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The Effect of VAT Rate on Corporate Investment: Evidence on VAT Collection Efficiency and Shadow Economy

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Dissertation

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Biographical Note

Catarina Maria de Oliveira Nogueira was born in Porto, in 1995. She completed the BSc in Economics at the School of Economics and Management of the University of Porto, in 2016. After completing the Bachelor Degree in Economics, she enrolled in the Master in Finance and Taxation at the School of Economics and Management of the University of Porto. The present dissertation marks the conclusion of the Master's Degree.

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Abstract

This paper aims to examine how Value Added Taxes (VAT) affect corporate investment, using a panel dataset on listed firms from the EU-28 countries, for the 2004-2015 period, and numerous changes in VAT rates spread over time and across countries. We estimate our models using Least Squares Method, with firm and year fixed effects. This study is relevant because most of the papers focus on the impact of corporate taxes, although currently over a third of EU-28 tax revenues come from VAT revenues. We show empirically that an increase in VAT standard rate has a negative impact on firms' investments. This effect is economically significant and stronger for: i. firms with lower profit margins, i.e., firms facing more elastic demand; ii. firms with lower international sales, i.e., firms more exposed to the domestic demand changes, caused by an increase in VAT Rate; iii. firms located in countries with lower levels of VAT Collection Efficiency and iv. firms from countries with higher levels of Shadow Economy. We contribute to the literature by showing that both Efficiency on VAT Collection and Shadow Economy levels have a significant impact on firms' investments. Taken together, our results contribute to the tax policy structure debate by showing that not only corporate, but also consumption taxes negatively affect corporate investment.

Keywords: Corporate Investment; VAT; VAT Collection Efficiency; Shadow Economy; Supply and Demand Elasticity.

Sumário

Esta dissertação tem como objetivo analisar de que forma o Imposto sobre o Valor Acrescentado (IVA) afeta o investimento das empresas, através de um conjunto de dados em painel para empresas cotadas dos 28 países da União Europeia (para o período de 2004 a 2015), e contemplando inúmeras alterações nas taxas de IVA ao longo do tempo e entre países. Estimamos os nossos modelos através do método dos Mínimos Quadrados, com efeitos fixos para a empresa e para o ano. Este estudo é relevante, dado que a maioria dos artigos se foca no impacto dos impostos sobre o rendimento das pessoas coletivas, embora as receitas fiscais resultantes da aplicação do IVA sejam neste momento superiores a um terço do total das receitas fiscais dos países da União Europeia. Apresentamos evidência empírica de que um aumento na taxa de IVA tem um efeito negativo no nível de investimento das empresas. Este efeito é economicamente significativo e mais acentuado para: i. empresas com baixas margens de lucro, i.e., empresas que enfrentam uma procura mais elástica; ii. empresas que comercializam maioritariamente os seus produtos no seu país de origem, i.e., empresas mais expostas a alterações na procura doméstica; iii. empresas localizadas em países com menores níveis de Eficiência na Recolha de IVA e iv. empresas de países com elevados níveis de Economia Paralela. Contribuímos para a literatura ao mostrar que a Eficiência na Recolha de IVA e o nível de Economia Paralela têm um impacto significativo ao nível do investimento das empresas. Em conjunto, os nossos resultados contribuem para o debate sobre a estrutura fiscal dos países, apresentando evidência de que não só os impostos sobre o rendimento das pessoas coletivas, mas também o IVA afetam negativamente o investimento das empresas.

Palavras-chave: Investimento; IVA; Eficiência da Recolha de IVA; Economia Paralela; Elasticidade da Procura e da Oferta.

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Chapter 1

Introduction

VAT revenues represent over a third of total tax revenues for governments in the European Union. Despite this, the impact of this tax on corporate investment is far from being widely studied, contrarily to the effect of corporate taxes. As far as we can tell, only one study investigates the effect of consumption taxes on corporate investment (Jacob, Michaely, & Müller, 2016).

Several studies contribute to the ongoing debate on the efficiency of consumption versus capital-based tax systems. On the one hand, there is the view that a consumption based tax system mitigates distortions on allocation of capital and firms' financing decisions, which leads to more growth (Barro, 1990; Hubbard, 1997; Arnold, Brys, Heady, Johansson, Schwellnus, & Vartia, 2011). Additonally, Chari, Nicolini and Teles (2016) consider that taxing capital imposes a higher tax on future goods so it should not be taxed in the long run. On the other hand there are authors defending that taxing capital is good in the long run (Conesa, Kitao, & Krueger, 2009) and a move into a consumption tax based system may have negative implications for all economic agents (Krusell, Quadrini, & Ríos-Rull, 1996).

The aim of our study is to contribute to the above-mentioned debate by analysing the effect of consumption taxes (particularly Value Added Tax Rate) in firms' investments. A simple partial equilibrium analysis suggests that firms are negatively affected by consumption taxes and the dimension of that effect depends on the supply and demand elasticities. Furthermore, we intend to introduce the administrative capacity of tax systems and the level of tax evasion in our study. To do so, we include in our estimation the VAT Collection Efficiency ratio, computed as Effective VAT Rate/Standard VAT Rate, and the estimates for the Shadow Economy proposed by Medina and Schneider (2017).

Using a sample of listed firms across the 28 countries of the European Union, for the 2004-2015 period, we find a negative effect of VAT Rate on corporate investment. A one percentage point increase in the VAT Rate decreases firms' investments by 4.53% of average investment. Besides this, we also find an enhanced negative effect of an increase in VAT Rate for firms facing higher demand elasticities (proxied by low profit margins) and for firms with lower international sales, i.e., firms more exposed to domestic demand changes. Taking into account the country level variables, VAT Collection Efficiency and Shadow Economy levels, we find a more pronounced negative effect on investment for firms located in countries with a low VAT Collection Efficiency and for firms from countries with higher levels of Shadow Economy.

While our paper does not allow us to draw conclusions about the overall efficiency of the tax systems, we contribute to the debate of tax system structure by showing that firms' investments respond negatively to increases in VAT Rate and their effect is more pronounced for firms facing high elastic demand, firms who are more exposed to domestic demand, firms located in countries with low VAT Collection Efficiency and firms from countries with high Shadow Economy levels. A balance must be found between capital and consumption taxes, both with negative impact on firms' investments. It would be wise for policymakers to consider those effects when determining their fiscal strategies. These fiscal policy decisions must consider the enhanced effects demonstrated in scenarios with higher Shadow Economy and lower VAT Collection Efficiency. The same change in the VAT Tax Rate may produce more adverse effects for firms located in countries with higher levels of tax evasion or lower efficiency on VAT collection, so it is crucial to adapt the policy to the specificities of each country.

The remaining paper is organized as follows: Section 2 presents an overview of the related literature and development of hypotheses. Section 3 presents the sample selection criteria, the variables definition and the methodology used. Section 4 describes the empirical results. Lastly, Section 5 presents the concluding remarks.

Chapter 2

Prior Literature and Development of Hypotheses

In this chapter, we introduce some contributions present in literature on the fields of taxation and firms' investment decisions, with particular incidence on Value Added Tax (VAT). The chapter is outlined as follows: first, we present a primer on the origin of VAT, followed by a discussion on tax system structure; second, we approach the relationship between VAT and corporate investment; third, we broach the impact of supply and demand elasticities on the tax burden and finally, we introduce, as our main contributions, the VAT Collection Efficiency and Shadow Economy as relevant factors on the topic of VAT impact on firms' investment. Throughout the chapter, we propose our six hypotheses of investigation, resulting from the previous analysis carried out on the literature shown.

2.1. VAT – A Brief History

The original idea of a VAT is credited to German businessman Wilhelm Von Siemens in the early 1920s. Nevertheless, decades passed until the highly regarded father of the tax, Maurice Lauré, then joint director of the French Tax Authority, implemented it in the country, in 1954.

Widespread adoption of this then novel form of taxation was not immediate, given that, by the late 1960s, no more than 10 countries had implemented the tax. The adoption of VAT took place in two key periods. The first, between 1960s and 1970s, occurred mostly in Western Europe and Latin America. Both the European Union (then European Economic Community) and the IMF were key in boosting adoption of VAT in this phase, by strongly

recommending it and, in the case of the first, by making it a requirement for membership[1] (Charlet, & Owens, 2010). The second phase, from the late 1980s, was raised by the introduction of VAT in some highly industrialized countries outside the EU, such as Australia, Canada, Japan, and Switzerland. In this period, there was also a great expansion of VAT in the transitional and developing economies of Africa and Asia (James, 2011).

"Many believe the VAT spread globally because it is the consumption tax best suited to the revenue needs of states in an increasingly globalized economy. Even those who recognize the role of key regional and international institutions in promoting VAT often attribute the motives behind the promotion to the merits of the policy instrument itself." (James, 2011, p.19). As a result, one could argue that its popularity can be attributed to a set of virtues, such as its neutral treatment of exports or its revenue-raising capacity. However, the most outlined fundamental strength of the tax is its incidence on consumption and not income, with potential implications on savings and investment.

2.2.   Tax System Structure

Considerable research has been conducted on the issue of firms' investment decisions since the seminal study of Modigliani and Miller (1958) (Myers, 1974; Mackie-Mason, 1990; Devereux, & Griffith, 1998). Furthermore, the focus on tax implications has gained a greater importance in a context of growing economic and fiscal competitiveness and complexity.

The ongoing debate on the efficiency of consumption versus capital-based tax systems has been led by different views of how different taxes affect investment. The proponents of a consumption-based tax system state that some distortions on allocation of capital and firm's financing decisions can be removed with that system, which leads to more economic growth (Barro, 1990; Hubbard, 1997). Empirical results support theoretical beliefs that economic growth can be increased by gradually moving the tax base towards consumption and immovable property (Arnold, Brys, Heady, Johansson, Schwellnus, & Vartia, 2011). A move towards a more consumption-based and a less capital-based tax system can produce efficiency gains (Hubbard, 1997; Altig, Auerbach, Koltikoff, Smetters, &

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[1] In 1967, by the First Council Directive (67/227/EEC) and Second Council Directive (67/228/EEC) of April 11th. In 1977, by the well-known Sixth Council Directive (77/388/EEC) of May 17th, that has given rise to the VAT Directive 2006/112/EC of November 28th, 2006.

Walliser, 2001) since it *"do[es] not affect the return to savings and investing"* (Hines, 2007). Additionally, Chari, Nicolini and Teles (2016) consider that taxing capital imposes a higher tax on future goods and, for that reason, capital should not be taxed in the long run.

On the other hand, there are authors arguing that moving into a consumption tax-based system does not benefit the median voter, in general, and that change may have negative implications for all economic agents (Krusell, Quadrini, & Ríos-Rull, 1996). Furthermore, Conesa, Kitao and Krueger (2009, p.34) consider that taxing capital heavily *"is optimal in the long run"* and Straub and Werning (2015, p.33) show, empirically, that *"the long run tax on capital is actually positive"*.

Therefore, understanding the possible impacts of consumption taxes, as VAT, on firms' decisions is of extreme importance, before adopting a clear position on the above-mentioned debate.

2.3. Value Added Tax and Corporate Investment

The effect of corporate taxes on investment has been extensively analysed (Summers, 1981; Auerbach, 1983; Cummins, Hassett, & Hubbard, 1996; Djankov, Ganser, McLiesh, Ramalho, & Shleifer, 2010). Djankov et al. (2010) show a significant negative effect of corporate taxes on corporate investment, with robust results when controlling for other taxes, such as personal income tax or VAT.

However, as far as we can tell, there is only one study concerning the impact of consumption taxes on investment (Jacob, Michaely & Müller, 2016), with conclusive results[2], which we will be using as a starting point for our analysis. These authors present robust results indicating that firms' investments are also responsive to changes in consumption taxes. Their results imply that both capital and consumption taxes have negative implications on firms' investments, which have far-reaching implications in the above-mentioned tax policy debate. This negative relation between consumption taxes and firms' investments

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[2] Alesina, Ardagna, Perotti and Schiantarelli (2002) have studied this issue before, based on macroeconomic data, but their results were inconclusive.

cannot be explained by the value added tax chain. Figure 1 displays an example of that mechanism, comprising a producer, a distributor, a retailer and a final consumer.

Figure 1 – Mechanism of a Value Added Tax Chain

$P_D = 10 \; T_D = 2$ $P_R = 15 \; T_R = 3$ $P_C = 30 \; T_C = 6$

| Producer | ⬅ | Distributor | ⬅ | Retailer | ⬅ | Final Consumer |

Net tax
$2 - 0 = 2$

Net tax
$3 - 2 = 1$

Net tax
$6 - 3 = 3$

Tax Authority

Total tax $= 2 + 1 + 3 = 6 = T_C$
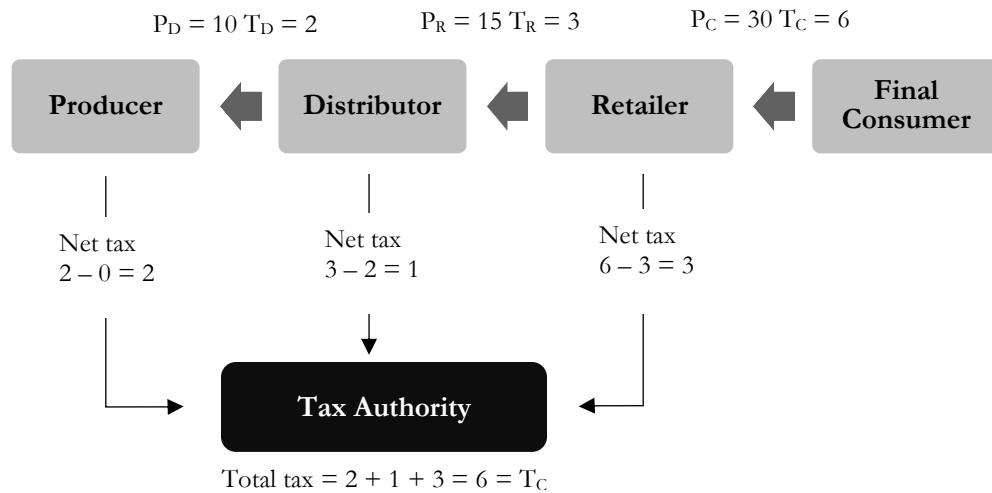
Through the supply chain, VAT is levied on each transaction: the distributor pays the gross amount of 12 units (10 units for the transacted goods (P_D) and 2 units for the VAT (T_D)) to the producer, assuming a VAT rate of 20%. Identically, the retailer pays the gross amount of 18 units to the distributor and the final consumer pays the gross amount of 36 units to the retailer. A tax credit, equivalent to the tax amount paid on purchases, is given to the distributor and retailer to assure that only the value added is taxed in each segment of the supply chain[3]. Therefore, the producer, distributor and retailer transfer to the tax authority the net tax of each transaction ($2 + 1 + 3 = 6$ units), that corresponds to the tax amount the final consumer has paid. Thus, consumers are the ones who effectively bear the tax, since they don't receive, as a credit, the amount they pay at the moment of purchase.

While the Value Added Tax Chain does not explain the negative relation between consumption taxes and firms' investment, since it does not present information about changes in quantity and price and how these changes would affect firms, Jacob, Michaely and Müller (2016) argue that their results may be explained by a simplified partial equilibrium analysis. According to this analysis, illustrated in Figure 2[4], after the introduction of a

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[3] In this case, we assume the producer owns the raw materials the final products originated from, meaning no purchases were made (tax credit is zero).
[4] The figure shows the incidence of a tax levied on suppliers. Similar results would be obtained if the tax was levied on consumers.

consumption tax, the demanded and supplied quantity suffers a reduction (q_A), comparing to the initial equilibrium quantity (q_E). Consumers must pay a superior price (P_C) and producers receive a lower price (P_P) than in the initial equilibrium (the difference between the price paid by consumers and the price received by producers is the tax amount).

Figure 2 - Effect of a Consumption Tax on Supply and Demand
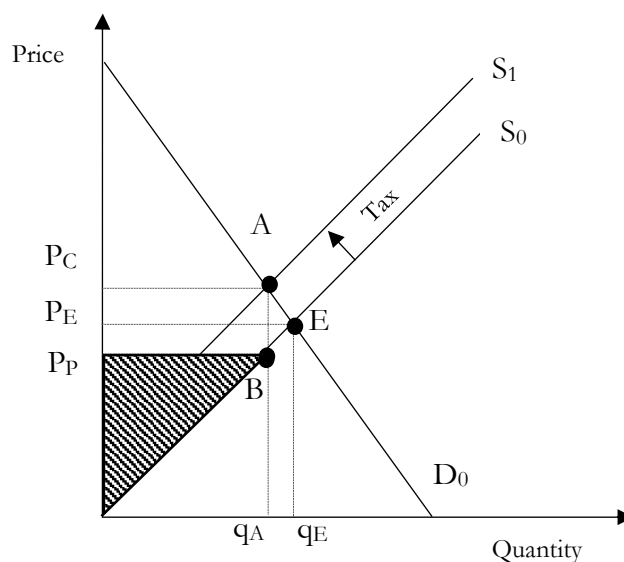
As displayed in Figure 2, the producers surplus is reduced from (P_E x q_E)/2 to (P_P x q_A)/2 and, for that reason, we expect a decrease in capital investments by firms as they adjust to this change. According to Poterba (1996) and DeCicca, Kenkel and Liu (2013), consumers don't bear the consumption tax entirely, hence firms are also negatively affected by it. Additionally, the decrease of the transacted quantity illustrated above is empirically supported by evidence showing that the level of consumption decreases with higher consumption taxes (Ellison, & Ellison, 2009; Goolsbee, Lovenheim, & Slemrod, 2010; Alm, & El-Ganainy, 2013; Einav, Knoepfle, Levin, & Sundaresan, 2014; Kolahi, Noor, & Kashmari, 2016). Consequently, we expect to show that firms' investments negatively respond to changes in consumption taxes, particularly in VAT. Therefore, our first hypothesis is stated as follows:

Hypothesis 1 (H1): An increase in the VAT rate has a negative impact on corporate investment.

2.4. Supply and Demand Elasticities and the Burden of Tax

The burden of the tax depends on supply and demand elasticities. In some specific situations, consumers may bear the entire tax burden, when the demand is totally inelastic, or the supply is perfectly elastic. In others, the tax burden may entirely fall on producers, when the supply is totally inelastic, or the demand is perfectly elastic. Following this line of thought, we intend to test if firms with lower supply elasticity respond more to consumption tax changes, than firms with higher supply elasticity. The proxy for a low supply elasticity is a low cash to assets ratio because firms with low cash holdings have a lower flexibility to adjust investments and more financial problems to internally finance those investments (Duchin, Ozbas, & Sensoy, 2010). This decreases cash-poor firms' returns on investment and, accordingly, investment levels. Thus, our second hypothesis is formally stated as follows:

Hypothesis 2 (H2): The impact of an increase in the VAT Rate on corporate investment is more negative for firms that have a lower cash to assets ratio.

Contrarily to supply, we expect that firms facing higher demand elasticity decrease investments more than firms facing lower demand elasticity, because they transfer a smaller portion of the consumption tax to consumers. To proxy for demand elasticity, we use the firm's profit margin, since firms with lower market power, measured by low profit margins, face more elastic demand (Lerner, 1934). Our third hypothesis is stated as follows:

Hypothesis 3 (H3): The impact of an increase in the VAT Rate on corporate investment is more negative for firms with lower profit margins.

Additionally, we intend to test the exposure of firms to domestic VAT changes. We expect that firms selling most of their output abroad are less likely to be affected by domestic tax rate changes, since international demand is not expected to change (Jacob, Michaely & Müller, 2016). To account for domestic sales, we use the ratio of domestic sales to total sales. We expect to show that firms with lower international sales (meaning higher domestic sales) have a more negative effect on their investment levels than firms with higher levels of international sales (i.e., lower domestic sales). We then propose our fourth hypothesis:

Hypothesis 4 (H4): The impact of an increase in the VAT Rate on corporate investment is more negative for firms with lower international sales.

2.5.   Effective Rate and Collection Efficiency

In addition to the effects on investment, there is empirical evidence showing a negative relationship between consumption taxes, particularly the VAT, and consumption, using the effective VAT Rate as the main variable (Alm, & El-Ganainy, 2013). We will consider the methodology of these authors to compute the effective tax rates for each country included in the sample, to compare effective with nominal taxation, allowing us to get a handle on the administrative capacity of tax systems.

Bearing in mind the close relationship between VAT and consumption, several studies (Aizenman, & Jinjarak, 2008; Keen, 2013; Hodzic, & Celebi, 2017; Ueda, 2017) dwell upon the Collection Efficiency of the VAT, making use of the C-Efficiency ratio (computed as the ratio between VAT revenue over aggregate consumption – Effective VAT Rate - and the Standard VAT Rate) and analysing economic, political and structural factors.

According to IMF (2017), the raise of a country's productivity can be done by improving the design of its tax system, which includes both policies and administration. Following a study of Ghazanchyan, Marto, Jonas and Douglass (2017, p.5) for IMF, improving efficiency of revenue collection is of major importance, since it allows to "*finance the same amount of investment with much lower debt levels and lower statutory tax rates, reducing the distortionary effect on consumption and investment*". Additionally, according to André and Hwang (2018), on their OECD working paper, a low VAT Collection Efficiency level (consequence of reduced VAT Rates for some goods and services) decreases tax revenues significantly, while also having a negative impact on welfare, by distorting spending decisions. Hence, lowering the number of goods and services with reduced VAT Rates would have a positive impact on the economy, since the same goals regarding social inequality would be achieved using targeted instruments.

Given this, we expect firms located in countries with lower VAT Collection Efficiency levels to experience more negative implications for their investment. Thus, our fifth hypothesis is formally stated as follows:

Hypothesis 5 (H5): The negative impact of an increase in the VAT Rate on corporate investment is more pronounced for firms located in countries with lower levels of VAT Collection Efficiency.

2.6. Shadow Economy

According to Aizenman and Jinjarak (2008), an analysis focused on efficiency ratios may be affected by the level of tax evasion. In this context, Zídková (2014) shows that the share of the Shadow Economy has a positive impact on the size of the VAT gap (theoretical versus collected VAT revenues). Thus, our decision to include a control variable for the Shadow Economy in our estimation stems from the analysis of previous literature in this field, which highlights the importance of accounting for its impact. In line with Ferreira-Tiryaki (2008), there is empirical evidence indicating that the bigger the size of the Shadow Economy in a country, the higher the tendency to experience greater volatility in economic activity cycles. Thus, countries with larger informal economies tend to face higher volatility in output, investment and consumption over the business cycle. To reflect the Shadow Economy in our estimation model, we will consider the most recent dataset available quantifying this variable (Medina, & Schneider, 2017). For that purpose, we present our sixth and last hypothesis, as follows:

Hypothesis 6 (H6): The impact of an increase in the VAT Rate on corporate investment is more negative for firms located in countries with higher levels of Shadow Economy.

With the purpose of summarizing the above-mentioned contributions stated in the first six subchapters, we present the following table including the main subjects and perspectives of each one:

Table 1 – Summary of Literature Review

Subject	Paper	Authors	Year
VAT Collection Efficiency	Tax reform to support growth and employment in Finland	André, and Hwang	2018
VAT Collection Efficiency	Value-Added Tax and Its Efficiency: EU28 and Turkey	Hodzic, and Celeb	2017
VAT Collection Efficiency	The Evolution of Potential VAT Revenues and C-Efficiency in Advanced Economies	Ueda	2017
Fiscal policy debate	Fiscal Monitor: Achieving More with Less	IMF	2017
Tax Revenue Collection Efficiency	Collect More, Spend Better: Public Investment in Asian Frontier Markets	Ghazanchyan, Marto, Jonas, and Douglass	2017

Table 1. *(continued)*

Subject	Paper	Authors	Year
Estimates of Shadow Economy	Shadow economies around the world: New results for 158 countries over 1991-2015	Medina, and Schneider	2017
Impact of consumption taxes on investment	The Effect of Consumption Taxes on Corporate Investment	Jacob, Michaely, and Müller	2016
Proponents of a consumption-based tax system	More on the optimal taxation of capital	Chari, Nicolini, and Teles	2016
Effect of consumption taxes on consumption	Effects of Value Add Tax on Consumption in Developing Countries	Kolahi, Noor, and Kashmari	2016
Opponents of a consumption-based tax system	Positive Long Run Capital Taxation: Chamley-Judd Revisited	Straub, and Werning	2015
Effect of consumption taxes on consumption	Sales Taxes and Internet Commerce	Einav, Knoepfle, Levin, and Sundaresan	2014
The effect of Shadow Economy on VAT Gap	Determinants of VAT GAP in EU	Zídková	2014
The effect of a change in a specific consumption tax on who bears the tax burden	Who Pays Cigarette Taxes? The Impact of Consumer Price Search	DeCicca, Kenkel, and Liu	2013
VAT Collection Efficiency	The anatomy of the VAT	Keen	2013
Relationship between consumption taxes and consumption	Value Added Taxation and Consumption	Alm, and El-Ganainy	2012
The origin of VAT	Exploring the Origins and Global Rise of VAT	James	2011
Proponents of a consumption-based tax system	Tax Policy for Economic Recovery and Growth	Arnold, Brys, Heady, Johansson, Schwellnus, and Vartia	2011
Effect of corporate taxes on investment	The Effect of Corporate Taxes on Investment and Entrepreneurship	Djankov, Ganser, McLiesh, Ramalho, and Shleifer	2010
Summary of tax research	A review of tax research	Hanlon, and Heitzman	2010
Effect of consumption taxes on consumption	Playing With Fire: Cigarettes, Taxes, and Competition from the Internet	Goolsbee, Lovenheim, and Slemrod	2010
Effect of cash on firms' ability to fund and adjust investments	Costly external finance, corporate investment, and the subprime mortgage credit crisis	Duchin, Ozbas, and Sensoy	2010
Opponents of a consumption-based tax system	Taxing Capital? Not a Bad Idea after All!	Conesa, Kitao, and Krueger	2009
Effect of consumption taxes on consumption	Search, Obfuscation, and Price Elasticities on the Internet	Ellison, and Ellison	2009
Impact of the Shadow Economy on the volatility of economic activity cycles	The informal economy and business cycles	Ferreira-Tiryaki	2008
VAT Collection Efficiency	The collection efficiency of the Value Added Tax: Theory and international evidence	Aizenman, and Jinjarak	2008

Table 1. *(continued)*

Subject	Paper	Authors	Year
Proponent of a consumption-based tax system	Taxing Consumption and Other Sins	Hines	2007
Effect of consumption taxes on corporate investment	Fiscal Policy, Profits, and Investment	Alesina, Ardagna, Perotti, and Schiantarelli	2002
Proponents of a consumption-based tax system	Simulating Fundamental Tax Reform in the United States	Altig, Auerbach, Koltikoff, Smetters, and Walliser	2001
The impact of effective corporate tax rate on the choice between alternative investment projects	The taxation of discrete investment choices	Devereux, and Griffith	1998
Proponent of a consumption-based tax system	How Different Are Income and Consumption Taxes?	Hubbard	1997
Opponents of a consumption-based tax system	Are consumption taxes really better than income taxes?	Krusell, Quadrini, and Ríos-Rull	1996
Effect of corporate taxes on investment	Tax Reforms and Investment: A Cross-Country Comparison	Cummins, Hassett, and Hubbard	1996
The effect of a change in consumption tax on who bears the tax burden	Retail Price Reactions to Changes in State and Local Sales Taxes	Poterba	1996
The impact of corporate income tax on investment decisions under nonlinearity and uncertainty	Some nonlinear tax effects on asset values and investment decisions under uncertainty	Mackie-Mason	1990
Economic growth models and tax systems	Government Spending in a Simple Model of Endogenous Growth	Barro	1990
Effect of corporate taxes on investment	Taxation, corporate financial policy, and the cost of capital	Auerbach	1983
Effect of corporate taxes on investment	Taxation and corporate investment: a q-theory approach	Summers	1981
Corporate financing and its implications on capital investment decisions	Interactions of corporate financing and investment decisions - implications for capital budgeting	Myers	1974
The cost of capital and investment decision-making	The Cost of Capital, Corporation Finance and the Theory of Investment	Modigliani, and Miller	1958
Effect of demand elasticity on firms' market power	The Concept of Monopoly and the Measurement of Monopoly	Lerner	1934

On the next chapter, we will present the sample selection criteria, the variables definition and the methodology used to estimate the proposed models.

Chapter 3

Methodology, Sample Selection and Variables

This chapter aims to show our data selection, the sample and variables specifications and the adopted estimation method. The chapter is presented as follows: first, we describe the sample; second, we define the variables included in our model and, lastly, we briefly explain the estimation method.

3.1. Sample Dataset

Our study will be based on a sample constituted by listed firms from the 28 countries of the European Union, during the 2004-2015 period. This sample selection is driven by the pioneering need to examine the impact of VAT Rate on corporate investment in this geographical area. The choice of the sample period, from 2004 to 2015, is motivated by the availability of data and the desire to include the most recent datasets, increasing the relevance of the conclusions drawn. Following exclusion criteria from Jacob, Michaely, and Müller (2016), we exclude all utilities, financial and insurance companies and, also, firms with missing data (including firms with missing DS Mnemonic Code information).

The main sources of information for our study are the Thomson Reuters Datastream Database, for firm-level variables, the World Bank, European Commission, Eurostat and Bank of Portugal Stats Databases, for country-level variables, the OECD Database, for tax policy variables and the paper of Medina and Schneider (2017), for our Shadow Economy variable. Our sample covers 50 916 panel observations. Table 2 shows an overview of the 28 countries and the number of observations per country in our sample.

Table 2 – Sample Composition

Country	Obs.	Percentage	Country	Obs.	Percentage
Austria	468	0.92	**Italy**	2 256	4.43
Belgium	996	1.96	**Latvia**	120	0.24
Bulgaria	1 476	2.90	**Lithuania**	204	0.40
Croatia	876	1.72	**Luxembourg**	48	0.09
Cyprus	552	1.08	**Malta**	96	0.19
Czech Republic	96	0.19	**Netherlands**	960	1.89
Denmark	1 080	2.12	**Poland**	5 016	9.85
Estonia	132	0.26	**Portugal**	492	0.97
Finland	1 428	2.80	**Romania**	900	1.77
France	6 768	13.29	**Slovakia**	108	0.21
Germany	5 388	10.58	**Slovenia**	288	0.57
Greece	1 800	3.54	**Spain**	1 356	2.66
Hungary	204	0.40	**Sweden**	5 052	9.92
Ireland	252	0.49	**United Kingdom**	12 504	24.56
			Total	**50 916**	**100.00**

As stated in Table 2, the United Kingdom is the country that makes the largest contribution to our sample, with almost 25% of the total observations. The United Kingdom is then followed by France, with more than 13%, Germany with around 11% and Sweden and Poland, with 10% each.

This table provides useful information for our estimation samples, presented in Chapter 4. In Column (2) of the result tables, we will present the results based on a sample excluding countries with less than 200 observations, i.e. excluding Czech Republic, Estonia, Latvia, Luxembourg, Malta and Slovakia.

Table 3 shows the VAT Standard Rates for the 2004-2015 period for each country of the sample. As Table 2, this table provides useful information for the estimation sample considered in Column (4) of the result tables presented in Chapter 4. In that column, we will present the results based on a sample excluding countries that suffered no changes on their VAT Standard Rate in the 2004-2015 period. This means we exclude Austria, Belgium, Bulgaria, Denmark, Malta and Sweden, as shown in Table 3.

Table 3 – VAT Standard Rates per country in 2004-2015 period

Country	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Austria	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Belgium	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
Bulgaria	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Croatia	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	23.0%	23.0%	25.0%	25.0%	25.0%	25.0%
Cyprus	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	17.0%	18.0%	19.0%	19.0%
Czech Republic	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	20.0%	20.0%	20.0%	21.0%	21.0%	21.0%
Denmark	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
Estonia	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Finland	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	23.0%	23.0%	23.0%	24.0%	24.0%	24.0%
France	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	19.6%	20.0%	20.0%
Germany	16.0%	16.0%	16.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%
Greece	18.0%	18.0%	19.0%	19.0%	19.0%	19.0%	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Hungary	25.0%	25.0%	20.0%	20.0%	20.0%	20.0%	25.0%	25.0%	27.0%	27.0%	27.0%	27.0%
Ireland	21.0%	21.0%	21.0%	21.0%	21.0%	21.5%	21.0%	21.0%	23.0%	23.0%	23.0%	23.0%
Italy	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	21.0%	21.0%	21.0%	22.0%	22.0%
Latvia	18.0%	18.0%	18.0%	18.0%	18.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
Lithuania	18.0%	18.0%	18.0%	18.0%	18.0%	19.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
Luxembourg	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	17.0%
Malta	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%
Netherlands	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	21.0%	21.0%	21.0%	21.0%
Poland	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Portugal	19.0%	21.0%	21.0%	21.0%	21.0%	20.0%	21.0%	23.0%	23.0%	23.0%	23.0%	23.0%
Romania	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	24.0%	24.0%	24.0%	24.0%	24.0%	24.0%
Slovakia	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Slovenia	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	22.0%	22.0%	22.0%
Spain	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	18.0%	18.0%	21.0%	21.0%	21.0%	21.0%
Sweden	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
United Kingdom	17.5%	17.5%	17.5%	17.5%	17.5%	15.0%	17.5%	20.0%	20.0%	20.0%	20.0%	20.0%

3.2. Variable Definition

We will now present the definitions of the variables included in our estimation. To explain the behaviour of our dependent variable, **Investment** of firm i in year t in country j, which is computed as Capital Expenditures scaled by lagged Total Assets, our main variable of interest is **VAT Rate**, which is the nominal value added tax on consumer goods by private households in the respective country j, in year t.

As independent variables, we include the following **Tax** variables: **Corporate Tax**, which is the top marginal corporate tax rate in country j in year t; **Dividend Tax**, that is the top marginal dividend tax rate in country j in year t; **Wage Tax**, that is the top marginal individual income tax rate on labour income in country j in year t.

We also include **Firm-level** variables, following prior literature on investment (e.g., Cummins, Hassett, & Hubbard, 1996; Baker, Stein, & Wurgler, 2002): **Cash**, that is Cash scaled by lagged Total Assets; **Operating Profit** which is Earnings Before Interest and Taxes (EBIT) scaled by lagged Total Assets; **Sales Growth**, that is the logarithmic growth rate of Sales from $t-1$ to t; **Leverage**, that is Total Debt scaled by Total Assets; **Size**, which is the natural logarithm of Total Assets; a proxy for **Interest Rate**, which is the ratio between the annual amount of interest incurred and total debt and **Price**, that corresponds to the price adjusted.

Additionally, we include the following **Country-level** variables, to mitigate remaining differences in economic conditions between countries: **Ln (GDP per capita)**, which is natural logarithm of GDP per capita in constant prices and **GDP Growth**, that is the annual percentage growth rate of GDP in constant prices, as proxies for the economic development in a country; **Inflation**, which is the rate of price change in a country as a whole as measured by the annual growth rate of the GDP implicit deflator; six institutional environment measures named **Control of Corruption**, that is the yearly estimate of a country's quality relating to control of corruption, **Government Effectiveness**, that is the yearly estimate of a country's quality relating to government effectiveness, **Political Stability**, which is the yearly estimate of a country's quality relating to political stability, **Rule of Law**, that is the yearly estimate of a country's quality relating to rule of law, **Regulatory Quality**, which is the yearly estimate of a country's quality relating to regulatory quality and **Voice and Accountability**, that is the yearly estimate of a country's quality relating to voice and

accountability, as important determinants of economic development and corporate investments (Djankov, McLiesh, & Ramalho, 2006) and **Stock Price Volatility**, as a measure of the country's risk.

To test the last five proposed hypotheses, we take into consideration dummy variables for **Low Cash Firms**, which is equal to one if the firm is below the bottom tercile of cash to assets ratio in the respective country-year, and zero otherwise; **Low Profit Margin**, which is equal to one if the firm is below the bottom tercile of profit margin in the respective country-year, and zero otherwise; **Low International Sales**, which is equal to one if the firm's ratio of international sales is below 7,5% of the median ratio of total firms (around 25% of the firms in the sample), and zero otherwise; **Low C-Efficiency**, which is equal to one if the firm is below the bottom tercile of c-efficiency ratio in the respective country-year, and zero otherwise; and **High Shadow Economy**, which is equal to one if the firm is over the top tercile of Shadow Economy ratio in the respective country-year, and zero otherwise. These dummies will be interacting with the four main tax variables and, for our purposes, we will focus our attention on their interaction with the VAT Rate variable. In the case of the dummy concerning low VAT efficiency, we will interact it with the VAT Rate variable only, since it is directly related with this specific tax. Table 4 presents a summary of the above-mentioned variables, with the corresponding definitions and expected signs.

Table 4 – Variable Definition and Expected Signs

Variable	Definition	Source	Expected Sign
Panel A: Tax Variables			
VAT Rate	VAT Rate is the value added tax rate in country j in year t.	European Commission	$(-)$
Corporate Tax Rate	Corporate Tax is the top marginal corporate tax rate in country j in year t.	European Commission	$(-)$
Wage Tax Rate	Wage Tax is the top marginal individual income tax rate on labour income in country j in year t.	European Commission	$(+)$
Dividend Tax Rate	Dividend Tax is the top marginal dividend tax rate in country j in year t.	OECD | Tax Handbooks	$(+/-)$
Panel B: Firm-Level Variables			
Investment	Investment is Capital Expenditures scaled by lagged Total Assets.	Datastream	|
Cash	Cash is Cash scaled by lagged Total Assets.	Datastream	$(+)$
Low Cash Firms	Low Cash Firms is a dummy variable equal to one if the firm is below the bottom tercile of cash to assets ratio in the respective country-year.	Datastream	$(-)*$

Table 4. *(continued)*

Variable	Definition	Source	Expected Sign
Panel B: Firm-Level Variables			
Operating Profit	Operating Profit is Earnings Before Interest and Taxes scaled by lagged Total Assets.	Datastream	(+)
Sales Growth	Sales Growth is the logarithmic growth rate of Sales from $t-1$ to t.	Datastream	(+)
Leverage	Leverage is Total Debt scaled by Total Assets.	Datastream	(+)
Size	Size is the natural logarithm of Total Assets.	Datastream	(+/−)
Interest Rate	Interest Rate is the ratio between the annual amount of interest incurred and Total Debt.	Datastream	(−)
Price	Price is the price adjusted.	Datastream	(+)
Low International Sales	International Sales is the ratio of international sales to total sales. Low International Sales is a dummy variable equal to one if the firm's ratio of international sales is below 7,5% of the median ratio of total firms.	Datastream	(−)*
Low Profit Margin	Profit margin is the Earnings Before Interest and Taxes scaled by Sales. Low Profit Margin is a dummy variable equal to one if the firm is below the bottom tercile of profit margin in the respective country-year.	Datastream	(−)*
Panel C: Country-Level Variables			
Ln (GDP per capita)	Ln (GDP *per capita*) is the natural logarithm of GDP *per capita* in constant USD.	Worldbank	(−)
GDP Growth	GDP Growth is the annual percentage growth rate of GDP in constant U.S. dollars.	Worldbank	(+)
Inflation	Inflation is the rate of price change in a country as measured by the annual growth rate of the GDP implicit deflator.	Worldbank	(+)
Control of Corruption	Control of Corruption is the yearly estimate of a country's quality relating to control of corruption.	Worldbank	(+)
Government Effectiveness	Government Effectiveness is the yearly estimate of a country's quality relating to government effectiveness.	Worldbank	(+)
Political Stability	Political Stability is the yearly estimate of a country's quality relating to political stability.	Worldbank	(+)
Rule of Law	Rule of Law is the yearly estimate of a country's quality relating to rule of law.	Worldbank	(+)
Regulatory Quality	Regulatory Quality is the yearly estimate of a country's quality relating to regulatory quality.	Worldbank	(+)
Voice and Accountability	Voice and Accountability is the yearly estimate of a country's quality relating to voice and accountability.	Worldbank	(+)
Stock Price Volatility	Stock Price Volatility is the average of the 360-day volatility of the national stock market index.	Worldbank	(−)

Table 4. *(continued)*

Variable	Definition	Source	Expected Sign
Panel C: Country-Level Variables			
Low C-Efficiency Ratio	C-Efficiency Ratio is an estimate of a country's VAT Collection Efficiency and is computed as the ratio between VAT revenue over the aggregate consumption and the standard VAT rate, i.e., the ratio between effective VAT rate and standard VAT rate. Low C-Efficiency Ratio is a dummy variable equal to one if the firm is below the bottom tercile of C-Efficiency ratio in the respective country-year.	Eurostat	(−)*
High Shadow Economy	Shadow Economy is the yearly estimate of the level of Shadow Economy in a country, according with Medina, and Schneider (2017). High Shadow Economy is a dummy variable equal to one if the firm is over the top tercile of Shadow Economy ratio in the respective country-year.	Medina, and Schneider (2017)	(−)*

*Expected sign for the interaction with the VAT Rate Variable.

3.3. Methodology

According to Jacob, Michaely and Müller (2016), we estimate the following panel data baseline model (1), based on a firm-level regression with firm and year fixed effects:

$$Inv_{i,j,t} = \alpha_0 + \beta_1 VAT\ Rate_{j,t} + \beta_2 Corporate\ Tax\ Rate_{j,t} + \beta_3 Wage\ Tax\ Rate_{j,t} +$$
$$\beta_4 Dividend\ Tax\ Rate_{j,t} + \delta \Pi_{j,t} + \gamma X_{i,j,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}$$

[Equation (1)]

where $Inv_{i,j,t}$ is investment of firm *i* in year *t* in country *j*; α_0 is a constant; $VAT\ Rate_{j,t}$ is our main explanatory variable, which is the nominal value added tax on consumer goods by private households in the respective country *j*, in year *t*; $Corporate\ Tax\ Rate_{j,t}$ is the top marginal corporate tax rate in country *j* in year *t*; $Wage\ Tax\ Rate_{j,t}$ is the top marginal individual income tax rate on labour income in country *j* in year *t*; $Dividend\ Tax\ Rate_{j,t}$ is the top marginal dividend tax rate in country *j* in year *t*; $\Pi_{j,t}$ is an extensive set of country-level control variables, mentioned in point 3.2.; $X_{i,j,t}$ is a set of firm-level control variables, also mentioned in point 3.2.; α_i and α_t are, respectively, firm fixed effects and year fixed effects and, finally, $\varepsilon_{i,t}$ is the white noise term.

Following Jacob, Michaely and Müller (2016), the inclusion of firm fixed effects allows that estimates are not resulting from time-invariant cross-country differences, since country level variables are only identified through changes over time. By including fixed effects, we are controlling for the average differences across firms and years, considering the unobservable factors, since it allows to reduce the omitted variable bias. We estimate our models using Eviews software (Version 10). After running the Hausman Test, we find that it would be more appropriate to include fixed effects instead of random ones.

To present more robust results, our variables are winsorized at 1%, 1.5% or 2%, according to the specifications of each one. Our statistical inference is based on White period robust standard errors.

To estimate our hypotheses H2, H3, H4 and H6, we add to the baseline equation (1) a dummy variable, interacting with the four tax variables, as equation (2) shows:

$$Inv_{i,j,t} = \alpha_0 + \beta_1 VAT\ Rate_{j,t} + \beta_2 Corporate\ Tax\ Rate_{j,t} + \beta_3 Wage\ Tax\ Rate_{j,t} + \beta_4 Dividend\ Tax\ Rate_{j,t} + \beta_5 VAT\ Rate_{j,t} * Dummy + \beta_6 Corporate\ Tax\ Rate_{j,t} * Dummy + \beta_7 Wage\ Tax\ Rate_{j,t} * Dummy + \beta_8 Dividend\ Tax\ Rate_{j,t} * Dummy + \delta\Pi_{j,t} + \gamma X_{i,j,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}$$

[Equation (2)]

where $Dummy = Low\ Cash\ Firms$ for H2, $Dummy = Low\ Profit\ Margin$ for H3, $Dummy = Low\ International\ Sales$ for H4 and $Dummy = High\ Shadow\ Economy$ for H6.

To estimate our hypothesis H5, we add to the baseline equation (1) a dummy variable, interacting with VAT Rate variable, which results in equation (3):

$$Inv_{i,j,t} = \alpha_0 + \beta_1 VAT\ Rate_{j,t} + \beta_2 Corporate\ Tax\ Rate_{j,t} + \beta_3 Wage\ Tax\ Rate_{j,t} + \beta_4 Dividend\ Tax\ Rate_{j,t} + \beta_5 VAT\ Rate_{j,t} * Dummy + \delta\Pi_{j,t} + \gamma X_{i,j,t} + \alpha_i + \alpha_t + \varepsilon_{i,t}$$

[Equation (3)]

where $Dummy = Low\ C - Efficiency$ for H5.

In the next chapter, we will analyse descriptive statistics for tax, firm and country variables and then present the estimation outputs of the regressions, with their respective interpretation.

Chapter 4

Results

In this chapter, we present the main results of our estimation models. The chapter is presented as follows: first, we present the univariate results, with a brief analysis of the descriptive statistics, and second, the multivariate results, with the main findings related to our estimation hypotheses.

4.1. Univariate Results

Table 5 presents the descriptive statistics for the tax, firm and country level variables. We present the mean, standard deviation, 1st quartile, median and 3rd quartile, as well as the number of observations for each variable for the period covered between 2004 and 2015.

Panel A of Table 5 summarizes the descriptive statistics of the tax variables. VAT Rates are on average 20,35% and don't vary much in our sample from 19,00% (1st Quartile) to 22,00% (3rd Quartile). Hungary is the country with the highest VAT standard rate in our sample (27,00%, since 2012), contrarily to Cyprus and Luxembourg, the countries with the lowest VAT standard rates (15,00%, until 2011 and 2014, respectively), as stated in Table 3 presented in Chapter 3.

In Panel B, we summarize firm-level control variables. On average, firms have capital expenditures of 4,45% of their lagged total assets, i.e. their investment levels. On average, firms hold about 12% of their assets as cash and have a total debt to total assets ratio of about 20%. Sales grow from *t-1* to *t* by about 7% and firms have average operating profits of 1,86% total assets. More than 40% of the firms' sales are foreign sales and, on average, firms present negative profit margins.

Panel C presents summary statistics on country-level variables. Countries have, on average, a GDP growth of 1,62% and an inflation rate of around 2%. The VAT Collection Efficiency ratio is, on average, over 60% and the levels of Shadow Economy are below 20% of the country's GDP.

Table 5 – Descriptive Statistics and Correlations

This table presents descriptive statistics and correlations for our variables for the period covered between 2004 and 2015. Panel A presents summary statistics for the tax variables. Panel B presents statistics on firm-level variables and Panel C presents statistics on country-level variables. Panel D presents correlations between the most relevant variables. Variables are defined in Table 4 presented in Chapter 3.

Variable	Mean	Std. Dev.	1st Quart.	Median	3rd Quart.	Obs.
Panel A: Tax Variables						
VAT Rate	0.2035	0.0261	0.1900	0.2000	0.2200	50 916
Corporate Tax Rate	0.2711	0.0685	0.2200	0.2800	0.3129	50 916
Dividend Tax Rate	0.2854	0.1103	0.1900	0.3000	0.3750	49 911
Wage Tax Rate	0.4464	0.0971	0.4000	0.4544	0.5023	50 916
Panel B: Firm-Level Variables						
Investment	0.0445	0.0561	0.0094	0.0262	0.0572	35 399
Cash	0.1253	0.1902	0.0203	0.0608	0.1477	31 032
Operating Profit	0.0186	0.2479	- 0.0031	0.0536	0.1114	36 315
Sales Growth	0.0694	0.5407	- 0.0454	0.1634	0.1742	35 738
Leverage	0.1990	0.1874	0.0275	0.1634	0.3133	41 172
Size	18.2976	2.4603	16.6488	18.1424	19.8350	41 588
Interest Rate	0.0898	0.2142	0.0254	0.0490	0.0777	39 823
Price	11.6600	21.9196	0.8800	3.4800	11.9500	37 170
Foreign Sales	0.4143	0.3400	0.0519	0.3979	0.7136	24 990
Profit Margin	- 0.0164	0.4641	0.0000	0.0514	0.1116	39 189
Panel C: Country-Level Variables						
Ln (GDP per capita)	10.3968	0.5584	10.3265	10.6080	10.7005	50 916
GDP Growth	0.0162	0.0280	0.0060	0.0197	0.0310	50 916
Inflation	0.0197	0.0175	0.0105	0.0178	0.0256	50 916
Control of Corruption	1.3269	0.7680	0.5908	1.5845	1.8594	50 916
Government Effectiveness	1.3415	0.5832	0.8344	1.5436	1.7370	50 916
Political Stability	0.6217	0.3785	0.3785	0.5570	0.9247	50 916
Rule of Law	1.3359	0.5981	0.8598	1.6158	1.7614	50 916
Regulatory Quality	1.3582	0.4224	1.0396	1.4951	1.7356	50 916
Voice and Accountability	1.2411	0.3065	1.0492	1.3067	1.4370	50 916
Stock Price Volatility	0.2074	0.0799	0.1472	0.1921	0.2524	49 394
C-Efficiency Ratio	0.6224	0.1125	0.5302	0.6247	0.6829	50 916
Shadow Economy	0.1829	0.0579	0.1335	0.1590	0.2296	50 916

Table 5. *(continued)*

This table presents descriptive statistics and correlations for our variables for the period covered between 2004 and 2015. Panel A presents summary statistics for the tax variables. Panel B presents statistics on firm-level variables and Panel C presents statistics on country-level variables. Panel D presents correlations between the most relevant variables. Variables are defined in Table 4 presented in Chapter 3.

	VAT Rate	Corporate Tax Rate	Dividend Tax Rate	Wage Tax Rate	Cash	Investment	International Sales	Profit Margin	C-Efficiency Ratio	Shadow Economy
Panel D - Spearman (above) and Pearson (*below*) correlations										
VAT Rate	1									
	1									
Corporate Tax Rate	-0,4628	1								
	-0,4177	*1*								
Dividend Tax Rate	-0,2173	0,0951	1							
	-0,1859	*0,1203*	*1*							
Wage Tax Rate	0,4201	0,1289	0,1703	1						
	0,3656	*0,2127*	*0,3174*	*1*						
Cash	-0,1007	0,0062	0,1980	0,0506	1					
	-0,0884	*-0,0254*	*0,1528*	*0,0208*	*1*					
Investment	-0,0181	0,0412	-0,0439	-0,0251	-0,0536	1				
	-0,0263	*-0,0037*	*-0,0271*	*-0,0625*	*-0,0339*	*1*				
International Sales	0,0263	0,0467	0,0233	0,1655	0,0777	0,0997	1			
	0,0466	*0,0398*	*0,0472*	*0,1735*	*-0,0144*	*0,0132*	*1*			
Profit Margin	-0,0158	0,0076	-0,0040	-0,0267	0,0574	0,1679	0,0775	1		
	0,0189	*0,0068*	*-0,0525*	*-0,0135*	*-0,1151*	*0,0816*	*0,0505*	*1*		
C-Efficiency Ratio	-0,5431	0,1752	0,1712	-0,1551	0,1213	0,0700	0,0296	0,0002	1	
	-0,7176	*0,3448*	*0,2306*	*-0,0832*	*0,0776*	*0,0149*	*0,0065*	*-0,0248*	*1*	
Shadow Economy	0,4799	0,1568	-0,5429	0,1853	-0,2188	0,0193	-0,0055	-0,0074	-0,5778	1
	0,3807	*0,0292*	*-0,6534*	*-0,0053*	*-0,1747*	*-0,0214*	*-0,0484*	*0,0381*	*-0,4204*	*1*

Panel D presents Pearson and Spearman correlations for the most relevant variables. For example, the correlation between VAT Rate and Investment is negative (both Spearman and Pearson), as suggested in our Hypothesis H1.

4.2. Multivariate Results

4.2.1. Main Results – Value Added Tax and Corporate Investment

Table 6 presents coefficient estimates from estimating our baseline Equation (1). We use four different samples in our estimations. In Column (1), we use the full sample, without restrictions. In Column (2), we exclude all the countries with less than 200 observations in our sample, since some countries have only few observations. As mentioned in Table 2 of Chapter 3, we exclude Czech Republic, Estonia, Latvia, Luxembourg, Malta and Slovakia. In Column (3), we exclude the smallest firms with Total Assets below EUR 10 million. Finally, in Column (4), we exclude all the countries that didn't suffer a change in their VAT Standard Rate in the 2004-2015 period. This means we exclude Austria, Belgium, Bulgaria, Denmark, Malta and Sweden, as stated in Table 3 of Chapter 3. The results on Columns (2), (3) and (4) are similar to the ones on Column (1), so we will base our analysis on the first column.

Consistent with our prediction in Hypothesis 1 (H1), we find that an increase in VAT Standard Rate affects firms' investment negatively. Using the coefficient estimations from Column (1), we find that a one percentage point increase in the VAT Rate decreases firms' investments by 4.53% (=-0.2014/0.0445[5]) of the sample average. Additionally, we also document significant effects of the Corporate Tax Rate and Wage Tax Rate variables on firms' investment. Consistent with prior literature, we find a negative relationship between corporate taxes and firms' investment. A one percentage point increase in the Corporate Tax Rate reduces Corporate Investment by 1.37% of average investment (=-0.0611/0.0445). Contrarily, we find a positive effect of Wage Tax Rate: a one percentage point increase in the Wage Tax Rate increases firm's investments by 2.17% of average investment (=0.0988/0.0455). This result is consistent with a substitution effect, when firms, on average, substitute capital with labour, as the marginal price on labour input increases following an increase in the wage taxes. The effect of Dividend Tax Rate on firms' investments is not statistically significant. The results on the control variables are in line with our expectations: for example, at the firm level, Cash holdings, Sales Growth, Operating Profits and Leverage have a positive impact on firms' investments. At the country level, GDP Growth and Control of Corruption also have a positive impact on firms' investments.

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[5] Investment sample average (see Panel B of Table 5).

Table 6 – VAT Rate and Corporate Investments

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. The estimation includes firm and year fixed effects. We report robust White period standard errors in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 Obs.	Countries with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Constant	0.1635	0.1503	0.2456	0.1048
	(0.2084)	(0.2120)	(0.2137)	(0.2268)
VAT Rate	**-0.2014****	**-0.1729****	**-0.2290*****	**-0.2032****
	(0.0797)	**(0.0791)**	**(0.0835)**	**(0.0877)**
Corporate Tax Rate	-0.0611**	-0.0521*	-0.0614**	-0.0746**
	(0.0286)	(0.0287)	(0.0297)	(0.0309)
Dividend Tax Rate	0.0053	0.0042	0.0099	0.0017
	(0.0150)	(0.0151)	(0.0152)	(0.0162)
Wage Tax Rate	0.0988***	0.0995***	0.0927***	0.0905***
	(0.0266)	(0.0270)	(0.0275)	(0.0285)
Cash	0.0308***	0.0308***	0.0321***	0.0314***
	(0.0066)	(0.0066)	(0.0085)	(0.0071)
Operating Profit	0.0247**	0.0237**	0.0476***	0.0271***
	(0.0097)	(0.0097)	(0.0141)	(0.0103)
Sales Growth	0.0118***	0.0119***	0.0131***	0.0120***
	(0.0025)	(0.0026)	(0.0032)	(0.0027)
Leverage	0.0168*	0.0165*	0.0141	0.0183*
	(0.0088)	(0.0088)	(0.0096)	(0.0097)
Size	0.0033*	0.0034*	0.0024	0.0029
	(0.0019)	(0.0019)	(0.0024)	(0.0021)
Price	0.0001***	0.0001***	0.0000+**	0.0001**
	(0.0000+)	(0.0000+)	(0.0000+)	(0.0000+)
Interest Rate	-0.0015	-0.0017	-0.0021	-0.0009
	(0.0036)	(0.0037)	(0.0040)	(0.0040)
Ln (GDP *per capita*)	-0.0130	-0.0136	-0.0191	-0.0038
	(0.0194)	(0.0199)	(0.0198)	(0.0216)
GDP Growth	0.1091***	0.1163***	0.1017***	0.1015***
	(0.0321)	(0.0329)	(0.0339)	(0.0343)
Control of Corruption	0.0100*	0.0102*	0.0081	0.0061
	(0.0056)	(0.0057)	(0.0056)	(0.0068)
Gov. Effectiveness	-0.0023	-0.0037	-0.0003	-0.0064
	(0.0054)	(0.0053)	(0.0056)	(0.0067)
Political Stability	-0.0089**	-0.0099**	-0.0070*	-0.0097**
	(0.0042)	(0.0041)	(0.0042)	(0.0043)
Rule of Law	-0.0166*	-0.0148	-0.0198**	-0.0119
	(0.0096)	(0.0097)	(0.0099)	(0.0117)
Regulatory Quality	0.0119	0.0141*	0.0110	0.0079
	(0.0080)	(0.0081)	(0.0082)	(0.0102)

Table 6. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 Obs.	Countries with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Voice and Account.	-0.0339**	-0.0299**	-0.0252*	-0.0430***
	(0.0133)	(0.0132)	(0.0130)	(0.0167)
Inflation	0.3645***	0.3447***	0.3599***	0.3959***
	(0.0794)	(0.0844)	(0.0805)	(0.0893)
Stock Price Volatility	-0.0256	-0.0140	-0.0266	-0.0331
	(0.0192)	(0.0196)	(0.0194)	(0.0207)
R-squared	0.4696	0.4706	0.4779	0.4657
Adjusted R-squared	0.3846	0.3858	0.3945	0.3813
Observations	25 014	24 703	22 968	21 800

4.2.2. Firm Heterogeneity: Supply Elasticity and the Burden of Tax

A partial equilibrium analysis suggests the burden of the tax depends on supply and demand elasticities. Table 7 presents coefficient estimates from estimating our Equation (2), with **Dummy = Low Cash Firms** as a proxy for low supply elasticity. The effect of demand elasticity will be presented on Table 8 of point 4.2.3.. The four columns correspond to the four different samples described in point 4.2.1.. We predicted in our Hypothesis 2 (H2) that cash-poor firms (represented by **Low Cash Firms** variable) would suffer a more negative effect on their investments, after an increase in VAT Standard Rate, compared with cash-rich firms. We expected this to happen, because we assumed cash-poor firms would have more difficulties in shifting a greater portion of the price increase due to the VAT Rate change to consumers.

Although the sign of the coefficient of the interaction variable **VAT Rate*Low Cash Firms** is negative in all the reported columns, the variable is not statistically significant in any of them. Thus, we don't find empirical evidence supporting H2, contrarily to Jacob, Michaely, and Müller (2016) who found that a one percentage point increase in consumption tax decreased cash-poor firms' investments by 2.12%, and only by 1.28% in the case of cash-rich firms.

Table 7 – VAT Rate and Corporate Investments, with Low Cash Holdings

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is below the bottom tercile of cash to assets ratio in the respective country-year (*Low Cash Firms*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1) Baseline	(2) Countries with more than 200 Obs.	(3) Countries with at least EUR 10M Total Assets	(4) Countries with changes in VAT Rate
Constant	0.1559	0.1444	0.2350	0.0885
	(0.2072)	(0.2107)	(0.2124)	(0.2256)
VAT Rate	**-0.2013****	**-0.1775****	**-0.2243****	**-0.2022****
	(0.0842)	**(0.0836)**	**(0.0886)**	**(0.0919)**
Corporate Tax Rate	-0.0779***	-0.0692**	-0.0783**	-0.1031***
	(0.0298)	(0.0298)	(0.0311)	(0.0331)
Dividend Tax Rate	0.0127	0.0116	0.0198	0.0129
	(0.0171)	(0.0173)	(0.0174)	(0.0178)
Wage Tax Rate	0.0990***	0.1014***	0.0893***	0.0917***
	(0.0312)	(0.0317)	(0.0325)	(0.0340)
VAT Rate*Low Cash Firms	**-0.0132**	**-0.0029**	**-0.0186**	**-0.0177**
	(0.0486)	**(0.0484)**	**(0.0522)**	**(0.0482)**
Corp. Tax Rate*Low Cash Firms	0.0345	0.0339	0.0328	0.0587**
	(0.0214)	(0.0214)	(0.0223)	(0.0253)
Div. Tax Rate*Low Cash Firms	-0.0148	-0.0151	-0.0215	-0.0226
	(0.0177)	(0.0177)	(0.0182)	(0.0169)
Wage Tax Rate*Low Cash Firms	-0.0116	-0.0154	-0.0040	-0.0208
	(0.0272)	(0.0274)	(0.0290)	(0.0287)
Cash	0.0287***	0.0287***	0.0298**	0.0291***
	(0.0067)	(0.0068)	(0.0089)	(0.0073)
Operating Profit	0.0246**	0.0236**	0.0472***	0.0271***
	(0.0097)	(0.0097)	(0.0140)	(0.0103)
Sales Growth	0.0117***	0.0119***	0.0130***	0.0120***
	(0.0025)	(0.0026)	(0.0032)	(0.0027)
Leverage	0.0171*	0.0167*	0.0144	0.0186*
	(0.0088)	(0.0088)	(0.0096)	(0.0097)
Size	0.0032*	0.0033*	0.0023	0.0028
	(0.0019)	(0.0019)	(0.0023)	(0.0021)
Price	0.0001***	0.0001***	0.0000+**	0.0001**
	(0.0000+)	(0.0000+)	(0.0000+)	(0.0000+)

Table 7. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is below the bottom tercile of cash to assets ratio in the respective country-year (*Low Cash Firms*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) |
	Baseline	Countries with more than 200 Obs.	Countries with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Interest Rate	-0.0015	-0.0017	-0.0021	-0.0008
	(0.0036)	(0.0037)	(0.0040)	(0.0040)
Ln (GDP per capita)	-0.0118	-0.0126	-0.0177	-0.0014
	(0.0193)	(0.0197)	(0.0197)	(0.0215)
GDP Growth	0.1012***	0.1079***	0.0945***	0.0877**
	(0.0321)	(0.0328)	(0.0338)	(0.0345)
Control of Corruption	0.0100*	0.0103*	0.0082	0.0060
	(0.0056)	(0.0056)	(0.0055)	(0.0068)
Government Effectiveness	-0.0017	-0.0031	0.0003	-0.0055
	(0.0054)	(0.0053)	(0.0056)	(0.0066)
Political Stability	-0.0091**	-0.0100**	-0.0072*	-0.0099**
	(0.0041)	(0.0041)	(0.0042)	(0.0043)
Rule of Law	-0.0173*	-0.0156	-0.0205**	0.396031
	(0.0096)	(0.0097)	(0.0100)	0.089379
Regulatory Quality	0.0113	0.0136*	0.0104	0.0061
	(0.0080)	(0.0081)	(0.0083)	(0.0102)
Voice and Accountability	-0.0335**	-0.0295**	-0.0250*	-0.0429**
	(0.0133)	(0.0131)	(0.0130)	(0.0167)
Inflation	0.3631***	0.3432***	0.3587***	0.3960***
	(0.0795)	(0.0843)	(0.0806)	(0.0894)
Stock Price Volatility	-0.0223	-0.0106	-0.0225	-0.0268
	(0.0191)	(0.0194)	(0.0195)	(0.0206)
R-squared	0.4698	0.4709	0.4782	0.4661
Adjusted R-squared	0.3847	0.3860	0.3947	0.3817
Observations	25 014	24 703	22 968	21 800

4.2.3. Firm Heterogeneity: Demand Elasticity and the Burden of Tax

As stated in point 4.2.2., we are now considering demand elasticity effects. In Table 8, we present the results from estimating Equation (2) with **Dummy = Low Profit Margin** as a proxy for high demand elasticity. The four columns correspond to the four different samples described in point 4.2.1.

In our Hypothesis 3 (H3), we predict that investments of firms with low profit margins react more negatively to an increase in VAT Standard Rate than those of more profitable firms. We will focus our attention on the interaction variable **VAT Rate*Low Profit Margin** of Table 8. The coefficient of this variable is negative in all the reported columns, and the interaction is highly significant. Taking the joint effect of Column (1), a one percentage point increase in VAT Standard Rate decreases low profit firms' investments by 5.99% of average investment (=-0.2727/0.0455), and only by 3,59% (=-0.1633/0.0455) in the case of high profit firms, which supports H3. The difference in responsiveness of the firms is statistically significant. These results are consistent with the notion that high profit margin firms face less elastic demand than low profit margin firms. Contrarily to supply, we show that demand elasticity has a significant impact on firms' investment responses to a VAT Rate change.

Table 8 - VAT Rate and Corporate Investments, with Low Profit Margin

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is below the bottom tercile of profit margin (EBIT/Sales) in the respective country-year (*Low Profit Margin*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Constant	0.1876	0.1727	0.2665	0.1295
	(0.2084)	(0.2118)	(0.2138)	0.2269
VAT Rate	**-0.1633****	**-0.1366***	**-0.1933****	**-0.1664***
	(0.0794)	**(0.0786)**	**(0.0827)**	**(0.0875)**
Corporate Tax Rate	-0.0599**	-0.0505*	-0.0627**	-0.0748**
	(0.0289)	(0.0289)	(0.0298)	(0.0315)
Dividend Tax Rate	-0.0012	-0.0025	0.0029	-0.0051
	(0.0159)	(0.0161)	(0.0161)	(0.0171)

Table 8. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is below the bottom tercile of profit margin (EBIT/Sales) in the respective country-year (*Low Profit Margin*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 obs.	Firms with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Wage Tax Rate	0.0901***	0.0912***	0.0854***	0.0824***
	(0.0275)	(0.0280)	(0.0280)	(0.0298)
VAT Rate*Low Profit Margin	**-0.1094***	**-0.1035**	**-0.1086**	**-0.1100***
	(0.0411)	**(0.0427)**	**(0.0427)**	**(0.0419)**
Joint Effect VAT Rate	**-0.2727***	**-0.2401***	**-0.3019***	**-0.2764***
t-statistic	**[3.3572]**	**[2.9831]**	**[3.4205]**	**[3.1583]**
Corp. Tax Rate*Low Profit Margin	-0.0040	-0.0058	0.0074	-0.0012
	(0.0219)	(0.0222)	(0.0241)	(0.0242)
Div. Tax Rate*Low Profit Margin	0.0301*	0.0311*	0.0355**	0.0319*
	(0.0162)	(0.0163)	(0.0171)	(0.0172)
Wage Tax Rate*Low Profit Margin	0.0230	0.0208	0.0201	0.0212
	(0.0230)	(0.0237)	(0.0244)	(0.0242)
Cash	0.0305***	0.0304***	0.0322***	0.0311***
	(0.0065)	(0.0065)	(0.0085)	(0.0071)
Operating Profit	0.0211*	0.0202*	0.0473***	0.0242**
	(0.0114)	(0.0115)	(0.0178)	(0.0123)
Sales Growth	0.0116***	0.0118***	0.0131***	0.0118***
	(0.0025)	(0.0026)	(0.0032)	(0.0028)
Leverage	0.0181**	0.0177**	0.0148	0.0195**
	(0.0087)	(0.0087)	(0.0094)	(0.0095)
Size	0.0032*	0.0033*	0.0022	0.0028
	(0.0019)	(0.0019)	(0.0023)	(0.0021)
Price	0.0001***	0.0001***	0.0000+**	0.0001**
	(0.0000+)	(0.0000+)	(0.0000+)	(0.0000+)
Interest Rate	-0.0015	-0.0017	-0.0021	-0.0010
	(0.0036)	(0.0036)	(0.0040)	(0.0040)
Ln (GDP per capita)	-0.0151	-0.0156	-0.0209	-0.0059
	(0.0195)	(0.0198)	(0.0199)	(0.0216)
GDP Growth	0.1049***	0.1144***	0.0990***	0.0959***
	(0.0322)	(0.0328)	(0.0343)	(0.0343)
Control of Corruption	0.0098*	0.0100*	0.0079	0.0060
	(0.0056)	(0.0057)	(0.0056)	(0.0067)

Table 8. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is below the bottom tercile of profit margin (EBIT/Sales) in the respective country-year (*Low Profit Margin*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Government Effectiveness	-0.0015	-0.0029	0.0003	-0.0054
	(0.0054)	(0.0053)	(0.0056)	(0.0067)
Political Stability	-0.0092**	-0.0102**	-0.0073*	-0.0100**
	(0.0041)	(0.0041)	(0.0042)	(0.0043)
Rule of Law	-0.0170*	-0.0150	-0.0201**	-0.0125
	(0.0097)	(0.0097)	(0.0100)	(0.0118)
Regulatory Quality	0.0123	0.0144*	0.0116	0.0083
	(0.0080)	(0.0081)	(0.0083)	0.0102
Voice and Accountability	-0.0348***	-0.0308**	-0.0258**	-0.0443***
	(0.0133)	(0.0131)	(0.0130)	(0.0167)
Inflation	0.3607***	0.3421***	0.3548***	0.3930***
	(0.0786)	(0.0840)	(0.0796)	(0.0884)
Stock Price Volatility	-0.0249	-0.0121	-0.0264	-0.0327
	(0.0192)	(0.0196)	(0.0195)	(0.0206)
R-squared	0.4703	0.4713	0.47886	0.4665
Adjusted R-squared	0.3853	0.3865	0.3951	0.3821
Observations	25 014	24 703	22 968	21 800

4.2.4. Exposure to VAT Standard Rate Changes

The next test centres on the exposure of a firm's output to domestic VAT Rate changes. Table 9 presents the regression results of estimating our Equation (2), with **Dummy = Low International Sales.** In our sample, almost 25% of the firms have low international sales. We predict, in our Hypothesis 4 (H4), that investments of firms with lower international sales (i.e., higher domestic sales) respond more negatively to an increase in VAT Rate.

We will focus our attention on the interaction variable **VAT Rate*Low International Sales** of Table 9. The coefficient of the variable is negative in all the reported columns, and the interaction is statistically significant. Analysing the joint effect, a one

percentage point increase in VAT Standard Rate decreases investments of firms with low international sales by 8.69% of average investment (=-0.3953/0.0455), and only by 5.61% (=-0.2554/0.0455) in the case of firms with higher levels of international sales. The difference in responsiveness of the firms is statistically significant and the results are consistent with H4. Jacob, Michaely and Müller (2016) showed that firms with low domestic sales did not respond to changes in the domestic consumption taxes. Contrarily to them, we show that even the investments of firms with low levels of domestic sales respond negatively to changes in domestic VAT Standard Rate. In fact, this finding is closer to the reality of the firms sales dynamics: it is plausible that a firm who sells a large portion of their output abroad is also affected by changes in the VAT Rate in its home country. Since the firm does not sell 100% of its production internationally, it may face the domestic demand changes, as a result of the increase of the domestic VAT Rate, which will have implications on its investments.

Table 9 - VAT Rate and Corporate Investments, with Low International Sales

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm's ratio of international sales is below 7,5% of the median ratio of total firms (*Low International Sales*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 obs.	Firms with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Constant	0.2770	0.2803	0.2809	0.1336
	(0.1968)	(0.1964)	(0.1983)	(0.1946)
VAT Rate	-0.2554***	-0.2192***	-0.2731***	-0.2684***
	(0.0789)	(0.0753)	(0.0789)	(0.0836)
Corporate Tax Rate	-0.0720***	-0.0603*	-0.0609*	-0.0867**
	(0.0325)	(0.0320)	(0.0330)	(0.0360)
Dividend Tax Rate	0.0246	0.0232	0.0255	0.0188
	(0.0162)	(0.0163)	(0.0163)	(0.0178)
Wage Tax Rate	0.0821***	0.0800***	0.0787***	0.0757**
	(0.0286)	(0.0288)	(0.0291)	(0.0315)
VAT Rate*Low International Sales	-0.1399*	-0.1476*	-0.1396*	-0.1553**
	(0.0731)	(0.0794)	(0.0772)	(0.0743)
Joint Effect VAT Rate	-0.3953***	-0.3668***	-0.4127***	-0.4237***
t-statistic	[3.5892]	[3.3257]	[3.7197]	[3.4800]
Corp. Tax Rate*Low International Sales	0.0460	0.0452	0.0281	0.0350
	(0.0357)	(0.0361)	(0.0362)	(0.0377)

Table 9. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm's ratio of international sales is below 7,5% of the median ratio of total firms (*Low International Sales*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Div. Tax Rate*Low International Sales	-0.0460	-0.0470	-0.0449	-0.0586
	(0.0326)	(0.0330)	(0.0338)	(0.0372)
Wage Tax Rate*Low International Sales	0.0683	0.0730	0.0757	0.0931*
	(0.0458)	(0.0478)	(0.0476)	(0.0511)
Cash	0.0241***	0.0243***	0.0253**	0.0239***
	(0.0074)	(0.0074)	(0.0098)	(0.0079)
Operating Profit	0.0125	0.0117	0.0360**	0.0147
	(0.0114)	(0.0114)	(0.0154)	(0.0123)
Sales Growth	0.0098***	0.0101***	0.0094***	0.0103***
	(0.0020)	(0.0021)	(0.0019)	(0.0022)
Leverage	0.0189***	0.0185**	0.0203*	0.0219**
	(0.0089)	(0.0089)	(0.0103)	(0.0099)
Size	0.0045**	0.0042**	0.0037	0.0045**
	(0.0019)	(0.0019)	(0.0024)	(0.0021)
Price	0.0001***	0.0001***	0.0001***	0.0000+***
	(0.0000+)	(0.0000+)	(0.0000+)	(0.0000+)
Interest Rate	-0.0027	-0.0028	-0.0048**	-0.0025
	(0.0019)	(0.0019)	(0.0019)	(0.0021)
Ln (GDP per capita)	-0.0253	-0.0269	-0.0239	-0.0072
	(0.0182)	(0.0182)	(0.0182)	(0.0185)
GDP Growth	0.1417***	0.1489***	0.1237***	0.1363***
	(0.0416)	(0.0395)	(0.0427)	(0.0450)
Control of Corruption	0.0111**	0.0115**	0.0099*	0.0016
	(0.0055)	(0.0056)	(0.0053)	(0.0069)
Government Effectiveness	0.0031	0.0009	0.0029	-0.0033
	(0.0057)	(0.0055)	0.0057	(0.0073)
Political Stability	-0.0079*	-0.0082	-0.0063	-0.0085**
	(0.0041)	(0.0041)	(0.0041)	(0.0043)
Rule of Law	-0.0213**	-0.0203**	-0.0243**	-0.0174
	(0.0102)	0.010198	(0.0103)	(0.0116)
Regulatory Quality	0.0130	0.0151*	0.0137	0.0140
	(0.0085)	(0.0085)	(0.0086)	(0.0113)

Table 9. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm's ratio of international sales is below 7,5% of the median ratio of total firms (*Low International Sales*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 obs.	Firms with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Voice and Accountability	-0.0298	-0.0238**	-0.0284**	-0.0453***
	(0.0121)	(0.0118)	(0.0121)	(0.0166)
Inflation	0.3881***	0.3245***	0.3790***	0.4170***
	(0.0813)	(0.0705)	(0.0825)	(0.0932)
Stock Price Volatility	-0.0278	-0.0196	-0.0256	-0.0414
	(0.0266)	(0.0275)	(0.0269)	(0.0280)
R-squared	0.4848	0.4884	0.5040	0.4740
Adjusted R-squared	0.3957	0.3999	0.4187	0.3838
Observations	20 347	20 194	19 054	17 625

4.2.5. Low VAT Collection Efficiency Impact

The subject of VAT Collection Efficiency has been widely studied, due to the strong connection between VAT and Consumption and its possible effects. Therefore, we suggested, when specifying our Hypothesis 5 (H5), firms located in countries with lower VAT Collection Efficiency would be more negatively affected by an increase in VAT Rate, than firms from countries with higher VAT Collection Efficiency. Table 10 presents the regression results of estimating our Equation (3), with **Dummy = Low C-Efficiency**.

The most important coefficient is the one of the interaction variable **VAT Rate*Low C-Efficiency** of Table 10. The coefficient is negative in all the reported columns, and the interaction is statistically significant. Considering the joint effect, a one percentage point increase in VAT Standard Rate decreases investments of firms located in countries with low VAT Collection Efficiency by 3.76% of average investment (=-0.1710/0.0455), and by 3.30% (=-0.1502/0.0455) in the case of firms from countries with higher VAT Collection Efficiency. The difference in responsiveness of the firms is statistically significant and the results support the prediction made in H5 as one of our main contributions for literature.

Table 10 – VAT Rate and Corporate Investments, with Low VAT Collection Efficiency

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact VAT Rate variable with a dummy variable equal to one if the firm is below the bottom tercile of c-efficiency ratio in the respective country-year (*Low C-Efficiency*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Constant	0.1367	0.1221	0.2171	0.0789
	(0.2081)	(0.2117)	0.2129	(0.2272)
VAT Rate	**-0.1502***	**-0.1162**	**-0.1722***	**-0.1479**
	(0.0845)	**(0.0837)**	**(0.0884)**	**(0.0942)**
Corporate Tax Rate	-0.0550*	-0.0453	-0.0547*	-0.0678**
	(0.0291)	(0.0291)	(0.0302)	(0.0314)
Dividend Tax Rate	0.0056	0.0045	0.0102	0.0019
	(0.0150)	(0.0151)	(0.0152)	(0.0162)
Wage Tax Rate	0.1013***	0.1021***	0.0952***	0.0917***
	(0.0265)	(0.0270)	(0.0273)	(0.0285)
VAT Rate*Low C-Efficiency	**-0.0208***	**-0.0228****	**-0.0233***	**-0.0201***
	(0.0115)	**(0.0115)**	**(0.0120)**	**(0.0117)**
Joint Effect VAT Rate	**-0.1710***	**-0.1390***	**-0.1955***	**-0.1680***
t-statistic	**[2.8298]**	**[2.6833]**	**[3.1629]**	**[2.5671]**
Cash	0.0308***	0.0307***	0.0321***	0.0313***
	(0.0066)	(0.0066)	(0.0085)	(0.0071)
Operating Profit	0.0246**	0.0236**	0.0474***	0.0270***
	(0.0097)	(0.0097)	(0.0140)	(0.0103)
Sales Growth	0.0118***	0.0120***	0.0132***	0.0121***
	(0.0025)	(0.0026)	(0.0032)	(0.0027)
Leverage	0.0167*	0.0164*	0.0140	0.0182*
	(0.0088)	(0.0088)	(0.0096)	(0.0097)
Size	0.0033*	0.0034*	0.0024	0.0029
	(0.0019)	(0.0019)	(0.0024)	(0.0021)
Price	0.0001***	0.0001***	0.0001**	0.0001**
	(0.0000+)	(0.0000+)	(0.0000+)	(0.0000+)
Interest Rate	-0.0015	-0.0017	-0.0022	-0.0009
	(0.0036)	(0.0037)	(0.0040)	(0.0040)
Ln (GDP per capita)	-0.0117	-0.0124	-0.0178	-0.0027
	(0.0195)	(0.0199)	(0.0198)	(0.0216)
GDP Growth	0.1110***	0.1194***	0.1031***	0.1045***
	(0.0321)	(0.0329)	(0.0339)	(0.0343)

Table 10. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact VAT Rate variable with a dummy variable equal to one if the firm is below the bottom tercile of c-efficiency ratio in the respective country-year (*Low C-Efficiency*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Control of Corruption	0.0096*	0.0098*	0.0078	0.0057
	(0.0056)	(0.0057)	(0.0056)	(0.0068)
Government Effectiveness	-0.0036	-0.0050	-0.0017	-0.0081
	(0.0055)	(0.0054)	(0.0057)	(0.0069)
Political Stability	-0.0110**	-0.0122***	-0.0093**	-0.0116**
	(0.0044)	(0.0044)	(0.0044)	(0.0045)
Rule of Law	-0.0129	-0.0107	-0.0160	-0.0077
	(0.0096)	(0.0097)	(0.0099)	(0.0118)
Regulatory Quality	0.0091	0.0110	0.0081	0.0043
	(0.0076)	(0.0078)	(0.0079)	(0.0098)
Voice and Accountability	-0.0305**	-0.0261**	-0.0215*	-0.0388**
	(0.0130)	(0.0128)	(0.0127)	(0.0163)
Inflation	0.3663***	0.3465***	0.3603***	0.3988***
	(0.0794)	(0.0844)	(0.0805)	(0.0893)
Stock Price Volatility	-0.0244	-0.0124	-0.0250	-0.0311
	(0.0192)	(0.0197)	(0.0195)	(0.0207)
R-squared	0.4697	0.4708	0.4781	0.4658
Adjusted R-squared	0.3847	0.3860	0.3946	0.3815
Observations	25 014	24 703	22 968	21 800

4.2.6. Influence of High Shadow Economy

There is empirical evidence showing as the level of Shadow Economy increases, the higher is volatility in output, investment and consumption over the business cycle. For this reason, we predict in our last Hypothesis 6 (H6) that the impact of an increase in VAT Rate is more negative for firms located in countries with high levels of Shadow Economy. Table 11 presents the results of estimating Equation (2), with **Dummy = High Shadow Economy**. We look carefully to the interaction's coefficient **VAT Rate*Low C-Efficiency** of Table 11. The coefficient is negative in all the reported columns, and the interaction is highly significant. Analysing the joint-effect, a one percentage point increase in VAT

Standard Rate decreases investments of firms located in countries with high levels of Shadow Economy by 7.65% of average investment (=-0.3481/0.0455), and by 3.19% (=-0.1419/0.0455) for firms from countries with lower Shadow Economy levels. The difference in responsiveness of the firms is statistically significant. These results support H6 and highlight the importance of accounting for Shadow Economy's impacts.

Table 11 - VAT Rate and Corporate Investments, with High Shadow Economy

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is over the top tercile of Shadow Economy ratio in the respective country-year (*High Shadow Economy*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	Countries with more than 200 obs.	Firms with at least EUR 10M Total Assets	Countries with changes in VAT Rate
Constant	0.1469	0.1388	0.2329	0.0831
	(0.2115)	(0.2153)	(0.2168)	(0.2283)
VAT Rate	**-0.1419***	**-0.1190**	**-0.1781****	**-0.1200**
	(0.0817)	**(0.0814)**	**(0.0844)**	**(0.0905)**
Corporate Tax Rate	-0.1127***	-0.0970**	-0.1155**	-0.1507***
	(0.0435)	(0.0441)	(0.0450)	(0.0503)
Dividend Tax Rate	0.0278	0.0236	0.0311	0.0370*
	(0.0187)	(0.0191)	(0.0190)	(0.0211)
Wage Tax Rate	0.0432	0.0497	0.0413	0.0076
	(0.0297)	(0.0310)	(0.0306)	(0.0350)
VAT Rate*Low Cash Firms	**-0.2062*****	**-0.1794****	**-0.1956*****	**-0.2571*****
	(0.0724)	**(0.0727)**	**(0.0742)**	**(0.0837)**
Joint Effect VAT Rate	**-0.3481*****	**-0.2984*****	**-0.3737*****	**-0.3771*****
t-statistic	**[3.7249]**	**[3.1835]**	**[3.7784]**	**[3.4742]**
Corp. Tax Rate*High Shadow Econ.	0.1205**	0.1028*	0.1238**	0.1697***
	(0.0559)	(0.0565)	(0.0564)	(0.0634)
Div. Tax Rate*High Shadow Econ.	-0.0252	-0.0213	-0.0218	-0.0421
	(0.0301)	(0.0303)	(0.0302)	(0.0360)
Wage Tax Rate*High Shadow Econ.	0.0640*	0.0560	0.0568	0.0878*
	(0.0358)	(0.0359)	(0.0366)	(0.0498)
Cash	0.0310***	0.0309***	0.0323***	0.0316***
	(0.0066)	(0.0066)	(0.0085)	(0.0071)
Operating Profit	0.0248**	0.0238**	0.0476***	0.0271***
	(0.0097)	(0.0097)	(0.0141)	(0.0103)
Sales Growth	0.0117***	0.0119***	0.0130***	0.0120***
	(0.0025)	(0.0026)	(0.0032)	(0.0027)

Table 11. *(continued)*

This table presents regression results on investment behaviour over the 2004–2015 period. We use capital expenditures over prior year's total assets (*Investment*) as the dependent variable. Independent Variables are described in Table 4 of Chapter 3. We additionally interact each tax policy variable with a dummy variable equal to one if the firm is over the top tercile of Shadow Economy ratio in the respective country-year (*High Shadow Economy*). The estimation includes firm and year fixed effects. We report robust White period standard error in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
	Baseline	**Countries with more than 200 obs.**	**Firms with at least EUR 10M Total Assets**	**Countries with changes in VAT Rate**
Leverage	0.0174**	0.0170*	0.0148	0.0192**
	(0.0088)	(0.0088)	(0.0096)	(0.0096)
Size	0.0031	0.0032*	0.0022	0.0027
	(0.0019)	(0.0019)	(0.0024)	(0.0021)
Price	0.0001***	0.0001***	0.0001**	0.0001**
	(0.0000$^+$)	(0.0000$^+$)	(0.0000$^+$)	(0.0000$^+$)
Interest Rate	-0.0015	-0.0016	-0.0021	-0.0009
	(0.0036)	(0.0037)	(0.0040)	(0.0040)
Ln (GDP per capita)	-0.0089	-0.0104	-0.0155	0.0019
	(0.0198)	(0.0202)	(0.0202)	(0.0217)
GDP Growth	0.0836***	0.0930***	0.0771**	0.0577
	(0.0323)	(0.0334)	(0.0340)	(0.0358)
Control of Corruption	0.0037	0.0046	0.0019	-0.0022
	(0.0061)	(0.0062)	(0.0060)	(0.0071)
Government Effectiveness	0.0010	-0.0008	0.0030	-0.0001
	(0.0059)	(0.0058)	(0.0061)	(0.0074)
Political Stability	-0.0096**	-0.0105**	-0.0075*	-0.0097**
	(0.0041)	(0.0041)	(0.0041)	(0.0043)
Rule of Law	-0.0162*	-0.0142	-0.0196**	-0.0129
	(0.0097)	(0.0097)	(0.0099)	(0.0119)
Regulatory Quality	0.0035	0.0066	0.0026	-0.0065
	(0.0088)	(0.0090)	(0.0091)	(0.0115)
Voice and Accountability	-0.0261*	-0.0229*	-0.0170	-0.0309*
	(0.0134)	(0.0134)	(0.0132)	(0.0164)
Inflation	0.3204***	0.3042***	0.3135***	0.3524***
	(0.0767)	(0.0816)	(0.0773)	(0.0858)
Stock Price Volatility	-0.0123	-0.0024	-0.0129	-0.0172
	(0.0200)	(0.0208)	(0.0199)	(0.0226)
R-squared	0.4700	0.4710	0.4783	0.4663
Adjusted R-squared	0.3850	0.3861	0.3948	0.3819
Observations	25 014	24 703	22 968	21 800

In the last chapter, we present the concluding remarks of the paper, followed by future research guidelines and limitations of our study.

Chapter 5

Conclusions

This paper investigates the effect of Value Added Tax (VAT) Rate on corporate investments using a sample of more than 50.000 panel observations from the 28 countries of the European Union, over the 2004–2015 period. Our identification is based on numerous changes in VAT rates, spread over time and across countries. We estimate our models with the Least Squares Method, including firm and year fixed effects.

We show that firms' investments are negatively responsive to an increase in VAT Standard Rate. We find this effect economically significant and stronger for: i. firms with lower profit margins, i.e., firms facing more elastic demand; ii. firms with lower international sales, i.e., firms more exposed to the domestic demand changes, caused by an increase in VAT Rate; iii. firms located in countries with lower levels of VAT Collection Efficiency and iv. firms from countries with higher levels of Shadow Economy. We contribute to the literature by showing that both Efficiency on VAT Collection and Shadow Economy levels have a significant impact on firms' investments.

Our results have important implications for the above-mentioned debate of tax policy structure. VAT is responsible for more than a third of EU-28 tax revenues, which makes it the main tax revenue for governments. Contrarily to the convention that consumption taxes are not a burden to firms, we find empirical evidence supporting the partial equilibrium analysis, with corporate investments negatively responding to increases in VAT Standard Rates. Thereby, policymakers need to find an equilibrium between capital and consumption taxation since both have negative impacts on firms' investments. As we've shown, these fiscal policy decisions must consider the enhanced effects demonstrated in scenarios with higher Shadow Economy and VAT Collection Efficiency. The same change

in the VAT Tax Rate may produce more adverse effects for firms located in countries with higher levels of Shadow Economy or lower VAT Collection Efficiency.

It would be interesting for future research to integrate more qualitative data not present in the financial statements of firms, in order to unveil more hidden effects affecting investment decisions. Besides this, it would be of value to widen the scope of the research on VAT effects to other types of investment, such as Foreign Direct Investment.

The main limitation of our study lies in the use of a firm level sample from 28 countries, that results in an unbalanced panel. This raises the concern that our results may be driven by VAT rate changes from countries with the greatest number of observations.

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