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24 September 2024

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Working paper | 2024-12

Who is most affected by a VAT change? Impact of VAT changes on consumer prices and EBIT

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Abstract

In theory, VAT is considered to be a pass-through item in a firm. However, research suggests otherwise: firms are unable to pass on the full VAT to consumers. Using the 2012 VAT reform in the Netherlands as a case study, I show that VAT changes result in a reduction of firms' EBIT and an increase in consumer prices. I observe an approximate 83 % VAT pass-through. When the sample of firms is divided into large and small firms, it is evident that the negative impact is concentrated in large firms. This study confirms the analysis results by employing a placebo VAT reform in 2010 and validating them externally using 22 VAT changes in a European panel of 15 countries. The VAT pass-through in the European context is only 42 %. The results are robust against endogeneity. The objective of this study is to determine which side of the market is more significantly affected by a change in VAT.

Keywords: VAT, Pass Through, EBIT, prices

1. Introduction

One of the fastest-growing sources of revenue for member countries of the Organization for Economic Co-operation and Development (OECD) in recent years has been general consumption taxes, particularly value added taxes (VAT), which are levied by 37 of the 38 OECD countries, with the exception of the United States (OECD 2023). The share of general consumption taxes in the total tax revenue of member countries is 21.40 % in 2021, a significant increase from 13.40 % in the mid-1970s (OECD 2023). Policymakers typically assume that changes in VAT, also known as indirect taxes, are fully and accurately passed through to consumer prices (Lustig et al. 2014) and therefore do not burden firms (Mack et al. 2005). In recent years, however, empirical studies have shown the opposite, with mixed results. When VAT changes, the pass-through to consumer prices can be complete, less complete ("under-shifting") or more than complete ("over-shifting") (Benedek et al.

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2020). In his analysis of two VAT changes, Carbonnier (2007) shows that consumers bear 57 % of the burden in the market for new cars and 77 % in the market for housing repair services ("under-shifting"). An example of "over-shifting" is observed in the alcohol market in Washington in 1991, where consumer prices rise by more than the amount of the tax within three months (Young and Bielińska-Kwapisz 2002).

Two important papers in the area of VAT research are Kosonen (2015) and Benzarti et al. (2020), which look at the VAT reduction on hairdressing services in Finland in January 2007, which was increased again by the same amount in January 2014. The results show that firms use the VAT reduction to increase their profits by reducing prices only slightly ("under-shifting"). In addition, firms pass on the VAT increase through prices in order to minimize the impact on their profits (Benzarti et al. 2020). Another important study examines the impact of VAT changes on French sit-down restaurants (Benzarti and Carloni 2019). Many studies in the field of VAT analyse the impact of changes in the reduced VAT rate on a narrow set of goods or services in a given country. It should be noted, however, that VAT is not uniformly applied to a given product. Finally, VAT is not a product-related tax (Benedek et al. 2020).

The change in the standard VAT rate, which affects most goods and services in a country, has received less attention in research to date. Jacob et al. (2019) analyse the increase in the standard VAT rate in the Netherlands in 2012 and provide important insights into the impact on corporate investment. Benedek et al. (2020) look at the other side of the market and answer the central question of how an increase in the standard VAT rate affects consumer prices. Motivated by this state of research, I extend this field of research to include a simultaneous analysis of the consumer and the firm side in the context of changes in the standard VAT rate.[2] In doing so, I analyse consumer prices on the consumer side and earnings before interest and taxes (EBIT) on the firm side. Following Jacob et al. (2019), in my first set of analyses I use a difference-in-differences (DiD) approach to examine the increase in VAT in the Netherlands in 2012. The reform is not caused by the

[2] In the following, the term "VAT" is used to refer to the standard VAT rate. Should I refer to a different VAT rate, I will explicitly indicate this.

economic situation in the Netherlands, but by pressure from the EU budget, as described by Jacob et al. (2019). Therefore, there is no risk that the reform is endogenous to economic conditions. Moreover, the reform is particularly suitable for empirical studies, as the increase of 2 percentage points from 19 % to 21 % is economically significant and is not affected by changes in other taxes (Jacob et al. 2019). The reform therefore allows for causal inference on the impact of VAT on consumer prices and corporate EBIT. As only the standard VAT rate increased in the Netherlands in 2012, the reduced VAT rate remained unchanged. This applies, for example, to agriculture, the food industry and the healthcare sector. Therefore, some firms were affected by the increased VAT, while others remained unaffected.

The consumer price dataset consists of 40 consumption categories and 5,184 monthly observations. All Dutch consumption categories affected by the VAT reform form the treatment group (*affected*), while all German consumption categories form the control group (*unaffected*). The firm dataset contains 721 firms and 3,225 annual observations. I use the five-digit Standard Industrial Classification (SIC) code to divide the sample into Dutch firms taxed at the standard VAT rate that are affected by the VAT reform (*affected*) and those that are not (*unaffected*). Since the impact of the VAT reform may depend on the size of the firm, I further divide the firm dataset into large and small firms. The sample period of the analyses is from 2010 to 2015. The results show that the VAT increase in the Netherlands has a positive impact on Dutch consumer prices, while it has a negative impact on the EBIT of Dutch firms. The negative impact is limited to large firms. I find no impact on small firms. About 83 % of the VAT burden is passed on in consumer prices. The remaining tax burden is borne by the firms themselves. This may be one reason for the decline in EBIT. Both the EBIT of affected and unaffected firms and consumer prices in the Netherlands and Germany developed similarly before the VAT increase. This supports the parallel trends assumption underlying my approach. To underline the robustness of my results, I conduct a placebo analysis in which the VAT increase is postponed to the end of 2010. All specifications show no statistical significance, which strengthens the confidence in the causality of my results and supports the assumption of parallel trends.

The empirical results of my study on the VAT increase in the Netherlands in 2012 are limited to one event and a relatively small sample. In my second set of analyses, I evaluate 22 VAT changes in 15 European countries in order to externally validate the results. I extend the sample period to the years 2006 to 2019 in order to capture as many VAT changes as possible. The identification approach is based on a first difference and a fixed effects regression. I can confirm the results of my main analysis. However, the VAT pass-through is lower in the European sample at 42 %. I find that a one percentage point increase in VAT leads to a 5.68 % decrease in firms' EBIT. The main problem with cross-country analysis is that VAT reform may be endogenous to economic conditions. Unobserved or poorly measured differences in economic conditions could affect my results. To address this issue, I proceed analogously to Jacob et al. (2019) and re-estimate the results. However, I only compare countries with similar levels of gross domestic product (GDP) and growth rates to ensure that the countries in the sample are subject to similar economic fluctuations. The results are slightly lower, but still statistically significant.

Both in the context of the Dutch VAT reform and in the European environment, firms are unable to pass on the full tax burden to consumer prices. Although the firms in my main analysis bear a significantly lower share of the VAT burden (17 % vs. 58 %), they experience a significant decline in EBIT in both analyses. A high elasticity of demand leads to a higher burden on a firm (Atkinson and Stiglitz 1976, Kotlikoff and Summers 1987 or Jacob et al. 2019). Therefore, my results suggest that firms face elastic demand in both the Dutch and European environments. However, demand in the Netherlands seems to be less elastic than in the 15 European countries. The mechanism of the negative EBIT reaction can be explained not only by the tax burden, but also by a possible decline in net sales. Especially in the context of the Dutch panel, this could be another possible explanation, as there is a relatively high tax pass-through. Higher consumer prices can lead consumers to consume less (Crossley et al. 2009) and to make cross-border purchases in countries with lower VAT rates (Thompson and Rohlin 2012, Hindriks and Serse 2019 or Jacob

et al. 2019). This leads to a decline in the sales of domestic firms, which can increase the negative impact on EBIT.[3]

In summary, my results suggest that VAT changes affect firms more than consumers. However, this conclusion should be treated with caution, as EBIT is only one of many ratios used to assess the economic health of a firm. However, it is important to note that a VAT change has a negative impact on both sides of the market. I would like to offer some important tax policy considerations, particularly with regard to the current debate in Germany. The Free Democratic Party (FDP) is calling for an increase in VAT to finance a reduction in corporate and personal income tax (Greive et al. 2023). The question is whether such a budget-neutral tax reform actually promotes economic growth when both consumers and firms are negatively affected by VAT increases. Unlike many other academic papers, my results are universal: I analyse a broad set of goods and services from different countries, cover both sides of the market, and thus provide a scientific decision support for fiscal policy measures regarding the standard VAT rate.

2. Dutch VAT reform and the expected impact

In essence, VAT is levied on all commercial activities associated with the production and distribution of goods and the provision of services (European Commission, 2023). Firms remit the VAT collected from consumers to the state and apply for a tax credit for the VAT they have paid on intermediate consumption. Only the added value is taxed in this process (Benzarti et al., 2020). Conversely, final consumers are unable to apply for a tax credit and thus bear the tax burden on the final value of the goods and services purchased (Benzarti et al. 2020). The European Union employs a variety of VAT rates, including the standard rate, the reduced rate, and special rates such as the zero rate. Although the VAT is levied throughout the European Union (EU), each EU country is permitted to set its own VAT rates. Nevertheless, the standard rate may not be lower than 15 %, and

[3] The analysis of sales is relevant for understanding the impact on EBIT, but is not part of this paper. Studies by Thompson and Rohlin (2012), Kosonen (2015), Benzarti et al. (2020) and Fuest et al. (2023), for example, demonstrate that VAT changes have an impact on the sales of the firms concerned.

the reduced rate may not be lower than 5 % (European Commission, 2023). This paper will concentrate on the standard VAT rate, which is applied to the majority of goods and services in a country.[4]

One empirical challenge in documenting the impact of VAT changes is the possible distortion of results due to the endogeneity of VAT reforms. The political will to change the tax framework can be motivated by complex circumstances. Policy makers tend to increase (decrease) VAT when the economy is weak (strong) (Vegh and Vuletin 2015). To avoid possible distortions due to endogeneity, I use the 2012 VAT reform in the Netherlands in my analysis. This reform is exogenous, as it was initiated independently of market conditions. The change was due to increasing pressure from the European Commission (Jacob et al. 2019). Another reason why the Dutch VAT reform of 2012 is particularly suitable for an empirical study is its rapid and unexpected implementation.[5] Furthermore, the change is economically significant, with an increase of 2 percentage points from 19 % to 21 %.

According to Kosonen (2015), the proportional change in consumer prices after the reform Δ can be calculated as follows:

$$\Delta = \frac{P^a - P^b}{P^b} \cdot 100 \qquad (1)$$

Here P^a is defined as the price after the reform, while P^b represents the price before the reform. The proportional change in consumer prices when the tax is passed on in full as part of the Dutch VAT reform can be calculated by substituting the different VAT rates into equation (1), while the price (the pre-tax price) φ is kept constant (cf. Kosonen 2015). Consequently, the relationships $P^a = \varphi \cdot 1{,}21$ and $P^b = \varphi \cdot 1{,}19$ apply to any consumer

[4] In their European sample of 15 countries, Benedek et al. (2020) found that 70 % of goods and services are subject to standard taxation. This equates to approximately 65 % of the total value of consumption..

[5] Jacob et al. (2019) mention the following reasons: (1) The Netherlands has historically had a stable VAT rate and (2) VAT was not changed even during the financial crisis from 2008 to 2009, when there was a budget deficit.

prices. Substitution of these values into equation (1) yields a complete tax pass-through of 1.68 %.

The models of Kotlikoff and Summers (1987) and Atkinson and Stiglitz (1976) illustrate that the greater the inelasticity of demand for one's own product and for other products, the greater the potential for passing the VAT onto consumer prices. The demand for food, which is typically subject to a reduced VAT rate, is less elastic (Fuest et al., 2023). Goods and services subject to the standard VAT rate are typically considered luxury goods (Crossley et al., 2009). Such products are generally more easily substituted, which results in a greater degree of elasticity in demand. In addition to the fact that I am analysing the standard VAT rate, the small size of the Netherlands and the long borders with Germany and Belgium also have an influence on the elasticity of demand. It is possible that consumers may be inclined to make their purchases in a country with lower taxes, such as Germany, in order to benefit from more favourable tax conditions.[6] Jacob et al. (2019) demonstrate that Dutch firms situated at the border were more significantly impacted by the 2012 VAT reform. Consequently, the firms in the sample appear to be confronted with a relatively elastic demand. The higher the elasticity of demand relative to supply and the lower the pass-through to consumer prices, the higher the tax burden on firms and the more pronounced the negative impact on the EBIT of Dutch firms.

I expect log consumer prices in the Netherlands to increase compared with log consumer prices in Germany, which are not affected by the VAT reform. Nevertheless, it is unlikely that the increase will be of the same magnitude as the VAT increase, which has been described as an 'under-shifting'. Due to the elasticity of demand, firms are unable to fully pass on the tax burden to consumer prices and must bear part of the tax burden themselves. As a result, the VAT increase also has a negative impact on firms (e.g., Kosonen 2015, Harju et al. 2018 or Benzarti et al. 2020). Therefore, I expect that the log EBIT of affected

[6] The distance from the center of the Netherlands to the German border is just under 50 km. In addition, a lower standard VAT rate of 19 % applies in Germany. Hindriks and Serse (2019) or Thompson and Rohlin (2012) show in their work that VAT tends to be easy to avoid through cross-border purchases.

Dutch firms taxed at the standard VAT rate to decline compared to unaffected Dutch firms taxed at the reduced VAT rate.

A change in the VAT can also affect a firm's net sales (e.g., Thompson and Rohlin 2012, Kosonen 2015, Benzarti et al. 2020 and Fuest et al. 2023). A decline in sales can serve to amplify the impact on EBIT. In their analysis of the impact of the VAT reduction in the UK at the end of 2009, Crossley et al. (2009) found that the reaction of consumption to the price change was one-to-one. A reduction in consumption will result in a decline in sales, which in turn can lead to a reduction in EBIT for firms. In the event of a sharp decline in sales, firms may be prompted to reduce their production volumes. In their model of asymmetric firms, Weyl and Fabinger (2013) show that those firms that reduce their output are particularly hard hit by VAT increases.[7] Conversely, the tax burden for consumers is determined by the average pass-through rate, which is averaged across all firms (Weyl and Fabinger, 2013). Consequently, it can be assumed that the firm side is more affected by the VAT reform than the consumer side.

Another crucial factor to consider when analysing the impact of VAT changes on firms is the firm's size. Harju et al. (2018) and Kosonen (2015) demonstrate that large firms, in particular, respond to a change in VAT. Consequently, I expect that large Dutch firms affected by the VAT reform in particular will experience a decline in log EBIT compared to large Dutch firms that are not affected. One potential explanation for this is that larger firms are better positioned to bear a portion of the tax burden and not fully pass on the VAT to prices. This could be attributed to their higher assets or greater financial strength.

3. Empirical approach and data

In this chapter, I first explain the empirical approach to the 2012 Dutch VAT reform and go into the data used on the consumer and firm side. I then explain the assumptions on which my identification approach is based.

[7] A detailed examination of sales, consumption or production volume is not conducted as part of this paper.

3.1. Empirical approach

To estimate the impact of a VAT increase on consumer prices and a firm's EBIT, I use a DiD approach:

$$Y_{i,j,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Affected_i + \beta_3 Affected_i \cdot Post_t + \gamma \mathrm{X}_{i,j,t} + \varepsilon_{i,j,t} \quad (2)$$

The dummy variable $post_t$ assumes the value 1 for all t in the time interval [2013;2015] and thus represents the period after the VAT increase. Otherwise (time interval [2010;2012]) it takes the value 0. In the regression with the consumer price dataset, the dummy variable $affected_i$ takes the value 1 if it is Dutch consumer prices and the value 0 if it is German consumer prices. In the regressions using the company dataset, the dummy variable $affected_i$ is assigned a value of 1 if the firm operates in an industry that is taxed at the standard rate and a value of 0 if the firm operates in an industry that is taxed at the reduced rate.[8] The classification of Dutch firms into affected and non-affected is approximated using the *SIC* code and the European Commission's annual report "VAT Rates applied in the Member States of the European Union" (2021).[9] The index i thus stands for consumption categories or firms, depending on the specification. The interaction coefficient β_3 indicates the estimated average impact of the VAT increase on the event $Y_{i,j,t}$. Depending on the specification, $Y_{i,j,t}$ is the natural logarithm of consumer prices (*ln_HICP*) or EBIT (*ln_EBIT*). The empirical strategy includes control variables at firm and country level ($X_{i,j,t}$). The country index j represents either the Netherlands or Germany in the consumer price specification. In contrast, in the specification of the firm data, the index j represents only the Netherlands. In the regression with the consumer price data, the unemployment rate and the GDP growth rate are controlled for at country level. In addition, control variables such as firm size, leverage and margin are included in the regression with

[8] In the regression with the firm data, the German firms do not prove to be a suitable control group, as they do not show any parallel trends to the Dutch firms before the VAT reform (see Appendix: Figure A1).
[9] An overview of the SIC codes assigned to the reduced VAT rate can be found in the Appendix, Table A3.

the firm data at firm level. Depending on the setting, the industry code or consumption category is also controlled for. The statistical inference is based on robust standard errors ($\varepsilon_{i,j,t}$).

3.2. Consumer price data

I use price data from Eurostat's Harmonized Indices of Consumer Prices (HICP), which are classified according to individual consumption by purpose (COICOP). The harmonized approach of the index makes it possible to compare price data between countries. Eurostat is an organization of the European Union that provides statistical information on the EU Member States (Eurostat 2024). The data set contains monthly, non-seasonally adjusted information on the prices of goods and services in the Netherlands and Germany for the period 2010 to 2015. The information on VAT rates by goods and countries is taken from the European Commission's annual report "VAT Rates applied in the Member States of the European Union" (2021). In this way, only consumption categories that are subject to the standard VAT rate in the Netherlands are included in the analysis. The quarterly GDP growth rate is taken from the OECD database, while the monthly seasonally adjusted unemployment rate is taken from Eurostat.

Table 1
Descriptive statistics, consumer price data (NL/GE)

	Mean	p25	p50	p75	StdDev.
HICP	98.34	94.94	98.48	100.49	7.09
Ln_HICP	4.59	4.55	4.59	4.61	0.07
Rate	0.1959	0.1900	0.1900	0.2100	0.0091
Unemp	0.0630	0.0510	0.0610	0.0770	0.0135
Gdp_gr	0.0034	-0.0009	0.0032	0.0063	0.0058

Note: The table shows descriptive statistics on consumer prices and country variables for 5,184 observations and 40 consumption categories in the period from 2010 to 2015. The definition of the variables can be found in Table A1 in the appendix.

The data set comprises a total of 40 consumption categories from Germany and the Netherlands.[10] Table 1 contains descriptive statistics on consumer prices and country controls for both countries. In the sample period, the VAT rate in Germany is 19 %, while in the Netherlands it is increased from 19 % to 21 %. Overall, the dataset contains a balanced panel with 5,184 monthly observations.

3.3. Firm data

I collect the data of Dutch firms for the period 2010 to 2015 from BvD Orbis via Wharton Research Data Services (WRDS). Specifically, I use the unconsolidated financial statements of listed and unlisted firms to precisely localize the activity of an individual firm and ensure that the firm operates exclusively in the Netherlands. Following Jacob et al. (2019), I specify that the firms have been in existence for at least four years and provide information on fixed assets, EBIT, profit before tax, liquidity, debt and assets. Observations with negative total assets, depreciation and amortization and fixed assets are excluded. As negative numbers cannot be logarithmised and my dependent variable is logarithmised, firms with negative EBIT are also excluded. Firms in the finance, real estate, energy and water supply and education sectors are also excluded from the analysis. The annual GDP growth rate is taken from the OECD database, while the annual seasonally adjusted unemployment rate is taken from Macrotrends. Overall, my data set comprises an unbalanced panel with 3,225 annual observations and 721 firms.

[10] A detailed list of the categories included can be found in the appendix, Table A2. The consumption category CP0311 is not included in the analysis due to a lack of price information.

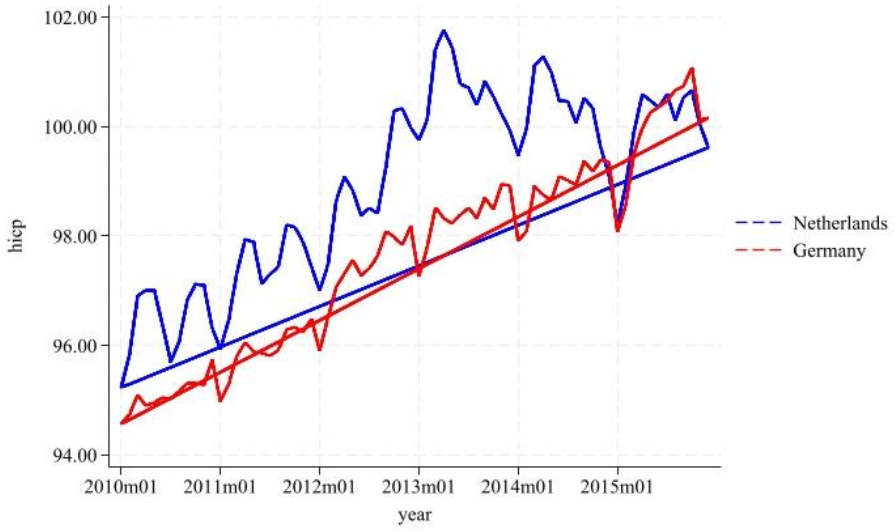
Table 2
Descriptive statistics, firm data (NL)

	N	Mean	p25	p50	p75	StdDev.
EBIT	3,225	2,366,839	-2,156	254,830	2,074,806	10,652,166
Ln_EBIT	2,380	13.20	11.71	13.67	14.94	2.45
Size	2,412	40,152,984	654,364	10,598,999	32,041,500	99,033,637
Sales	3,225	76,966,207	1,125,657	17,508,000	67,388,316	293,080,000
Leverage	2,412	0.7752	0.3601	0.6008	0.8938	0.8141
Margin	3,225	0.0072	-0.0020	0.0247	0.0700	0.2927
Unemp	3,225	0.0636	0.0582	0.0687	0.0724	0.0097
Gdp_gr	3,225	0.0064	-0.0013	0.0134	0.0155	0.0112

Note: The table contains descriptive statistics on the variables at firm and country level for 721 firms and 3,225 observations in the period from 2010 to 2015. The definitions of the variables can be found in Table A1 in the appendix.

Table 2 contains descriptive statistics of the variables at firm and country level for the firm sample. On average, the Dutch firms in the sample have an EBIT of approximately € 2.4 million and sales of approximately € 77 million per year. The average unemployment rate in the Netherlands in the sample period is 6.36 %, while GDP grows by 0.64 % on average.

Panel A: Consumer prices



Panel B: EBIT

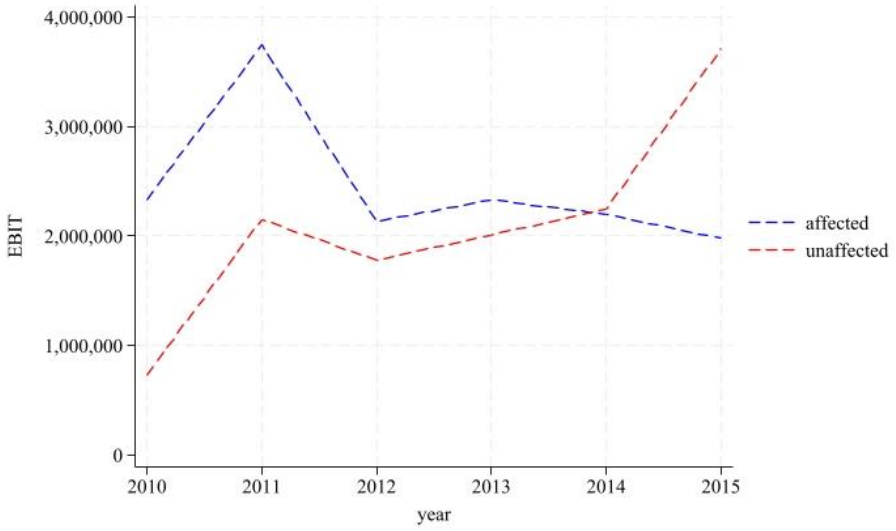


Figure 1: Parallel trends in the treatment and control groups

3.4. Assumptions

This paper uses the DiD method to estimate the impact of the VAT reform on log consumer prices and log EBIT under certain assumptions. The most important assumption of this approach is the existence of parallel trends in the treatment and control group (Huntington-Klein 2022). In terms of my analysis, the assumption of parallel trends means that EBIT or prices in the treatment group would have developed similarly to the control group without the change in VAT in 2012. I cannot test this assumption for the years after the reform. However, I can analyse whether the EBIT and prices of the treatment and control group follow a common trend before the VAT increase.

Figure 1 provides visual evidence that the control groups represent a counterfactual case constellation for the pre-reform treatment groups. Panel A shows that average consumer prices in Germany and the Netherlands develop similarly until the date of the VAT reform in the Netherlands (October 2012). Thereafter, consumer prices in the Netherlands rise significantly, while in Germany they follow the same linear upward trend as in previous years. This disproves the fear that consumer prices in Germany are being influenced by another simultaneous economic shock. A similar pattern can also be seen in the trend of EBIT in Panel B. Before the reform, the EBIT of affected and unaffected Dutch firms is similar. From 2013 onwards, however, they develop in almost opposite directions. The graphic confirmation of the parallel trends between the control and treatment groups in both specifications allows me to draw causal conclusions about the impact of the VAT reform. The results presented here are therefore not based on differences in the time trends between the groups before the VAT increase.

4. Empirical results

In this chapter, I present the results of the main analysis of the Dutch VAT reform of 2012. I run two regressions, first with log consumer prices and then with log EBIT as the dependent variable. To test the robustness of the results, I use a placebo tax change in 2010. The regression results are based on the DiD method described in chapter 3.

Table 3
Difference-in-Differences estimation, consumer prices (NL/GE)

	(1) Ln_HICP	(2) Ln_HICP
Affected	0.014***	0.011***
	(0.004)	(0.003)
Post	0.033***	0.027***
	(0.003)	(0.002)
Affected · Post	-0.001	0.014***
	(0.004)	(0.005)
Controls	No	Yes
Fixed effects	No	Yes
R^2	0.063	0.516
Observations	5,184	5,184

Note: The table contains the results of the DiD estimates on the development of log consumer prices in the context of the 2012 VAT increase in the Netherlands. The sample period covers the period from 2010 to 2015. I compare price data from the Netherlands (*affected*) with price data from Germany (*unaffected*). Column (2) includes country controls as well as consumption category and seasonal fixed effects. The robust standard errors are given in parentheses, *p<0,1; **p<0,05; ***p<0,01.

4.1. Consumer prices

Table 3 shows the results of the DiD regression with Dutch consumer prices that are affected by the VAT reform compared to German consumer prices that are not affected by the VAT reform. Column (1) contains the basic regression without controls and fixed effects. Specification (2) controls for several country variables (GDP growth rate and unemployment rate) and contains fixed effects on the consumption categories. Seasonal price fluctuations are reduced by seasonal fixed effects in the second specification. The interaction coefficient *Affected · Post* in the third row indicates the estimated average impact of the VAT reform on the log consumer price.

The preferred estimate in column (2) shows a statistically significant interactive coefficient and can be interpreted as follows: Consumer prices taxed at the standard VAT rate in the Netherlands increase by approximately 1.40 % compared to German consumer prices as a result of the 2012 VAT reform. This corresponds to around 83 % of a full tax shift ("under-shifting").[11] My results show that the Dutch firms affected by the VAT reform are

[11] The full tax pass-through is 1.68 % (see chapter 2).

not able to increase consumer prices to the same extent as the tax increase. Kosonen (2015) estimates a significantly lower pass-through of around 50 % for a reduction in VAT on hairdressing services in Finland. In comparison to Kosonen (2015), I analyse a VAT increase and a broad group of goods and services that make up the majority of a country's economy. My result is consistent with the findings of Benedek et al. (2020), who analyse the impact of VAT reforms by type of reform (standard rate, reduced rate and reclassification). The authors estimate the average pass-through based on 23 VAT changes and come to the conclusion that the cumulative total impact of a change in the standard rate indicates a pass-through of almost 80 %. These results are most comparable to mine, as they also analyse the change in the standard VAT rate and not just the reduced VAT rate for a specific good or service.

To summarize, the impact of the 2012 VAT increase in the Netherlands on consumers can be considered significant due to the 83 % pass-through of the tax burden to consumer prices. Compared to Kosonen (2015), demand in the Dutch environment appears to be less elastic, but Dutch firms are also unable to pass on the entire tax burden to consumer prices. Nevertheless, my results suggest that demand is elastic, as firms bear part of the tax burden. The elastic demand in the Netherlands can be explained by the fact that due to the small size of the country and the long borders with Belgium and Germany, consumers have the opportunity to simply make cross-border purchases and thus avoid the increased tax rate in the Netherlands.

4.2. Earnings before interest and taxes (EBIT)

In the next analysis, I take a closer look at the firms as the opposite side of the market. Table 4 shows the results of the DiD estimation with log EBIT as the dependent variable. Columns (1) and (2) refer to all Dutch firms in the sample, column (3) to small and column (4) to large Dutch firms. The firm sample is categorized using two dummy variables, *small* and *large*. *Small* (*large*) takes the value 1 if the firm size (measured by the variable *size*) is below (above) the median of the total sample. The simple estimate is shown in column (1). Columns (2) to (4) control for firm and country variables as well as for the industry code. Due to the logarithmisation of the dependent variable and the control variable *size*,

which is defined as the natural logarithm of the balance sheet total, the firm sample is reduced in the analysis. The sample size is also influenced by the control variable *leverage*. This is defined as total debt and scaled with the balance sheet total of the previous period.

The statistically significant interaction coefficient *Affected · Post* in column (2) indicates that the EBIT of affected Dutch firms decreases by about 51 % compared to unaffected Dutch firms after the 2012 VAT reform. I cannot find any impact on small firms (column 3). Large Dutch firms affected by the VAT reform experience a decrease in EBIT of around 46.90 % compared to large unaffected firms (column 4). This effect seems too strong. Figure 1, Panel B, shows that the EBIT of affected firms decreases after the VAT reform at the end of 2012, while the EBIT of unaffected firms increases significantly. The high interaction coefficient can be explained by the huge increase in the EBIT of the unaffected firms two years after the reform (2014).

Table 4
Difference-in-Differences estimation, Earnings before interest and taxes (NL)

	Complete Sample		Small firms	Large firms
	(1)	(2)	(3)	(4)
	Ln_EBIT	Ln_EBIT	Ln_EBIT	Ln_EBIT
Affected	-0.249	-0.078	0.225	0.202
	(0.173)	(0.216)	(0.312)	(0.154)
Post	0.400**	0.551	-0.252	0.357
	(0.197)	(0.516)	(0.810)	(0.382)
Affected · Post	-0.358	-0.510**	-0.226	-0.469***
	(0.229)	(0.254)	(0.402)	(0.179)
Size		0.000***		
		(0.000)		
Leverage		-0.623***	-0.234***	0.250**
		(0.076)	(0.072)	(0.124)
Margin		2.475***	2.761***	7.865***
		(0.549)	(0.588)	(0.665)
Controls	No	Yes	Yes	Yes
R^2	0.008	0.214	0.049	0.237
Observations	2,380	1,775	611	1,164

Note: The table shows the results of the DiD estimates of EBIT development in the context of the 2012 VAT increase in the Netherlands for the period from 2010 to 2015. I compare data from Dutch firms that are active in an industry affected by the VAT reform (*affected*) with firms that are not affected (*unaffected*). Controls at firm and country level as well as the industry code are included (columns 2 to 4). The sample is broken down by firm size in columns (3) and (4). The robust standard errors are given in parentheses, *p<0,1; **p<0,05; ***p<0,01.

The reason for the significant increase in EBIT of non-affected Dutch firms after the VAT reform requires further research. One possible explanation for the profits of such firms as a result of the reform could be that consumers are increasingly purchasing goods and services that are not affected by the VAT reform and whose prices have remained unchanged. Benedek et al. (2020) express their concerns regarding the use of control groups in the domestic market that are not directly affected by the VAT reform to determine the impact of the VAT change: This characterization of the counterfactual control group could be problematic if the two-way effects between affected and unaffected firms are large. In my analysis, this seems to be the case. The actual decline in EBIT of the affected Dutch firms is probably smaller. However, in Figure 1, Panel B, it is clear that the EBIT of the affected firms decreases (blue line). The direction of the impact is therefore less problematic. In addition, I validate the results later in the paper using a European sample. My second analytical approach minimizes this potential source of bias.

Confidence in the results can be further strengthened by the work of Jacob et al. (2019), who analyse the same 2012 VAT reform in the Netherlands. The results show that the VAT increase reduces firms' profitability, as firms cannot pass on the tax in full to consumers. Profitability is defined here as the pre-tax profit in relation to the balance sheet total of the previous period. Other studies, such as those by Kosonen (2015) and Benzarti et al. (2020), also examine the impact of VAT changes on firm profits, but in the context of a reduced VAT rate. Benzarti et al. (2020) estimate a decline in corporate profits of 0.1 logarithmic points with an increase in VAT. Previous studies, such as those by Kosonen (2015) and Harju et al. (2018), show similar results in relation to small and large firms. Although Kosonen (2015) analyses a VAT reduction, he also comes to the conclusion that larger firms react more strongly to the VAT reform. Harju et al. (2018) analyse the price reaction of restaurants to a large VAT reduction in two different European countries. In particular, large restaurants belonging to a chain lowered prices quickly and completely, while small firms ignored the reform. The study by Harju et al. (2018) does not examine firm EBIT, but the behaviour of the large firms is similar to my results.

Table 5
Difference-in-Differences estimation, placebo analysis (NL/GE und NL)

	Price data	Firm data		
	Complete sample	Complete sample	Small firms	Large firms
	(1)	(2)	(3)	(4)
	Ln_HICP	Ln_EBIT	Ln_EBIT	Ln_EBIT
Affected	0.010***	0.198	-0.190	0.261
	(0.004)	(0.288)	(0.339)	(0.232)
Post	0.032***	0.347	0.465	0.176
	(0.004)	(0.357)	(0.450)	(0.278)
Affected · Post	-0.006	-0.558	-0.508	-0.206
	(0.006)	(0.383)	(0.468)	(0.306)
Margin		2.807***		
		(0.819)		
Leverage		-0.317***	-0.039	-0.207*
		(0.067)	(0.063)	(0.110)
Size		0.000***	3.347***	5.774***
		(0.000)	(1.183)	(1.037)
Country controls	Yes	Yes	Yes	Yes
Fixed effects	Yes	No	No	No
Control SIC Code	No	Yes	Yes	Yes
R^2	0.741	0.311	0.082	0.223
Observations	3,840	633	251	382

Note: The table shows the results of the DiD estimates for the 2010 placebo VAT reform in the Netherlands for the period from 2008 to 2012. Column (1) shows the regression with log consumer prices, column (2) with log EBIT and columns (3) and (4) with log EBIT as the dependent variable separately for large and small firms. The dummy variable *Post* assumes the value 1 for the years 2011 and 2012 after the placebo reform. Depending on the specification, I include controls at firm and country level and the industry code as well as seasonal fixed effects and fixed effects of consumption categories. The robust standard errors are given in parentheses, *p<0,1; **p<0,05; ***p<0,0.

A comparison of the results on the consumer and firm side is not possible due to the bias of the results on firm EBIT as part of the Dutch VAT reform of 2012. However, it can be summarized that the VAT increase in the Netherlands in 2012 allows initial conclusions to be drawn about the causal effect of VAT on consumer prices and EBIT. Consumer prices are rising, while EBIT is falling as a result of a VAT increase. Firms cannot fully shift the tax burden onto consumer prices ("under-shifting") and therefore bear part of the tax burden themselves. This may be one reason for the decline in firms' EBIT. The negative impact on EBIT due to the VAT increase can also be amplified by the decline in net sales, for example due to cross-border purchases (Thompson and Rohlin 2012 or Jacob et al. 2019) or due to lower consumption by consumers (Crossley et al. 2009). The Dutch firms

in my sample therefore appear to be confronted with elastic demand. Overall, my results suggest that VAT increases have a negative impact on both the consumer and the firm side.

4.3. Robustness test: Placebo reform

To assess the robustness of the main results, I use a placebo reform in 2010, following the approach of Jacob et al. (2019). My sample covers the period 2008 to 2012. The estimation of equation (2) is repeated, but with a dummy variable $post_t$, which takes the value 1 for the period from 2011 to 2012 (after the placebo reform) and otherwise has the value 0 for the period from 2008 to 2010 (before the placebo reform). The price dataset contains 3,840 observations and 32 consumption categories, while the firm dataset contains 1,296 observations and 301 firms.[12] The results of the placebo analysis with the price and firm dataset are shown in Table 6. There are no statistically significant coefficients for either the log consumer price (column 1) or the log EBIT (column 2) as the dependent variable in my estimation. Compared to the main results, the interaction coefficient of the placebo estimate with the log consumer price as the dependent variable even points in the opposite direction. Even in the specification with small (column 3) and large firms (column 4), I find no statistically significant change in log EBIT as a result of a placebo VAT change. The results of the placebo analysis suggest that the changes in consumer prices and EBIT that I document in the main analysis are due to the actual 2012 VAT reform. Furthermore, the assumption of parallel trends before the reform, as described in chapter 3.3, is confirmed.

[12] Due to the assumption that firms must have been in existence for at least 4 years, the sample size is greatly reduced in this sample period. The results remain unchanged even without this assumption for a larger sample.

Table 6
Average VAT rates (EU)

	VAT	Increases	Ø-height	Decreases	Ø-height
Belgium	21.00 %				
Germany	19.00 %	1	3.00 %		
Estonia	20.00 %	1	2.00 %		
Finland	24.00 %	2	1.00 %		
France	19.60 %	1	0.40 %		
Greece	23.00 %	3	1.67 %		
Ireland	23.00 %	2	1.25 %	1	0.50 %
Italy	22.00 %	2	1.00 %		
Luxemburg	15.00 %	1	2.00 %		
Netherlands	21.00 %	1	2.00 %		
Austria	20.00 %				
Portugal	23.00 %	2	1.50 %	1	1.00 %
Slovenia	20.00 %	1	2.00 %		
Slovakia	20.00 %	1	1.00 %		
Spain	21.00 %	2	2.50 %		
Total		20		2	

Note: The table provides an overview of the average VAT rates as well as the number and average amount of increases and decreases in the sample period from 2006 to 2019 in the countries of my EU sample.

5. External validity: European sample

Although the Dutch VAT reform of 2012 allows conclusions to be drawn about the impact of VAT on consumer prices and EBIT, it is unclear whether these results are also transferable to other countries. An external validity check may shed light on whether my previous results are only attributable to the 2012 VAT increase in the Netherlands or are also valid for other countries and VAT reforms. My second series of analyses extends the sample to a European setting and includes information from 15 countries. I choose a European panel to ensure a certain geographical, economic and cultural proximity. I assume that economic development within Europe is more similar than on a global level and that various economic shocks tend to influence certain regions more strongly (Smolyansky and Ljungqvist 2018 or Hundsdoerfer 2023). This assumption represents the first step in solving the endogeneity problem, which arises from the fact that changes in VAT could be endogenous to economic conditions.

The consumer and firm data set comprises 15 European countries with a common currency, the euro. An overview of the 15 EU countries, the average VAT rate in the sample

period and the average increases and decreases per country can be found in Table 6. The average VAT rate of all countries in the sample period is 20.77 %. Luxembourg has the lowest average VAT rate at 15.00 %, while Finland has the highest at 24.00 %. A total of 20 VAT increases and 2 VAT reductions are examined. In the sample period, the average change in VAT amounts to approx. 1.52 %. The data set contains only 2 VAT reductions due to the legislation of Directive 2006/112/EC, which was adopted by the European Commission in 2006. The member states are bound to certain rules by the directive: (1) increasing the standard VAT rate to above 15 % and the reduced VAT rate to above 5 %; (2) limiting the reduced VAT rate to a predetermined group of goods in order to prevent artificial VAT reductions by reclassifying goods from the standard rate to the reduced rate; (3) any VAT reduction below 15 % (or reclassification from 15 % to 5 %) must be approved by all member states (Council of the European Union 28. 11.2006).

The results of my second set of analyses in the European context are valuable to strengthen and generalize the confidence in my results in the context of the Dutch VAT reform of 2012. The estimation is based on a small sample of firms and only one country. Furthermore, the estimation is potentially biased with log EBIT as the dependent variable. In the next two chapters, I explain the empirical procedure and the data used for the consumer and firm side. I then present the results of the first difference (consumer price dataset) and fixed-effects regression (firm dataset).[13] At the end of the chapter, I explain the endogeneity problem in more detail and describe how I reduce it through further analyses.

5.1. Consumers: Empirical approach and data

I collect price data from Eurostat's Harmonized Indices of Consumer Prices (HICP), which classify individual consumption by purpose (COICOP). The consumer price dataset contains monthly, non-seasonally adjusted information on the prices of goods and services from 15 European countries. I have extended the sample period compared to my main

[13] A fixed-effects regression generalizes a DiD regression with several time periods, currencies and countries. The identification assumption of both models remains the same: without the tax change, there would have been no change in the treatment group compared to the control group (Huntington-Klein 2022).

analysis to the period from 2006 to 2019 in order to capture as many VAT changes as possible. The information on VAT rates by goods and countries comes from the European Commission's annual report "VAT Rates applied in the Member States of the European Union" (2021). The report also contains information on VAT changes, stating the month and year in which a change took place. The quarterly GDP growth rates and annual corporate tax rates are taken from the OECD database, while I take the monthly seasonally adjusted unemployment rates from Eurostat. To make the results comparable with those of the main analysis, I use the same consumption categories. In total, the consumer price dataset comprises 40 consumption categories from 15 countries with 82,152 monthly observations.[14] The consumer prices are comparable to the Dutch sample due to index harmonization and have an average value of about 100.42 over the sample period.[15]

Based on Poterba (1996), Besley and Rosen (1999) and Benedek et al. (2020), this paper presents a simplified representation of the relationship between changes in consumer prices and VAT rates. This representation can be interpreted as a linear approximation, which can be used to show the basic impact of VAT increases on consumer prices (Benedek et al. 2020). I perform estimates for the following empirical model, which considers the monthly logarithmic changes in the consumer price index $Y_{i,j,t}$ as the dependent variable:

$$\Delta\mathrm{Ln}(Y_{i,j,t}) = \alpha_0 + \beta_1 \Delta\mathrm{Ln}\left(1 + Rate_{i,j,t}\right) + \gamma \mathrm{X}_{j,t} + \delta_i + \delta_t + \varepsilon_{i,j,t} \qquad (3)$$

where i, j and t are indices for consumption category, country and time (month-year) respectively. The coefficient β_1 measures the impact of a change in VAT on the consumer price of consumption category i at time t and thus represents the pass-through coefficient with respect to VAT changes. Based on the results of my main analysis, I expect $0 < \beta_1 < 1$ to hold. The empirical strategy includes country-level control variables ($X_{j,t}$), consisting of the unemployment rate (*unemp*), the GDP growth rate (*gdp_gr*) and the corporate tax

[14] A detailed list of the categories included can be found in the Appendix, Table A2. The consumption category CP0444 is not included in the analysis due to a lack of price information.

[15] The descriptive statistics of the country variables are identical to those of the firm dataset and can be found in Table 7.

rate (*corp_rate*). δ_i and δ_t are consumption category and time fixed effects. The statistical inference is based on robust standard errors ($\varepsilon_{i,j,t}$), which are clustered at the level of the country consumption category.

5.2. Firms: Empirical approach and data

I obtain financial information from listed firms in 15 EU countries for the period 2006 to 2019 from Compustat Global via WRDS. Firms with negative total assets, zero EBIT and zero sales are excluded. In addition, I assume that firms have total assets, sales, EBIT and profit before tax and have been in existence for at least four years (cf. Jacob et al. 2019). Firms from the financial, real estate, energy and water supply, and education sectors are excluded from the sample. I take the annual GDP growth rates, unemployment rates and corporate tax rates from the OECD database. In total, the firm dataset comprises a panel of 21,305 annual observations and 1,766 firms.

Table 7
Descriptive statistics, firms (EU)

	N	Mean	p25	p50	p75	StdDev.
Panel A: Firm variables						
EBIT	21,305	267.66	0.19	7.80	74.62	1,567.35
Ln_EBIT	16,437	3.07	1.32	2.99	4.89	2.53
Size	19,410	3,425.11	40.41	191.48	1,218.10	11,691.68
Sales	21,305	3,286.24	29.61	163.89	1,065.66	24,090.75
Leverage	19,355	0.6300	0.4463	0.5987	0.7581	0.3143
Margin	21,305	-0.2511	0.0067	0.0536	0.1053	1.9164
Panel B: Country variables						
Rate	21,305	0.2012	0.1900	0.2000	0.2100	0.0176
Unemp	21,305	0.0908	0.0580	0.0840	0.1030	0.0486
Gdp_gr	21,305	0.0113	0.0045	0.0146	0.0229	0.0265
Corp_rate	21,305	0.2613	0.1926	0.2600	0.3443	0.0784

Note: The table shows descriptive statistics on firm and country variables for the period from 2006 to 2019 in 15 European countries. The European panel contains 1,766 firms and 21,305 annual observations. The definitions of the variables can be found in Table A1 in the appendix.

Table 7 shows descriptive statistics for firm and country variables. In the sample analysed, European firms have an average EBIT of around € 268 and sales of around € 3,286 per year. In comparison, the corresponding values in the Dutch firm dataset are significantly higher. This suggests that the European firm dataset includes fewer profitable firms and a larger number of smaller firms. This observation is also confirmed when looking at

the variable *size*, which is defined as total assets in the previous period and is significantly higher in the Dutch sample. The average unemployment rate in the European countries is 9.08 % in the sample period, while GDP grows by an average of 1.13 %. Although the unemployment rate in the European sample is on average 2.68 % higher than in the Netherlands, the European countries record a higher average GDP growth rate.

To estimate the relationship between VAT and EBIT at the firm level, I perform a fixed-effects regression with the following equation:

$$Y_{i,j,t} = \alpha_0 + \beta_1 Rate_{j,t} + \gamma \mathrm{X}_{i,j,t} + \delta_i + \delta_t + \varepsilon_{i,j,t} \quad (4)$$

where i, j and t are a firm, country and time index respectively. The event $Y_{i,j,t}$ represents the natural logarithm of EBIT (*ln_EBIT*). The independent variable is the VAT rate ($rate_{j,t}$) in country j and year t. Based on the results of my main analysis, I expect $\beta_1 < 0$ to hold. The empirical strategy includes firm- and country-level control variables ($X_{i,j,t}$). In the regressions, the unemployment rate (*unemp*), the GDP growth rate (*gdp_gr*) and the corporate tax rate (*corp_rate*) are controlled for at country level. At the firm level, I control for firm size, leverage, margin and industry code. δ_i and δ_t are fixed effects for firm and time. The statistical inference is based on robust standard errors clustered at firm level ($\varepsilon_{i,j,t}$).

Table 8
Fixed effects regression, consumer prices (EU)

	(1) Δ Ln_HICP	(2) Δ Ln_HICP
Δ Ln(1 + Rate)	-0.057	0.420***
	(0.100)	(0.091)
Controls	No	Yes
Fixed effects	No	Yes
R^2		0.045
Observations	81,663	81,663

Note: The table shows the pass-through elasticity coefficients with respect to VAT changes in 15 EU countries for the period from 2006 to 2019. In specification (1) a simple estimation is made, while in column (2) time fixed effects and country controls are included. The robust standard errors clustered at country-consumption category level are given in parentheses, *p<0,1; **p<0,05; ***p<0,01.

5.3. Consumers: Empirical results

The results of the estimation of equation (3) with the monthly logarithmic changes in the consumer price index as the dependent variable are shown in Table 8. The calculation of the rate of change for VAT and consumer prices reduces the number of monthly observations to 81,663. The first column shows the naive estimate. I find a positive and statistically significant pass-through elasticity coefficient in specification (2), in which country controls and time fixed effects are included. This coefficient can be interpreted as follows: If VAT increases by 1 %, consumer prices increase by 0.42 %. This corresponds to a tax pass-through to consumer prices of 42 % ("under-shifting"). Compared to the results of the Dutch VAT reform, the tax shifting in the European environment is significantly lower (83 % vs. 42 %). The firms in the European sample do not pass on the entire tax burden to consumer prices and thus bear a larger part of the tax increase themselves.

5.4. Firms: Empirical results

In order to shed light on the other side of the market, the firms, in the next step, I run the fixed-effects regression of equation (4) with log EBIT as the dependent variable. The regression results are shown in Table 9. In columns (1) and (2), the regression is carried out with the entire sample, while in columns (3) and (4) only small and large firms are included. Due to the logarithm to the dependent variable and due to the control variables *size* and *leverage* in specifications (2) to (4), the sample size is reduced.[16] In all specifications I find a negative and statistically significant coefficient, except in specification (3) for small firms. This indicates that a higher VAT rate leads to lower EBIT for firms. From an economic perspective, the coefficient for VAT in column (2) can be interpreted as follows: A one percentage point increase in VAT leads to a 5.68 % decrease in EBIT for a European firm. Compared to the level of the coefficient in the Dutch VAT reform of 2012, the magnitude in this case seems realistic. Analogous to the results of the 2012 Dutch VAT reform,

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[16] Logarithmisation with negative values is not possible. In addition, the variable *leverage* is defined as total debt, which is scaled with the balance sheet total of the previous period. This eliminates further observations.

a statistically significant decline in EBIT is only evident for large firms, but not for small firms. An increase in VAT of one percentage point leads to a decrease in EBIT of approx. 4.95 % for a large European firm (column 4).

If I relate the increase in consumer prices to the decrease in EBIT due to a VAT increase, it becomes clear that companies are faced with more elastic demand. An increased elasticity of demand leads to a reduction in the ability of firms to pass on the additional tax burden to consumers (Atkinson and Stiglitz 1976, Kotlikoff and Summers 1987 or Jacob et al. 2019). The tax burden may be one reason for the decline in firms' EBIT. The results once again make it clear that both consumers and firms are affected by a VAT reform. However, the impact of a VAT reform appears to hit firms harder, as they bear a larger share of the tax burden.[17] Weyl and Fabinger (2013) come to the conclusion that the impact of taxes on firms is stronger if the tax causes them to reduce their volumes. The incidence on consumers depends only on the average pass-through rate, which is weighted across all firms (Weyl and Fabinger 2013). Whether firms are induced to reduce volumes (e.g., due to low demand) in the context of these studies requires further research.

[17] Firms pass on 42 % of the tax increase to consumers and therefore bear 58 % of the tax burden themselves.

Table 9
Fixed effects regression, EBIT (EU)

	Complete sample		Small firms	Large firms
	(1)	(2)	(3)	(4)
	Ln_EBIT	Ln_EBIT	Ln_EBIT	Ln_EBIT
Rate	-7.257***	-5.682***	-2.152	-4.946***
	(1.425)	(1.484)	(2.591)	(1.728)
Size		11.395***		
		(0.392)		
Leverage		0.172***	0.166**	0.201***
		(0.049)	(0.069)	(0.065)
Margin		0.000***	11.936***	11.166***
		(0.000)	(0.524)	(0.610)
Controls	No	Yes	Yes	Yes
Fixed effects	No	Yes	Yes	Yes
R^2	0.041	0.429	0.440	0.413
Observations	16,437	14,963	6,262	8,701

Note: The table shows the results of the regression with fixed effects on the development of log EBIT in connection with changes in VAT in 15 EU countries in the period from 2006 to 2019. The regression results for the entire sample can be found in columns (1) and (2), for small firms in column (3) and for large firms in column (4). Columns (2) to (4) include country controls, annual fixed effects and firm fixed effects. The robust standard errors clustered at firm level in parentheses, *p<0,1; **p<0,05; ***p<0,01.

5.5. Endogeneity

Political decision-makers do not arbitrarily decide to increase or reduce a country's VAT. Various reasons can motivate a change in VAT. These reasons can be roughly divided into political, institutional and economic factors, as discussed by Benzarti et al. (2020): Political motivations may, for example, lie in the fiscal orientation of conservative governments. Institutional incentives, such as the EU's efforts to harmonize VAT, can also play a role. Economic motivations relate to the adaptation of VAT to changing economic conditions in order to counteract them. Economic factors in particular have a potential impact on my identification strategy, as the economic situation of a country can affect VAT rates as well as consumer prices and the EBIT of a firm.

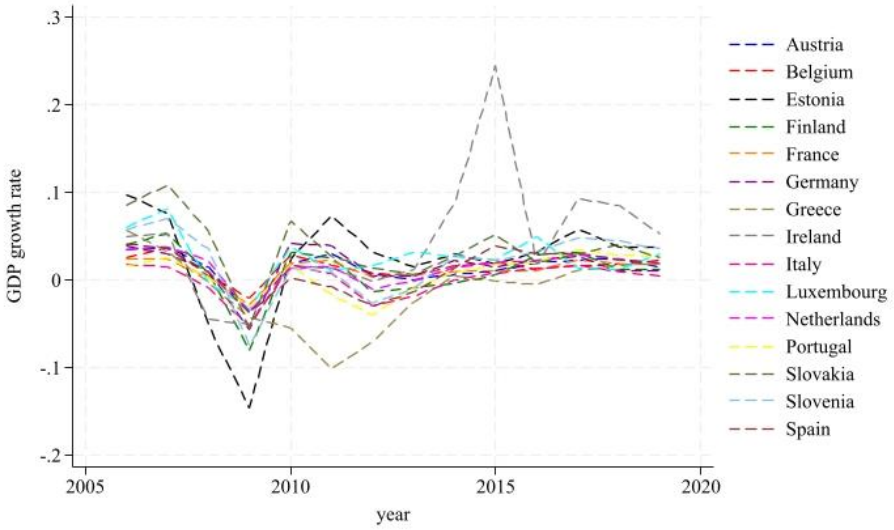
Table 10
Fixed effects regression, endogeneity

	(1) Rate
Gdp_gr_{t-2}	-0.029***
	(0.004)
$Unemp_{t-2}$	0.157***
	(0.004)
Fixed effects	Yes
R^2	0.630
Observations	17,642

Note: The table shows the results of the regression with fixed effects of VAT on GDP growth (t-2) and the unemployment rate (t-2). The dependent variable is the VAT. I include time fixed effects. Due to the two-fold lag of the predictors, the sample period only covers the years 2008 to 2017. The robust standard errors are given in parentheses, *p<0,1; **p<0,05; ***p<0,01.

Concerned that the VAT reform might be endogenous to economic conditions in my European sample, I first run a regression on key economic indicators at the country level. I choose GDP and the unemployment rate as proxies for a country's economic activity. The basic idea is that in phases of expansion (recession), GDP increases (decreases) while the unemployment rate decreases (increases) (National Bureau of Economic Research 2023). I follow a similar approach as Hundsdoerfer (2023) and regress VAT on twice lagged GDP growth rates and unemployment rates. The sample for this analysis covers the period from 2008 to 2017 due to the two lags of the predictors. The results of the fixed-effects regression are shown in Table 10.

Panel A: GDP growth rate per country



Panel B: GDP per capita per country

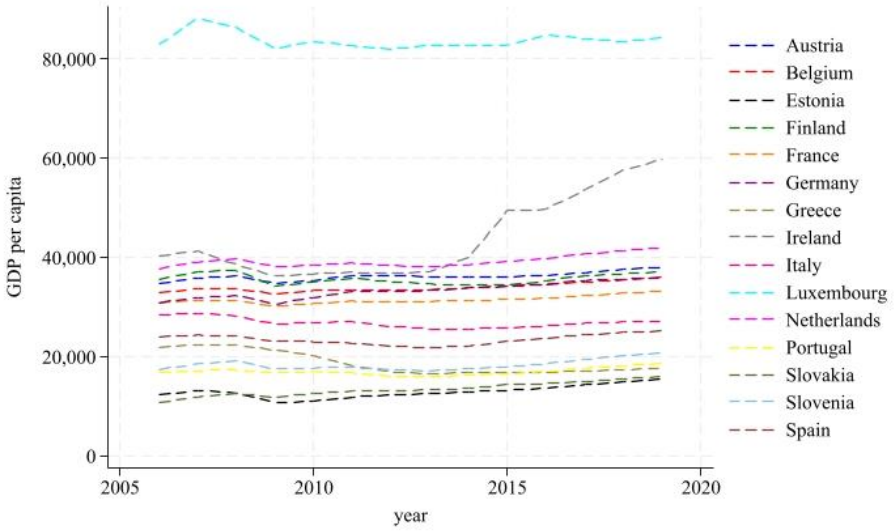


Figure 2: Comparison of economic conditions in European countries.

Economic conditions, represented by GDP growth and the unemployment rate, appear to have an impact on VAT. Column (1) shows that VAT has a negative correlation with the past GDP growth rate and a positive correlation with the past unemployment rate. The latter could be due to a decline in revenue from wage taxes and an increase in the need for public funds (Hundsdoerfer 2023). The results show that when the lagged GDP growth

rate increases, i.e., in a phase of expansion, VAT falls. Countries that are in an economic upswing (increase in GDP growth rate and decrease in unemployment rate) therefore tend to reduce VAT. The VAT rates in my sample do indeed seem to be determined endogenously. It is possible that unobserved or mismeasured differences in economic conditions reflect the relationship between VAT, consumer prices and EBIT in my European analysis.

To address the endogeneity problem, I use a similar approach to Jacob et al. (2019) and compare countries with similar economic conditions in my sample. This approach limits my sample to countries that have similar GDP rate of growth and start from the same GDP base. Figure 2 compares the economic conditions of European countries based on GDP growth rates (Panel A) and GDP per capita (Panel B) during the sample period. The figures show that the countries in the sample experience comparable fluctuations in their economic conditions. Overall, however, I identify three outliers: Ireland (grey line) and Greece (brown line) in Panel A and Ireland (grey line) and Luxembourg (cyan line) in Panel B.

I re-estimate equation (3) and equation (4) with a smaller sample of 12 European countries in total. This reduces my European firm dataset to 18,754 observations and 1,570 firms in the period from 2006 to 2019. The price dataset is reduced to 60,816 observations. Table 11 shows the regression results with the smaller European sample. The results of the estimation of equation (3) with the consumer price dataset are shown in column (1), while the results of the estimation of equation (4) with the firm dataset are shown in columns (2) to (4). A distinction is made between small and large firms in columns (3) and (4). All coefficients point in the same direction as in the analysis with the entire sample and are statistically significant (with the exception of the results for small firms). The tax pass-through according to column (1) is 39.30 % and is thus slightly lower than for the entire sample (42 %). In specification (2), the impact on the log EBIT of -3.95 is also lower than in the analysis with the complete European sample (-5.68).

Table 11
First difference and fixed effects regression, EU countries with similar economic conditions

	Price data	Firm data		
	Complete sample	Complete sample	Small firms	Large firms
	(1)	(2)	(3)	(4)
	Δ Ln_HICP	Ln_EBIT	Ln_EBIT	Ln_EBIT
Δ Ln(1 + Rate)	0.393***			
	(0.122)			
Rate		-3.951**	1.073	-4.395**
		(1.682)	(3.412)	(1.784)
Margin		11.621***	11.925***	11.670***
		(0.423)	(0.596)	(0.659)
Leverage		0.179***	0.165**	0.248***
		(0.051)	(0.072)	(0.065)
Size		0.000***		
		(0.000)		
Controls	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes
R^2	0.042	0.444	0.437	0.443
Observations	60,454	13,225	5,564	7,661

Note: The table shows the results of the estimates of equations (3) and (4) for 12 EU countries with similar economic conditions in the sample period from 2006 to 2019. Column (1) contains the regression results of equation (3) on the consumer side, while columns (2) to (4) show the results of equation (4) on the firm side. Column (3) and column (4) split the firm sample into small and large firms. All specifications include country controls and time fixed effects. The robust standard errors clustered at country-consumption category level (1) or at firm level (2-4) in parentheses, *p<0,1; **p<0,05; ***p<0,01.

Firms are even less able to pass on the burden of VAT increases to consumer prices and bear a higher share of the tax burden themselves. At the same time, the impact of the tax burden on EBIT has decreased. This could be explained by the fact that consumers do not react as sensitively to price increases. Consumption remaining the same, for example, would not reduce firms' sales, which in turn would have an impact on EBIT. Overall, the results continue to indicate that an increase in VAT has a negative impact on firms' EBIT and at the same time leads to higher consumer prices. Firms bear a larger share of the tax burden.

6. Conclusion

Firms are not in a position to pass on VAT in full to consumer prices. The tax burden falls partly on them, which can reduce the firm's EBIT. The burden placed on a firm by the change in VAT depends on the elasticity of demand compared to supply (Atkinson and

Stiglitz 1976, Kotlikoff and Summers 1987 or Jacob et al. 2019). An increased elasticity of demand leads to a higher burden on firms and a lower price increase on the consumer side. In this paper, I examine the impact of the standard VAT rate on consumer prices and the EBIT of firms. To estimate the causal effect of the VAT rate, I use the VAT reform in the Netherlands, where the VAT rate is increased from 19 % to 21 % in October 2012. To externally validate the main results, I use a panel of 15 European countries with a total of 22 VAT changes in the sample period. The results are robust to endogeneity. In both the Dutch and the European setting, I can show that VAT changes have an impact on consumer prices and firms' EBIT.

In the Netherlands, consumer prices are rising by 1.40 % compared to German consumer prices, which are not affected by the VAT reform. This corresponds to 83 % of a full tax pass-through. In the European sample, I find a significantly lower tax pass-through of 42 %. In both the Dutch and the European context, VAT has a negative impact on the EBIT of firms. A one percentage point increase in VAT leads to a 5.68 % decrease in EBIT for European firms and a 4.95 % decrease for large European firms. No impact can be observed for small firms. To counter the risk of endogeneity, I restrict the sample to countries with similar economic conditions. This reduces the sample to 12 European countries. The analysis suggests that the effect of VAT on consumer prices and EBIT is somewhat weaker than initially assumed.

In summary, my results show that firms bear part of the tax burden themselves. As a result, the overall increase in VAT will not be reflected in consumer prices. The tax burden borne may be a reason for the decline in firms' EBIT. In the Dutch VAT reform, the share of the tax burden borne by firms is only 17 %, while in my European analysis it is 58 %. Both analyses show a decline in EBIT. These results suggest that it is not only the additional tax burden that causes the decline in firms' EBIT. Increases in VAT, for example, can lead to a decline in consumption due to rising prices (Crossley et al. 2009). They can also encourage cross-border purchases (Thompson and Rohlin 2012, Hindriks and Serse

2019 or Jacob et al. 2019). Both effects lead to a decline in sales for domestic firms[18], which in turn can increase the negative impact on EBIT. Firms find themselves in a dilemma situation: if consumer prices are increased too much, a decline in sales could have a negative impact on firms despite a low tax burden. On the other hand, firms that do not transfer the tax burden to consumer prices bear it themselves. This also has a negative impact on firms. In conclusion, it can be stated that a change in VAT is associated with a considerable negative impact on the economy, affecting both consumers and firms. Firms appear to be more affected by a change in VAT than consumers. Nevertheless, it should be noted that EBIT is only one of a number of key figures that reflect the performance of a firm.

In addition to extending my work to analyse the net sales of firms as a dependent variable, an examination of the quantity of goods and services sold could provide important insights to explain the mechanism of the negative impact of VAT on EBIT. Benzarti et al. (2020) have examined the quantity approximately by regressing it on variable and fixed costs. In addition, an extension of the regression to include dynamic effects can provide information on whether EBIT or consumer prices return to their pre-reform trend after a longer period of time. Cashin and Unayama (2021) examine the response of spending and consumption to VAT increases and find that spending is only sensitive to the VAT increase in the months immediately before or after the reform and then returns to its pre-reform trend. Dynamic specifications can also help to identify announcement effects or delayed adjustments (see e.g., Hundsdoerfer 2023).

In summary, my findings have important implications for debates on the design of tax policy. It is often assumed that VAT does not affect firms and has a positive impact on economic growth (Mack et al. 2005). However, my results refute this assumption and support the conclusion of Jacob et al. (2019) that a budget-neutral tax reform, which provides for an increase in VAT to finance a reduction in corporate income tax, has no positive impact on economic growth. Both consumers and firms are negatively affected by the

[18] The studies by Thompson and Rohlin (2012), Kosonen (2015), Benzarti et al. (2020) and Fuest et al. (2023), for example, show that VAT changes have an impact on the sales of the firms concerned.

VAT. The question of who ultimately benefits from a VAT increase therefore remains open.

Appendix

Table A1
Variable definition

Panel A: Firm data	
Ln_EBIT	Natural logarithm of EBIT
Post	Dummy variable that assumes the value of 1 for the years 2013 to 2015 (after the reform) and 0 otherwise (before the reform)
Affected	Dummy variable that takes the value of 1 if the firm operates in an industry that is taxed at the standard VAT rate
Size	Total assets of the previous period, winsorised to [0.1]
Leverage	Total debt, scaled with the balance sheet total of the previous period, winsorised to [0.1]
Sales	Sales
Margin	EBIT, scaled with sales, winsorised to [0,1]
Small	Dummy variable that takes the value of 1 if the size of the firm is below the median of the overall sample
Large	Dummy variable that assumes the value of 1 if the size of the firm is above the median of the total sample
Unemp	Annual unemployment rate
Gdp_gr	Annual growth rate of gross domestic product
Rate	Annual standard VAT rate
Corp_rate	Annual corporate income tax rate

Table A1
Variable definition (continued)

Panel B: Price data	
Ln_HICP	Natural logarithm of the monthly harmonized consumer price index
Δ Ln_HICP	Monthly natural logarithmic changes in the harmonized consumer price index
Post	Dummy variable that assumes the value of 1 for the years 2013 to 2015 (after the reform) and 0 otherwise (before the reform)
Affected	Dummy variable that assumes the value of 1 if it is a non-domestic consumer price
Winter	Dummy variable that assumes the value of 1 when the month is 1, 2 and 12
Spring	Dummy variable that assumes the value of 1 when the month is 3, 4 and 5
Summer	Dummy variable that assumes the value of 1 when the month is 6, 7 and 8
Autumn	Dummy variable that assumes the value of 1 when the month is 9, 10 and 11
Unemp	Monthly unemployment rate
Gdp_gr	Quarterly growth rate of gross domestic product
Rate	Monthly Standard VAT rate
Δ Ln(1 + Rate)	Monthly logarithmic changes in the VAT rate
Corp_rate	Corporate Rate

Table A3
Consumption categories

COICOP	Consumption categories
CP0211	Spirits
CP0212	Wine
CP0213	Beer
CP022	Tobacco
CP0311	Clothing materials
CP0312	Garments
CP0313	Other articles of clothing and clothing accessories
CP032	Footwear
CP0431	Materials for the maintenance and repair of the dwelling
CP0444	Other services relating to the dwelling n.e.c.
CP0452	Gas
CP0511	Furniture and furnishings
CP0512	Carpets and other floor coverings
CP0513	Repair of furniture, furnishings and floor coverings
CP052	Household textiles
CP0531	Major household appliances whether electric or not
CP0532	Small electric household appliances
CP0533	Repair of household appliances
CP054	Glassware, tableware and household utensils
CP055	Tools and equipment for house and garden
CP0561	Non-durable household goods
CP0562	Domestic services and household services
CP0711	Motor cars
CP0712_14	Motor cycles, bicycles and animal drawn vehicles
CP0721	Spare parts and accessories for personal transport equipment
CP0722	Fuels and lubricants for personal transport equipment
CP0723	Maintenance and repair of personal transport equipment
CP0724	Other services in respect of personal transport equipment
CP0912	Photographic and cinematographic equipment and optical instruments
CP0913	Information processing equipment
CP0914	Recording media

Note: The table provides an overview of all consumption categories used in the analysis. In the Dutch price dataset, the consumption category CP0311 is missing due to missing price information. In the European price dataset, consumption category CP0444 is excluded due to missing price information.

Table A3
Consumption categories (continued)

COICOP	Consumption categories
CP0915	Repair of audio-visual, photographic and information processing equipment
CP0921	Major durables for outdoor recreation
CP0922	Musical instruments and major durables for indoor recreation
CP0931	Games, toys and hobbies
CP0932	Equipment for sport, camping and open-air recreation
CP0934	Pets and related products
CP0953	Miscellaneous printed matter
CP096	Package holidays
CP1212	Electrical appliances for personal care
CP0123	Personal effects n.e.c.

Note: The table provides an overview of all consumption categories used in the analysis. In the Dutch price dataset, the consumption category CP0311 is missing due to missing price information. In the European price dataset, consumption category CP0444 is excluded due to missing price information.

Table A3
Industries subject to the reduced VAT rate (NL)

SIC Code	Description
100 – 192	Agricultural Production-Crops
200 – 291	Agricultural Production - Livestock and Animal Specialties
2000 – 2083	Food and Kindred Products (without Alcohol)
2086 – 2099	Food and Kindred Products (without Alcohol)
2700 – 2796	Printing, Publishing and Allied Industries
4000 – 4173	Railroad Transportation
4200 – 4231	Motor Freight Transportation
4300 – 4311	Postal Service
4400 – 4499	Water Transportation
4500 – 4583	Transportation by Air
5122	Pharmacy goods, pharmaceuticals, drugs, drugstore goods, cosmetics
5141 – 5159	Food and other agricultural products
5192 – 5193	Books, Flowers
5400 – 5499	Food Stores
5800 – 5813	Eating and Drinking Places
5942 – 5943	Bookshops, stationery shops
5992	Flower shops
7000 – 7041	Hotels, Rooming Houses, Camps, and Other Lodging Places
7231 – 7241	Hairdresser
7900 – 7999	Amusement and Recreation Services
8000 – 8099	Health Services
8400 – 8422	Museums, Art Galleries and Botanical and Zoological Gardens

Note: The table provides an overview of the sectors in the Netherlands that are subject to the reduced VAT rate (Unaffected). The information on VAT rates by product and country is taken from the annual report "VAT Rates applied in the Member States of the European Union" by the European Commission (2021).

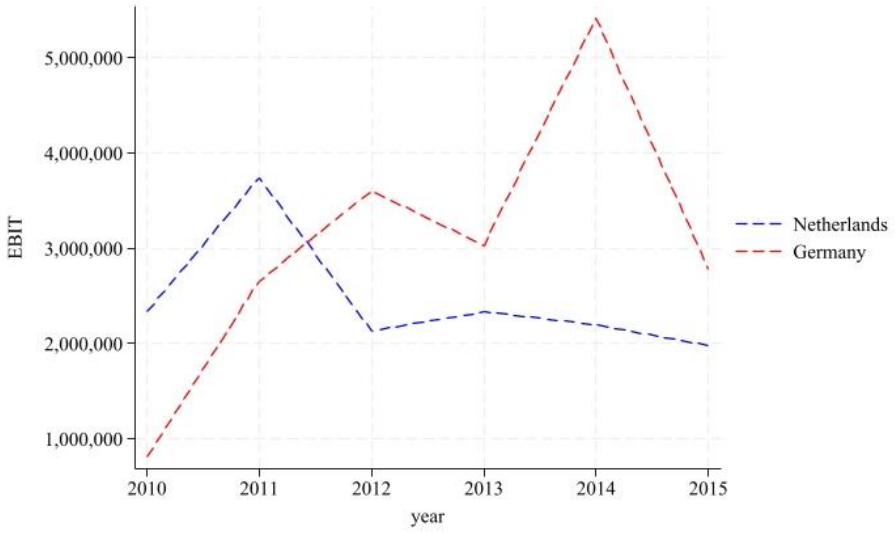
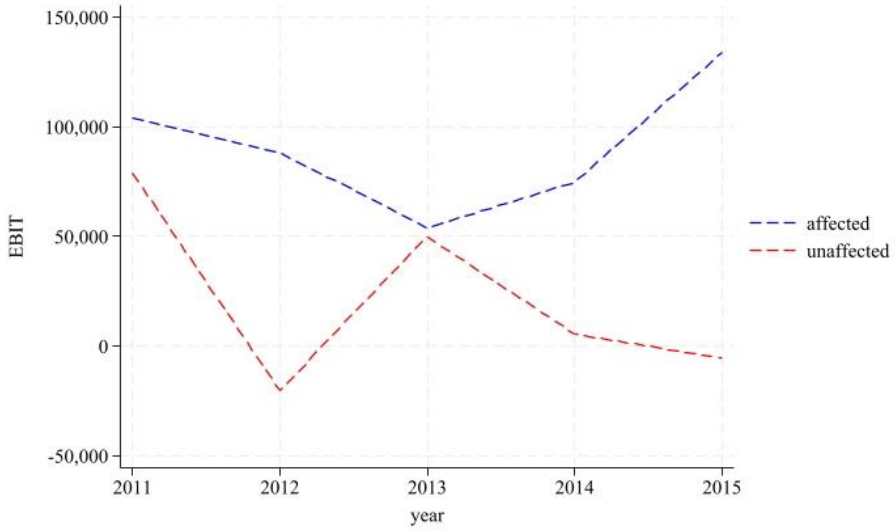


Figure A1: Development of the EBIT of German and Dutch firms

Note: Figure A1 shows that the development of EBIT of German firms differs significantly from that of Dutch firms. From 2013 in particular, after the VAT reform in the Netherlands, the EBIT of German firms rises sharply until 2014 and then falls again just as sharply. The sharp rise can be explained by the fact that German firms benefit from the VAT increase in the Netherlands. Germany borders the Netherlands. Consumers near the border can simply replace Dutch goods and services affected by the VAT increase with German goods and services. Jacob et al. (2019) also analyse the 2012 VAT reform in the Netherlands and show that Dutch firms that are confronted with increased demand or are located on the border with Germany or Belgium reduce their investments to a greater extent. Whether German firms actually benefit as much as shown in the figure requires further investigation. Other possible explanations for the situation could be an economic shock in Germany and errors in the data.

Panel A: Small firms



Panel B: Large Firms

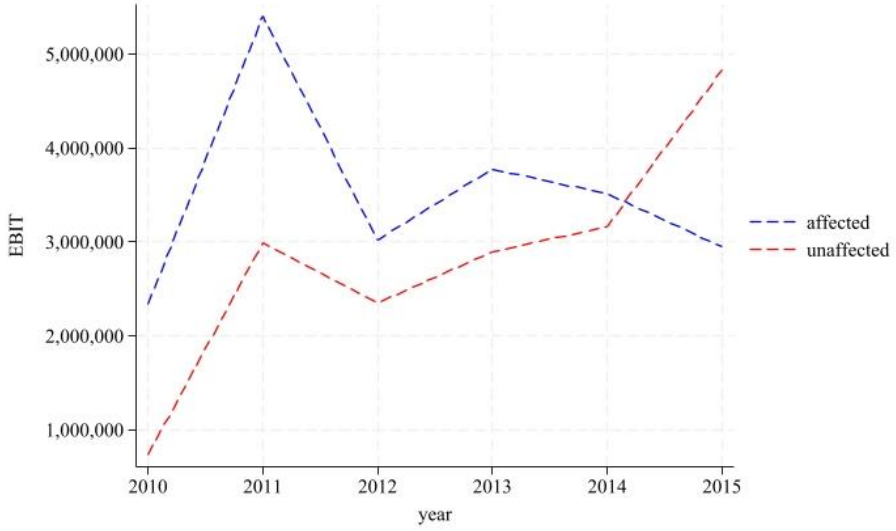
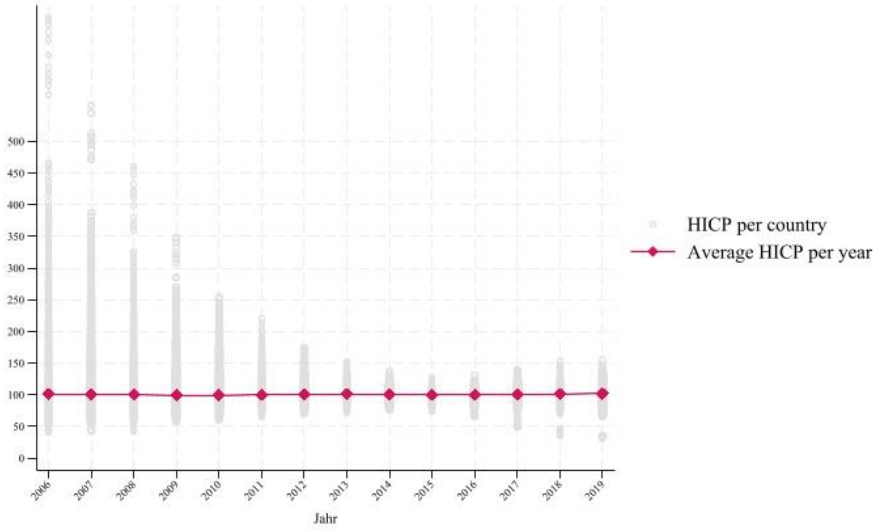


Figure A2: Development of EBIT of Dutch firms by firm size

Panel A: Consumer prices (EU)



Panel B: Earnings before interest and taxes (EU)

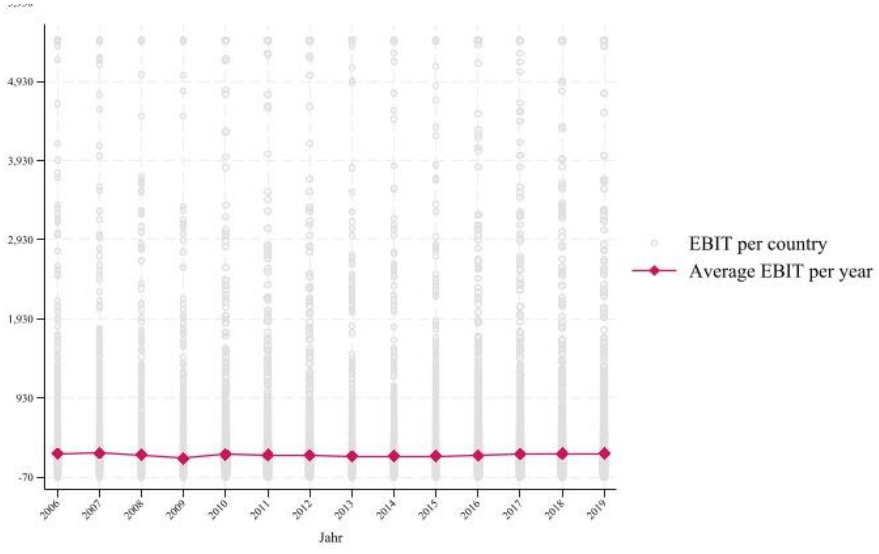


Figure A3: Development of EBIT and consumer prices of European firms on average per year and per country

References

Atkinson, A. B.; Stiglitz, J. E. (1976): The Design of Tax Structure: Direct versus Indirect Taxation. In: *Journal of Public Economics* 6, S. 55–75.

Benedek, D.; Mooij, R. A.; Keen, M.; Wingender, P. (2020): *Varieties of VAT Pass Through. In: International Tax and Public Finance* 27 (4), S. 890–930.

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

Benzarti, Y.; Carloni, D.; Harju, J.; Kosonen, T. (2020): What goes up may not come down: Asymmetric Incidence of Value-Added Taxes. In: *Journal of Political Economy* 128 (12), S. 4438–4474.

Besley, T. J.; Rosen, H. S. (1999): Sales Taxes and Prices: An Empirical Analysis. In: *National Tax Journal* 52 (2), S. 157–178.

Carbonnier, C. (2007): Who pays Sales Taxes? Evidence from French VAT Reforms, 1987–1999. In: *Journal of Public Economics* 91, S. 1219–1229.

Cashin, D.; Unayama, T. (2021): The Spending and Consumption Response to a VAT Rate Increase. In: *National Tax Journal* 74 (2), S. 313–346.

Crossley, T. F.; Low, H.; Wakefield, M. (2009): The Economics of a Temporary VAT Cut. In: *Fiscal Studies* 30 (1), S. 3–16.

European Commission (2021): VAT rates applied in the Member States of the Europen Union, last checked on 25.12.2023.

European Commission (2023): What is VAT? Available online at https://taxation-customs.ec.europa.eu/what-vat_en, last checked on 14.12.2023.

Eurostat (2024): Wer wir sind. Pub. by Europäische Kommission. Available online at https://ec.europa.eu/eurostat/de/web/main/about-us/who-we-are, last checked on 14.01.2024.

Fuest, C.; Neumeier, F.; Stöhlker, D. (2023): The Pass-Through of Temporary VAT Rate Cuts: Evidence from German Supermarket Retail. In: *CESifo Working Paper*.

Greive, M.; Hildebrand, J.; Olk, J. (2023): Vorstoß der FDP sorgt für Ärger in der Ampel. Pub. by Handelsblatt. Available online at https://www.handelsblatt.com/politik/deutschland/hoehere-mehrwertsteuer-vorstoss-der-fdp-sorgt-fuer-aerger-in-der-ampel/28992662.html, last checked on 14.01.2024.

Harju, J.; Kosonen, T.; Nordström Skans, O. (2018): Firm Types, Price-Setting Strategies, and Consumption-Tax Incidence? In: *Journal of Public Economics* 165, S. 48–72.

Hindriks, J.; Serse, V. (2019): Heterogeneity in the Tax Pass-Through to Spirit Retail Prices: Evidence from Belgium. In: *Journal of Public Economics* 176, S. 142–160.

Hundsdoerfer, J. (2023): Value Added Taxes and Corporate Borrowing. In: *Working Paper, SSRN 4553385*.

Huntington-Klein, N. (2022): The Effect: An Introduction to Research Design and Causality. 1. Ed. Boca Raton, Florida: CRC Press.

Jacob, M.; Michaely, R.; Müller, M. A. (2019): Consumption Taxes and Corporate Investment. In: *The review of Financial Studies* 32 (8), S. 3144–3182.

Kosonen, T. (2015): More and cheaper Haircuts after VAT Cut? On the Efficiency and Incidence of Service Sector Consumption Taxes. In: *Journal of Public Economics* 131, S. 87–100.

Kotlikoff, L. J.; Summers, L. H. (1987): Tax Incidence. In: *Handbook of public economics*, Pub. by Auerbach A. J.; Feldstein M. (2), S. 1043–1092.

Lustig, N.; Pessino, C.; Scott, J. (2014): The Impact of Taxes and Social Spending on Inequality and Poverty in Argentina, Bolivia, Brazil, Mexico, Peru, and Uruguay: Introduction to the Special Issue. In: *Public Finance Review* 42 (3), S. 287–303.

Mack, C.; Breaux, J.; Frenzel, W. E.; Garrett, E.; Lazear, E. P.; Muris, T. J. et al. (2005): Simple, Fair, and Pro-Growth: Proposals to Fix America's Tax System. In: *Report of the President's Advisory Panel on Federal Tax Reform*. Available online at https://home.treasury.gov/system/files/131/Report-Fix-Tax-System-2005.pdf.

National Bureau of Economic Research (2023): Business Cycle Dating. Available online at https://www.nber.org/research/business-cycle-dating, last checked on 30.12.2023.

OECD (2023): Revenue Statistics 2023: Tax Revenue Buoyancy in OECD Countries. In: *OECD Publishing*. Available online at https://www.oecd.org/tax/tax-policy/revenue-statistics-highlights-brochure.pdf.

Poterba, J. M. (1996): Retail Price Reactions to Changes in State and Local Sales Taxes. In: *National Tax Journal* 49, S. 165–176.

Rat der Europäischen Union (28.11.2006): Richtlinie 2006/112/EG. Available online at https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX%3A32006L0112, last checked on 29.12.2023.

Smolyansky, M.; Ljungqvist, A. (2018): To Cut or Not to Cut? On the Impact of Corporate Taxes on Employment and Income. In: *NBER Working Paper No. 20753*.

Thompson, J. P.; Rohlin, S. M. (2012): The Effect of Sales Taxes on Employment: New Evidence from Cross-Border Panel Data Analysis. In: *National Tax Journal* 65 (4), S. 1023–1042.

Vegh, C. A.; Vuletin, G. (2015): How is Tax Policy conducted over the Business Cycle? In: *American Economic Journal: Economic Policy* 7, S. 327–370.

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

Young, D. J.; Bielińska-Kwapisz, A. (2002): Alcohol Taxes and Beverage Prices. In: *National Tax Journal* 55 (1), S. 57–74.