605
AuthCode:11 - 004339
Verified by PIN
CHANGE £0.00
Number of items: 8
2hC MULTISAVE £1.00
2hC SAVINGS AT MORRISONS

****

Today you could have earned 100 More Points

For more details visit www.morrisons.com/more

****

Your Survey Entry No:62002671200185
20/09/2019 17:47:31 00267 120 0185 1120
2hC THANK YOU FOR SHOPPING
2hC AT MORRISONS

Figure 4: Retail store receipts in Belgium

11 Oct 2019
With a tax portion display

TICKET DE CAISSE
Vendredi 11/10/2019 13:35:47:38
Caisse

Description	Prix €
1 Coffret 2 bouteilles 1 verre	8,00
1 Eco gel-douche/bain trapp	3,90
1 Fromage jeune	14,23
1 Sablés pur beurre Klaarland	4,90
1 Val/Dé à coudre	3,25
Total à payer :	**34,28**
Base TVA 6 % :	*18,05*
Base TVA 21 % :	*12,52*
TVA :	*3,71*

ABBAYE N.D. D'ORVAL
Orval, 1
6823 Villers-devant-Orval (BELGIQUE)
TVA BE0406525020
BE04267005404131 GEBABEBB
Abbaye Tél. : 061 31 10 60
Mag. Tél. 061 32 51 13 Fax 061 32 51 46
magasin@orval.be - www.orval.be

11 Oct 2019
Without a tax portion display

Intermarché

JAMBES
RUE MAJOR MASCAUX 20
5100 JAMBES
TEL : 081 / 31.34.10
FAX : 081 / 30.98.10

CHIMAY TRAPPISTE 5TR	2,99 EUR
COURGETTE VRAC	
0,410 kg X 1,89EURO/kg	0,77 EUR
HERTA DIND NAT S/NIT	2,99 EUR
NT:IDS COPPA 10T 100	1,79 EUR
BAGUETTE EPI	0,89 EUR
CANDICO CASSON.BLOND	1,79 EUR
CROISSANT DROIT PUR	0,49 EUR
CROISSANT DROIT PUR	0,49 EUR
CHAUSSON/TRIANGLE	0,79 EUR
TOMATE CHERIE GRAPPE	
0,115 kg X 6,99EURO/kg	0,80 EUR
St-Eloi melange douc	1,49 EUR
MONTANT DU	15,28 EUR
CB VISA	15,28 EUR

Nombre d'articles vendus= 11
A RENDRE 0,00 EUR
ESPECES 0,00 EUR
****

NO SECURITE: 36060550
9:06:56 11/10/2019
M06612 C001 01014 T0041
MERCI DE VOTRE VISITE. A BIENTOT.

OUVERT
LUNDI : 12H30 - 19H00
MARDI à DIMANCHE : 08H30 - 19H00

JOURS FERIES :
08H30 - 19H00

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