

Essays on Tax Policy and its Effect on Firm Behaviour

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List of Abbreviations

AO	Abgabenordnung
BFH	Bundesfinanzhof
BilMoG	Bilanzrechtsmodernisierungsgesetz
BMF	Bundesministerium für Finanzen
BPO	Betriebsprüfungsordnung
BRH	Bundesrechnungshof
BVerfG	Bundesverfassungsgericht
CVCs	Corporate Venture Capitalists
EATR	Effective Average Tax Rate
EITC	Earned Income Tax Credit
EStG	Einkommensteuergesetz
ETRs	Effective Tax Rates
FES	Fiscal Equalisation Scheme
GewStG	Gewerbsteuergesetz
GG	Grundgesetz
GVCs	Governmental Venture Capitalists
HGB	Handelsgesetzbuch
IVCs	Independent Venture Capitalists
KStG	Körperschaftsteuergesetz
LC	Large Companies
MC	Medium Companies
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
RETT	Real Estate Transfer Tax

LIST OF ABBREVIATIONS

SC	Small Companies
SMEs	Small and Medium Enterprises
TBRs	Tax-back Rates
UStG	Umsatzsteuergesetz
VAT	Value-Added Tax
VC	Venture Capital
VSC	Very Small Companies

LIST OF ABBREVIATIONS

Chapter 1

Introduction

*“The art of taxation consists in so plucking the goose
as to obtain the largest possible amount of feathers
with the smallest possible amount of hissing.”*

Jean-Baptiste Colbert, finance minister of Louis XIV

One of the central issues in public finance is to find optimal tax systems. The quote of Colbert illustrates that the question of how to raise tax revenue has been of high importance to policymakers for a very long time. Since the contributions of Ramsey (1927) and Pigou (1928), a large strand of literature has tried to develop and design optimal tax policies. Different to many beliefs, administering and paying taxes causes costs for both tax administrations and taxpayers. On the one hand, tax administrations must administer and enforce the tax laws which requires financial and human resources. On the other hand, taxpayers must not only pay taxes, they must obey both tax laws and accounting rules, which leads to compliance costs. Assuming that taxpayers want to reduce their tax burden, they will react with substitution, tax evasion and avoidance activities to frictions or incentives in the tax system (e.g., Sandmo, 1981). Hence, an optimal tax system should consider both the interplay between tax administrations and taxpayers and minimise welfare losses caused by distortions of resource allocation and taxpayers' behaviour (e.g., Sandmo, 1976).

From a normative perspective, optimal tax systems should be designed in a way to guarantee efficiency and equity amongst taxpayers. Efficiency of taxation requires a tax system that minimises misallocation of resources and raises a certain level of tax revenue with the least economic or behavioural distortions (see, e.g., Sandmo, 1981; Alm, 1996). As to equity of taxation, there exists no uniform definition of an equitable system of taxation since different political or social groups will define equity of taxation differently. Generally, equity of taxation is often described as tax systems which guarantee that taxpayers with the same financial capacity carry the same tax burden (*horizontal equity*) and taxpayers with different levels of financial capacity are taxed differently (*vertical equity*) (Scotchmer and Slemrod, 1989; Slemrod, 1990; Alm, 1996).

In order to navigate the trade-off between equity and efficiency of taxation, lawmakers and tax administrations can implement different tax administrative policies and regulations. With regard to efficiency of taxation, size-dependent regulations and thresholds are one major tax instrument to guarantee this issue of taxation. In order to economise on administrative costs of collecting, administering, and enforcing the tax laws, many governments introduce preferential tax policies and regulations for smaller firms (International Tax Dialogue, 2007). However, size-dependent thresholds can induce taxpayers to adjust their behaviour and tax administrations might face unintended behavioural responses of taxpayers. Additionally, behavioural responses might cause welfare costs and an excess burden of taxation (e.g., Auerbach and Hines, 2002). One of the most important tax instruments to guarantee the normative issue of equity of taxation is tax enforcement. Since not all taxpayers are perfectly tax compliant and tax evasion exists, tax enforcement plays a crucial role to guarantee equity of taxation amongst taxpayers. Generally, tax enforcement has preventive and deterrence effects on taxpayers and can increase tax compliance rates and contribute to fair taxation (Kaplou, 1990; Andreoni, Erard and Feinstein, 1998). Therefore, optimal tax systems cannot be designed without considering optimal tax enforcement policies.

Besides the normative issues of taxation, another central question in public finance is how taxes affect investments and entrepreneurship (see, e.g., Hall and Jorgenson, 1967). Since taxes can affect investment and production decisions, a large strand of literature has analysed the impact of taxes on different forms of investments (e.g., Devereux and Griffith, 1998; Djankov et al., 2010; Zwick and Mahon, 2017). The answer to this question is central for the design of tax policies since policymakers often use tax incentives to foster investment and economic growth. Consequently, policymakers need to know whether and how firms and investors react to tax incentives in order to design appropriate tax systems.

Tax policies and taxes influence taxpayers' everyday lives, e.g., how much they should work or consume or how much tax revenue is available to fund public goods. If tax systems do not guarantee that all taxpayers have to obey the tax laws, e.g., through loopholes, exemptions in the tax code or low enforcement, taxpayers' acceptance and intrinsic motivation to comply with the tax laws can decrease. Especially, this is of high importance since there has been a growing number of publications and analyses revealing that a huge amount of tax revenue is lost each year because of tax evasion and tax avoidance. In Germany, there is an estimated annual loss in tax revenue of approximately 125 billion Euro according to the European Tax Gap (see for more information Murphy, 2019). Other scandals such as "Cum-Ex" have cost billions of Euro and shown that there is an enormous potential for improvement for German lawmakers and tax administrations to better design their tax systems and tax policies. For these reasons, this dissertation aims to contribute to provide a better understanding of how taxpayers react to tax policy instruments and tax incentives and how tax enforcement is implemented in the German states. Additionally, this work contributes to understand how tax policies can influence firms' and investors' behaviour, especially when investing in startups. By developing technological business models and shaping the economic future, startups are essential for the future economic development of Germany as a business location. Since it has been argued in the past that there is not enough innovation and entrepreneurial spirit in Germany, it is even more important for policymakers to create appropriate economic and tax frameworks which encourage entrepreneurs to take the risk of

founding their own business (see, e.g., McKinsey & Company, 2021).

This dissertation consists of three self-contained essays and contributes to find optimal tax policies by analysing different tax policy instruments and taxpayers' behavioural responses to them. Moreover, it also provides new evidence on how German firms react to administrative interventions and taxes and how tax enforcement is designed in the German sub-national states. A large part of this dissertation relies on a self-collected data set which contains information about tax enforcement in the German states. This data set is unique since information about tax enforcement at the German state level has not yet been collected or released. Additionally, this data set is complemented by tax data from the Research Data Centre of the Federal Statistical Office which differentiates this work from the majority of empirical research in taxation which uses financial data. No study has yet used tax data in such detail to analyse behavioural responses of firms and tax enforcement in Germany.

Chapter 2 of this dissertation contributes to a better understanding of how German firms react to different size-dependent tax administrative thresholds which aim to foster Small and Medium Enterprises (SMEs) and increase the efficiency of taxation. Tax administrations face the challenge to use their financial and human resources most efficiently in order to administer and collect taxes. The German tax administration, similarly to tax administrations in many other countries, has therefore size-dependent thresholds in place to partition firms into different tax-related categories in order to economise on administrative costs. Using data from the statistics about the Business Tax for several years, the results show that frictions in tax administrative regulations cause behavioural responses of firms. Additionally, the study shows that tax administrations can prevent behavioural firm responses by designing more complex thresholds which are regularly adjusted. From an economic perspective, the findings illustrate that tax administrations should carefully consider the design of size-dependent thresholds in order to avoid unintended behavioural responses of firms which can lead to a reduction in tax revenue.

Chapter 3 analyses tax enforcement in the German sub-national states and examines whether there are any structural differences in their tax enforcement activities. Tax enforcement is one of the most important tax policy instruments to guarantee equity of taxation amongst taxpayers. It has been argued for many years that conservative governments of richer sub-national states use lax tax enforcement as a strategic tool for tax competition between German states to protect their economies. Since these claims have never been proven with comprehensive data or empirical studies, this study uses state-level data which is gathered from German states' Ministries of Finance to analyse whether these claims hold true. The analyses show that audit cycles differ significantly between the German states which might indicate that some states use low audit ratios as a strategic tool for tax competition. Moreover, no evidence is found that the German fiscal equalisation scheme causes a significant difference between states' tax enforcement activities and there is no consistent evidence that there are differences in rightwing and leftwing governments' tax enforcement efforts. Most importantly, the study illustrates that smaller firms are less tax compliant than larger firms which raises doubts as to whether the current tax enforcement strategy in Germany fulfills its legal mandate. For the analyses, self-collected data from the German states' 16 Ministries of Finance is used, which is retrieved through parliamentary inquiries ("Kleine Anfragen") from members of the states' parliaments and requests according to states' freedom of information acts ("Informationsfreiheitsgesetze"). To the best of my knowledge, data in such detail has not yet been collected or published for German sub-national states. Hence, the contribution of chapter 3 is to make use of this unique data set to analyse tax enforcement activities at the state level over several years.

While this dissertation aims at providing new insights about efficiency and equity of taxation in chapters 2 and 3, the perspective changes in chapter 4 which is joint work with Laura Kristina Uhl. In this chapter, we focus on one of the most intensely discussed questions in public finance - how taxes affect investments and entrepreneurship. We exploit a tax reform in Sections 8c/8d German Corporate Income Tax Act (KStG) which improves firms' possibilities to carry forward losses and deduct these losses from future profits. Before this

tax reform, the possibility to carry forward and deduct losses was very restricted in case a certain amount of a company's shares was sold. Since startups, due to a lack of monetary resources, usually sell large parts of their shares in their early lives, they have been particularly affected by this strict loss deductibility rule. Data from startups' investment rounds is used to analyse whether this tax reform had a significant impact on startup investments in Germany. To do this, a synthetic control group out of other European countries is created in order to compare startup investments in Germany with startup investments in the synthetic counterpart of Germany. While we do not find a significant increase in investments for all startups, we can show that especially early-stage startups with their first investment rounds benefit from this tax reform. We contribute by showing that tax policies, which aim to improve the economic principle of investment neutrality, can influence investment behaviour and firms' economic conditions.

As a whole, this dissertation contributes to provide a better understanding of the possible impacts of tax policies on efficiency and equity of taxation, firms' behavioural responses and investment decisions.

Chapter 2

Do Firms React to Tax

Administrative Thresholds?

Evidence from Germany

2.1 Introduction

One major challenge in public finance is to find optimal tax systems which minimise the resource cost involved in assessing, collecting, and paying taxes (Sandmo, 1976). Optimal tax systems should be designed in a way to balance the two major principles of taxation: equity and efficiency (Alm, 1988). Hence, available resources should be used efficiently and taxpayers should be treated fairly while not distorting economic decisions or causing undesirable costs for both tax administrations and taxpayers. In many countries, tax administrations have introduced special tax regimes with size-dependent regulations and exemption thresholds for smaller firms in order to fulfill the efficiency principle of taxation (see for more information International Tax Dialogue, 2007). However, these size-dependent thresholds can cause behavioural responses of firms since they create unintended and undesired incentives for firms to stay below these thresholds due to increasing tax burdens or regulatory requirements above them (e.g., Harju, Matikka and Rauhanen, 2019). These tax law specific frictions can lead to lower tax compliance rates and lower tax revenues since firms have incentives to use tax avoidance and tax evasion activities to manage down their size (e.g., Chetty, 2009; Saez, Slemrod and Giertz, 2012). In order to reduce distortionary and evading behaviours of firms, policymakers need to know whether and how firms react to administrative interventions in order to set them optimally.

In this paper, I study firms' behavioural responses to different size-dependent tax administrative thresholds in Germany. The three different tax administrative thresholds that I analyse are: i) size-dependent tax enforcement thresholds; ii) a size-dependent tax credit threshold; and iii) a size-dependent tax accounting threshold. In particular, I exploit discontinuities in firms' choice sets which different tax policy instruments implemented by the German tax administration create. I examine whether these administrative thresholds, which are in place to increase efficiency of taxation, cause any behavioural response in firms' profit reporting behaviour.

2.1. INTRODUCTION

First, I analyse whether firms respond to different tax enforcement intensity thresholds that increase with firm size. While the same tax laws apply to firms both above and below the size-dependent thresholds, the audit probability and intensity changes discretely at these thresholds. The more profit and sales a firm generates, the more often it is subject to an audit. Additionally, German tax administrations spend more time and human resources on auditing larger companies than on smaller companies. Audits are usually costly for firms since they not only have to spend time and money dealing with an audit but also might face significant supplementary tax payments.

Second, I analyse whether firms respond to a tax credit threshold above which they are obligated to pay Business Tax (“Gewerbesteuer”). If the Business Tax income (“Gewerbeertrag”) is below this threshold, companies will not have to pay any Business Tax at all. Paying taxes is naturally associated with additional costs which some taxpayers might wish to circumvent.

Third, I analyse whether firms react to the introduction of a tax accounting threshold above which books and records have to be kept and a more expensive and time-consuming accounting method has to be applied. Once this threshold is reached, companies can no longer be exempted from record keeping and face higher administrative and compliance costs since they can no longer use a simplified accounting method and are legally required to keep records. Since the possibility to apply these simplified accounting methods and the related tax accounting threshold have been introduced in 2009, I can analyse whether firms react to the introduction of this threshold by comparing their behaviour in profit reporting before and after its implementation.

All these tax administrative frictions create incentives for companies to bunch just below the relevant thresholds to avoid additional scrutiny or costs. Bunching below these thresholds can be achieved by size management which can be any legal or illegal activity undertaken by a firm, e.g., generating less profit or underreporting it, or overreporting costs in order to reduce firm size. However, behavioural responses to administrative interventions will always cause costs and deadweight losses since firms have to spend resources to manage down their size (see, e.g., Chetty, 2009; Saez, Slemrod and Giertz, 2012; Fack and Landais, 2016).

For my analyses, I use Business Tax return data for German firms for the years 2004, 2007, and from 2010 to 2014 which is provided by the Research Data Centre of the Federal Statistical Office (“Forschungsdatenzentrum”). This Business Tax return data contains all German companies which are obligated to pay Business Tax over several years. This allows me to compare the behavioural responses to these different thresholds and analyse whether firms adjust to changing thresholds over time. The empirical analysis in this paper follows the bunching approach which has been widely used in recent years. The bunching method allows to analyse firms’ behavioural responses to thresholds in taxes and other forms of regulations. The estimation strategies used in this paper follow closely the ones used by Saez (2010), Kleven and Waseem (2013), and Almunia and Lopez-Rodriguez (2018).

As my main result, I find clear evidence of bunching responses at both the Business Tax credit and tax accounting threshold but no bunching response at the tax enforcement thresholds. The heterogeneous behavioural responses at the thresholds might originate from firms’ different cost-benefit analyses and the different characteristics of the thresholds. My findings show that firms react to administrative thresholds in order to benefit from size-dependent regulations. I can also show that tax administrations have the possibility to influence firms’ behavioural responses through different designs of these thresholds. Although I find that approximately 10,600 firms bunch at the tax accounting threshold and 24,700 firms at the tax credit threshold, the overall decrease in tax revenue seems to be modest.

Behavioural responses of firms to size-dependent administrative thresholds are a highly relevant issue for policymakers since they have to be taken into account when designing optimal tax policies. Tax administration policies comprise the design of tax rates, tax bases, tax enforcement, accounting systems, and regulatory requirements. If governments knew how taxpayers respond to tax administrative interventions, they would be able to design optimal tax administration policies to reduce both the costs of taxation and deadweight losses as well as increase their tax revenue. Moreover, policymakers should always carefully question whether size-dependent thresholds have the intended positive impacts in order to increase

2.1. INTRODUCTION

the efficiency of taxation and bolster Small and Medium Enterprises (SMEs) or whether these thresholds cause undesired behavioural responses of these firms.

My study aims at contributing to find optimal tax policies by analysing behavioural responses of firms to different tax administration policies and their corresponding thresholds. This unique setting allows me to simultaneously analyse companies' behavioural responses to different thresholds that are associated with different incentives and efficiency costs. The contribution of this paper is to make use of three different tax enforcement thresholds which represent three different discontinuities in tax enforcement intensity. These tax enforcement thresholds vary over time, therefore I can analyse whether firms responds to these changing thresholds. Other papers that analyse bunching do not examine time-dependent behavioural responses (see, e.g., Almunia and Lopez-Rodriguez, 2018).¹ Additionally, I examine the behavioural responses of firms to tax credit and tax accounting thresholds that are associated with other benefits and costs and do not change over time. Therefore, this paper is the first to analyse and compare the behavioural responses of companies to different tax administrative frictions and thresholds. Making use of these discontinuities in administrative interventions, I can exploit these different thresholds which have been neglected by other research papers so far and which are important for the design of optimal tax policies. Additionally, this paper is the first to use tax return data for different tax administrative thresholds since other studies often use financial statements for their analyses (see, e.g., Almunia and Lopez-Rodriguez, 2018; Bernard, Burgstahler and Kaya, 2018; Hoopes, Robinson and Slemrod, 2018).

This paper contributes to several strands of literature. First, there have been several studies trying to find optimal tax administration policies and measures of the impact of administrative interventions (Sandmo, 2005; Kopczuk and Slemrod, 2006; Slemrod, 2007; Bigio and Zilberman, 2011; Dharmapala, Slemrod and Wilson, 2011; Pomeranz, 2015; Kleven, Kreiner and Saez, 2016). Second, there has been a large number of studies analysing the behavioural responses of individuals or firms around thresholds related to tax avoidance and tax evasion activities

¹There exists a recent study from 2022 which analyses as well size-dependent tax enforcement in Germany. However, they do not take into account the tax accounting and tax credit thresholds and only use data for one year (2010), see Klimsa and Ullmann (2022).

(Saez, 2010; Kleven and Waseem, 2013; Brockmeyer, 2014; Devereux, Griffith and Klemm, 2014; Agostini et al., 2018; Almunia and Lopez-Rodriguez, 2018; Best and Kleven, 2018; Tennant and Tracey, 2019). Third, this study relates to literature about size-dependent policies and size-dependent regulations that define the eligibility threshold to get a tax credit (Saez, 2010; Chetty et al., 2011; Chetty and Saez, 2013; Chetty, Friedman and Saez, 2013), to register for certain taxes (Keen and Mintz, 2004; Onji, 2009; Kanbur and Keen, 2014; Liu et al., 2021), or behavioural responses of companies to public disclosure requirements (Bernard, Burgstahler and Kaya, 2018; Hoopes, Robinson and Slemrod, 2018). Fourth, this study adds to the literature about the tax accounting costs of taxation. Both Asatryan and Peichl (2017) and Harju, Matikka and Rauhanen (2019) show that tax accounting and the related tax compliance costs are highly relevant, especially for smaller firms. Additionally, I contribute to the literature studying the reasons and mechanism behind taxpayers' behavioural responses (Benzarti, 2020; Gelber, Jones and Sacks, 2020).

In the following section 2.2, I introduce the theoretical and institutional backgrounds in Germany. In section 2.3, I develop the hypotheses and give an overview about related literature before describing the data and research design in section 2.4. Sections 2.5 and 2.6 contain the empirical results and robustness tests. The study closes with limitations and a conclusion in sections 2.7 and 2.8.

2.2 Theoretical Background and Institutional Setting

2.2.1 Tax Avoidance vs. Tax Evasion

When analysing individual or corporate taxpayer behaviour, it is important to differentiate between tax evasion and tax avoidance. Tax evasion is illegal and violates the tax law, e.g., a taxpayer deliberately conceals income from the tax authority which is subject to personal or corporate taxes. Tax avoidance is legal and does not violate the tax law, and therefore taxpayers exploit loopholes in the tax law to reduce their overall tax liability. With regard to size management,

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

firms have three possibilities to stay below thresholds: first, they can scale down their real output and forego profitable business opportunities; second, they can use legal tax avoidance (e.g., splitting a larger firm into two separate entities) to manage down their size; third, firms can use illegal tax evasion (e.g., underreporting profits or overreporting costs) to stay below a threshold. The majority of empirical evidence suggests that some firms manage down their size through illegal tax evasion (see, e.g., Chetty, 2009; Kleven et al., 2011; Almunia and Lopez-Rodriguez, 2018). Hence, analysing and understanding tax evasion was and still is of great importance since it exacerbates inequality amongst taxpayers by redistributing the tax burden and it also raises the cost of tax collection (see, e.g., Alstadsæter, Johannesen and Zucman, 2019).² However, my data does not allow to differentiate between the channels which firms use to bunch, and therefore I am not able to disentangle in more detail how firms manage down their size. From a tax revenue perspective, it makes no difference whether firms use tax evasion or tax avoidance since both channels lead to lower tax revenues. For these reasons, firms' behavioural responses comprise all forms of size management in this study.

2.2.2 Size-Dependent Regulations and Efficiency of Taxation

In the context of optimal tax systems, efficiency of taxation is generally defined as a tax system which guarantees an optimal allocation of resources (see, e.g., Sandmo, 1976). Tax systems should be designed to minimise economic distortions and navigate the trade-off between production efficiency and revenue efficiency (see for further information Best et al., 2015). Hence, tax administrations should use their available financial and human resources in the most efficient way without causing any undesired distortions or behavioural responses of taxpayers. Since tax administrations have only limited resources to administer and collect taxes, they have often introduced size-dependent regulations in order to use their resources more efficiently. The idea behind these size-dependent regulations and

²For further information regarding the theoretical framework and the standard model of tax evasion, see the appendix 2.A.

thresholds is that tax administrations should economise on administrative costs by exempting smaller firms from certain taxes or accounting requirements and concentrate on larger firms (see, e.g., Dharmapala, Slemrod and Wilson, 2011). For these reasons, German tax administrations, similarly to other countries, have put several size-dependent tax thresholds in place which I will describe and analyse in the following sections.

2.2.3 Tax Enforcement Thresholds

2.2.3.1 Tax Enforcement and Optimal Tax Policy

The first tax administrative threshold which I analyse are size-dependent tax enforcement thresholds which are determined by the German tax administration. Tax enforcement is one major pillar of tax policies since tax enforcement can guarantee equity amongst taxpayers. Germany, similar to many other countries, partitions firms according to their size into different size classes for their tax enforcement activities in order to use their resources most efficiently (e.g., Kanbur and Keen, 2014; Bachas, Fattal Jaef and Jensen, 2019). To date, there is only limited empirical information and evidence on whether and how firms respond to these different size-dependent tax enforcement thresholds. Fack and Landais (2016) analyse tax enforcement elasticity in a personal environment in France, whereas Almunia and Lopez-Rodriguez (2018) analyse tax enforcement elasticity in a corporate environment in Spain. Both groups of authors find that tax enforcement changes the elasticity of taxable income and that tax elasticities are sensitive to policy instruments available to tax authorities, e.g. the level of tax enforcement. Different to the elasticity of taxable income, tax enforcement elasticity of taxable income is defined by Keen and Slemrod (2017) as a measure of how different administrative interventions, e.g., tax enforcement, influence the tax revenue which is collected. Therefore, tax administrations need to know whether and how firms respond to size-dependent tax enforcement intensity thresholds in order to design tax enforcement activities cost-effectively and cost-efficiently.

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

2.2.3.2 Institutional Setting

The legal framework for tax enforcement in Germany is anchored in Sections 193-203a of the German Fiscal Code (AO) as well as in the audit regulation (BPO), which are both federal tax laws. According to Section 2 (1) BPO, the purpose of audits is to guarantee the uniformity of taxation based on all relevant tax issues. The execution of tax enforcement is the responsibility of the federal states but the Federal Fiscal Court (BFH) as well as administrative orders of the Federal Ministry of Finance (BMF) are thought to guarantee the comparability of tax enforcement and an uniform interpretation of tax laws.

2.2.3.3 Size-Dependent Thresholds

According to Section 3 BPO, companies are classified into different size classes based on their sales and profit as criteria. Companies are classified as very small companies (VSC), small companies (SC), medium companies (MC), and large companies (LC). Additionally, companies are categorised into different firm types comprising trading, manufacturing, freelancers and services companies.³ The firm type classification is based on the industry identification number (“Gewerbezahlnzahl”) which is based on the NACE codes. For these different firm types, company size thresholds usually differ, and therefore a trading company with the same profit and sales as a manufacturing company will be classified into a different size class if either profit or sales are above the respective threshold. These size classifications thresholds are binding for a regular audit cycle of three years and are therefore adjusted every three years by the German tax authority and the BMF. The announcement of the new size classifications usually takes place several months before the new audit cycle begins, e.g., in August 2009 for the audit cycle from 2010 to 2012.⁴ Therefore, firms have to continuously adapt to these changing circumstances which will lead to efficiency costs (e.g. Slemrod, 2007).

³Further firm types are financial institutions, insurances, and agricultural companies. Since special rules are applied to these firms, I do not include them in my analyses.

⁴See Bundesministerium der Finanzen (2009).

The classification of the firms is based on the latest assessed Business Tax and Value-Added Tax (VAT) returns that are available to the tax administrations. Audit plans are set up in the year prior to the year in which the audits will be conducted, meaning that the audit plan for 2010 is set up in 2009. Simultaneously, company size classification also has to be done in the year prior to the audit, meaning in 2009 for an audit in 2010. In 2009, the latest assessed tax return available to the tax authorities will probably stem from the year 2007.⁵ The new classification of company sizes for the audit cycle from 2010 to 2012 was released on 20th August 2009. If companies wanted to respond to these new company size classifications in 2010, they would need to manage their size using their tax returns of 2007 before even knowing the new thresholds. Furthermore, companies can never be entirely sure which tax returns will be used for the size classification which makes strategic planning of size management very difficult. Both profit and sales thresholds for the size classification have increased over time. Although they do not increase in constant relative terms, the range can usually be roughly estimated but it still remains a very vague estimate.⁶

2.2.3.4 Audit Procedure and Case Selection

Generally, German tax administration spends most resources on auditing LC due to the legal obligation to continuously audit these firms (see Section 4 (2) BPO). LC are audited on average every 4.7 years whereas MC, SC and VSC are audited every 14.7, 30.0 and 101.0 years respectively. Furthermore, average tax gains realised from audits of these companies range from only 15,000 Euro (VSC) to 255,000 Euro (LC) depending on the companies' size classes.⁷ Since the risk of a shortfall in tax revenue is higher for larger firms, German tax administration spends more time and human resources on auditing MC and LC than on VSC and SC. Figure 2.2.1 shows the discrete increases in audit ratios for the different firm size classes. One can see that audit ratios are very low for VSC and SC,

⁵Assuming that companies usually have tax advisors handling their tax obligations, they have time to file their tax return until the last day in February two years after the end of the respective year, meaning in this case until the 28th February 2009. See Section 149 AO.

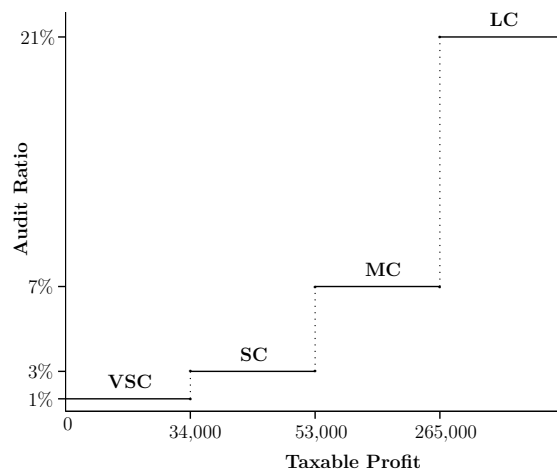
⁶See table 2.A.3 in the appendix for more detail.

⁷Both audit cycles and tax gains are calculated as an average from 2010 to 2014 based on my hand-collected data from the states' Ministries of Finance.

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

low for MC, but relatively high for LC. Since there are differences in audit ratios between the different size classes, firms have incentives to bunch below the size-dependent thresholds to avoid more frequent audits. Overall, audit plans are compiled by including firms that legally have to be continuously audited, risk-based case selection and random case selection for preventive reasons.

Figure 2.2.1: Average Audit Ratios per Company Size Class



Notes: This figure shows the average audit ratios for VSC, SC, MC, and LC for the years 2010 to 2014 (profit not to scale). For the calculation of the average audit ratios, the self-collected data is used.

2.2.3.5 Audit Quality

Generally, tax administrations do not give any instructions to auditors how long an audit should last, independent of the company size class. Up to sales of 600 million Euro, auditors work alone and not as a team. This means that independent of being LC with sales below 600 million Euro or VSC, there will always be one auditor responsible for auditing the firm. Generally, all auditors have the same education and attend the same training sessions. However, auditors of VSC and SC (“Amtsbetriebsprüfung”) are usually less experienced and have a lower salary than auditors of MC and LC (“Betriebsprüfung”) who are more experienced and earn more.⁸ For this reason, one can assume that, on average, MC and LC are audited by more experienced auditors than VSC and SC.

⁸This information is provided by an employee of the Oberfinanzdirektion Baden-Wuerttemberg.

Hence, firms might have incentives to manage down their size to avoid being audited by a more experienced auditor.

2.2.4 Tax Accounting Threshold

2.2.4.1 Tax Accounting and Optimal Tax Policy

The second tax administrative threshold which I analyse is a size-dependent accounting threshold which was introduced in Germany in 2009. Tax accounting regulations are another major pillar of tax policies since accounting requirements will cause tax compliance costs for both tax authorities and taxpayers. On the one hand, the administration and collection of taxes will always cause costs for tax authorities. On the other hand, obeying tax laws and following tax accounting rules will cause compliance costs for taxpayers. In this setting, tax accounting and compliance costs can be defined as all costs incurred by taxpayers in complying with the requirements of the tax system, e.g., preparing and filing tax returns, accounting costs, as well as cognitive costs related to learning and understanding the tax system (see Alm, 1988; Harju, Matikka and Rauhanen, 2019).

Several studies have analysed the importance and magnitude of tax accounting and compliance costs for individual taxpayers and businesses (Slemrod and Sorum, 1984; Pitt and Slemrod, 1989; Slemrod and Blumenthal, 1996; Slemrod and Venkatesh, 2002; Guyton et al., 2003; Asatryan and Peichl, 2017; Gillitzer and Skov, 2018; Meiselman, 2018; Harju, Matikka and Rauhanen, 2019; Benzarti, 2020). These studies all find that tax compliance costs are large and that they are relevant for firms. Eichfelder and Vaillancourt (2014) find that about two thirds of compliance costs are due to accounting rules. Additionally, tax accounting and compliance costs are also included in optimal taxation frameworks since they can also influence taxpayers' decisions and behaviours (see, e.g., Alm, 1988; Kanbur and Keen, 2014; Keen and Slemrod, 2017).

One of the most important and comprehensive changes in German accounting principles was the implementation of the accounting law (BilMoG) in 2009. One of the main goals of this accounting law was to reduce the regulatory and administrative burden of SMEs and facilitate accounting rules for these firms (see for more information Förster and Schmidtman, 2009; Richter, 2009).

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

Since this reform, SMEs have the size-dependent possibility to apply simplified accounting methods and be exempted from record keeping in order to bolster the small business sector. If firms stay below this administrative threshold, they face lower tax accounting and compliance costs which might induce behavioural responses of firms. For these reasons, it is important to analyse whether and how firms react to this accounting threshold in order to design optimal tax and accounting policies. To the best of my knowledge, no study has yet analysed the impact of BilMoG and the related tax accounting threshold on firms' profit reporting behaviour.

2.2.4.2 Simplified Tax Accounting Rules and Record Keeping

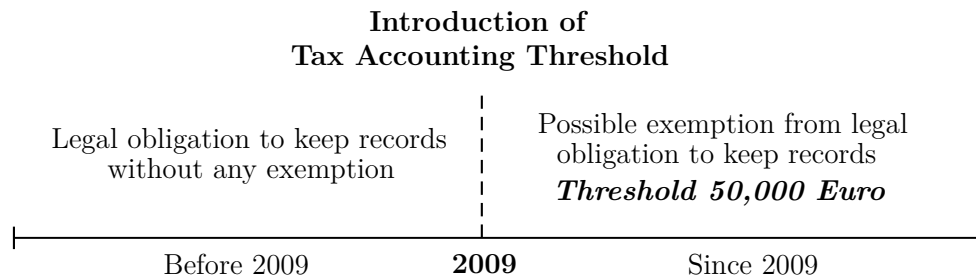
In Germany, there exist two different laws regulating accounting and record keeping rules for firms. One is anchored in the AO and one in the German Commercial Code (HGB). Sections 140, 141 AO prescribe that companies with sales of more than 500,000 Euro or a profit of more than 50,000 Euro are obligated to keep records.⁹ Besides this obligation according to tax law, there exists also an obligation according to Section 238 HGB which prescribes that every businessman ("Kaufmann") is obligated to keep records.¹⁰ The obligation to keep records according to the HGB is simultaneously the link for the obligation to keep records according to AO. Once a businessman or business is obligated to keep records according to Section 238 HGB, there is automatically the obligation to keep records according to AO. Before the introduction of BilMoG in 2009 and the size-dependent exemption possibility, businessmen could not be exempted from record keeping even if profit and sales were relatively low. This has changed with the implementation of Section 241a HGB in 2009 which was one major part of

⁹These articles are only binding for firms generating income according to Section 15 German Income Tax Act (EStG). Freelancers ("Freiberufler") such as lawyers and doctors who generate income according to Section 18 EStG do not fall under Sections 140, 141 AO and therefore do not have to keep records even if they generate profits of more than 50,000 Euro.

¹⁰Section 1 (2) HGB defines that usually every commercial firm is a businessman unless its type and scope does not require a commercial firm. Very small companies with no or few employees and relatively low sales are usually no businessmen. Section 6 HGB prescribes that partnerships ("Offene Handelsgesellschaften"), limited partnerships ("Kommanditgesellschaften"), and limited liability companies ("Gesellschaften mit beschränkter Haftung") are classified as a businessman solely due to their legal form. Once a company is classified as a businessman, it has to register in the Commercial Register ("Handelsregister") and it is obligated to keep records according to Section 238 HGB.

BilMoG (see, e.g., Förster and Schmidtman, 2009). As of this year, Section 241a HGB contains an exemption for sole proprietors (“Einzelkaufmann”). If a sole proprietor generates both sales of less than or equal to 500,000 Euro and profit of less than or equal to 50,000 Euro, then he is exempted from record keeping and can use simplified accounting rules. Once introduced, the threshold was identical for both HGB and AO.¹¹ Therefore, BilMoG and the implementation of Section 241a HGB gave sole proprietors the possibility to use simplified accounting methods both according to HGB and AO.¹²

Figure 2.2.2: Development of Tax Accounting Threshold over Time



Notes: This figure shows the development of the tax accounting threshold over time and the changes through the introduction of Section 241a HGB in 2009.

Furthermore, if firms stay below this threshold, they are also entitled to use the simplified tax accounting method (“Einnahmenüberschussrechnung”) according to Section 4 (3) EStG. It was also the legislative intention to allow sole proprietors to use “Einnahmenüberschussrechnung” to relieve SMEs from administrative and regulatory burdens (see, e.g., Richter, 2009). Once this threshold is reached, firms must apply the more costly and more time consuming tax accounting method (“Bestandsvergleich”) according to Section 4 (1) EStG.

¹¹Although profits according to German tax law and profits according to HGB can differ, this is not a major issue for smaller firms. The reason is that differing profits will only occur for firms which apply the accounting method “Bestandsvergleich” since smaller firms using “Einnahmenüberschussrechnung” do not have the right to apply certain tax options. Therefore, profits will be mostly identical for VSC and SC which allows me to study the tax accounting threshold while controlling for both legal requirements to keep records. Slight differences might appear from non-deductible expenses according to Section 4 (5) EStG. Since I do not have data about firms’ reported profits according to HGB, I can only use reported taxable profit from the statistics of Business Tax return data.

¹²For this reason, I refer to this threshold as a tax accounting threshold although Section 241a HGB is not a tax law. However, since the thresholds are identical and linked to each other, Section 241a HGB is simultaneously a tax accounting threshold.

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

This rule requires firms to set up balance sheets, apply double-entry bookkeeping (“Doppelte Buchführungspflicht”), and perform yearly inventories. Different to that, “Einnahmenüberschussrechnung” allows firms to simply record revenue and expenses, and they can influence the point in time at which revenue or expenses have to be recorded according to Section 11 EStG. This temporal influence is important for firms since it can help them to shift revenue or expenses from one fiscal year to another which is not possible according to Section 4 (1) EStG.

For these reasons, companies which are required to apply the more stringent tax accounting method and keep records will face higher internal and external administrative costs. This will lead to higher tax compliance costs and less flexibility for firms, and therefore they have an incentive to bunch below this accounting threshold to avoid higher tax accounting and compliance costs.

Unlike the size-dependent tax enforcement intensity thresholds, this threshold is not adjusted regularly and has remained the same from 2009 until 2015.¹³ Therefore, it might be associated with less efficiency costs for companies to respond to this tax accounting threshold. Most importantly, by comparing the behavioural responses in years before and after the implementation of this threshold, I am able to analyse whether firms react to the size-dependent possibility to use simplified accounting methods.

2.2.5 Tax Credit Threshold

2.2.5.1 Tax Credit Eligibility and Optimal Tax Policy

The third tax administrative threshold which I analyse is a size-dependent tax credit threshold for the German Business Tax. Tax credits or tax reliefs for smaller firms are another major pillar of tax policies since they can be used in order to bolster the small business sector and provide financial reliefs for SMEs. Germany, similar to many other countries, has put eligibility thresholds in place below which small companies do not have to pay the respective tax (see, e.g., Section 11 GewStG). The majority of research about this topic has focused on VAT eligibility thresholds in different countries, and found that firms strategically bunch below

¹³Section 241a HGB has been adjusted in 2016 and remained identical since then. The thresholds according to Section 141 AO have remained identical from 2002 to 2015.

these VAT thresholds to avoid paying VAT (Onji, 2009; Harju, Matikka and Rauhanen, 2019; Liu et al., 2021).

In Germany, certain firms are eligible to get a Business Tax credit of 24,500 Euro. This tax credit was mainly put in place to bolster SMEs and relieve these firms from additional Business Tax liability (for further information, see Brandis and Heuermann, 2021). If firms report a Business Tax income of 24,500 Euro or less, they will not have to pay any Business Tax at all. To date, there is no evidence available whether firms strategically respond to tax credits in Germany. Therefore, it is important to analyse firms' behavioural responses to this tax credit threshold in order to design optimal tax policies which do not cause any unintended frictions or undesired behavioural responses of firms.

2.2.5.2 Business Tax Credit

According to Section 2 (1) German Business Tax Act (GewStG), every business which is run in Germany is subject to Business Tax.¹⁴ Since the Corporate Tax reform (“Unternehmensteuerreform”) in 2008, businessmen, partnerships and limited partnerships are entitled to a Business Tax credit of 24,500 Euro per year according to Section 11 (1) S. 3 No. 1 GewStG. If a firm reports a Business Tax income of 24,500 Euro or less, it will not have to pay any Business Tax at all. Consequently, exceeding the Business Tax credit threshold induces a discontinuous increase in Business Tax liability which is naturally associated with additional costs which certain taxpayers might wish to circumvent. Particularly, the overall Business Tax rate will be 0% if firms report a Business Tax income equal to or less than 24,500 Euro which is essentially lower than the average Business tax rate of 13.8%.¹⁵ However, the increase in Business Tax liability between reporting a Business Tax income of 24,500 Euro instead of 24,600 Euro is low since the Business Tax credit would then still reduce the Business Tax income to

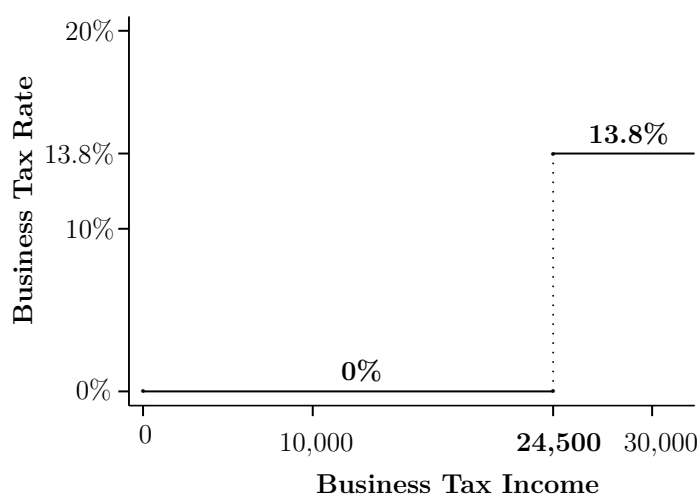
¹⁴Freelancers generating income according to Section 18 EStG are not obligated to pay any Business Tax at all.

¹⁵The average Business Tax rate is calculated based on the information provided by the Federal Statistical Office (“Statistisches Bundesamt”) about the average Business Tax rate for the years 2010 to 2014, (see Statistisches Bundesamt, 2010).

2.2. THEORETICAL BACKGROUND AND INSTITUTIONAL SETTING

100 Euro.¹⁶ Similarly to the tax accounting threshold, the Business Tax credit threshold is not adjusted regularly and has remained unchanged from 2008 until today. For this reason, it might be easier and less distorting for companies to respond to this threshold. Both the tax accounting and tax credit thresholds are limited to certain legal forms, and therefore my setting allows to examine the different behavioural responses of taxpayers who have the possibility to manage their size and those who do not.

Figure 2.2.3: Business Tax Rate



Notes: This figure shows the Business Tax Rate depending on the Business Tax income. Once the threshold of 24,500 Euro is reached, the Business Tax rate increases discretely from 0% to 13.8% on average.

2.2.6 Size Management and Efficiency Costs

If companies want to strategically bunch below a threshold which is associated with more costs or scrutiny, they are required to scale down their output in order to disguise their actual firm size. Behavioural responses of firms to administrative interventions will always cause optimisation costs and lead to inefficiencies since

¹⁶This would result in a Business Tax liability of approximately 13.80 Euro. There also exists the possibility to credit the Business Tax against the Personal Income Tax according to Section 35 EStG. Even if the Business Tax is not fully credited against the Personal Income Tax, it reduces the financial incentive to bunch below the Business Tax credit threshold. Whether the Business Tax is fully credited against the Personal Income Tax depends on the “Gewerbsteuerhebesatz” and whether the taxpayer has to pay Personal Income Tax. Since I cannot control whether taxpayers are eligible for crediting the Business Tax liability against their Personal Income Tax liability, I do not take it into account.

companies must spend resources for their size management which might have been used more efficiently (see Chetty, 2009; Saez, Slemrod and Giertz, 2012; Fack and Landais, 2016).

First, firms can switch from accrual accounting methods to net income methods to shift the recognition of revenue to the next fiscal year. However, in Germany these methods are prescribed by Section 4 EStG and switching is only possible for certain firms. Second, firms can theoretically split up into separate legal entities in order to redistribute profits and sales to several legal entities (see, e.g., Onji, 2009; Agostini et al., 2018). Third, firms can deliberately reduce their size by reducing real business activities meaning that profitable business opportunities are forgone (see Harju, Matikka and Rauhanen, 2019). Fourth, firms can reduce their size by either underreporting sales and profits or overreporting costs to stay below these administrative thresholds (Chetty, 2009; Kleven et al., 2011; Almunia and Lopez-Rodriguez, 2018).

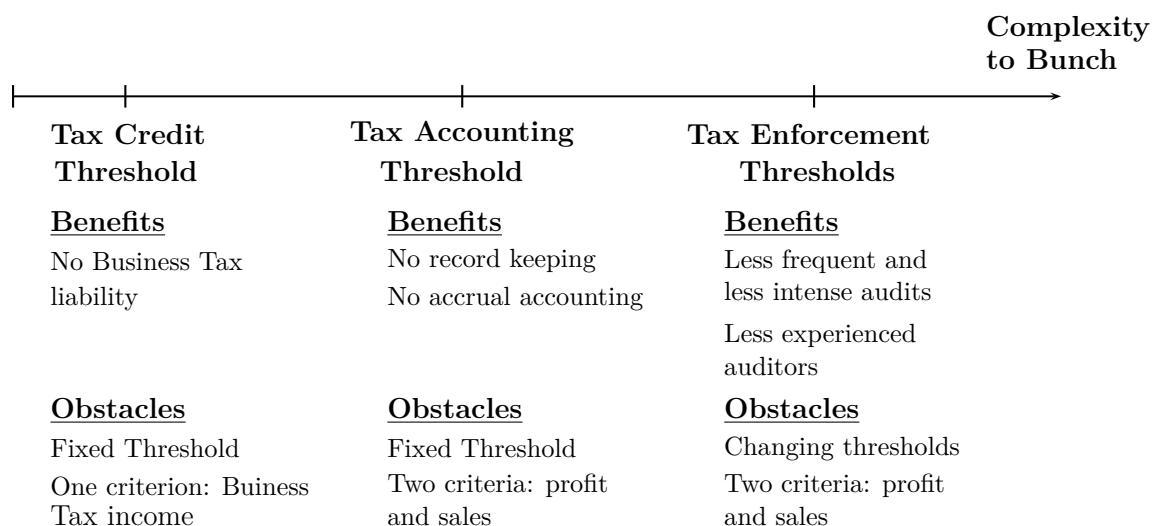
Using tax evasion or tax avoidance for size management will always cause some kind of efficiency costs since taxpayers have to spend resources to disguise their non-compliance (e.g., keeping two different books or foregoing business opportunities). Size management can distort resource allocation and its costs depend on several factors such as firm size, sector, and the traceability of records. The more paper trail a firm's business activities leave, the more difficult size management might get. The more people have to be involved in disguising a firm's actual size, the more complicated it might get. Additionally, only firms within a certain window above the threshold might be able to manage their sizes since downsizing to a large extent might cause the tax authorities' suspicion. Generally, only firms assuming that the benefits from bunching below a threshold will outweigh the associated efficiency costs will decide to manage their size.

As described in sections 2.2.3, 2.2.4, and 2.2.5, the design of these size-dependent tax administrative thresholds differs. Each of these thresholds is associated with different benefits and adjustment costs for firms in order to bunch below the relevant thresholds. Additionally, the predictability and reliability to plan one's size management differs for the respective thresholds since different criteria and time horizons are applied. Figure 2.2.4 gives an overview of the

2.3. HYPOTHESES DEVELOPMENT AND LITERATURE REVIEW

complexity of size management for each of the three thresholds. As described above, the thresholds are designed differently. The tax credit threshold is relatively straightforward, whereas the tax enforcement thresholds are determined in the most complicated way. Hence, one can assume that there will be heterogeneity in firm responses and firms will not react uniformly to these thresholds. If governments knew how firms reacted to these different thresholds, they would be able to design optimal tax policies to both increase efficiency of taxation and reduce the costs of taxation.

Figure 2.2.4: Overview of Complexity to Bunch



Notes: This figure gives an overview of the difficulty to bunch for the three tax administrative thresholds.

2.3 Hypotheses Development and Literature Review

A major strand of literature has focused on analysing behavioural responses of individuals and firms at size-dependent tax thresholds. These researchers analyse if one can perceive any abnormal behaviour around these cut-off points and estimate whether there is any excess mass below the threshold. The common assumption always is that there is a region just above the threshold associated with disadvantageous consequences that is dominated by the region just below

this threshold.

One of the most important contributions in relation to tax related thresholds are the papers by Saez (2010) and Almunia and Lopez-Rodriguez (2018). Saez (2010) uses individual tax return data to analyse possible bunching at the kink points of the US federal income tax schedule. He estimates the compensated elasticity of reported income with respect to the marginal tax rate. He finds obvious evidence of bunching at the first kink point of the Earned Income Tax Credit (EITC) but only for taxpayers that are self-employed. Furthermore, he can also prove bunching behaviour at the threshold of the first tax bracket where personal tax liability starts. However, he does not find evidence of bunching for higher kink points of the tax schedule. Almunia and Lopez-Rodriguez (2018) analyse the effect of size-dependent tax enforcement on firms' tax compliance and the welfare implications of this type of policy in Spain. They use data from financial statements that all Spanish firms must submit, and find that firms react to avoid being under stricter tax enforcement by strategically bunching below the eligibility threshold. This response is heterogeneous across firms depending on the traceability of their transactions. Firms monitored by the Large Taxpayer Unit report larger tax bases which indicates that this policy can be an effective tool to reduce tax evasion. Furthermore, they conclude that devoting additional resources to increase tax enforcement to smaller firms would lead to net welfare gains at the margin. Aside these two studies, there exists further literature examining the evasion and avoidance responses at certain tax specific thresholds (see, e.g., Kleven and Waseem, 2013; Brockmeyer, 2014; Devereux, Griffith and Klemm, 2014; Agostini et al., 2018; Best and Kleven, 2018; Tennant and Tracey, 2019).

The setting in this study is similar to the setting of Almunia and Lopez-Rodriguez (2018) but allows to examine the bunching responses at three different tax enforcement intensity thresholds. The presence of discontinuities in the German tax enforcement intensity scheme offers incentives for companies to declare one Euro less taxable profit or sales to get below the thresholds. Audits are usually costly for firms since they not only have to spend time and money dealing with the audit but also face significant supplementary tax payments.

2.3. HYPOTHESES DEVELOPMENT AND LITERATURE REVIEW

Hence, firms will bunch below these size-dependent tax enforcement thresholds to avoid more frequent audits and additional tax payments.

Hypothesis 1: *German firms bunch below the size-dependent tax enforcement thresholds to avoid stricter and more frequent tax enforcement.*

Other research has analysed the importance and magnitude of tax accounting regulations and the associated tax compliance costs for taxpayers (Slemrod and Sorum, 1984; Guyton et al., 2003; Asatryan and Peichl, 2017; Gillitzer and Skov, 2018; Meiselman, 2018; Harju, Matikka and Rauhanen, 2019; Benzarti, 2020).

In Germany, there is one tax accounting threshold which is related to these studies. If firms stay below this threshold, they are exempted from record keeping and can apply simplified accounting rules. Once firms exceed this threshold, they can no longer be exempted from record keeping and have to apply more costly accounting methods. Therefore, firms will bunch below this tax accounting threshold in order to avoid additional tax compliance costs.

Hypothesis 2: *German firms bunch below the tax accounting threshold to avoid undesirable accounting requirements and compliance costs.*

Other literature has focused on analysing eligibility thresholds to certain taxes, e.g., the threshold at which one has to register and pay VAT (see Keen and Mintz, 2004; Onji, 2009; Kanbur and Keen, 2014; Liu et al., 2021). These research papers examine whether firms strategically respond to these eligibility thresholds by minimising their size or by splitting up in several entities to stay below the thresholds and avoid paying taxes. Further analyses have examined non-tax related cut-off points such as labour law regulations which might lead to distortions in companies' business size or decisions and macroeconomic implications of these size-dependent policies (see, e.g., Guner, Ventura and Xu, 2008; Gourio and Roys, 2014; Garicano, Lelarge and van Reenen, 2016). Other research has examined whether low-income individual taxpayers in the US respond to tax credits which the tax system offers them (Saez, 2010; Chetty et al., 2011; Chetty and Saez, 2013; Chetty, Friedman and Saez, 2013).

For certain taxes, there is a threshold level of profit or sales below which taxpayers are eligible to get a tax credit. Once firms exceed this threshold, they

are obligated to pay the respective tax. In my German setting, there is a cut-off point at the Business Tax credit threshold. If the Business Tax income is equal to or below this threshold, companies will get a tax credit and they do not have to pay any Business Tax at all. Although the increase in Business Tax liability is modest (see section 2.2.5.2), companies might still have incentives to manage down their size in order to reduce their Business Tax liability to zero.

Hypothesis 3: *German firms bunch below the Business Tax credit threshold to avoid paying any Business Tax at all.*

Another strand of literature has focused on the heterogeneity in behavioural responses of firms in relation to tax related thresholds. Several papers have found that size management depends to a high degree on the possibility to evade taxes. Kleven et al. (2011) use a tax enforcement field experiment in Denmark to analyse taxpayers' differential behaviours with regard to tax evasion. They find that tax evasion is close to zero for income subject to third-party reporting but significant for self-reported income. Slemrod, Blumenthal and Christian (2001), Gruber and Saez (2002), Kopczuk (2005), Saez (2010), Chetty and Saez (2013), and DeBacker et al. (2018) find similar results in their analyses. Hence, there is substantial heterogeneity in tax evasion depending on the possibilities a taxpayer has to under-report his income. Additionally, different criteria and rules are applied to these three tax administrative thresholds (see figure 2.2.4), which makes size management more or less complicated. With regard to the tax credit and tax accounting thresholds, not all firms can benefit from staying below these thresholds since only certain legal forms are eligible for these size-dependent advantages. Hence, my setting allows to examine the differential behavioural responses of taxpayers depending on the respective tax threshold.

Hypothesis 4: *German firms react differently to these size-dependent thresholds and bunching depends on firms' possibilities and the design of the thresholds.*

2.4 Data and Research Design

2.4.1 Data

For my empirical analyses, I use the statistics about the Business Tax for the years 2004, 2007 and from 2010 to 2014 provided by the Research Data Centre of the Federal Statistical Office and the Statistical Office of the German states (see FDZ, 2019).¹⁷ The Business Tax statistics contain firm-level data of all German firms that are eligible to pay Business Tax, therefore my data contains the entire population of German firms which have to pay Business Tax. The database is the firms' assessed Business Tax returns which are supplied by the German states' tax authorities and then combined to one data set by the Federal Statistical Office. The federal states' tax authorities submit the data to their Statistical Office at the state level where a plausibility check is done. Once this is done, data is submitted from States' Statistical Offices to the Federal Statistical Office where the final data set is created. The final data set contains information about the assessed Business Tax returns of all companies that are obligated to pay Business Tax, meaning all forms of sole proprietors, partnerships and corporations. The data contains information about a company's legal form, its location at the city level and at the state level as well as an industry identification number which is used for the assignment to the different firm types. Since identification with the 5-digit NACE codes leads to double classifications, I combine two different variables to get the complete 6-digit NACE code to avoid any misclassifications. I drop firms with negative or missing profit and Business Tax income or missing industry identification numbers. Table 2.4.1 shows the exact sample selection process. Profit is defined as the profit according to Section 15 EStG for sole proprietors and partnerships and according to Sections 7, 8 German Corporate Income Tax Act (KStG) for corporations. Section 7 GewStG refers to Section 15 EStG and Sections 7, 8 KStG, therefore the reported profit in the Business Tax returns is identical to the reported profits in Personal Income Tax and Corporate Income Tax returns.

¹⁷Before 2010, data is only available every three years, hence I cannot include 2008 and 2009 in my analyses.

Table 2.4.1: Sample Selection

	N	%
Raw data for whole sample	22,431,941	100.00%
Firms with negative or missing profit	5,386,797	24.01%
Firms with negative or missing Trade Tax income	664,076	2.96%
Firms with missing industry identification number or double identification due to incomplete industry identification number	1,650,410	7.36%
Final sample	14,730,658	65.67%

This table shows the sample selection process for the whole sample (2004, 2007, 2010-2014).

For this reason, there is no need to gather data about Personal Income Tax or Corporate Income Tax returns since Business Tax returns contain all relevant information.

The information of a company's profit is used in the analyses regarding the size-dependent tax enforcement and tax accounting thresholds. For the analysis of behavioural responses at the tax credit threshold, Business Tax income is used instead of profit which always is rounded down to the nearest hundred Euro (see Sections 7-11 GewStG). For sole proprietors and partnerships, this rounded down Business Tax income is reduced by the Business Tax credit of 24,500 Euro. Thus, in case a sole proprietor or partnerships report a Business Tax income of 24,500 Euro or less, the assessed Business Tax amount ("Gewerbesteuermessbetrag") is zero and no Business Tax has to be paid. Since freelancers are neither obligated to pay Business Tax nor to keep records, they are not included in the Business Tax data set and therefore not part of the sample. Consequently, they can also not be included in the analyses regarding the behavioural responses at the size-dependent tax enforcement and tax accounting thresholds.

As described in sections 2.2.3.3 and 2.2.4.2, the size classifications for the tax enforcement and tax accounting thresholds are usually based on both reported profit and sales. However, it was impossible to clarify whether both taxable and non-taxable transactions are used for the calculation of overall sales, or whether only taxable transaction are used.¹⁸ The more serious concern in regard to the

¹⁸Even after long research, dozens of phone calls and e-mails no person responsible at the "Oberfinanzdirektion" Hesse or Baden-Wuerttemberg could say which variables are exactly used to calculate the relevant sales of a firm.

2.4. DATA AND RESEARCH DESIGN

VAT data stems from the fact that these VAT data sets only contain periodic VAT returns (“Umsatzsteuervoranmeldungen“) but no annual VAT returns (“Umsatzsteuerjahreserklärung“). Since the annual VAT return will very often differ from the periodic VAT returns, and since the size classification is done based on the annual VAT return, it is not possible to reliably assess a company’s firm size based on the periodic VAT returns.¹⁹ For these reasons, I only take profit from the Business Tax data into account to avoid any bias with regard to sales from the VAT data.

2.4.2 Descriptive Statistics

Table 2.4.2 shows the information about the descriptive statistics for the relevant variables profit and Business Tax income for the years 2004 and 2007 as well as from 2010 to 2014. I display the descriptive statistics for the the different years and different firm types (manufacturing, trading, and services). Overall, my final sample consists of 14,730,658 firm-year observations.

The Research Data Centre of the Federal Statistical Office does not report minimum and maximum values for the observations due to an confidentiality agreement, hence I can only report mean, median, and standard deviation. Information about the distribution of the different legal forms (sole proprietors, partnerships, and corporations), firm types (manufacturing, trading, and services) as well as the distribution of observations in the German states are reported in tables 2.A.4, 2.A.5, 2.A.6, 2.A.7, and 2.A.8 in the appendix. Table 2.A.4 shows that the distribution of legal forms is well-balanced and nearly identical for the three firm types. Hence, my results are not influenced by a different distribution of legal forms in the respective firm type classifications. As one can see in table 2.4.2, profit and Business Tax income differs between the different firm types.

¹⁹According to Section 18 German VAT Act (UStG), companies must file periodic VAT returns either monthly or quarterly. After the end of the year, they are obligated to file an annual VAT return according to Section 18 UStG with their overall sales of the last year. Annual and periodic VAT returns can differ due to returned goods or subsequent discounts. More importantly, firms can use different methods to when sales have to be recorded (“Ist-Versteuerung” vs. “Soll-Versteuerung”) according to Sections 16, 20 UStG.

Table 2.4.2: Descriptive Statistics

Variables	N	Mean	Median	Std. Dev.
Whole Sample				
Profit	14,730,658	144,708	25,224	6,107,691
Trade Tax Income	14,730,658	136,395	22,600	6,743,956
Manufacturing				
Profit	4,115,270	224,310	27,053	9,076,362
Trade Tax Income	4,115,270	217,942	24,400	10,100,000
Trading				
Profit	3,049,925	120,025	25,165	1,925,106
Trade Tax Income	3,049,925	116,497	23,000	2,070,036
Services				
Profit	7,565,463	111,358	24,477	5,130,703
Trade Tax Income	7,565,463	100,058	21,500	5,606,414
2004 & 2007				
Profit	3,487,584	100,054	25,339	2,658,998
Trade Tax Income	3,487,584	90,356	23,800	3,410,866
Manufacturing				
Profit	927,754	154,980	28,254	3,582,761
Trade Tax Income	927,754	147,482	26,550	4,432,048
Trading				
Profit	765,908	89,873	24,874	1,121,954
Trade Tax Income	765,908	83,536	23,700	1,060,451
Services				
Profit	1,793,922	76,271	24,290	2,383,165
Trade Tax Income	1,793,922	64,037	22,200	3,041,379
2010-2014				
Profit	11,243,074	158,559	25,183	6,832,386
Trade Tax Income	11,243,074	146,094	22,200	6,436,073
Manufacturing				
Profit	3,187,516	244,490	26,657	10,100,000
Trade Tax Income	3,187,516	233,643	23,700	9,754,800
Trading				
Profit	2,284,017	130,166	25,327	2,127,535
Trade Tax Income	2,284,017	129,143	22,800	2,149,274
Services				
Profit	5,771,541	122,338	24,500	5,707,360
Trade Tax Income	5,771,541	104,449	21,200	5,128,915

This table shows the descriptive statistics for the years 2004 and 2007 as well as from 2010 to 2014. The Research Data Centre of the Federal Statistical Office does not report minimum and maximum values for the observations due to an confidentiality agreement. Profit and Business Tax income are reported in Euro.

2.4. DATA AND RESEARCH DESIGN

On average, manufacturing firms report higher levels of profit and Business Tax income than trading and services firms. Additionally, average profit and Business Tax income levels have increased enormously from 2004 and 2007 to the years from 2010 to 2014.

2.4.3 Research Design

2.4.3.1 Bunching

The following section describes the research design which is used to analyse the behavioural responses of firms around the thresholds described above. The estimation technique closely follows the bunching estimation strategy of Chetty et al. (2011), Kleven and Waseem (2013), and Almunia and Lopez-Rodriguez (2018). Apart from these two studies, there exists a lot of literature applying the bunching estimation strategy to tax related thresholds (see, e.g., Saez, 2010; Kleven et al., 2011; Chetty and Saez, 2013; Bastani and Selin, 2014; Brockmeyer, 2014; Devereux, Griffith and Klemm, 2014; Kopczuk and Munroe, 2015; Dwenger et al., 2016; Best and Kleven, 2018).

The basic assumption of the bunching estimator is that there is a threshold featuring a discontinuity in incentives which causes certain behavioural responses of taxpayers. Since the region above the threshold is dominated by the region just below the threshold, these behavioural responses lead to missing mass above and excess mass below the threshold. Without these discontinuities and given that the number of companies in each bin will probably be lower with more reported profits, the observed distribution of firms in each bin should decline with higher profits. Bunching estimators rely on constructing a counterfactual which imitates the distribution in the absence of these incentivising thresholds and then comparing it with the observed distribution. In line with Kleven and Waseem (2013) and Almunia and Lopez-Rodriguez (2018), I fit a fifth-degree polynomial to the observed distribution of profit or Business Tax income while excluding a certain range around the thresholds to avoid bias due to behavioural responses.

Firms are grouped into profit or Business Tax income bins of width w , and the polynomial regression is estimated in the following way:

$$C_j = \sum_{i=0}^q \beta_i \cdot (p_j)^i + \sum_{i=p_{lb}}^{p_{ub}} \gamma_i \cdot 1[p_j = i] + \varepsilon_j \quad (2.4.1)$$

where C_j is the number of firms in bin j , p_j is the profit level in bin j , $[p_{lb}, p_{ub}]$ is the excluded range, q is the order of the polynomial, and γ_i is a bin fixed-effect for each bin in the excluded range.²⁰ The counterfactual distribution is then obtained as the predicted values from equation 2.4.1 without considering the excluded range so that the distribution is smooth around the threshold and not biased from behavioural responses of firms. The excess mass or bunching mass is then estimated as the difference between the observed and counterfactual bin counts in the bunching range (i.e., in the excluded range around the threshold). I set the excluded bunching range as three bins right and either three or six bins left to the relevant thresholds depending on the difference between the real and counterfactual distribution.²¹

2.4.3.2 Round-Number Bunching

A problem in credibly identifying bunching at these thresholds might result from the tendency of firms to report profits in round numbers (see section 2.5). However, this finding is in line with prior studies. Brockmeyer (2014) and Devereux, Griffith and Klemm (2014) both use UK Corporate Tax return data, while Kleven and Waseem (2013) use Personal Income Tax return data from self-employed individuals in Pakistan. All studies find the same result that taxpayers have a tendency to report profits or income in round numbers, especially for lower income levels. Carslaw (1988) and Thomas (1989) find similar results for New Zealand and the US when using firms' financial data. This leads to excess mass points at integer numbers which can bias the bunching estimate, especially if

²⁰The function $\gamma_i \cdot 1[p_j = i]$ takes on the value 1 for each of the bins in the excluded interval.

²¹I determine the bins in a way that observations directly above the threshold are in the first bin above the respective threshold. E.g., regarding the 50,000 Euro tax accounting threshold, the 50,000 Euro bin contains observations with profits between 49,501 Euro and 50,000 Euro, which results in the bin width of 500. Hence, a firm with a reported profit of 50,001 Euro is in the first bin above the threshold containing profits between 50,001 Euro and 50,500 Euro.

2.5. EMPIRICAL RESULTS

these thresholds are located themselves at round numbers. In my data, round-number bunching has a specific structure in the sense that some round numbers are rounder than others, e.g., there is mainly round-number bunching at multiples of 5,000 Euro and 10,000 Euro. With regard to the reported Business Tax income, firms have the tendency to report their Business Tax income at multiples of 1,000, 5,000, and 10,000 Euro. For this reason, it is important to control for round-number bunching as developed by Kleven and Waseem (2013), especially when a threshold is located at a round number since otherwise one could overstate the behavioural bunching response at these thresholds. In all specifications, I use round-number fixed effects (multiples of 1,000, 5,000 Euro and/or 10,000 Euro) to capture firms' tendency to round their reported profit and Business Tax income. The counterfactual distribution is then estimated by fitting a fifth-degree polynomial to the distribution while omitting the excluded range, but not omitting the contribution of round-number fixed effects. Hence, the counterfactual distribution takes into account that taxpayers have a tendency to report profit and Business Tax income in round numbers.

2.5 Empirical Results

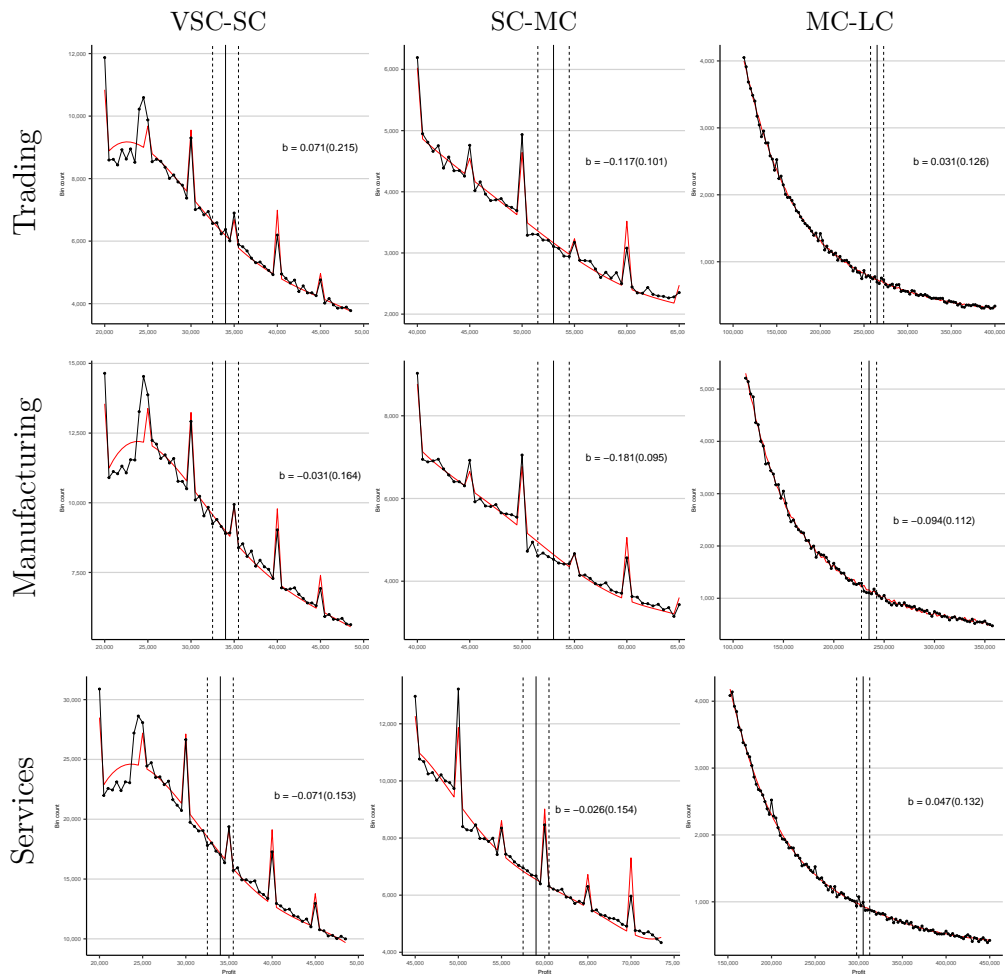
2.5.1 Tax Enforcement Thresholds

Figures 2.5.1 and 2.5.2 show the results of the distribution of profit and its counterfactual for all size-dependent tax enforcement thresholds (VSC-SC, SC-MC, and MC-LC). Figure 2.5.1 shows the results for the audit cycle from 2010 to 2012, whereas figure 2.5.2 shows the results for the audit cycle from 2013 and 2014.²² The first line of graphs shows the distribution for trading firms, followed by manufacturing and services firms, and I also control for round-numbers at multiples of 5,000 and 10,000 Euro. The solid black line shows the actual profit distribution, whereas the solid red line shows the counterfactual distribution. The vertical black lines show the relevant thresholds, and the vertical dotted lines the excluded range around the thresholds. As one can see from the bunching coefficients in the graphical illustrations, I do not find evidence for behavioural

²²The year 2015 has not been available when the project was started.

bunching responses at the different size-dependent thresholds to support my first hypothesis. None of the different firm types seem to react to the size-dependent thresholds to avoid stricter and more frequent audits. Hence, unlike Almunia and Lopez-Rodriguez (2018), I do not find evidence for bunching at size-dependent tax enforcement thresholds to support my first hypothesis.²³

Figure 2.5.1: Tax Enforcement Thresholds (2010-2012)



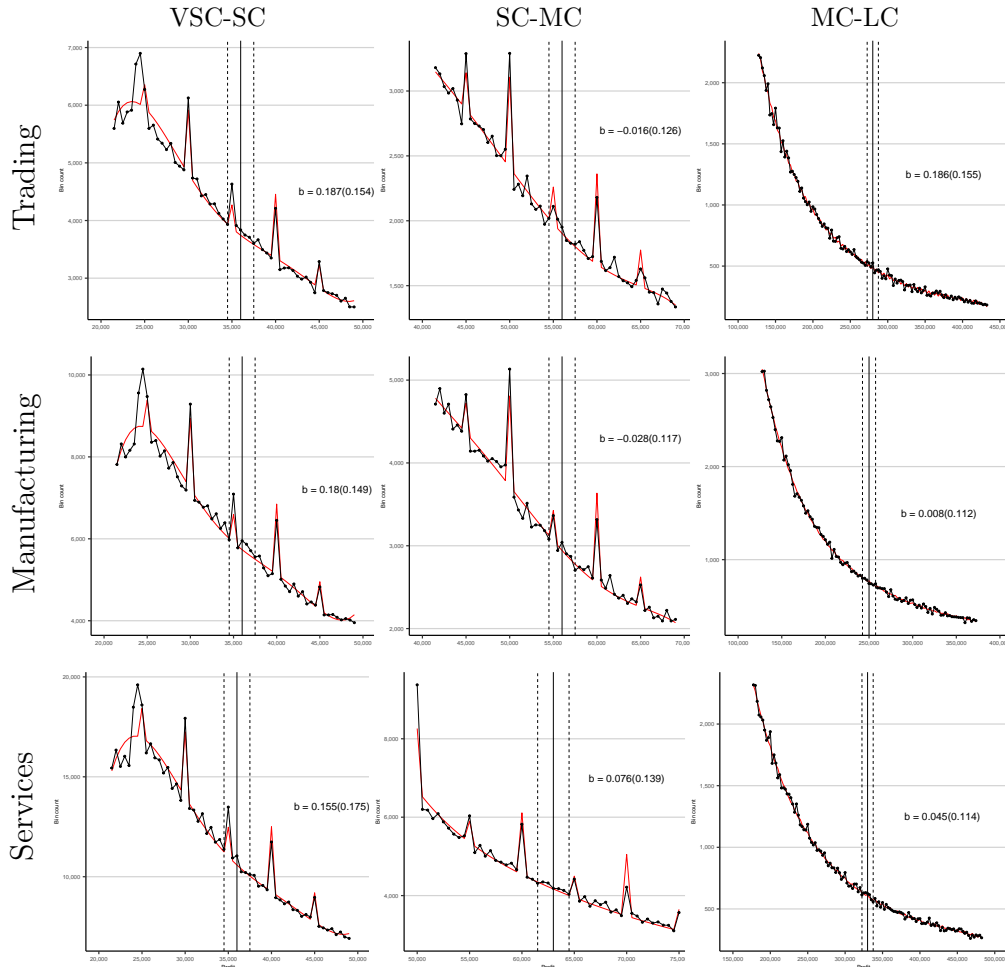
Notes: The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2012. The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

²³This remains unchanged when I use the years 2004 and 2007 instead of 2010 to 2014, and therefore I do not report these results since the number of observations is lower.

2.5. EMPIRICAL RESULTS

However, they analyse a size-dependent tax enforcement threshold in Spain which has remained identical since its establishment in 1995 and which only has one criterion (operating revenue) in place. Consequently, it might be easier for Spanish firms to undertake size management to avoid stricter tax enforcement than it is for German firms.

Figure 2.5.2: Tax Enforcement Thresholds (2013-2014)



Notes: The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2013 to 2014. The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

As described above, one possible explanation is that efficiency costs associated with size management are too big which makes bunching and downsizing one's profit too costly. Additionally, the constant changing of the thresholds as well as the unpredictability of how the size classification is done might prevent

behavioural responses of firms. However, I do find evidence for round-number bunching (multiples of 5,000 Euro and 10,000 Euro) and it is surprising that firms rather react to round-numbers than to the size-dependent tax enforcement thresholds.

For service firms, the relevant SC-MC threshold for the years 2010 to 2012 is 59,000 Euro but as one can see in figure 2.5.1, firms do not react at all to this threshold. They rather round their profit to 60,000 Euro which one can see in the spike in the distribution. If service firms wanted to bunch below this threshold, they would have to manage down their size by 1,000 Euro but one cannot see any evidence for behavioural responses. As mentioned above, the finding of round-number bunching is in line with prior studies. Brockmeyer (2014), Devereux, Griffith and Klemm (2014), Kleven and Waseem (2013), Carslaw (1988), and Thomas (1989) all find the same result that taxpayers have a tendency to report profits or income in round numbers, especially for lower income levels. Three possible explanations remain: first, firms want to bunch but it is both too costly and too complicated (for the reasons mentioned above); second, firms are not aware of these different size-dependent tax enforcement thresholds since audits occur quite rarely; third, firms are aware of these tax enforcement thresholds but they prioritize other administrative thresholds such as the tax accounting threshold.

2.5.2 Tax Accounting Threshold

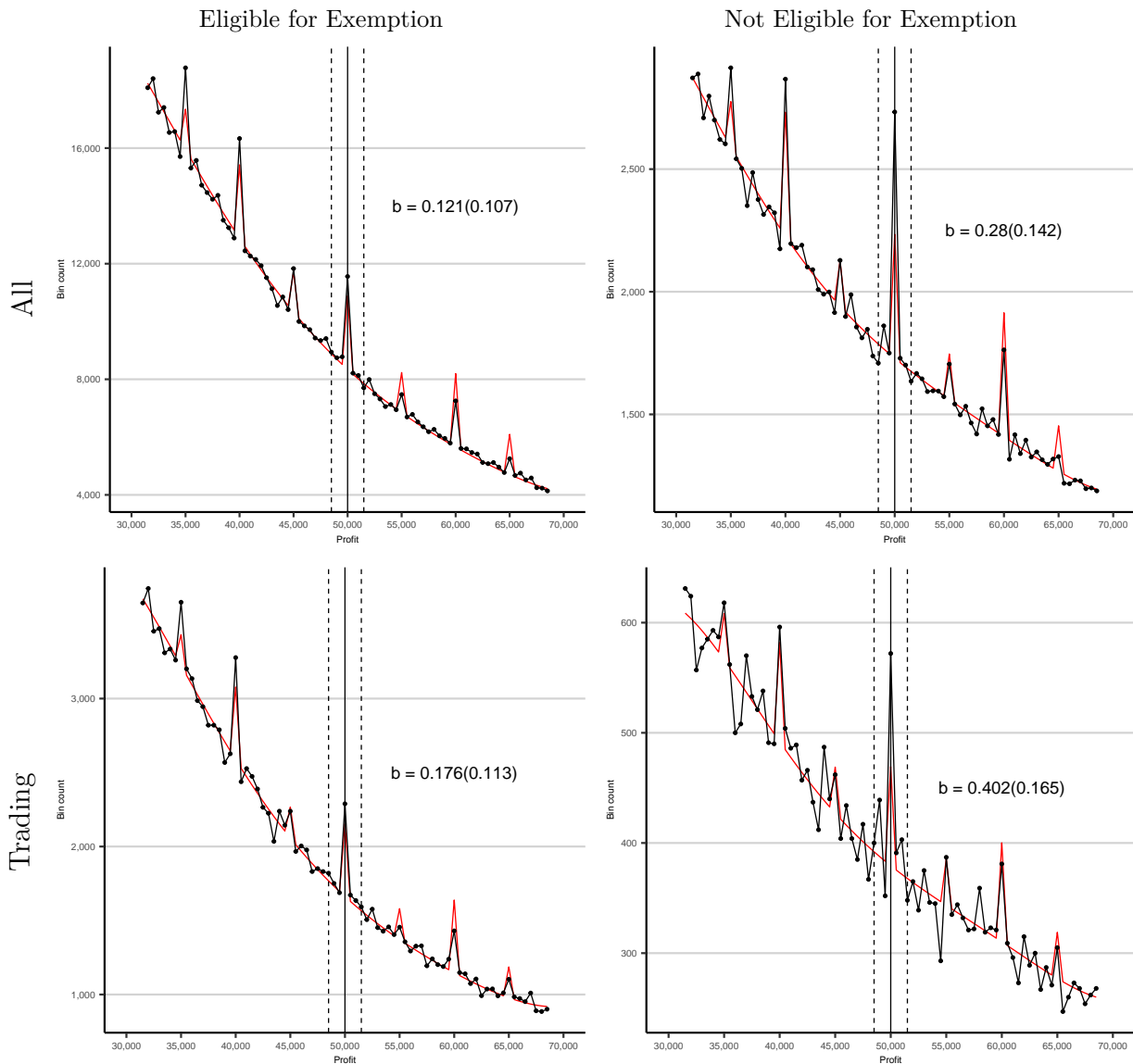
Figures 2.5.3 and 2.5.4 show the results of the distribution of profit and its counterfactual for the years before the implementation of the tax accounting threshold and the corresponding possibility to be exempted from record keeping. Since the Research Data Centre of the Federal Statistical Office does only provide the statistics about the Business Tax return data for 2004 and 2007, I cannot use yearly data to examine the behavioural responses before the reform. The graphs on the left show the distribution for firms which are eligible for the exemption to not keep records, whereas the graphs on the right show the distribution for firms

2.5. EMPIRICAL RESULTS

which are legally required to keep records independent of their profit.²⁴ The first row of graphs shows the distribution for all firms, followed by the different company types (trading, manufacturing, and services). The solid black line shows the actual profit distribution, whereas the solid red line shows the counterfactual distribution. The vertical black lines show the relevant tax accounting threshold of 50,000 Euro, and the vertical dotted lines the excluded range around the threshold. Since firms have a tendency to report profits in round numbers, and the tax accounting threshold is itself located at a round number, it is important to control for round-number bunching. Otherwise, the bunching estimate could be biased and one could overstate the behavioural bunching response when a threshold is located at a round number. Therefore, I control for round-number bunching at multiples of 5,000 and 10,000 Euro. Similarly to sections 2.5.1 and 2.5.3, I also control for the different firm types (trading, manufacturing, and services). Figures 2.5.5 and 2.5.6 show the estimation results of the distribution of profit and its counterfactual for the years after the implementation of Section 241a HGB and the corresponding possibility to use simplified accounting methods. Figures 2.5.3 and 2.5.4 show no evidence for behavioural bunching responses before the implementation of the tax accounting threshold in 2009. Hence, before the implementation of Section 241a HGB, firms do not bunch below the profit level of 50,000 since they have to keep records independent of their reported profits. Although I find round-number bunching at multiples of 5,000 and 10,000 Euro, there is no excess mass just below the 50,000 Euro threshold and firms do also bunch at 30,000, 40,000, and 60,000 Euro of reported profits. However, as one can see from the bunching coefficients in figures 2.5.5 and 2.5.6 as well as in table 2.5.1, I find clear evidence of bunching just below the tax accounting threshold of 50,000 Euro after the implementation of Section 241a HGB and the possible exemption from record keeping.

²⁴See table 2.A.1 in the appendix for an overview of firms which are eligible for the exemption to not keep records and firms which are not.

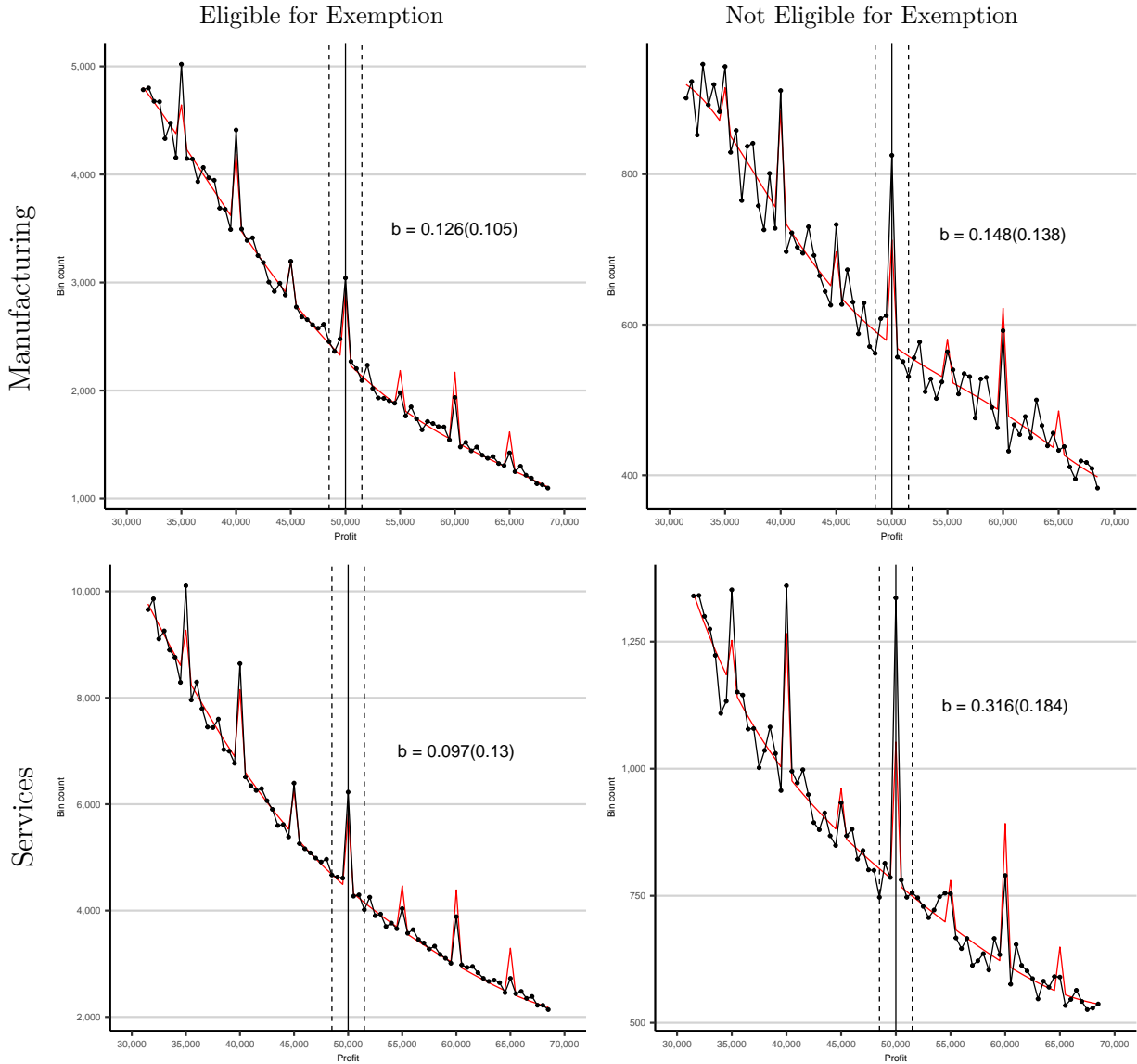
Figure 2.5.3: Tax Accounting Threshold (2004&2007)



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2004 and 2007. The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

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Figure 2.5.4: Tax Accounting Threshold (2004&2007)



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2004 and 2007. The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

Table 2.5.1: Bunching Estimates for the Tax Accounting Threshold (2010-2014)

Firm Type	Bunching Estimate	Standard Error
All	0.301	0.137
Trading	0.254	0.125
Manufacturing	0.374	0.153
Services	0.279	0.135

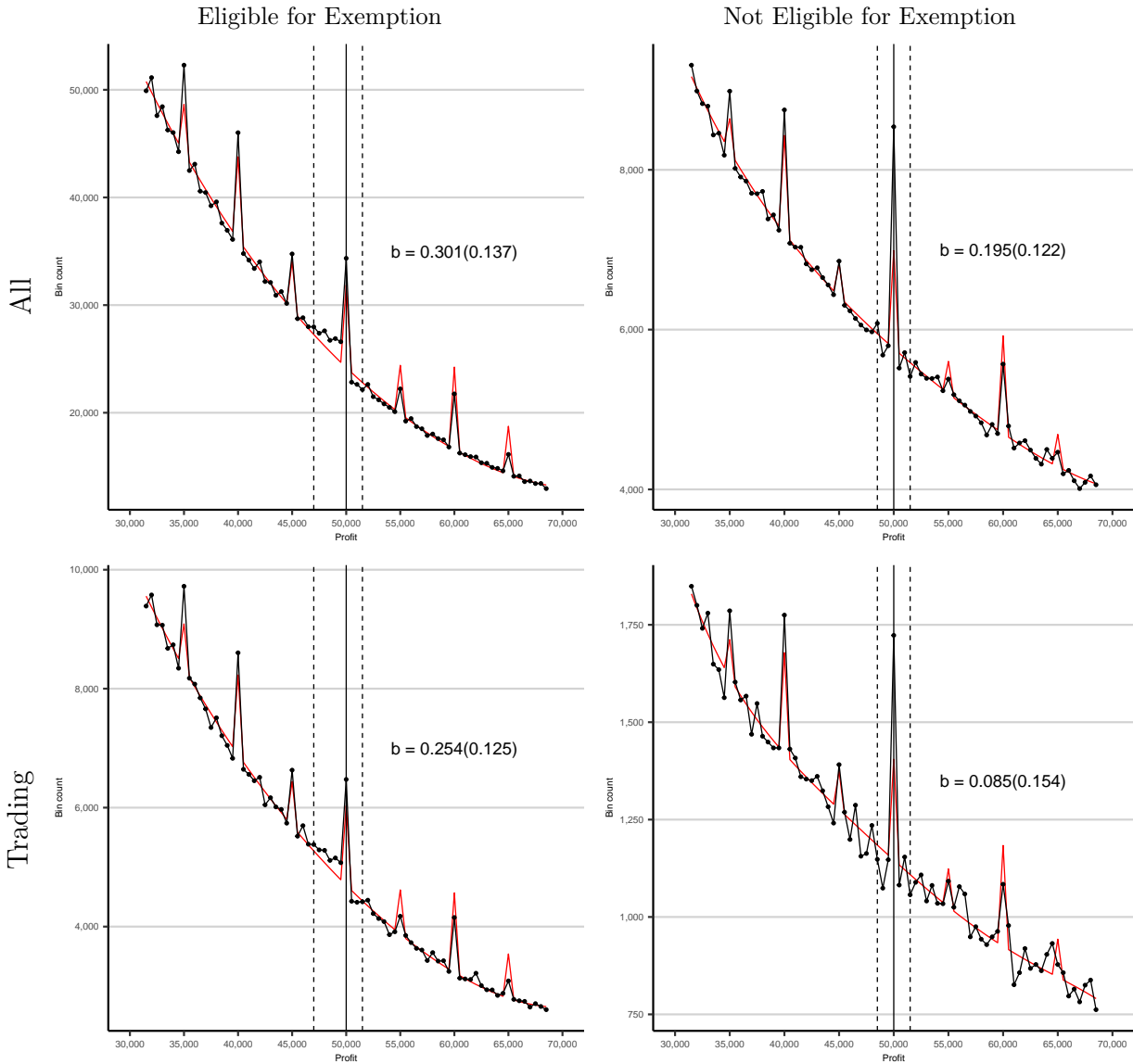
This table displays the bunching estimates for the tax accounting threshold after its introduction for the years from 2010 to 2014 for firms which are eligible to be exempted from record keeping.

The bunching estimates for firms which are eligible for the record keeping exemption are all statistically significant which supports my second hypothesis.²⁵ Firms which are eligible to be exempted from record keeping according to Section 241a HGB strategically bunch at or below a profit of 50,000 Euro to avoid the legal obligation to keep records and use a more stringent accrual accounting method. One can see excess bunching mass on the left of the 50,000 Euro threshold and missing mass on the right of the threshold. My finding of bunching at a tax accounting threshold is in line with Asatryan and Peichl (2017) and Harju, Matikka and Rauhanen (2019) who both find bunching behaviour of SMEs at a tax accounting and compliance threshold. Although firms have the tendency to report their profits in round numbers (multiples of 5,000 Euro and 10,000 Euro), excess bunching mass can only be seen just below the 50,000 Euro tax accounting threshold (see also the placebo tests in section 2.6). As one can see from the distribution of profits, there is no excess bunching mass left to 30,000, 40,000, and 60,000 Euro in reported profit. Additionally, only firms that are eligible for the exemption to not keep records bunch below this threshold. Firms which always have to keep records and apply accrual accounting methods do not bunch below the threshold since there is no benefit for them to undertake size management.

²⁵Statistical significance is calculated by taking the bunching estimate and dividing it by the standard deviation. The result is then compared to the 95% confidence interval and the relevant value of 1.96 (see for more information Wooldridge, 2013, p. 187).

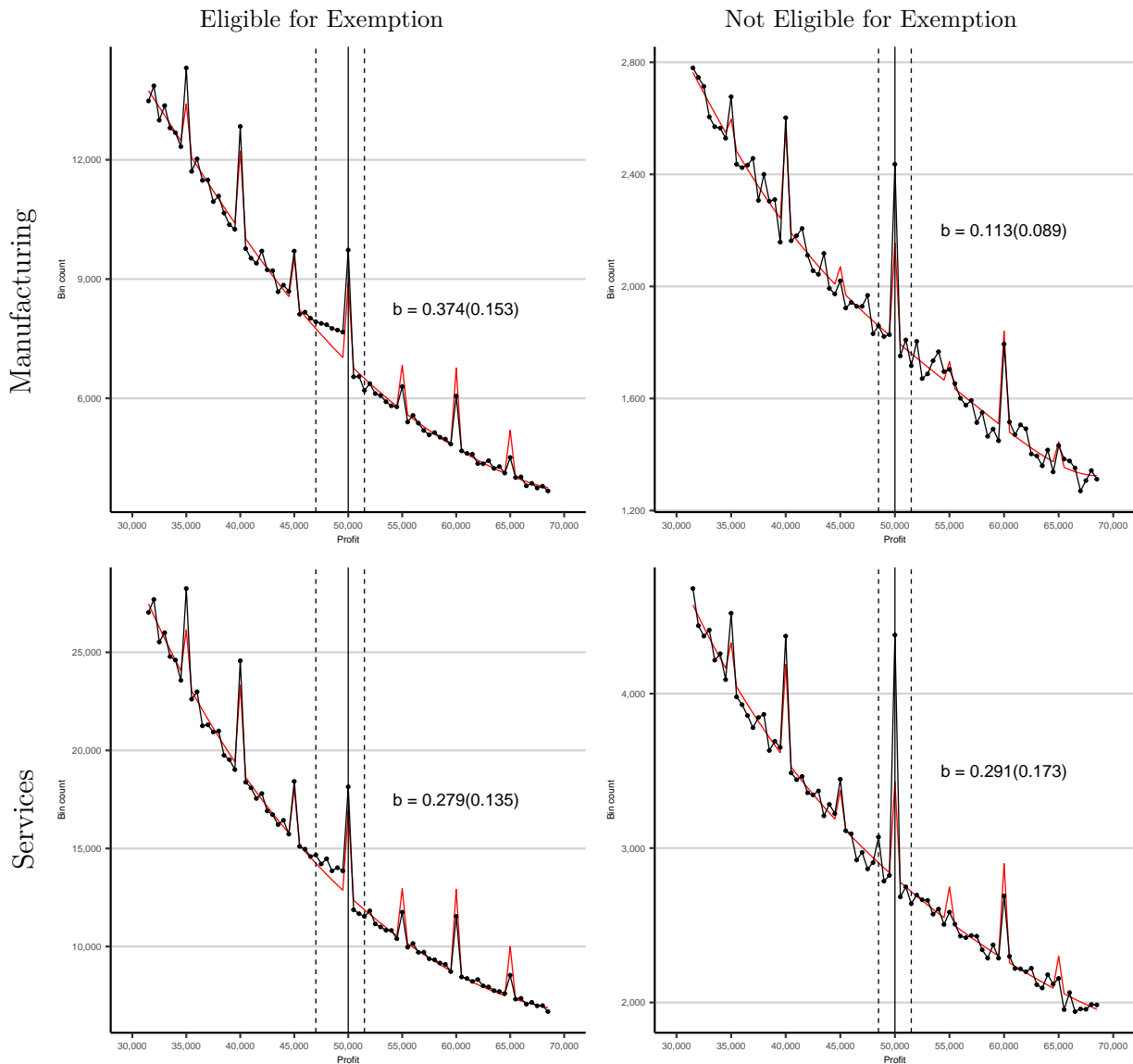
2.5. EMPIRICAL RESULTS

Figure 2.5.5: Tax Accounting Threshold (2010-2014)



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers (multiples of 5,000 Euro and 10,000 Euro). The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

Figure 2.5.6: Tax Accounting Threshold (2010-2014)



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers (multiples of 5,000 Euro and 10,000 Euro). The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB. Round-number bunching at multiples at 5,000 and 10,000 Euro is controlled for.

2.5. EMPIRICAL RESULTS

Furthermore, all company types show a behavioural bunching response at the tax accounting threshold, however the bunching mass is biggest for manufacturing firms with a coefficient of 0.374.²⁶ The heterogeneous behavioural responses of firms is proof for my fourth hypothesis since the magnitude of bunching depends on firm types. One possible explanation is that manufacturing firms fear the additional costs and efforts associated with record keeping and the accrual accounting method more than trading and services firms. This might stem from the business environment of craftsmen who work manually and wish to spend less time on record keeping. Another explanation might be that manufacturing firms have more possibilities to manage down their firm size than trading and services firms. Almunia and Lopez-Rodriguez (2018) also find differential bunching responses of firms depending on the sector in which the firms operate. Their explanation is that firms which sell mostly to other firms will show stronger bunching responses than firms which mostly sell to final consumers. They argue that it is easier to cross-check tax returns of firms with intermediate input sales since the buying firm will record the expenses to claim tax credits. In contrast, cross-checking tax returns of firms which mostly sell to final consumers in cash might be more difficult. They conclude that the more paper trail a firm's business activities leave, the higher is their incentive to bunch below the threshold. It is unclear whether their conclusions in relation to a tax enforcement intensity threshold can be transferred to the tax compliance threshold. It might be easier for firms which leave less paper trail to manage down their size than for firms with more paper trail since it is then easier for tax authorities to cross-check their tax returns.

To better illustrate how many firms bunch below the tax accounting threshold and how much profit and tax revenue is lost, I do a simple back-of-the-envelope calculation for the example when all firm types are included. In a first step, I take the difference between the number of firms in the real and counterfactual distribution in the excluded region below the threshold (the difference in bin counts). In total, approximately 10,600 firms undertake size management to get below the tax accounting threshold. In a second step, I calculate the amount of

²⁶The bunching mass cannot be interpreted intuitively (e.g., Bastani and Selin, 2014), therefore I do a simple back-of-the-envelope calculation.

profit and tax revenue that is lost because of firms' behavioural responses. To do this, I assume that in the absence of this tax accounting threshold, firms would have reported 50,001 Euro in profit and not a profit of exactly or just below 50,000 Euro.²⁷ In total, a profit of approximately 16 million Euro is lost. Taking an overall tax burden of roughly 45%, this results in a total tax loss of 7.2 million Euro. However, given the fact that this is the total sum for five years (2010 to 2014), the consequences from a tax revenue perspective seem to be modest. I do not have any estimations on firms' actual tax accounting and compliance costs, therefore I cannot calculate an estimate of how much tax accounting and compliance costs firms save if they stay below the threshold. Since the tax savings for firms bunching just below the threshold are modest, it seems probable that their bunching response is driven by lower tax accounting and compliance costs below the threshold.

2.5.3 Tax Credit Threshold

Figures 2.5.7 and 2.5.8 show the results of the distribution of Business Tax income and its counterfactual for the years 2010 to 2014.²⁸ The graphs on the left show the distribution for firms that are eligible for the Business Tax credit, whereas the graphs on the right show the distribution for firms that are not eligible for the Business Tax credit.²⁹ The first line of graphs shows the distribution for all firms, followed by the different company types (trading, manufacturing, and services). The solid black line shows the actual Business Tax income distribution, whereas the solid red line shows the counterfactual distribution. The vertical black lines show the relevant tax credit threshold of 24,500 Euro, and the vertical dotted lines the excluded range around the threshold.

²⁷To do this, I take the assumed profit amount of 50,001 Euro and subtract the average profit amount in each bin below the threshold. E.g., for the bin containing observations with profits from 48,001 to 48,500 Euro, I take the bin's average profit of 48,250 Euro, hence the lost profit amounts to 1,751 Euro (50,001 Euro - 48,250 Euro). In a last step, I multiply the lost profit with the number of firms in the respective bin.

²⁸I do not take into account the years 2004 and 2007 since there have been some changes to the Business Tax rate due to the Corporate Tax reform in 2008, see Brandis and Heuermann (2021).

²⁹See table 2.A.2 in the appendix for an overview of firms which are eligible for the tax credit and firms which are not.

2.5. EMPIRICAL RESULTS

Again, since firms which are eligible to get the tax credit have the tendency to round their Business Tax income at round numbers (multiples 1,000, 5,000, and 10,000 Euro), I control for round-number bunching at these multiples in order to control for their behaviour when estimating the counterfactual distribution. Similarly to sections 2.5.1 and 2.5.2, I also control for the different firm types to avoid that my results are solely driven by a certain firm type.

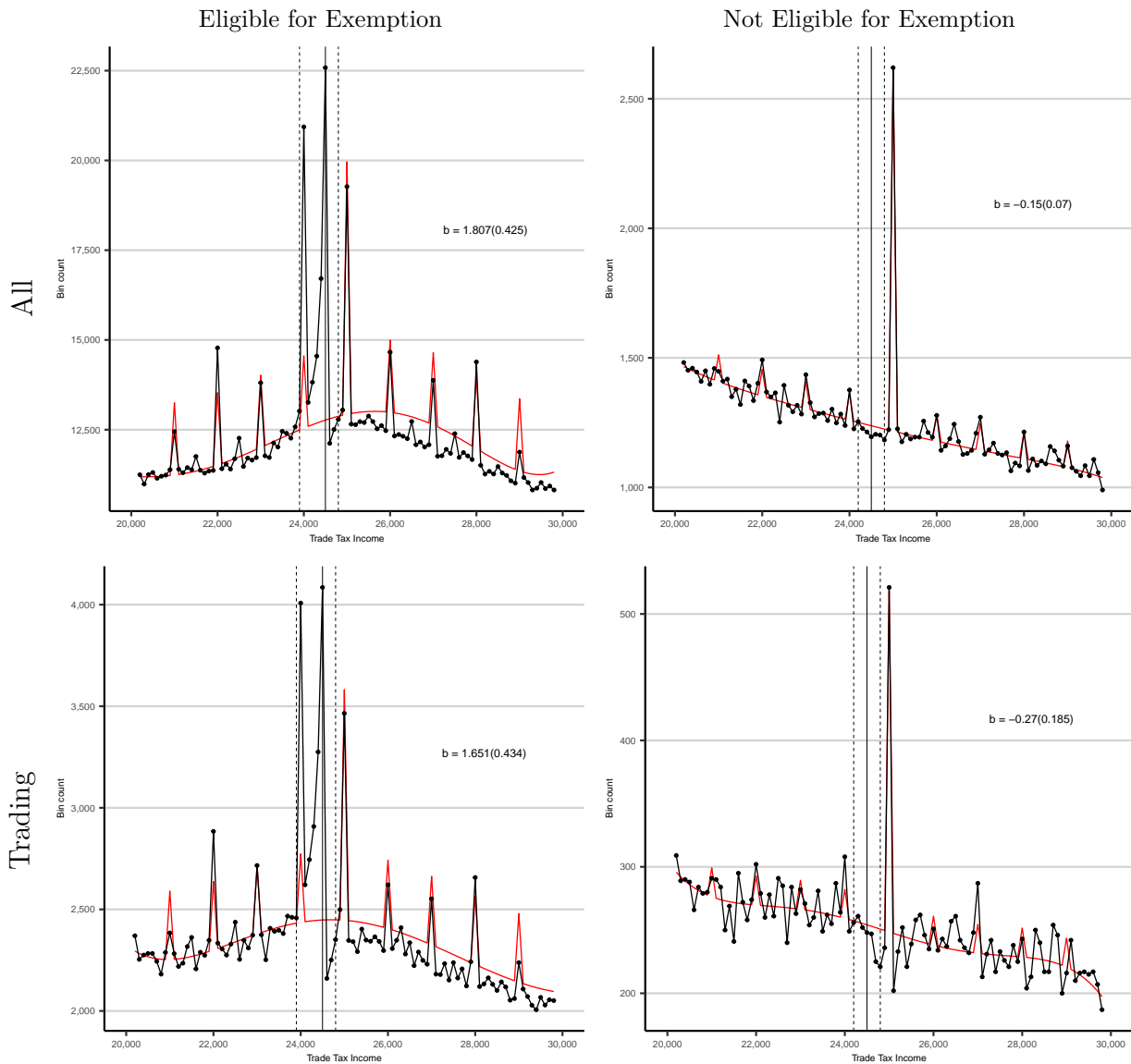
As one can see from the bunching coefficients in the graphical illustrations and in table 2.5.2, I do find strong evidence for behavioural bunching responses at the Business Tax credit threshold to support my third hypothesis. Firms which are eligible for getting the Business Tax credit strategically bunch at or below a Business Tax income of 24,500 Euro to avoid paying any Business Tax at all. These firms round their Business Tax income to exactly 24,000 Euro and 24,500 Euro or between 24,000 and 24,500 Euro which one can see in the spikes in the distribution at these Business Tax income levels. In this regard, it is even more astonishing that one can also see clear bunching mass in the bins of 24,100, 24,200, 24,300, and 24,400 Euro which cannot be found in other comparable bins. This illustrates that firms bunch below the tax credit threshold independent of whether it is a round number or not. This finding is in line with the results of Saez (2010), Chetty et al. (2011), Chetty and Saez (2013), and Chetty, Friedman and Saez (2013) who all find clear evidence of bunching at kink points where tax liability starts but not at higher kink points. Moreover, my result is also in accordance with Onji (2009), Harju, Matikka and Rauhanen (2019), and Liu et al. (2021) who find strong bunching responses at the VAT eligibility threshold.

Table 2.5.2: Bunching Estimates for the Tax Credit Threshold (2010-2014)

Firm Type	Bunching Estimate	Standard Error
All	1.807	0.425
Trading	1.651	0.434
Manufacturing	1.996	0.495
Services	1.771	0.338

This table displays the bunching estimates for the tax credit threshold for the years from 2010 to 2014 for firms which are eligible to get the Business Tax credit.

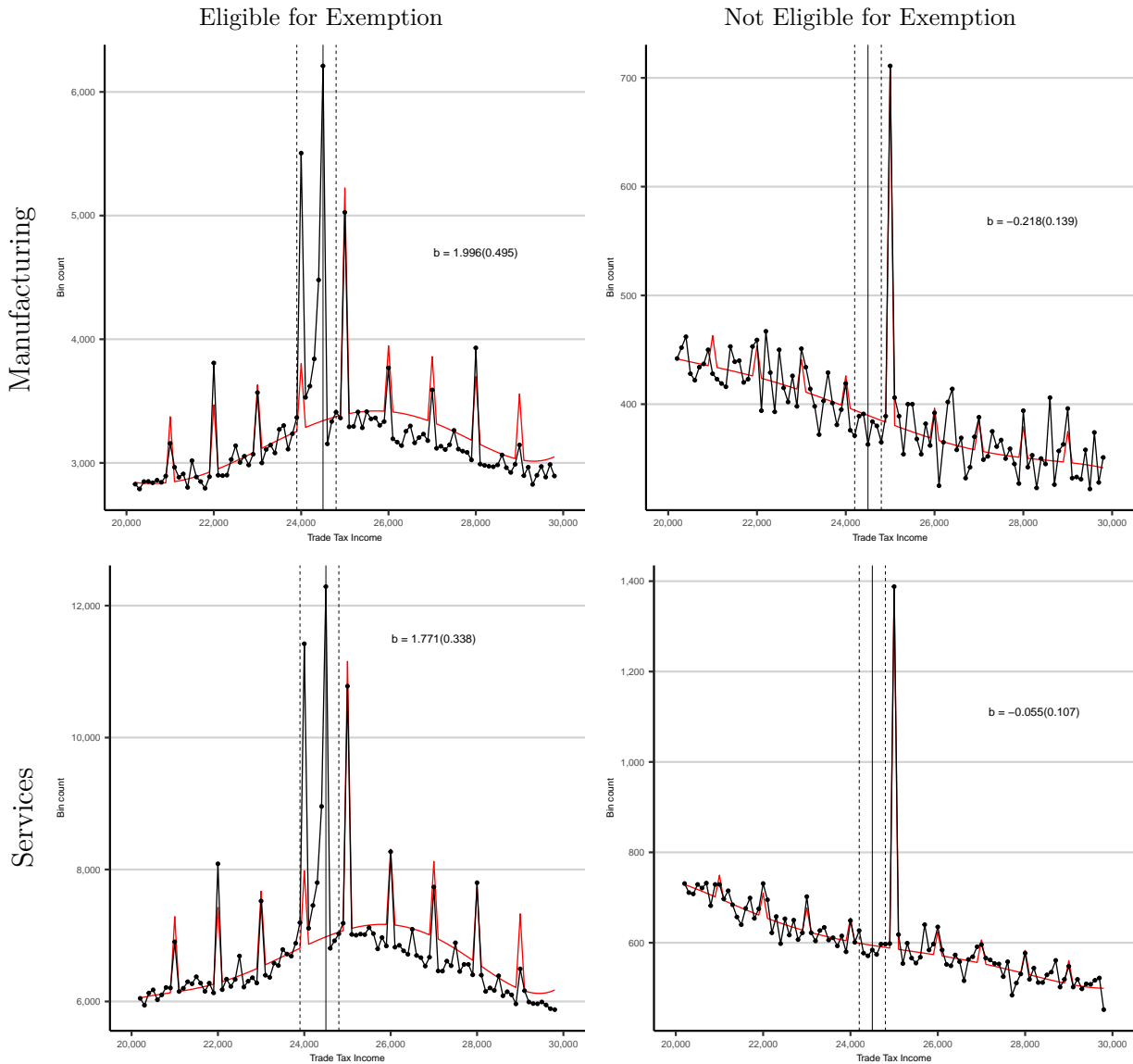
Figure 2.5.7: Tax Credit Threshold (2010-2014)



The graphs show the distribution of Business Tax income (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers. The x-axis shows Business Tax income, the y-axis the bin count with a bin width of 100. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 24,500 Euro. Round-number bunching at multiples at 1,000, 5,000 and 10,000 Euro is controlled for.

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Figure 2.5.8: Tax Credit Threshold (2010-2014)



The graphs show the distribution of Business Tax income (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers. The x-axis shows Business Tax income, the y-axis the bin count with a bin width of 100. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 24,500 Euro. Round-number bunching at multiples at 1,000, 5,000 and 10,000 Euro is controlled for.

The bunching estimates for all specifications are statistically significant and similarly to section 2.5.2, the bunching mass of 1.996 is biggest for manufacturing firms which shows again the heterogeneous behavioural responses of firms of different types (see also table 2.5.2). This differential bunching responses of firms depending on their firm type is in line with the result found in section 2.5.2 and by Almunia and Lopez-Rodriguez (2018). Manufacturing firms might have more possibilities to manage down their Business Tax income than trading and services firms, and therefore they are able to report Business Tax incomes at or just below the threshold of 24,500 Euro. I also find a heterogeneous response in relation to the eligibility to get the tax credit since the behavioural bunching response of firms entirely depends on firms' eligibility to get the Business Tax credit. Firms which are not eligible for the credit do not bunch below the threshold of 24,500 Euro which supports my fourth hypothesis. In line with the results in relation to the tax enforcement and tax accounting threshold, these firms bunch at round-numbers but one cannot see any spike in the distribution at the threshold of 24,500 Euro. As one can see in the graphical illustrations, these firms round their Business Tax income especially at multiples of 5,000 and 10,000 Euro but do not react at all to the tax credit threshold of 24,500 Euro. My finding of heterogeneous behavioural responses is in line with several papers which have also found that behavioural responses depend to a high degree on the possibility taxpayers have to evade taxes (Slemrod, Blumenthal and Christian, 2001; Gruber and Saez, 2002; Kopczuk, 2005; Saez, 2010; Kleven et al., 2011; Chetty and Saez, 2013; DeBacker et al., 2018). Hence, I find that there is substantial heterogeneity in managing down one's Business Tax income depending on whether a firm is eligible for the credit or not.

Similarly to section 2.5.2, I repeat my back-of-the-envelope calculation in order to get an estimate of how many firms bunch below the tax credit threshold and how much Business Tax revenue is lost. Taking the difference between firms' real and counterfactual distribution in the excluded region below the threshold for all firm types, I can show that approximately 24,700 firms manage down their Business Tax income in order to not pay any Business Tax at all. Assuming that firms would report 24,600 Euro in Business Tax income if there was no tax

2.5. EMPIRICAL RESULTS

credit threshold, I calculate a loss in Business Tax income of roughly 340,000 Euro.³⁰ From a tax revenue perspective, this loss in tax revenue seems to be very small given the fact it is the estimate for five years (2010 to 2014). The financial incentive for firms is also relatively small since their Business Tax liability would be very low if they reported a Business Tax income of 24,600 Euro (see also section 2.2.5). Hence, given the low financial incentives and that there are no other benefits associated with this tax credit, such a strong bunching response seems to be surprising. Either firms overestimate the financial benefits from bunching below the tax credit threshold or there are other factors influencing their behaviour for which I cannot control.

2.5.4 Comparison of Results

As described above, I do not find behavioural bunching responses at the tax enforcement thresholds, but strong bunching responses at both the Business Tax credit and tax accounting threshold. The differentiated behavioural responses at these thresholds might originate from firms' different cost-benefit analyses regarding size management and the thresholds' different characteristics. Generally, only firms assuming that the benefits from bunching below a threshold will outweigh the associated efficiency costs will decide to manage their size. Firms will increase their action up to the point where the marginal benefit of their actions, less taxes, scrutiny, or regulatory requirements, equals the marginal costs or the compliance costs. Since I find behavioural responses at both the tax credit and tax accounting thresholds, firms are generally able to manage down their size. This finding is in line with prior literature about bunching and size-management of firms (see Saez, 2010; Kleven and Waseem, 2013; Almunia and Lopez-Rodriguez, 2018). Moreover, my results are similar to the findings of Asatryan and Peichl (2017) and Harju, Matikka and Rauhanen (2019) who both find that especially

³⁰First, I take the assumed Business Tax income of 24,600 Euro in the absence of the tax credit threshold. Since these firms get a Business Tax credit of 24,500 Euro, it remains a Business Tax income of just 100 Euro. I multiply the 100 Euro with the number of bunching firms (24,700). Next, I take this sum and multiply it with the "Gewerbsteuermesszahl" and the average "Gewerbsteuerhebesatz" from the years 2010 to 2014 (393%) which leads to my final estimate of 340,000 Euro. For further information how the Business Tax is calculated, see Sections 11, 12 ff. GewStG.

SMEs react to size-dependent thresholds. Most importantly, they find that SMEs specifically react to simplifying accounting and compliance procedures which is identical to my results. Given the relatively low financial incentive, it is surprising that the bunching response at the tax credit threshold is so much stronger than at the tax accounting threshold. Either firms overestimate the benefits at the tax credit threshold or bunching is significantly more complex at the tax accounting threshold since both profit and sales have to be scaled down.

The fact that I do not find evidence for bunching at the tax enforcement thresholds can be explained in two ways: first, firms underestimate the benefits associated with being subject to less frequent and less intense audits due to low overall audit ratios; second, size management is too costly since the design of the tax enforcement thresholds is relatively complicated and requires ongoing adjustments. With regard to the SC-MC tax enforcement threshold, the threshold for trading and manufacturing firms is located at 53,000 Euro for the years from 2010 to 2012, which is close to the tax accounting threshold of 50,000 Euro. Hence, if firms stay below the the tax accounting threshold of 50,000 Euro, they are also automatically below the SC-MC tax enforcement threshold. This might partly explain why there is no bunching at or below a profit level of 53,000 Euro.

Theoretically, the biggest incentive for firms to bunch is at the MC-LC tax enforcement threshold since the average audit ratio jumps discretely from 6.6% for MC to 21.4% for LC. Additionally, once a firm is classified as LC, it is subject to ongoing audits of all fiscal years. However, I do not find evidence for bunching at this MC-LC tax enforcement threshold. A possible explanation might be that even if firms wanted to stay below the thresholds, they might be too large to manage down their size. The larger a firm is, the more complicated size management becomes since more people have to be involved in disguising the actual size which might make size management nearly impossible.

The heterogeneity in firm responses depending on the relevant threshold, which supports my fourth hypothesis, illustrates that tax administrations can influence firms' behavioural responses by designing differently complex thresholds. Behavioural responses might be avoided if tax administrations both regularly adjust the thresholds and choose different threshold specific criteria.

2.6. ROBUSTNESS TESTS

However, this is also associated with more costs for tax administrations. Hence, tax administrations should balance between efficiency criteria and the intended benefits for SMEs and firms' unintended behavioural responses around these size-dependent thresholds. It remains unclear whether these policies are beneficial from a broader perspective since tax revenue is lost due to bunching and size management. Therefore, size-dependent regulations may not increase the efficiency of taxation if tax revenue is lost due to behavioural bunching responses which policymakers should take into account for the design of optimal tax policies.

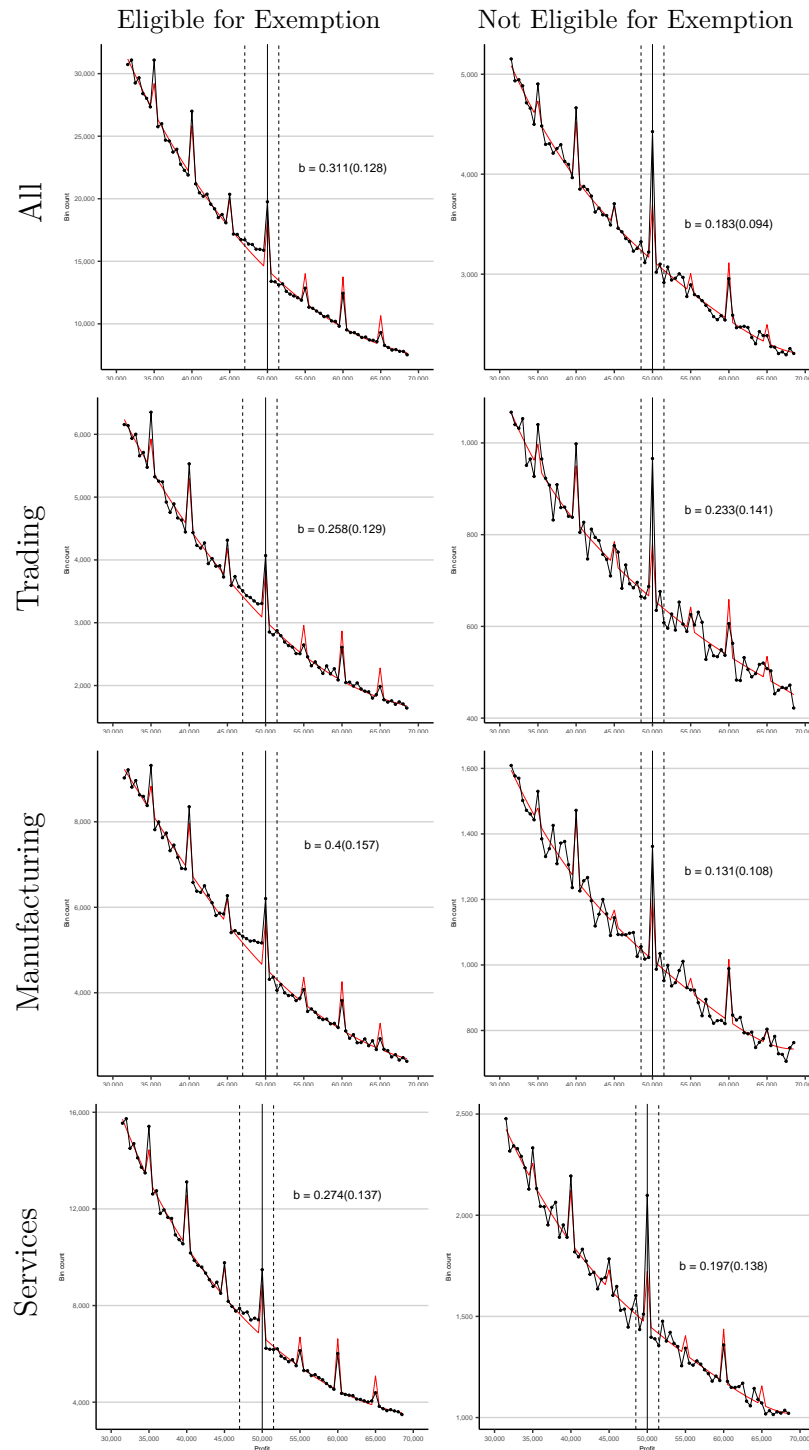
2.6 Robustness Tests

In order to test the robustness of my findings, I conduct several robustness tests. First, I control for firms which belong to tax groups since in these cases profit is only available at the level of the tax group and not at the firm level. I cannot control for firms belonging to a tax group in my main specifications since this variable is only available for the VAT data and I lose a lot of observations when merging it with the Business Tax data. I also drop observations whose tax returns might have been subject to an audit. The majority of tax returns is processed and assessed automatically based on a risk management system. For this reason, the Business Tax statistics contain mainly tax return data which has not been changed by the tax authorities. However, if companies are subject to an audit, their submitted tax returns will most probably not correspond to the data in the Business Tax statistics. The relevant variable in the data contains several codes and since their exact meaning remains unclear, I only include these variables in my robustness tests.³¹

Second, similarly to Kleven and Waseem (2013), Almunia and Lopez-Rodriguez (2018), Best and Kleven (2018), I use a sixth-degree polynomial to estimate the distribution of the counterfactual. As one can see in figures 2.6.1, 2.6.2, 2.6.3, and 2.6.4, the bunching estimates remain largely unchanged and mostly significant for the different specifications which confirms my main results in section 2.5.

³¹No employee at the "Oberfinanzdirektion" Hesse or Baden-Wuerttemberg could tell what they actually mean and when they are exactly used.

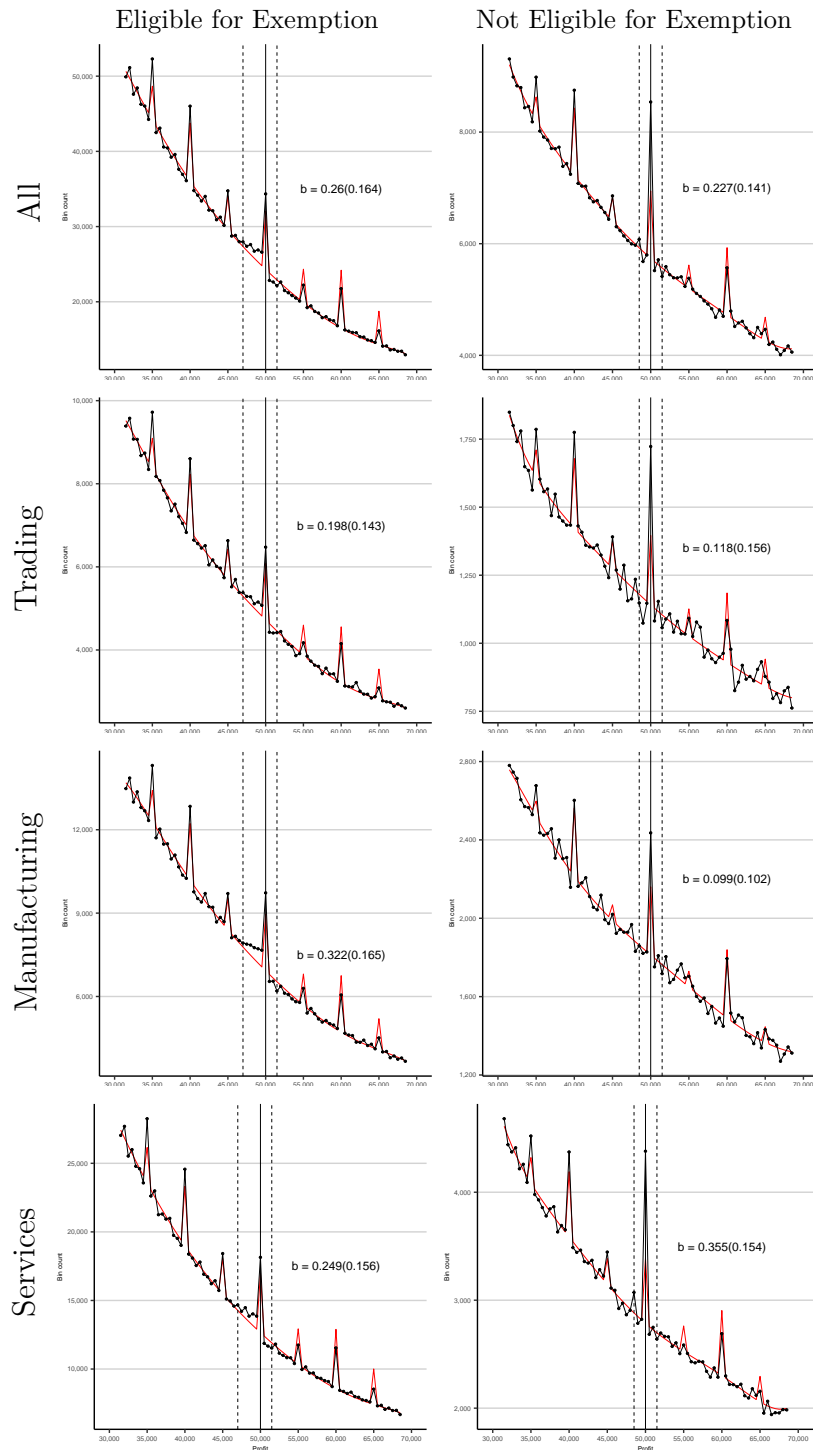
Figure 2.6.1: Robustness Test: Tax Accounting Threshold (2010-2014) with controlling for tax groups and corrections by tax administration



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers (multiples of 5,000 Euro and 10,000 Euro). The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB.

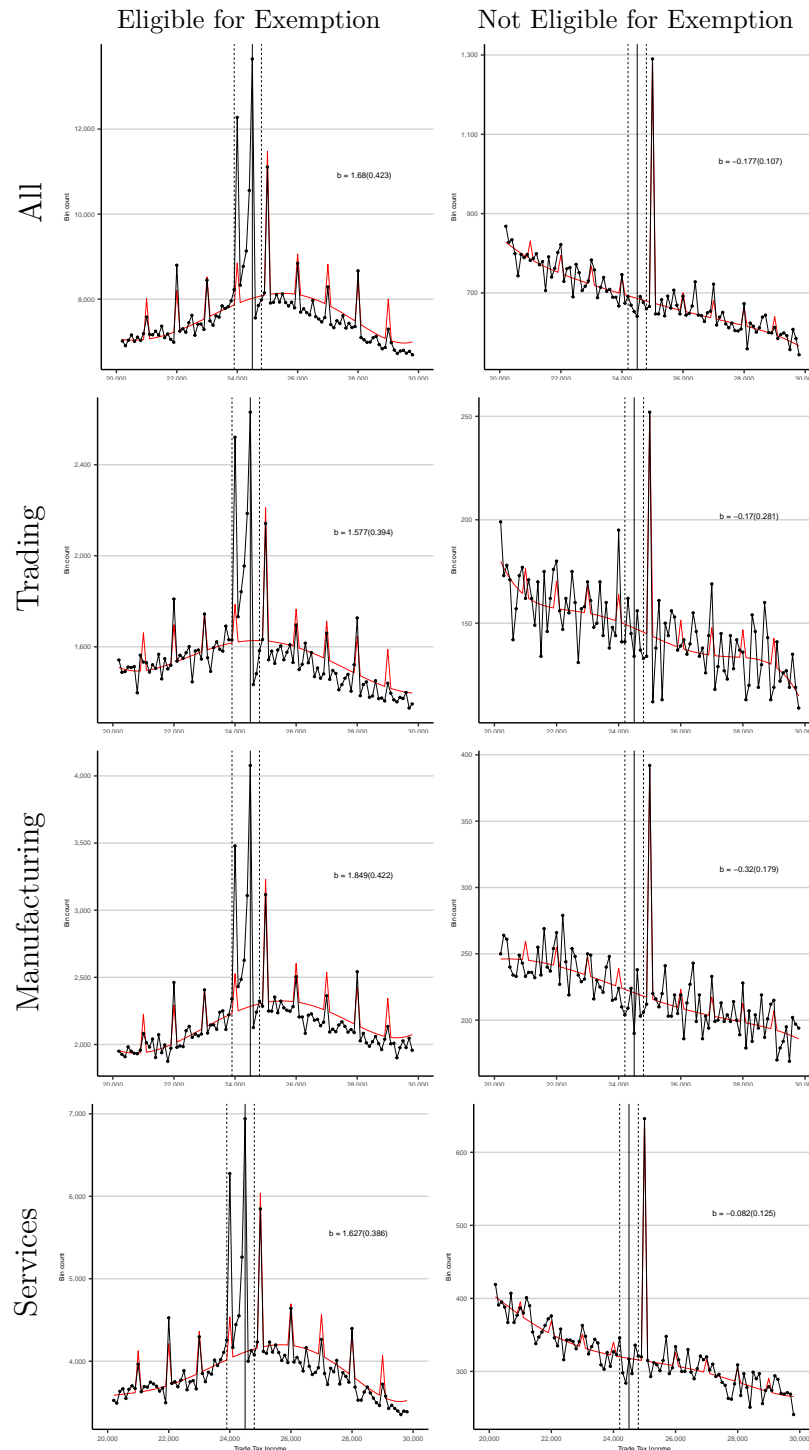
2.6. ROBUSTNESS TESTS

Figure 2.6.2: Robustness Test: Tax Accounting Threshold (2010-2014) with sixth-degree polynomial



The graphs show the distribution of profits (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers (multiples of 5,000 Euro and 10,000 Euro). The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 50,000 Euro. The graphs in the left column show the distribution for firms which are eligible to Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB.

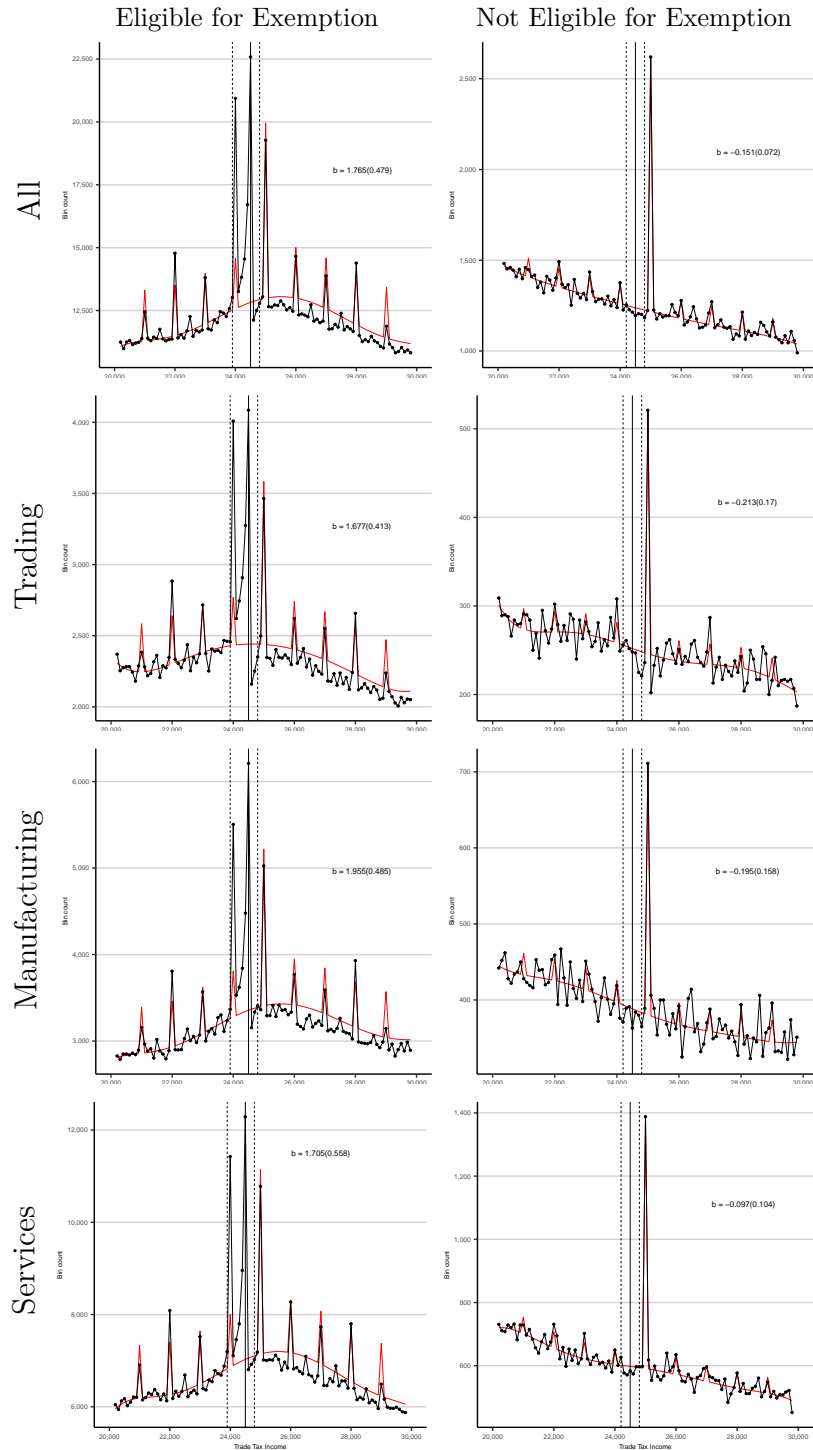
Figure 2.6.3: Robustness Test: Tax Credit Threshold (2010-2014) with controlling for tax groups and corrections by tax administration



The graphs show the distribution of Business Tax income (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers. The x-axis shows Business Tax income, the y-axis the bin count with a bin width of 100. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 24,500 Euro. The graphs in the left column show the distribution for firms which are eligible for the tax credit, whereas firms in the right column do not qualify for the tax credit.

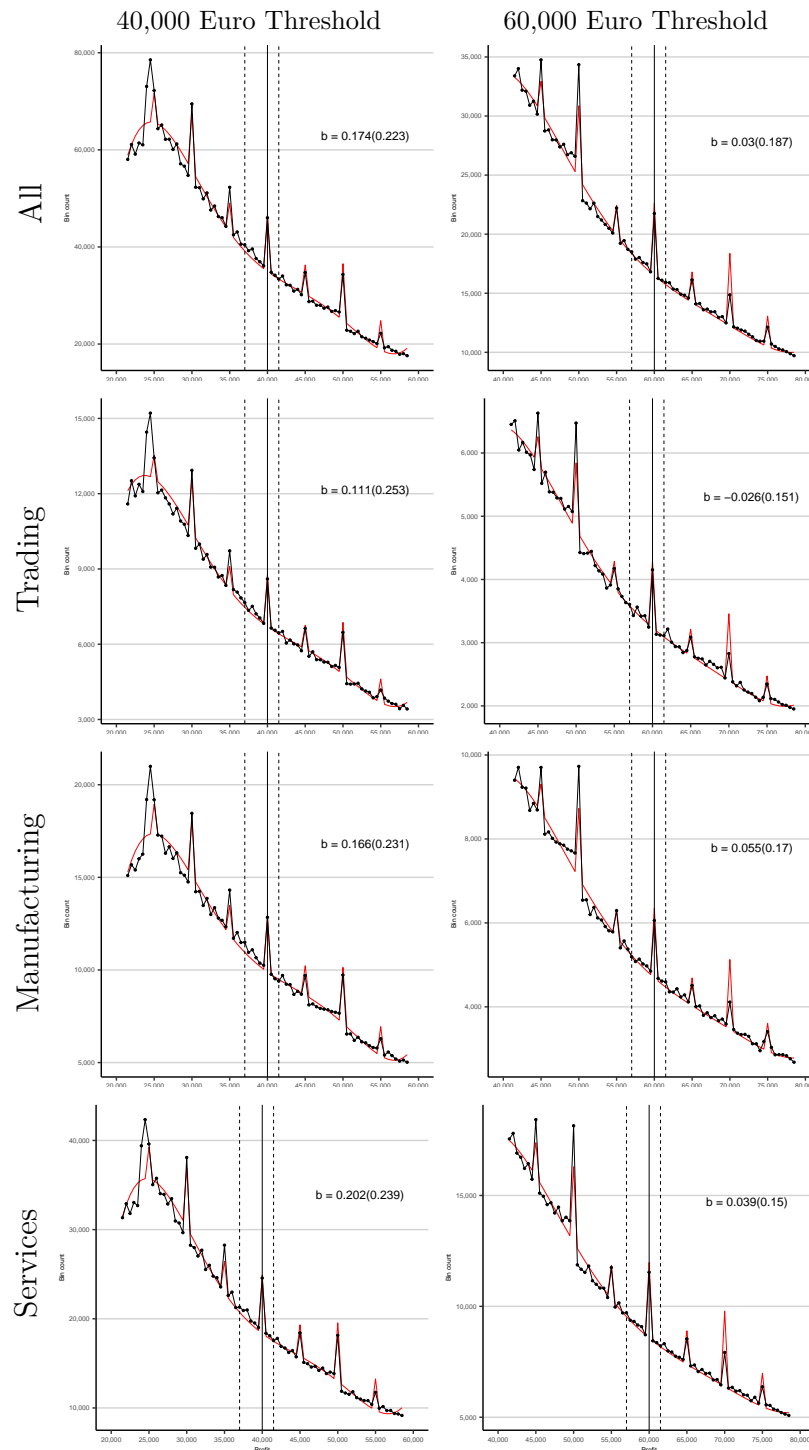
2.6. ROBUSTNESS TESTS

Figure 2.6.4: Robustness Test: Tax Credit Threshold (2010-2014) with sixth-degree polynomial



The graphs show the distribution of Business Tax income (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers. The x-axis shows Business Tax income, the y-axis the bin count with a bin width of 100. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold of 24,500 Euro. The graphs in the left column show the distribution for firms which are eligible for the tax credit, whereas firms in the right column do not qualify for the tax credit.

Figure 2.6.5: Robustness Test: Placebo Studies for Hypothetical Tax Accounting Thresholds at 40,000 Euro and 60,000 Euro (2010-2014)



The graphs show the distribution of profit (solid black line) and its estimated counterfactual distribution (solid red line) for the years 2010 to 2014 while controlling for round-numbers. The x-axis shows profit, the y-axis the bin count with a bin width of 500. The vertical black line shows the thresholds, the vertical dotted black lines show the excluded range around the threshold. The graphs in the left column show the distribution for firms which are eligible for Section 241a HGB, whereas firms in the right column do not qualify for Section 241a HGB.

2.7. LIMITATIONS

However, the bunching estimate for the tax accounting threshold, when the counterfactual is determined by a sixth-degree polynomial regression, remains only significant for manufacturing firms. For trading and services firms, the estimate of the bunching mass gets insignificant. This underlines the strong bunching response of manufacturing firms but does not confirm an equally strong response of other firm types when a sixth-degree polynomial is used for the counterfactual. Furthermore, I run placebo tests with hypothetical tax accounting thresholds at 40,000 and 60,000 Euro to test the robustness of my findings at the 50,000 Euro tax accounting threshold. I show the results for firms which are eligible for the tax accounting threshold in figure 2.6.5. As one can see, there is no excess bunching mass just below the hypothetical 40,000 and 60,000 Euro thresholds which confirms that the bunching response at the 50,000 Euro threshold is caused by the discontinuities in tax accounting and compliance requirements. All bunching estimates are smaller than their standard errors and consequently statistically insignificant.

2.7 Limitations

The Business Tax return data contains all German companies which are obligated to pay Business Tax, and therefore allows to analyse the behavioural responses of all German firms and not just of a smaller sub-sample. However, the data also has some shortcomings which might impact the reliability of results. As described in section 2.4, it was impossible to simultaneously control for both profit and sales since the definition of sales was ambiguous, and only periodic but no annual VAT returns were available. Ideally, when analysing the tax enforcement intensity and tax accounting thresholds, one should control for both profit and sales to avoid any bias, and analyse behavioural responses more accurately. Additionally, I do not have data about firms' reported profit according to HGB, therefore I can only control for their taxable profit. However, managing down one's taxable profit exactly at or below 50,000 Euro but reporting a higher profit according to HGB does not have any benefits for firms since they would be then obligated to keep records according to HGB and automatically according to AO. Another shortcom-

ing of the data is that there is no clear documentation of the correction variable which defines whether the tax returns have been adjusted (e.g., after an audit) or whether they have been approved as handed in by the firms. Therefore, it is not possible to reliably control for tax returns that have been subject to an audit or other changes by the tax authorities. Furthermore, size management causes efficiency costs which comprise several different cost factors, e.g., administrative costs, organisational costs, information costs, and adjustment costs. Since there is no information about the composition of efficiency costs in the data available, it is not possible to identify which type of efficiency costs is most important for firms. Finally, the data does not allow to analyse through which channels firms manage down their size. Size management can be done by reducing economic activity (e.g., foregoing profitable business opportunities), by legal tax avoidance (e.g., re-arrangement of income), or by illegal tax evasion (e.g., income and profits are not declared for taxation). Although the majority of empirical evidence suggests that firms manage down their size through illegal tax evasion (see, e.g., Chetty, 2009; Kleven et al., 2011; Almunia and Lopez-Rodriguez, 2018), I am not able to disentangle in more detail which channels firms use to manage down their size.

2.8 Conclusion

In this study, I analyse firms' behavioural responses to different size-dependent tax administrative thresholds in Germany. This paper is the first to simultaneously analyse the impact of tax enforcement, tax credit, and tax accounting thresholds on firms' profit reporting behaviour over several years. This allows me to compare the behavioural responses to these different thresholds and analyse whether and how firms respond to them. All these tax law specific discontinuities create incentives for firms to bunch just below the relevant thresholds to avoid additional scrutiny or costs. However, behavioural responses to administrative interventions will always cause efficiency costs, and therefore only firms assuming that the benefits from bunching below a threshold will outweigh the associated costs will manage their size.

2.8. CONCLUSION

My study contributes to find optimal tax policies by analysing behavioural responses of firms to different tax administrative policies which aim to bolster SMEs and increase the efficiency of taxation. I find strong bunching responses at both the Business Tax credit and tax accounting thresholds but no bunching responses at the tax enforcement thresholds. The heterogeneous behavioural responses at the thresholds might originate from firms' different cost-benefit analyses and the thresholds' different characteristics.

My results are important for policymakers in order to design optimal tax policies. First, I can show that size-dependent thresholds can cause behavioural responses of firms around these thresholds. The behavioural responses at the tax credit and tax accounting thresholds show that SMEs react to and benefit from tax laws and rules that reduce their tax liability and tax compliance costs. However, it remains unclear whether these policies are beneficial from a broader perspective since tax revenue is lost due to bunching and tax evasion. Second, I can show that there is heterogeneity in firms' behavioural response to these size-dependent thresholds. The magnitude of the response depends on the design of the thresholds and on the possibilities a firm has to strategically bunch below them. Heterogeneity in firm responses illustrates that tax administrations can influence or prevent bunching responses by designing more complex thresholds. Hence, if tax administrations want to avoid unintended behavioural responses, they must apply different criteria for size classifications and constantly adjust the respective thresholds.

Furthermore, it is important to take the behavioural responses of firms into account when designing optimal tax policies since otherwise unintended frictions and behavioural responses might occur. Although these size-dependent regulations aim to increase efficiency of taxation and bolster SMEs, it remains unclear whether this is welfare improving since tax revenue is lost due to firms' size management activities. Additionally, firms spend time and effort for their size management which might lead to an inefficient allocation of their resources. Further research should try to analyse whether these thresholds incentivise smaller firms to stay uncompetitively small (e.g., generating less income) or to engage in tax evasion (e.g., underreporting their income). Future research should also ex-

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amine in more detail the drivers of firms' behavioural responses, especially at the tax credit threshold. Finally, one should analyse whether behavioural responses vary in the different sub-national states and whether there is a similar bunching response at the VAT eligibility threshold.

2.A Appendix

2.A.1 Model of Tax Evasion

The standard model of tax evasion dates back to Allingham and Sandmo (1972) and was further refined by Yitzhaki (1974). In this theoretical model, individual taxpayers maximise their expected utility while taking into account a probability of audit and penalty for cheating. Taxpayers face a decision on whether and to what extent they are willing to avoid taxes by deliberately underreporting their taxable income. They can either declare their actual income or underreport it in order to pay less taxes. For a taxpayer, this is a decision under uncertainty since ex-ante it is unclear whether he will be better off with underreporting his income since after a possible investigation by the tax authority he could be even worse off than declaring his true income in the first place. The standard model of tax evasion by Allingham, Sandmo, and Yitzhaki has been the starting point for further adjustments of the model by other researchers.

Initially, only individual taxpayers were considered in further refinements of the standard model of tax evasion (see, e.g., Friedland, Maital and Rutenberg, 1978; Clotfelter, 1983; Spicer and Hero, 1985; Crane and Nourzad, 1986).

Besides individual taxpayers, companies also have possibilities to underreport their taxable income. Firms take their evasion costs, tax rate, and audit probability into account when deciding whether to be tax compliant or not. Corporate tax evasion differs from individual tax evasion since one also has to take into account firm-specific components (see, e.g., Slemrod, 2004). Other studies which include companies in the standard model of tax evasion are Marrelli and Martina (1988), Cremer and Gahvari (1993), Chen and Y. (2005), Crocker and Slemrod (2005), and Bigio and Zilberman (2011).

In the aforementioned studies about the standard model of tax evasion, social norms or social interactions that might influence tax evasion decisions are not taken into account. However, there is a large literature emphasising that tax evasion is affected by social norms and social interactions.

It is shown in these studies that social conformity, social learning, and fairness influence the decision of a taxpayer whether to evade taxes or not (e.g., Spicer and Becker, 1980; Gordon, 1989; Myles and Naylor, 1996; Andreoni, Erard and Feinstein, 1998; Fortin, Lacroix and Villeval, 2007).

2.A.2 Overview about Eligibility for Tax Accounting Thresholds

Table 2.A.1: Overview about Eligibility for Tax Accounting Threshold

Eligible for Tax Accounting Threshold	Not Eligible for Tax Accounting Threshold
Sonstige Einzelgewerbetreibende	Kommanditgesellschaft
Sonstige selbständige Personen	Offene Handelsgesellschaft
Sonstige natürliche Personen	GmbH & Co. KG
Gesellschaft bürgerlichen Rechts	Gesellschaft mit beschränkter Haftung
	Unternehmergeellschaft
	Aktiengesellschaft

This table gives an overview of firms which are eligible for the exemption to not keep records and use simplified accounting methods and firms which are not depending on their legal form. For a better understanding, legal forms are expressed in German.

2.A.3 Overview about Eligibility for Tax Credit Thresholds

Table 2.A.2: Overview about Eligibility for Tax Credit Threshold

Eligible for Tax Credit Threshold	Not Eligible for Tax Credit Threshold
Sonstige Einzelgewerbetreibende	Gesellschaft mit beschränkter Haftung
Sonstige selbständige Personen	Unternehmergeellschaft
Sonstige natürliche Personen	Aktiengesellschaft
Gesellschaft bürgerlichen Rechts	
Kommanditgesellschaft	
Offene Handelsgesellschaft	
GmbH & Co. KG	

This table gives an overview of firms which are eligible for the tax credit and firms which are not depending on their legal form. For a better understanding, legal forms are expressed in German.

2.A.4 Tax Enforcement Thresholds (in Euro)

Table 2.A.3: Size-Dependent Tax Enforcement Thresholds for 2010-2012 and 2013-2014

Company type	Criterion	2010 - 2012				2013 - 2014			
		VSC-SC	SC-MC	MC-LC	MC-LC	VSC-SC	SC-MC	SC-MC	MC-LC
Trading	Profit	34,000	53,000	265,000	36,000	56,000	56,000	280,000	
	Sales	160,000	840,000	6,900,000	170,000	900,000	900,000	7,300,000	
Manufacturing	Profit	34,000	53,000	235,000	36,000	56,000	56,000	250,000	
	Sales	160,000	480,000	4,000,000	170,000	510,000	510,000	4,300,000	
Services	Profit	34,000	59,000	305,000	36,000	63,000	63,000	330,000	
	Sales	160,000	710,000	5,300,000	170,000	760,000	760,000	5,600,000	

2.A.5 Distribution of Legal Forms

Table 2.A.4: Distribution of Legal Forms

Company type	Legal forms for Whole Sample	N	%
All		14,730,658	100.00%
	Sole proprietors and natural persons	9,622,534	65.32%
	Partnerships	1,772,200	12.03%
	Corporations	3,335,924	22.65%
Manufacturing		4,115,270	100.00%
	Sole proprietors and natural persons	2,564,918	62.33%
	Partnerships	564,485	13.72%
	Corporations	985,867	23.96%
Trading		3,049,925	100.00%
	Sole proprietors and natural persons	2,070,552	67.89%
	Partnerships	327,848	10.75%
	Corporations	651,525	21.36%
Services		7,565,463	100.00%
	Sole proprietors and natural persons	4,987,064	65.92%
	Partnerships	879,867	11.63%
	Corporations	1,698,532	22.45%
All	Legal forms for 2004 & 2007	3,487,584	100.00%
	Sole proprietors and natural persons	2,262,983	64.89%
	Partnerships	424,769	12.18%
	Corporations	799,832	22.93%
Manufacturing		927,754	100.00%
	Sole proprietors and natural persons	549,176	59.19%
	Partnerships	125,978	13.58%
	Corporations	252,600	27.23%
Trading		765,908	100.00%
	Sole proprietors and natural persons	519,662	67.85%
	Partnerships	85,405	11.15%
	Corporations	160,841	21.00%
Services		1,793,922	100.00%
	Sole proprietors and natural persons	1,194,145	66.57%
	Partnerships	213,386	11.89%
	Corporations	386,391	21.54%
All	Legal forms for 2010 - 2014	11,243,074	100.00%
	Sole proprietors and natural persons	7,359,551	65.46%
	Partnerships	1,347,431	11.98%
	Corporations	2,536,092	22.56%
Manufacturing		3,187,516	100.00%
	Sole proprietors and natural persons	2,015,742	63.24%
	Partnerships	438,507	13.76%
	Corporations	733,267	23.00%
Trading		2,284,017	100.00%
	Sole proprietors and natural persons	1,550,890	67.90%
	Partnerships	242,443	10.61%
	Corporations	490,684	21.48%
Services		5,771,541	100.00%
	Sole proprietors and natural persons	3,792,919	65.72%
	Partnerships	666,481	11.55%
	Corporations	1,312,141	22.73%

2.A. APPENDIX

2.A.6 Distribution of Observation in German States

Table 2.A.5: Distribution of Observations in the German States

State	N	%
Whole sample	14,730,658	100.00%
Schleswig-Holstein	498,527	3.38%
Hamburg	362,093	2.46%
Lower Saxony	1,193,668	8.10%
Bremen	103,151	0.70%
North Rhine-Westphalia	3,363,039	22.83%
Hesse	1,094,713	7.43%
Rhineland-Palatinate	638,701	4.34%
Baden-Wuerttemberg	1,843,100	12.51%
Bavaria	2,503,083	16.99%
Saarland	211,330	1.43%
Berlin	633,385	4.30%
Brandenburg	405,827	2.75%
Mecklenburg-Western Pomerania	408,392	2.77%
Saxony	711,775	4.83%
Saxony-Anhalt	355,309	2.41%
Thuringia	404,565	2.75%
2004 & 2007	3,487,584	100.00%
Schleswig-Holstein	120,248	3.45%
Hamburg	80,102	2.30%
Lower Saxony	290,702	8.34%
Bremen	26,042	0.75%
North Rhine-Westphalia	791,292	22.69%
Hesse	244,628	7.01%
Rhineland-Palatinate	145,558	4.17%
Baden-Wuerttemberg	437,667	12.55%
Bavaria	599,796	17.20%
Saarland	53,656	1.54%
Berlin	121,028	3.47%
Brandenburg	95,866	2.75%
Mecklenburg-Western Pomerania	107,338	3.08%
Saxony	181,588	5.21%
Saxony-Anhalt	91,738	2.63%
Thuringia	100,335	2.88%

Table 2.A.6: Distribution of Observations in the German States

State	N	%
2010 - 2014	11,243,074	100.00%
Schleswig-Holstein	378,279	3.36%
Hamburg	281,991	2.51%
Lower Saxony	902,966	8.03%
Bremen	77,109	0.69%
North Rhine-Westphalia	2,571,747	22.87%
Hesse	850,085	7.56%
Rhineland-Palatinate	493,143	4.39%
Baden-Wuerttemberg	1,405,433	12.50%
Bavaria	1,903,287	16.93%
Saarland	157,674	1.40%
Berlin	512,357	4.56%
Brandenburg	309,961	2.76%
Mecklenburg-Western Pomerania	301,054	2.68%
Saxony	530,187	4.72%
Saxony-Anhalt	263,571	2.34%
Thuringia	304,230	2.71%

2.A.7 Distribution of Firm Types and Legal Forms in the German States (in Percent)

Table 2.A.7: Distribution of Firm Types in the German States

State	Manufacturing	Trading	Services
Schleswig-Holstein	29.29%	20.63%	50.08%
Hamburg	15.42%	21.19%	63.38%
Lower Saxony	30.19%	20.81%	48.99%
Bremen	18.44%	23.30%	58.26%
North Rhine-Westphalia	25.76%	21.25%	52.99%
Hesse	25.65%	19.87%	54.48%
Rhineland-Palatinate	29.95%	20.45%	49.60%
Baden-Wuerttemberg	31.62%	19.86%	48.52%
Bavaria	29.30%	20.56%	50.14%
Saarland	28.03%	22.83%	49.14%
Berlin	19.44%	18.73%	61.83%
Brandenburg	36.62%	17.65%	45.74%
Mecklenburg-Western Pomerania	29.17%	17.52%	53.31%
Saxony	33.29%	19.86%	46.85%
Saxony-Anhalt	33.76%	18.73%	47.51%
Thuringia	34.71%	19.59%	45.70%

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Table 2.A.8: Distribution of Legal Forms in the German States

State	Sole Proprietors	Partnerships	Corporations
Schleswig-Holstein	63.98%	14.27%	21.75%
Hamburg	53.91%	13.08%	33.01%
Lower Saxony	61.53%	15.10%	23.36%
Bremen	51.29%	18.35%	30.36%
North Rhine-Westphalia	65.83%	12.53%	21.64%
Hesse	65.89%	11.61%	22.51%
Rhineland-Palatinate	67.79%	11.08%	21.13%
Baden-Wuerttemberg	63.96%	13.19%	22.86%
Bavaria	63.97%	12.55%	23.48%
Saarland	71.58%	7.51%	20.91%
Berlin	61.74%	9.34%	28.92%
Brandenburg	69.62%	9.14%	21.24%
Mecklenburg-Western Pomerania	78.93%	7.93%	13.14%
Saxony	69.54%	8.75%	21.72%
Saxony-Anhalt	71.54%	8.73%	19.73%
Thuringia	74.50%	8.25%	17.25%

CHAPTER 2.

Chapter 3

Is there Competition in Tax Enforcement between German States?

3.1 Introduction

Tax competition is one of the most intensely discussed issues in economic policy since increasing economic integration and capital mobility have encouraged both countries and companies to engage in tax competition. From a broader perspective, international tax competition is mostly seen as harmful since it leads to lower tax rates and possibly to lower tax revenues (Devereux, Griffith and Klemm, 2014). In the European Union, tax harmonisation and coordination is sought to reduce tax competition between member states. On a supranational level, organisations such as the OECD have developed and put in place measures such as the Base Erosion and Profit Shifting (BEPS) program to combat international tax competition, tax evasion, and tax avoidance. However, tax competition can also happen on national level if sub-national governments in federal countries have the legal authority to independently decide about at least one pillar of their tax policies. If countries or sub-national governments compete in tax policies, this can have negative impacts on equity of taxation since some taxpayers might benefit from controversial tax planning activities to reduce their tax burden. Several investigative publications such as the Panama Papers and the Pandora Papers have raised public awareness that tax competition can negatively affect equity of taxation amongst taxpayers.¹

However, in the debate about tax competition, public attention is mainly drawn to tax competition in tax rates and tax bases (Devereux, Griffith and Klemm, 2014). Mostly forgotten in this debate is one major pillar of tax policy, namely tax enforcement. Tax enforcement is an important tax policy instrument since tax revenues and Effective Tax Rates (ETRs) are not solely determined by tax rates and tax base definitions but also by tax enforcement activities of a country or sub-national governments. If countries and sub-national governments cannot independently set their tax rates and tax bases because of tax harmonisation, tax enforcement might become the only available strategic tool for tax competition both between and within countries. Thus, countries and sub-national

¹See, e.g., the website of the International Consortium of Investigative Journalists for more details; <https://www.icij.org/investigations/panama-papers/>; <https://www.icij.org/investigations/pandora-papers/> (June 7, 2022).

3.1. INTRODUCTION

governments might have incentives to use tax enforcement as a tax policy tool for tax competition.

In this paper, I use an unique data set to study the tax enforcement activities of the 16 federal states in Germany, and I analyse whether the German fiscal equalisation scheme and government ideology influence their tax enforcement activities. Additionally, I develop a relative measure of how much tax gain per Euro of reported profit tax administrations raise in order to examine tax enforcement in the states and check whether the current tax enforcement strategy fulfills its legal obligation.

First, I study whether there are structural differences between federal states' tax enforcement activities in Germany. Tax rates and tax bases are determined by German federal law and consequently harmonised across the federal states. However, tax administration, tax collection, and tax enforcement are the responsibilities of the federal states, and therefore tax enforcement activities can be designed largely independently by each state. This might incentivise states' governments to use tax enforcement as a strategic tool for tax competition between German states.

Second, I analyse whether the German fiscal equalisation scheme has any influence on federal states' tax enforcement activities. In Germany, it has long been argued that the fiscal equalisation scheme might have an impact on sub-national governments' tax policies since it distorts states' tax revenue before and after fiscal equalisation. If a state raises one additional Euro of tax gain from audits, then only a certain amount of this additional Euro remains within this state. For this reason, fiscal equalisation might have an impact on states' tax enforcement activities (e.g., Bönke, Schröder and Jochimsen, 2017; Buettner and Krause, 2021).

Third, I analyse whether government ideologies of German sub-national governments have an influence on their tax enforcement activities. Policymakers from the political left have accused conservative state governments to use lax tax enforcement and low audit ratios as a tax policy tool for tax competition in order to attract companies and gratify their constituencies (e.g., Schick, 2011). Specifically, I study leftwing and rightwing governments' tax enforcement activities and

whether a change from a rightwing to a leftwing government in the German states Baden-Wuerttemberg and North Rhine-Westphalia has any impact on the states' tax enforcement activities.

Fourth, I examine German tax administration's tax enforcement strategy and whether this strategy fulfills its legal obligations. Since German tax administrations focus on auditing bigger firms, audit ratios of smaller firms are very low. This might violate the legal mandate of tax enforcement in Germany which is to guarantee uniformity of taxation ("Gleichmäßigkeit der Besteuerung"). By developing a relative measure of tax gain per Euro of reported profits for the different firm size classes, I analyse whether such differences in audit ratios can be justified by firms' different levels of tax compliance.

For my analyses, I use self-collected data from the German states' 16 Ministries of Finance, which I have retrieved through requests according to states' freedom of information acts ("Informationsfreiheitsgesetze") and parliamentary inquiries ("Kleine Anfragen") from members of the states' parliaments. This data contains detailed information about the states' tax enforcement activities and the staffing of their tax administrations for the years 2000 to 2018. Data in this detail about tax enforcement in Germany has neither been published at the state level nor at the federal level, and therefore this unique data set allows me to analyse and compare German states' tax enforcement activities over time. I also use data from the states' budget plans, and data from the statistics about the Business Tax provided by the Research Data Centre of the Federal Statistical Office and the Statistical Office of the German states. For my empirical analyses, I use descriptive analyses, Fixed-Effects regressions, as well as the Synthetic Control Method.

As my main results, I find that audit cycles differ significantly between the German states which might indicate that some states use low audit ratios as a strategic tool for tax competition. I do not find evidence that the German fiscal equalisation scheme causes a significant difference between states' tax enforcement activities. Furthermore, I find no consistent evidence that there are differences in rightwing and leftwing governments' tax enforcement efforts. Most importantly, I can show that there are huge differences in audit cycles between states and

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firms of different size classes. Moreover, I can show that smaller firms are less tax compliant than larger firms which raises doubts as to whether the current tax enforcement strategy in Germany fulfills its legal mandate.

Differences in tax enforcement activities between the German states are a highly relevant issue for policymakers and the public since it has important implications for the design of tax policies and the system of taxation in Germany. Governments should also be aware that fiscal equalisation schemes might hinder states to fully exploit their fiscal base. Additionally, possible differences in government ideology to use tax enforcement activities as a tax policy tool to pursue one's political agenda can have important implications for both politicians and citizens. Politicians might be able to use tax enforcement activities to gratify the needs and wishes of their constituencies which might incentivise citizens to cast their ballot for them in the next election. Hence, citizens will see whether parties keep their electoral promises and align their tax policy according to their political values.

My study aims at contributing to both analyse tax enforcement in the German states and examine whether tax enforcement fulfills its legal mandate. The unique contribution of my study is the detailed data set about German states' tax enforcement activities which have never been collected and published in such detail and for such a time frame before. Therefore, my paper is the first to use such data to analyse and describe tax enforcement in the German states. This is an important contribution since tax enforcement is a major tax policy tool for policymakers and has important impacts on equity of taxation and on taxpayers' tax burden and tax morale.

This paper contributes to several strands of literature. First, there is large literature about tax competition and its implications on tax policy (Kanbur and Keen, 1993; Edwards and Keen, 1996; Devereux, Lockwood and Redoano, 2007; Agrawal, Fox and Slemrod, 2015; Agrawal, 2016). Second, there have been several studies trying to find optimal tax enforcement policies (Besley and McLaren, 1993; Khan, Khwaja and Olken, 2016; Carrillo, Pomeranz and Singhal, 2017). Third, there has been a large number of studies analysing whether there is competition in tax enforcement between countries or between sub-national govern-

ments in federal countries (Stöwhase and Traxler, 2005; Vandebussche, Crabbé and Janssen, 2005; Durán-Cabré, Esteller-Moré and Salvadori, 2015). Fourth, this study relates to literature about the impact of fiscal equalisation schemes both on tax competition (Brülhart and Jametti, 2006; Eichner and Runkel, 2012; Becker and Kriebel, 2017; Brülhart and Jametti, 2019), and tax enforcement (Durán-Cabré, Esteller-Moré and Salvadori, 2015; Chen, 2017; Jia, Ding and Liu, 2020). Additionally, this paper also adds to literature about the impact of fiscal equalisation on tax policy (Baretti, Huber and Lichtblau, 2002; Egger, Koethenbuerger and Smart, 2010) and tax enforcement (Stöwhase and Traxler, 2005; Bönke, Schröder and Jochimsen, 2017) in Germany. Fifth, this study is related to literature about partisan theory both in tax policies (Jha et al., 1999; Ponomareva and Zhuravskaya, 2004; Esteller-Moré, 2005, 2011; Traxler, 2012), as well as partisan theory in German politics (Zohlnhöfer, 2003; Potrafke, 2011; Kauder and Potrafke, 2013) and German tax policy (Krause and Potrafke, 2020).

In the following section 3.2, I introduce the theoretical and institutional backgrounds of tax enforcement in Germany. In sections 3.3 and 3.4, I briefly describe fiscal equalisation and government ideologies in Germany. In section 3.5, I develop the hypotheses and give a short overview about related literature before I describe the data and research design in sections 3.6 and 3.7. Sections 3.8 and 3.9 contain the empirical results and robustness tests. The study closes with limitations and a conclusion in sections 3.10 and 3.11.

3.2 Tax Enforcement in Germany

3.2.1 Institutional Setting and Importance of Tax Enforcement

The legal framework for tax enforcement is anchored in the German Fiscal Code (AO), audit regulation (BPO), and the German Basic Law (GG). For further information regarding the legal framework or size-dependent tax enforcement, see chapter 2, section 2.2.3. The federal states have to provide every year statistics about their tax enforcement activities and report these statistics to the Federal

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Ministry of Finance (BMF) according to Section 35 (2) BPO. The summarised data is only published at the federal level by the BMF and no data about tax enforcement activities at the state level exists.

During my observation period, the German states have raised on average tax gains from audits of 14.7 billion Euro each year which highlights the importance of tax enforcement.² During an audit, the legal treatment and handling of certain tax issues of a company are almost always changed. Hence, a company's tax returns can subsequently be changed and its tax liability increased.³ Since audits are done retrospectively for the last three fiscal years, companies must then also pay interest on the additional tax payments which are assessed during an audit.⁴ One could argue that tax enforcement only leads to a timing effect of when taxes have to be paid, e.g., the point in time when taxes have to be paid is shifted from one fiscal year to another plus the additional interest payments. However, this argument only holds true for tax issues which balance out over time, e.g., the depreciation of a tangible fixed asset is changed retrospectively by an auditor. In this case, only the timing of tax payments is changed and interests have to be paid.⁵ However, audits do very often reveal tax issues which would have led to final tax losses since they would have never been recovered if there had not been an audit. Bigger companies use transfer pricing or patent boxes to shift revenue and profits from high-tax to low-tax countries, whereas owners of smaller companies do very often try to claim private costs as business costs or do not record sales and profits at all.⁶

Ultimately, tax enforcement is also of high importance to serve as a deterrence and preventive effect to increase tax morale and tax compliance amongst taxpayers (see also Bundesrechnungshof, 2006). If taxpayers know that audit

²This value is calculated as a yearly average from 2000 to 2018 using my hand-collected data about states' tax enforcement activities.

³See Sections 164, 165 ff. AO

⁴See for more information Sections 233-239 AO.

⁵E.g., a company has depreciated too much of a machinery in the past, and the auditor changes the depreciation amount retrospectively. On the one hand, this will lead to additional tax payments from previous years plus interest payments since taxes are paid too late. On the other hand, depreciation was consequently too low in recent years and this is why the tax liability for these years will be decreased. Overall, the company only has to pay additional interest for not paying taxes on time in the past.

⁶Information about audit findings are retrieved from an employee of Oberfinanzdirektion Baden-Wuerttemberg who does not wish to be cited by name.

probability is credibly high, then they will consider very carefully whether they try to evade taxes or not.

3.2.2 Tax Enforcement and Equity of Taxation

In a world with perfect tax compliance and tax morale, tax enforcement would be redundant. However, many studies have shown that tax evasion exists and always has (see, e.g., Saez, 2010; Chetty et al., 2011; Kleven et al., 2011; Kleven, Kreiner and Saez, 2016). For these reasons, tax enforcement plays a crucial role to guarantee uniformity and equity of taxation.

In Germany, Section 2 BPO prescribes that the purpose of audits is to guarantee uniformity of taxation and the basic principles of German tax law. The basic principles of the German tax law are a taxation according to fiscal capacity, the welfare state principle, legality, and uniformity.⁷ Uniformity of taxation means that all issues which are subject to taxation (e.g., generating profits, earning income, or inheriting wealth) have to be treated and taxed equally. If there is a deficit in enforcement of tax laws, uniformity of taxation is violated, e.g., legal and actual tax liabilities differ. Uniformity of taxation is also interrelated with equity of taxation. The two basic principles of equity of taxation are horizontal and vertical equity (see, e.g., Scotchmer and Slemrod, 1989; Slemrod, 1990; Alm, 1996).⁸ Taxpayers with the same income should carry the same tax burden (*horizontal equity*), while taxpayers with different income levels should be taxed differently (*vertical equity*). If there are substantial differences in audit cycles between German states or between firms of different sizes, both uniformity and equity of taxation are violated. Hence, optimal tax systems cannot be designed without considering optimal tax enforcement strategies which navigate the trade-off between raising tax revenue and ensuring equity and uniformity of taxation (e.g., Kaplow, 1990).

⁷See articles 104a to 108 of the GG.

⁸There does not exist an uniform definition of equity of taxation since this also depends on one's personal and social beliefs. For reasons of simplicity, I refer to equity of taxation as it was defined by Scotchmer and Slemrod (1989), Slemrod (1990), and Alm (1996).

3.2. TAX ENFORCEMENT IN GERMANY

3.2.3 Tax Enforcement Strategy

German tax enforcement is split up into “Amtsbetriebsprüfung” and “Betriebsprüfung” which have their own pool of auditors.⁹ “Amtsbetriebsprüfung” is responsible for auditing VSC and SC whereas “Betriebsprüfung” is responsible for auditing MC and LC. Although the number of VSC and SC is significantly larger than the number of MC and LC, “Amtsbetriebsprüfung” has less auditors available than “Betriebsprüfung”.¹⁰ Since Section 4 (2) BPO requires tax administrations to continuously audit LC, a lot of resources are used to audit larger firms. Table 3.2.1 gives an overview about the results of tax enforcement for the different company size classes. I use my hand-collected data to calculate average values for the time period from 2000 to 2018.

Table 3.2.1: Overview about Size-Dependent Tax Enforcement

	VSC	SC	MC	LC
Audit Cycle ¹	100.9	28.1	13.7	4.6
Tax Gain per Year ²	878	645	1,248	11,913
Tax Gain per Audit ³	14,429	15,840	23,320	319,910

¹in years ²in million Euro ³in Euro

This table gives an overview about size-dependent tax enforcement for the different company size classes as an average for the years from 2000 to 2018.

As one can see, LC are audited on average every 4.6 years whereas MC, SC and VSC are audited every 13.7, 28.1 and 100.9 years respectively. Furthermore, average yearly tax gains raised from audits range from 645 million Euro for SC to 11,913 million Euro for LC. Overall, tax gains raised from audits of LC made up 81% of total tax gains, followed by MC (9%), VSC (6%), and SC (4%). It shows that German tax administrations follow a risk-based approach for their tax enforcement strategy and audit case selection. It is important to note that risk-based does not mean the risk of cheating but the risk of a shortfall in tax revenue. Since LC deal with more complex tax issues, have larger balance sheet

⁹There is also “Konzernprüfung” which is responsible for auditing corporate groups with sales of more than 600 million Euro.

¹⁰In Baden-Wuerttemberg for example, in the period between 2006 and 2018, “Amtsbetriebsprüfung” had on average a pool of 504 auditors for 1,055,632 VSC and SC, whereas “Betriebsprüfung” had a pool of 1,475 auditors for 141,713 MC and LC. Put differently, “Amtsbetriebsprüfung” had only 25% of overall auditors but had to audit 88% of all firms whereas “Betriebsprüfung” had 75% of auditors for auditing 12% of all firms.

positions, and operate across borders, there is relatively a higher risk of a shortfall in tax revenue according to the tax authority (Bundesrechnungshof, 2006).

This risk-based tax enforcement strategy has been criticised for over 15 years by the German Federal Audit Court (BRH). According to the BRH, audit ratios of VSC and SC are far too low due to a shortage of auditors in all German states. It is criticised that with such low audit ratios of VSC and SC, the preventive effect of tax enforcement is vanished. According to the BRH, this risk-based tax enforcement strategy does not fulfill its legal obligation since these huge differences in audit cycles negatively affect equity and uniformity of taxation. If MC and LC were relatively to their profits less tax compliant than VSC and SC, German tax administrations could justify these differences in audit cycles to a certain extent. However, tax administrations have not yet provided any evidence to show that the higher a taxpayer's profit or income, the less tax compliant he is (see for more information Bundesrechnungshof, 2006).¹¹

From an efficiency point of view, tax authorities should focus on auditing MC and LC since average tax gains per audit are larger the bigger a company is (see also table 3.2.1).¹² Focusing on larger firms is also recommended by multilateral organisations such as the IMF and the OECD (e.g., Benon, Baer and Toro, 2002; CTPA, 2011). By doing this, they argue that one could raise higher tax revenues and increase the efficiency of tax administrations.

However, the legal obligation of tax enforcement in Germany is not to raise as much tax revenue as possible but to guarantee equity and uniformity of taxation (see section 3.2.2). Hence, simply focusing on MC and LC but neglecting VSC and SC does not fulfill the principle of equity of taxation. My data allows to analyse this size-dependent and risk-based tax enforcement approach by calculating tax gains raised per Euro of profit for the different company size classes. This allows

¹¹There has also been a lawsuit by the owner of a restaurant claiming that there is a structural lack of tax enforcement of cash intensive businesses, especially small businesses. Although the Federal Fiscal Court (BFH) dismissed the case, the court urged lawmakers to not ignore the obviously existing differences and problems regarding tax enforcement of cash intensive businesses. See, e.g., Urteil vom 16. September 2021, IV R 34/18, Kein strukturelles Vollzugsdefizit bei bargeldintensiven Betrieben im Jahr 2015, <https://www.bundesfinanzhof.de/de/entscheidung/entscheidungen-online/detail/STRE202110233/> (May 25, 2022).

¹²Naturally, audits of LC will last longer and therefore need more human resources than audits of VSC and SC. Since I do not have information about the duration of audits, I cannot take it into account in my analyses.

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me to analyse whether relative tax gains differ between the different firm size classes which has never been done before. Hence, I contribute to provide evidence in order to analyse the German size-dependent and risk-based tax enforcement strategy. This is especially important for policymakers and the public since tax enforcement has to fulfill its legal obligation.

3.2.4 Competition in Tax Enforcement

In Germany, tax rates and tax bases are determined by German federal law and are therefore completely harmonised across the 16 German states. Only the Real Estate Transfer Tax (RETT) and the local Business and Property Tax rates can be determined independently by the states and the local municipalities. While tax laws are federal law and have to be approved by the German parliament, tax administration, tax collection, and tax enforcement are the responsibilities of the states. For this reason, states can design their own audit strategies and have the freedom to interpret complex tax issues and imprecise wording of the tax code. Consequently, tax enforcement intensity, audit ratios, and the amount of tax revenue collected by each federal state depends on the quality and quantity of tax enforcement activities in the states. Furthermore, state governments can decide about the funding of their tax enforcement tools, their staffing, and their targeted number of audits.¹³ Additionally, Germany has tried for more than 20 years to implement an uniform IT-based risk management system for the tax administrations in the federal states but states still work with different technical standards.¹⁴

For these reasons, state governments can use tax enforcement as a strategic tool for tax competition between the states in order to attract companies and

¹³Although the Standing Conference of the Ministers of Finance of the states (“Finanzministerkonferenz der Bundesländer”) sets the targeted audit cycles for the different company size classes, these targets are not legally binding and rather a recommendation. There is no controlling body to monitor the states’ audit cycles and there are no punishments or consequences in case a state does not meet the recommended targets (Bundesrechnungshof, 2006).

¹⁴In order to harmonise audits between the states, an IT-based risk management system was implemented. However, since states modified the algorithms individually and tax officers reacted differently to inconsistencies, harmonisation of tax audits was not achieved. Until today, states still use their own IT systems and no harmonisation was achieved. Therefore, states had and still have the opportunity to align their tax enforcement intensity with their own political and economic objectives (see Bundesrechnungshof, 2006, 2019).

foster their own economy. This can be achieved by either less frequent or less strict audits, e.g., below-average audit cycles or below-average tax gains raised from audits in relation to firms' profits. This is specifically important since all costs related to tax enforcement activities have to be carried by the federal states but not the entire tax revenue raised from audits remains in the states because of the German fiscal equalisation scheme. Hence, the combination of uniform tax laws, decentralised tax collection, and equalising transfers might lead to inefficiencies (for more information about the German fiscal equalisation scheme, see section 3.3).

Furthermore, federal states' government ideologies might also have an impact on whether tax enforcement is used as a strategic tax policy tool for tax competition. For many years, leftwing politicians have accused rightwing state governments to use lax tax enforcement as a strategic tool for location policy in order to attract companies and rich individuals in their states (see section 3.4 for further information). My study therefore aims to analyse whether these claims hold true by exploiting my unique data set to examine a possible impact of fiscal equalisation and different government ideologies on states' tax enforcement activities.

3.2.5 Optimal Tax Enforcement

For tax administrations, it is essential to implement tax enforcement strategies which balance between an efficient usage of available resources and the legal obligation to guarantee equity of taxation. From a fiscal point of view, it is argued that tax administrations should use their available resources to focus their audits on taxpayers with the highest tax gains per audit (Benon, Baer and Toro, 2002; CTPA, 2011). From a legal and normative point of view, tax enforcement should guarantee equity and uniformity of taxation, e.g., comparable tax issues should be assessed and taxed identically for all taxpayers. Researchers have long tried to find and develop optimal tax enforcement strategies. Besley and McLaren (1993) and Khan, Khwaja and Olken (2016) have analysed how performance pay and wage incentives can influence the efficiency of auditors to raise more tax revenue. Khan, Khwaja and Olken (2016) use a setting in Pakistan

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and find that performance pay can be quite effective in raising additional tax revenue. Alm (1996) and Slemrod (2019) analyse theoretically which level of tax enforcement is optimal to raise as much tax revenue as possible. They argue that higher levels of tax enforcement will cause behavioural responses since taxpayers always respond to changes in tax rates or tax enforcement, e.g., by increasing tax avoidance or tax evasion. Increasing tax enforcement is naturally associated with higher administrative and compliance costs and behavioural responses of taxpayers. Alm (1996) and Slemrod (2019) argue that the optimal level of tax enforcement is where marginal costs equate marginal benefits, e.g., additional tax revenue should equal additional monetary and social or behavioural costs. Other studies analysing optimal tax enforcement strategies are Slemrod and Yitzhaki (1987), Scotchmer and Slemrod (1989), Kaplow (1990), Franzoni (2000), Boadway and Sato (2009), and Carrillo, Pomeranz and Singhal (2017).

However, while the majority of researchers analyses optimal tax enforcement policies from an efficiency point of view, my data is not detailed enough to further analyse the efficiency of tax enforcement in Germany, e.g., how wage incentives for auditors could increase the tax revenue. As described above, the legal obligation of tax enforcement in Germany is to guarantee equity and uniformity of taxation and not to raise as much tax revenue as possible. Therefore, my hand-collected data about tax enforcement offers the unique opportunity to analyse tax enforcement strategies in Germany from an equity point of view.

3.3 Fiscal Equalisation in Germany

In Germany, similarly to many other federal countries, there exists a fiscal equalisation scheme between the federal government and the federal states as well as between the states. This system was introduced in 1969 and adjusted several times. Its purpose is to adequately balance the different financial strengths of the states within Germany according to Article 107 GG. The system of equalising transfers in Germany consists of different stages and layers which will not be

covered in more detail.¹⁵

There exists large literature suggesting that the system of equalising transfers in Germany has an impact on the behaviour of state governments and causes inefficiencies and distortions. This may cause negative fiscal externalities between the states and the different levels of government (see, e.g., Boadway and Flat-ters, 1982; Barette, Huber and Lichtblau, 2002; Köthenbürger, 2002; Traxler and Reutter, 2008; Scherf, 2020). One reason for this finding is that the German fiscal equalisation system discriminates between states' tax revenues before and after equalising transfers which might lead to inefficient decisions from a welfare and equity point of view (see Cremer and Gahvari, 2000; Barette, Huber and Lichtblau, 2002). If a system of equalising transfers as in Germany is in place, tax enforcement strategy and intensity might depend on state-specific returns on the tax gains raised from enforcement activities. If a state raises one additional Euro of tax gain from audits, then only a certain amount of this additional Euro remains within the state. This ratio has been defined as state-specific tax-back rates (TBRs) by Ragnitz (2014). These TBRs measure how much states can keep of one additional Euro in taxes raised after fiscal equalisation (Barette, Huber and Lichtblau, 2002; Bönke, Schröder and Jochimsen, 2017).

Tax collection incentives and tax enforcement activities might be distorted if higher tax revenues from audits do not entirely remain in the state. Wealthier federal states which have to make and do not receive equalising transfer payments, namely Baden-Wuerttemberg, Bavaria, and Hesse, have filed lawsuits against the fiscal equalisation scheme. These states have argued that the German fiscal equalisation scheme would be unjust and cause disincentive effects.¹⁶ It has also been argued for a long time that the German fiscal equalisation scheme would

¹⁵In 1999, the German Federal Constitutional Court (BVerfG) decided that the system of equalising transfers had to be reorganised by the end of 2003. In 2017, a reform of the fiscal equalisation was decided which took effect in January 2020. Therefore, the same system of equalising transfers was in place for the majority of my observation period and consequently there is no bias from a changing fiscal equalisation scheme. For more detailed information regarding the German fiscal equalisation scheme see Bundesministerium der Finanzen (2019) and Gesetz über den Finanzausgleich zwischen Bund und Ländern (Finanzausgleichsgesetz - FAG).

¹⁶See, e.g., BVerfG, Urteil des Zweiten Senats vom 11. November 1999 - 2 BvF 2/98 -, Rn. 1-347, https://www.bundesverfassungsgericht.de/SharedDocs/Entscheidungen/DE/1999/11/f19991111_2bvf000298.html (May 15, 2022).

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discourage wealthier states, especially Baden-Wuerttemberg, Bavaria, and Hesse, from fully exploiting their fiscal base. Troost (2016) claims that these states put too little effort in their tax enforcement activities because they cannot retain all tax revenue raised from audits. However, this line of argument is not entirely convincing since the fiscal equalisation scheme might prevent both taker and giver states from fully exploiting their fiscal base. If a taker state raises additional tax revenue from audits, then this tax revenue will decrease the equalising transfer payments which this state receives. Overall, the net increase in available financial resources for this state will be limited to a large extent. If a giver states raises additional tax revenue from audits, then this tax revenue will be redistributed to other states and only a relatively small amount can be retained within the state (for more information see Ministerium für Finanzen Baden-Württemberg, 2017; Buettner and Krause, 2021).¹⁷ For these reasons, accusing only rich states of not entirely exploiting their fiscal base and of lax tax enforcement because of disadvantageous incentives of the fiscal equalisation scheme seems not convincing.

3.4 Government Ideology in Germany

3.4.1 Partisan Theory

Since the 1970s, it has been of great interest to researchers to investigate whether government ideology and different political parties in power have an influence on a country's economic policy-making. This so called partisan theory dates back to Hibbs (1977), who was the first to analyse possible differences between Democratic and Republican governments in the United States in relation to their macroeconomic policy-making. The basic idea behind partisan theory is that politicians gratify and prioritize the needs and wishes of their constituencies and adapt their political agenda accordingly. Historically, leftwing governments are said to rather gratify the needs of citizens with lower income, e.g., the working class, whereas rightwing governments rather gratify the needs of citizens with

¹⁷The exact amounts of decreasing equalising transfer payments received or redistributed tax revenue to other states depend on the states' fiscal capacity ("Finanzkraft"). Fiscal capacity determines the degree of "Auffüllung" or "Abschöpfung". For more detailed information, see (Ministerium für Finanzen Baden-Württemberg, 2017).

higher income, e.g., self-employed and high-income earners (see Hibbs, 1977; Alesina, 1987).¹⁸ Since one of the primary concerns of governments and politicians is to be reelected, one can assume that partisan politicians will put economic policy measures in place to satisfy their constituencies to convince them to cast their ballot for them in the next election.

In Germany, rightwing governments have been accused by leftwing politicians and some media to use lax tax enforcement for horizontal tax competition between the states in order to attract companies and rich individuals.¹⁹ Schick (2011) claims that conservative state governments deliberately reduce the staffing of their tax administrations and neglect their duty to guarantee equity and uniformity of taxation. At the German federal level, leftwing and rightwing parties have been converging in the last years, especially since the grand coalition consisting out of CDU/CSU and SPD was formed in 2005 (Lau, 2009; Egle and Zohlnhöfer, 2010; Niedermayer, 2011; Berz, 2019). However, this development might be different at the state level since parties are also influenced by regional tendencies and there are differences between federal parties and the respective state parties (Bräuninger, Debus and Müller, 2020). It has been shown in some studies that there exist party-related differences between leftwing and rightwing governments in the German states, e.g. in relation to public spending for education and internal security (see, e.g., Potrafke, 2011). The difference between leftwing and rightwing governments in Germany might stem from parties' different beliefs concerning equity, justice, redistribution, and governmental interventions. One possible way to transfer these different attitudes into policy making is by aligning economic and tax policy decisions according to one's political agenda. Tax policy is an important part of a federal and state government's economic policy agenda since it determines the budget and therefore also the degree of government expenditures. For example, the leftwing government in Baden-Wuerttemberg has

¹⁸For the German setting, it is questionable whether it still holds true that leftwing governments only represent low-income citizens and rightwing governments rather high-income citizens. The GRÜNE, a party rather from the left political spectrum, have voters with a relatively high income which contradicts the assumption that parties represent citizens and voters according to their average level of income (Niedermayer, 2013). Hence, there might no longer be differences between leftwing and rightwing parties in relation to the social status of citizens but in relation to their attitudes and social preferences.

¹⁹See, e.g., <https://www.handelsblatt.com/finanzen/steuern-recht/steuern/finanzbehoerden-verloren-im-steuer-dschungel/8910572.html> (March 17, 2022).

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justified the increase in the RETT rate in 2011 to better fund childcare and early childhood education.²⁰

In order to examine whether one can see ideology-induced policies in the German states, one requires policy tools that are solely influenced by the state governments and not prescribed by the federal government. One very important aspect of state's tax policy is its tax enforcement strategy. From a state's revenue point of view, revenue raised by tax enforcement is an important pillar of a state's available public funds, and tax enforcement is needed to guarantee equity of taxation among companies and individuals. It can also be used to fund other political programs or be redistributed to other political or social areas. For these reasons, governments in favour of income redistribution, equity of taxation, and governmental interventions might use tax enforcement as a tool to pursue their political agenda and reward their constituencies.

Ideology-induced tax enforcement strategies and differences between the German states have not yet been examined. For this reason, my study aims to provide evidence whether states' tax enforcement activities are influenced by different government ideologies.

3.4.2 Political Parties and State Governments

Generally, Germany is a federal republic in which political power is divided between the federal government and the sub-national federal states. Federalism is the most important political principle in this context which means that the German state is sub-divided in independent layers of national and sub-national governments. The 16 German states do not have sovereignty in all political affairs but they can participate at the federal government's legislative procedures. Additionally, sub-national states can independently decide about their education programs, police, tax administration and tax enforcement (see for more information Bundeszentrale für politische Bildung, 2013).

Furthermore, Germany is a party democracy since parties play a vital role in the political system. Parties penetrate all areas of the political system and

²⁰See, e.g., <https://stm.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/ausbau-der-kleinkindbetreuung-und-fruehkindlichen-bildung-sollen-mit-hoererer-grunderwerbsteuer-fina/> (February 16, 2022).

serve as a connecting link between these different areas. Members of parties form a major part of the political citizenship, their extra-parliamentary organisations contribute to the formation of the political will, and their deputies control the most important parts of the system of government at the federal and at the state level. Parties' central role in the German political system is reinforced legally by stating them as a necessary part of the liberal and democratic basic order according to Article 21 GG (see for more information Niedermayer, 2013; Bukow, Jun and Niedermayer, 2016). The political landscape in Germany is shaped by six political groups: CDU/CSU, SPD, FDP, GRÜNE, LINKE, and AfD. At the federal level, Germany had a grand coalition from 2005 to 2009 and from 2014 to 2021, and a new coalition consisting of SPD, GRÜNE, and FDP since then. At the state level, the composition of state governments and state parliaments has changed enormously in the last years. This development offers the opportunity to examine these changes in order to measure the influence of leftwing and rightwing governments. Leftwing governments consist of SPD (single government), SPD/GRÜNE, SPD/LINKE, SPD/LINKE/GRÜNE, SPD/GRÜNE/FDP, and LINKE/SPD/GRÜNE. Rightwing governments consist of CDU or CSU (as single government), CDU/FDP, and CSU/FDP.

3.4.3 Government Ideologies and Tax Enforcement

In order to analyse whether there is any influence of government ideology on a state's tax enforcement activities, one needs to find a measure how changing government ideologies influence a state's tax enforcement activities. To do this, I use Fixed-Effects regressions and the Synthetic Control Method. Since not all state governments change within my observation period, the Synthetic Control method focuses on the change in governments in Baden-Wuerttemberg and North Rhine-Westphalia.

In Baden-Wuerttemberg, a leftwing government was elected in 2011 after Baden-Wuerttemberg has been governed approximately 58 years by a rightwing government. This change in government ideology can be seen as a landslide change since it was the first time in German history that the GRÜNE occupied the position as Prime Minister, especially given the situation that Baden-

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Wuerttemberg used to have the reputation as being rather conservative.

Moreover, North Rhine-Westphalia is the second state to be analysed in more detail. In 2005, a rightwing government was elected before there was a change to a leftwing government in 2010. With Norbert Walter-Borjans, the cabinet of Prime Minister Hannelore Kraft (both SPD) had a finance minister who was one of the leading political figures to strengthen tax enforcement.²¹

Additionally, both states are economically very important and they represent approximately 35% of the German population. Baden-Wuerttemberg has always been a giver state of the fiscal equalisation scheme whereas North Rhine-Westphalia has first been a giver and then a taker state. Therefore, both states offer a suitable setting to analyse whether tax enforcement activities are influenced by government ideology. I do not consider other German states since none of them offers a comparable setting as in Baden-Wuerttemberg and North Rhine-Westphalia.

3.5 Hypotheses Development and Literature Review

Tax competition, its implications on tax policies, and the reasoning behind tax competition has been of great interest for researchers for a long time. While there has been a focus on international tax competition, there is a growing number of publications analysing national tax competition within a country.

One strand of literature analyses whether tax enforcement is used as a strategic tool for horizontal tax competition within a country.²² Vandenbussche, Crabbé and Janssen (2005) examine whether there is regional tax competition in Belgium by analysing firms' ETRs in different regions. They find evidence for regional tax competition between Northern and Southern regions within Belgium since ETRs of comparable firms differ significantly. Durán-Cabré, Esteller-Moré and Salvadori (2015) investigate whether there is horizontal competition in tax en-

²¹During his time as finance minister, North Rhine-Westphalia purchased several data carriers with information about tax evaders which raised public awareness of this topic. See, e.g., <https://www.lto.de/recht/nachrichten/n/steuerdaten-cd-nrw-fuenf-millionen/> (June 4, 2022).

²²Horizontal tax competition means tax competition at the state level, e.g., German sub-national states compete against each other.

forcement in Spain. They show that tax enforcement can serve as an additional tool for tax competition between regional administrations within Spain. Further studies about tax enforcement and its impact on tax competition are Cremer and Gahvari (2000) and Stöwhase and Traxler (2005).

The setting of my study is similar to the aforementioned studies since tax rates and tax bases are harmonised across the 16 German states but tax administration and tax enforcement are the responsibilities of the German states. Since there is economic and political heterogeneity between German states, different attitudes towards tax policy exist. Therefore, German states have incentives to use tax enforcement as a strategic tool for tax competition to protect their own economy and attract companies.

Hypothesis 1: *Federal states in Germany use tax enforcement as a strategic tool for horizontal tax competition.*

Other literature has analysed whether local policies, decentralisation, and fiscal transfers have an influence on sub-national governments' tax enforcement activities. Chen (2017) analyses whether the abolition of an agricultural tax in China influences county governments' tax enforcement activities. He finds that sub-national states in China use tougher tax enforcement to offset the associated revenue loss but this effect is weakened if the counties receive a lower proportion of total tax revenue after sharing its own tax revenue with other counties. Jia, Ding and Liu (2020) analyse whether a decentralisation reform associated with improved tax autonomy and fiscal transfers to county governments in China has an impact on their local tax enforcement activities. They find that local tax enforcement has been reduced after the reform due to opposing incentive effects of the reform. Since local governments receive increased fiscal transfers after the reform, they reduce their local tax enforcement activities. Apart from these studies, there exists other literature analysing whether fiscal equalisation schemes and fiscal transfers have an impact on tax competition (Flowers, 1988; Dahlby, 1996; Esteller-Moré and Solé-Ollé, 2002; Dahlby and Wilson, 2003; Brülhart and Jametti, 2006; Buettner, 2006; Libman and Feld, 2013; Fox, Hill and Murray, 2015; Becker and Kriebel, 2017; Ferede, 2017; Brülhart and Jametti, 2019). Other studies specifically investigate whether the German fiscal equalisation scheme

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has an impact on German tax policies. Bönke, Schröder and Jochimsen (2017) investigate whether the German fiscal equalisation scheme causes distortions in sub-national governments' efforts to fully exploit their tax bases. They find that the enforcement of the tax law differs across the states depending on the share of an additional Euro of tax revenue which they can internalize and keep within their state. According to the authors, states have an incentive to align ETRs of their taxpayers with the level of TBR in their state. However, their results should be interpreted very carefully since their observation period and empirical methods are very limited. Buettner and Krause (2021) study the effects of the German fiscal equalisation scheme on the state governments' tax policy. They find that redistribution of revenues provides incentives for federal states to raise rather than to lower their RETT rates. Further studies about the impact of the German fiscal equalisation scheme on tax policy in Germany are Baretta, Huber and Lichtblau (2002), Stöwhase and Traxler (2005), and Egger, Koethenbueger and Smart (2010).

Although it is publicly argued that the fiscal equalisation scheme only distorts giver states' tax enforcement activities, I have shown in section 3.3 that equalising transfer payments distort both taker and giver states' efforts to fully exploit their fiscal potential. Theoretically, there is no reason to assume that the German fiscal equalisation scheme does only distort giver states' incentives to collect taxes.

Hypothesis 2: *The German fiscal equalisation scheme does not cause significant differences between taker and giver states' tax enforcement activities.*

Other research has analysed whether different political orientations and government ideologies have an impact on tax policy. Young, Reksulak and Shughart (2001) analyse whether there is any political influence on the IRS in the US. They find evidence that there are differences in tax enforcement in districts depending on the political representation and importance to elections. The authors conclude that the IRS should be subject to an independent oversight board since it can be influenced by political power. Pettersson-Lidbom (2008) uses a large panel data set from Swedish local governments to analyse to what extent party control makes a difference in determining fiscal and economic policies. He uses a regression-discontinuity design to estimate causal effects of government ideology

on economic outcomes, and finds that leftwing governments tax 2-3% more than rightwing governments. Krause and Potrafke (2020) analyse whether government ideology has an influence on the RETT rates in the German states. They exploit the reform in 2007 which allowed the German federal states to independently set RETT rates. They can show that leftwing and center governments were more active in increasing the RETT rates than rightwing governments. They conclude that governments that are in favour of income redistribution are more likely to tax capital which can easily be done by increasing the RETT since this will affect high-income earners more than low-income earners. Further studies analysing the influence of government ideology on tax policy are Jha et al. (1999), Ponomareva and Zhuravskaya (2004), Esteller-Moré (2005, 2011), and Traxler (2012).

Since different political parties form the sub-national governments, my setting offers the possibility to examine whether government ideology in Germany has an impact on the states' tax enforcement activities. Leftwing political parties represent themselves as parties who care a lot about social, economic, and tax equity as well as redistribution from rich to poor people through government interventions (see, e.g., BÜNDNIS 90/DIE GRÜNEN and SPD, 2010, 2011; BÜNDNIS 90/DIE GRÜNEN, 2013; SPD, 2013). Rightwing political parties rather stand for economic freedom, self-responsibility and few government interventions (see, e.g., CDU and FDP, 2005*a,b*; CDU/CSU, 2013; FDP, 2013). Since leftwing governments are said to prioritize social and tax equity, they might use tax enforcement as a tax policy tool to pursue their political agenda and increase equity of taxation.²³

Hypothesis 3: *Leftwing governments use tax enforcement as a tax policy tool to pursue their political agenda and increase equity of taxation.*

Furthermore, there is an increasing tendency of German tax administrations to organise their tax enforcement activities from an efficiency point of view. Tax administrations focus their audits on larger firms since they fear a loss in tax revenue and therefore audit cycles for VSC and SC are very high. As described in sections 2.3 and 2.5.3 of chapter 2, firms' possibilities to evade taxes depend

²³Again, there is no uniform definition of equity of taxation since it depends on political, social, and economic beliefs.

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on their firm size. Kleven et al. (2011) and Kleven, Kreiner and Saez (2016) both find that tax evasion is correlated with firm size and that smaller firms are relatively less tax compliant than larger firms. Kleven et al. (2011) use Danish tax data to analyse a tax enforcement field experiment in Denmark. They use upward audit adjustments (increase in tax liability) as dependent variable and find a statistically significant evidence of firm size, measured as the number of employees, on upward audit adjustments. If a firm employs less than ten employees, then upward audit adjustments are significantly bigger than for firms with more employees. Kleven, Kreiner and Saez (2016) also use Danish tax data to analyse tax enforcement in Denmark and find that firms' tax compliance rate, measured as the ratio of tax evasion to revenue, is lower the smaller the firm size, measured as the number of employees. Tax evasion is measured as the amount of taxes evaded which is detected through an audit, e.g., underreporting profit or overreporting costs. Tax compliance is lowest for self-employed entrepreneurs and firms with one or less than five employees. If there are substantial differences in audit cycles between different company size classes or between states, the legal mandate of tax enforcement might be violated because it is not guaranteed that all tax-related issues are treated and taxed equally (see also section 3.2.2). Especially, tax administrations have not yet provided any evidence that larger firms are relatively less tax compliant than smaller firms which could justify their enforcement strategy from an equity point of view.

Hypothesis 4: *German tax administration's tax enforcement strategy does not fulfill its legal mandate.*

3.6 Data and Descriptive Statistics

3.6.1 Data

For my empirical analyses, different data is used. The majority of my analyses is based on hand-collected data about tax enforcement activities in German states for the years from 2000 to 2018. As described above, the federal states have to report every year statistics about their tax enforcement activities to the BMF. However, this data is not released at the state level but only at the federal level. For this reason, data collection was extremely time consuming and difficult since many federal states did not want to release their data about tax enforcement.

In a first step, I approached all states and asked them to share data on their tax enforcement activities. Only four out of 16 states complied with my request (Rhineland-Palatinate, Mecklenburg-Western Pomerania, Hesse, and Bremen). In a next step, I filed requests according to the states' freedom of information acts ("Informationsfreiheitsgesetze") in the remaining states, which resulted in another six states sharing their data with me (Thuringia, Schleswig-Holstein, Saxony-Anhalt, Saarland, North Rhine-Westphalia, and Brandenburg). Since some states were only willing to share their data for a relatively high fee and not all states have freedom of information acts in place, I approached state parliamentarians in a next step (Bavaria, Berlin, Hamburg, Lower Saxony, Baden-Wuerttemberg, and Saxony). These state parliamentarians, mainly from LINKE, GRÜNE and SPD, filed parliamentary inquiries ("Kleine Anfragen") for me which state governments have to answer within one month.²⁴ As one can see, the process of data collection was very challenging and took over two years. Nevertheless, my data set offers unique possibilities to analyse tax enforcement in Germany since data in such detail and for such a time frame has never been collected or published before.

Moreover, I combine my hand-collected data with the statistics about the Business Tax for the years 2010 to 2014 provided by the Research Data Centre of

²⁴In Berlin, Hamburg, and Saxony politicians from the LINKE filed the request. In Bavaria and Lower Saxony politicians from the GRÜNE filed the request, whereas in Baden-Wuerttemberg from the SPD. See for example the answer to the parliamentary inquiry which Nico Brünler (LINKE) filed for me in Saxony; Drucksache 7/392, Antwort vom 03.12.2019. Available at <https://edas.landtag.sachsen.de/> (June 4, 2022).

3.6. DATA AND DESCRIPTIVE STATISTICS

the Federal Statistical Office and the Statistical Office of the German states (see also chapter 2, section 2.4). This allows me to create another unique data set to analyse the tax gains raised from audits with firms reported profits. By doing this, I can calculate the tax gain raised from an audit in relation to one Euro of profit for the different company size classes. This allows me to analyse tax gains for the different company size classes in relation to their economic and fiscal potential and whether these relative tax gains differ between the states. I also use data from the states' budget plans about their yearly number of apprentices for tax and financial officers ("Steuer- und Finanzanwärter").²⁵ When a new parliament is elected and a new government takes over office, politicians only have limited possibilities to immediately change the state's tax enforcement activities. The number of auditors cannot be increased immediately since it usually takes several years from recruitment to when employees can be used as auditors. For short-term changes, politicians can therefore only increase the number of apprentices for tax and financial officers who are recruited on a yearly basis. Information about the number of recruitments of each state is taken from the states' yearly budget plans as well as from inquiries from the states' Ministries of Finance. Control variables for the creation of the synthetic control groups, e.g., GDP per capita and debt per capita, are retrieved from the Federal Statistical Office.²⁶

Additionally, I develop a relative measure of tax gain in relation to one Euro of reported profit for the different company size classes and states. If a company is audited in year t , then the last three fiscal years ($t - 1$, $t - 2$, and $t - 3$) are subject to this audit. Therefore, I take the tax gains raised from audits per company size class in year t and divide it by the sum of profits of the last three fiscal years per company size class.²⁷ By doing this, I can develop a measure of tax gains per Euro of profits which companies have reported in their Business Tax returns. This calculation is done both at the state level as well at the federal

²⁵States' budget plans are available on the websites of their Ministries of Finance or states' Statistical Offices; e.g., https://www.statistik-bw.de/shp/2012/pages/hhp_2012.pdf (January 15, 2020).

²⁶See Statistisches Bundesamt (2019*a,b,c*)

²⁷E.g., assume that a firm has reported profits of 60,000 Euro in years $t - 1$, $t - 2$, and $t - 3$. An audit in year t reveals a tax gain of 30,000 Euro which the firm has to pay as additional tax payments. Hence, the tax gain per Euro of the firm's reported profits in the Business Tax returns is 0.17 Euro ($\frac{30,000}{180,000}$).

level. See the appendix 3.A for a more detailed explanation how these calculations are done. Since I cannot calculate this variable for the whole time period, I use the quota of tax gains from audits to a state's GDP for my regressions and for some of my analyses to proxy the strength of audits (similar to Barette, Huber and Lichtblau, 2002; Jia, Ding and Liu, 2020). I use GDP to control for different economic conditions since tax gains depend on the economic situation. States with higher GDP and more economic potential do automatically raise more tax gains from audits in nominal terms. I divide the tax gain in year t with the moving average of GDP of the years $t - 1$, $t - 2$, and $t - 3$ since the last three fiscal years are subject to this audit.

3.6.2 Descriptive Statistics

Table 3.6.1 displays the information about the descriptive statistics for the variables used in my analyses. Some states did not report information for the whole time period from 2000 to 2018, hence the number of observations differs for some variables.²⁸ Due to heterogeneity in states' economic potentials and size, the number of auditors, the number of companies as well as the tax gains raised from audits differ quite significantly. For example, the number of auditors which state governments have at their yearly disposal ranges from 98 (Saarland) to 3,376 (North Rhine-Westphalia) depending on the states' size and number of companies to be audited. In relation to the synthetic control method for Baden-Wuerttemberg, I include seven years (2004-2010) into the analysis before the change in government ideology in 2011 which results in 49 year-state-combinations.²⁹

²⁸Brandenburg and Saxony-Anhalt have only reported incomplete data about their tax enforcement for a few years. For Berlin, there are no budget plans publicly available for the entire observation period and the state government has never responded to my requests, hence I could not include their number of yearly apprentices.

²⁹In North Rhine-Westphalia, the change in government ideology is in 2010, hence I include the years from 2004 to 2009 in to the analyses (42 year-state-combinations). I report the descriptive statistics for the 49 year-state-combinations for Baden-Wuerttemberg.

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Table 3.6.1: Descriptive Statistics

Variables	N	Mean	Median	Std. Dev.	Min	Max
Auditors	270	940.39	570	897.87	98	3,376
Audits LC	266	2,792	1,451	2,565	254	9,067
Audits MC	261	3,953	2,534	3,375	260	12,717
Audits SC	261	3,016	2,032	2,790	125	10,721
Audits VSC	261	4,501	2,763	4,431	173	17,586
Tax gain LC ¹	264	857	330	1,110	24.70	4,940
Tax gain MC ¹	264	89.80	52.30	92.50	4.90	457
Tax gain SC ¹	264	46.40	26.10	53.70	0.90	250
Tax gain VSC ¹	264	63.20	31.30	78.60	1.02	433
Number LC	288	11,800	6,121	11,884	1,305	42,492
Number MC	288	51,233	28,620	50,321	5,790	17,405
Number SC	288	75,864	46,148	78,837	7,529	333,424
Number VSC	282	367,240	236,403	335,046	34,823	1,258,224
Audit quota LC ²	261	0.22	0.22	0.03	0.15	0.30
Audit quota MC ²	261	0.08	0.08	0.02	0.04	0.11
Audit quota SC ²	261	0.04	0.04	0.01	0.02	0.06
Audit quota VSC ²	261	0.01	0.01	0.00	0.00	0.03
ln(debt pc)	49	8.68	8.76	0.47	7.80	9.57
ln(GDP pc)	49	10.11	10.23	0.55	8.06	10.56
ln(CPI)	49	4.50	4.50	0.03	4.43	4.54
Unemployment rate ²	49	0.09	0.08	0.05	0.04	0.20

¹in million Euro ²in percent

This table shows the descriptive statistics for the years from 2000 to 2018. Data is retrieved from parliamentary inquiries from members of the states' parliaments, requests according to states' freedom of information acts, and the Federal Statistical Office.

3.7 Research Design

3.7.1 Empirical Challenges

When analysing tax enforcement and the possible political, economic, and administrative impacts on tax enforcement, the biggest challenge is to reliably estimate causal effects. The main challenge in establishing a causal relationship is to hold all other relevant factors fixed, which is also known as *ceteris paribus*. If one is successful in holding all relevant factors fixed, one can make a statement that one

variable has a causal effect on another variable.³⁰

The problem in relation to tax enforcement is that there is no common definition of what lax or strict tax enforcement is or how it should be estimated. While there is a lot of theoretical literature about tax enforcement (see, e.g., Cremer and Gahvari, 2000; Stöwhase and Traxler, 2005), the empirical literature estimating causal effects is very scarce. Table 3.7.1 gives an overview about the empirical literature about tax enforcement.

Table 3.7.1: Overview about Empirical Literature

Author	Estimation Strategy	Dependent Variable
Baretti, Huber and Lichtblau (2002)	OLS, FE, Hausman-Taylor	$\frac{\text{tax revenue}}{\text{GDP}}$
Vandenbussche, Crabbé and Janssen (2005)	OLS, FE	<i>ETR</i>
Bönke, Schröder and Jochimsen (2017)	OLS	<i>audit ratio</i>
Durán-Cabré, Esteller-Moré and Salvadori (2015)	OLS, FE, IV	$\frac{\text{audits}}{\text{tax returns}}$
Chen (2017)	Difference-in-differences	<i>Effective VAT Rate</i>
Jia, Ding and Liu (2020)	Difference-in-differences	$\frac{\text{fiscal revenue}}{\text{GDP}}$

One can see that the authors use different dependent variables since there is no universally accepted definition of how changes in and influences on tax enforcement activities should be measured. Each of the different dependent variables can be criticised since none of them perfectly captures tax enforcement activities.

First, simply using the ratio of tax revenue collected per year and the GDP of the same year causes inaccuracies. The collected tax revenue does not only depend on tax enforcement activities, it also depends on how many and which firms have been audited. Additionally, tax revenue does also depend on the economic situation and since usually at least three fiscal years are subject to an audit, one should not only control for the current GDP but also for the economic situation in the last years.

³⁰For more information about causal relationships see Wooldridge, 2010, pp. 12-16 and Wooldridge, 2013, pp. 3-4.

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Second, using ETRs as dependent variable has several flaws. ETRs are usually calculated by using financial data instead of tax data which might bias the impact of tax enforcement on them since usually financial data and tax data differ. Moreover, ETRs can be influenced by several factors and not just tax enforcement activities which is difficult to control for.

Third, audit ratios are also not an ideal measure for tax enforcement activities since simply comparing the number of audits or audit ratios gives only information about quantity but not about the quality and strength of the audits. Furthermore, changes in tax enforcement might take some time until one can see any impact on audit ratios since it is impossible to adjust audit ratios to a large extent on a yearly basis. Hence, using audit cycles or audit ratios might cause time biases.

Since my data does not allow to follow one of the estimation strategies in table 3.7.1, I use different dependent variables and estimation strategies to analyse tax enforcement in the German states. Generally, I refrain from claiming my results as causal effects and rather as correlations since I do not have variables to control for all confounding factors.

3.7.2 Estimation Strategies

For my empirical analyses, several estimation techniques are used to analyse tax enforcement activities in German states. First, I use descriptive graphs in order to analyse whether there are structural differences between states' tax enforcement activities and whether fiscal equalisation influences tax enforcement. Second, I use Fixed-Effects regressions as well as the Synthetic Control Method to empirically examine tax enforcement in German states and whether changes in states' government ideologies have any impact on their tax enforcement activities.

As dependent variables in my regressions, I use the quota of tax gain to GDP as a proxy for the strength of audits. I also use the quota of apprentices to the number of companies to be audited as a proxy for the efforts to strengthen tax enforcement since the number of apprentices can be changed on a yearly basis. I do not use audit cycles or audit quotas as dependent variables since time lags could bias my results (see also section 3.6.1).

3.7.3 Fixed-Effects Regressions

Fixed-Effects regressions are used to control for unobservable heterogeneity at the state level (Wooldridge, 2010, pp. 484-488). One of the key assumptions for Fixed-Effects regressions is that the unobserved effect is constant and does not change over time. Given the structure of the underlying data set and heterogeneity in German states' characteristics, it is important to control for time-constant and unobserved effects.³¹ The specification for the Fixed-Effects regressions looks the following:

$$\ln K_{i,t} = \beta_0 + \beta_1 \cdot Z_{i,t} + ideology_{i,t} + \theta_i + \rho_t + \varepsilon_{i,t} \quad (3.7.1)$$

$\ln K_{i,t}$ is the dependent variable and depending on the regressions either the quota of tax gains raised from audits to GDP or the quota of apprentices to the number of companies to be audited in state i and year t . $Z_{i,t}$ captures all state-specific control variables in order to better explain the relation between $\ln K_{i,t}$ and $ideology_{i,t}$. $ideology_{i,t}$ is a dummy capturing different government ideologies, and ρ_t is a year dummy variable to control for time-specific effects.³² Fixed effects for the respective states are expressed by the variable θ_i in order to control for unobserved and time-constant state-specific heterogeneity. It is important to include fixed effects since otherwise a correlation between these unobserved characteristics and $Z_{i,t}$ might result in biased estimations. Finally, $\varepsilon_{i,t}$ represents the error term consisting of μ_i and $\nu_{i,t}$. μ_i denotes the unobservable individual-specific effect and $\nu_{i,t}$ denotes the remainder disturbance (see Baltagi, 2005, pp. 11-14; Wooldridge, 2013, pp. 484-491).

³¹However, the Fixed-Effects estimator allows for an arbitrary correlation between the state Fixed-Effects and the explanatory variables in any time period. For further information about Fixed-Effects estimation and the underlying assumptions, see Wooldridge (2010).

³²The dummy for $ideology_{i,t}$ is equal to one in years in which a leftwing government has passed the state's budget plan since the number of apprentices is determined in states' budget plans.

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3.7.4 Synthetic Control Method

Since tax enforcement data is only available as aggregated state-level data, there are not enough observations available for a classic difference-in-differences regression with another state. The Synthetic Control Method is a systematic way to create a control group which has not been subject to a change in government ideology but which resembles as closely as possible the treated group. Ideally, the created synthetic control group behaves exactly the same as the treated state before the change in government ideology so that any difference thereafter can be attributed to the change in government ideology itself. In turn, the basic idea of this method is that a combination of control variables makes an untreated group of observations ex ante comparable to the treated state regarding certain characteristics. I construct the synthetic control group by using a weighted average of several German states based on the states' similarities to Baden-Wuerttemberg and North Rhine-Westphalia in the years prior to the change in government ideology (2010 in North Rhine-Westphalia and 2011 in Baden-Wuerttemberg) regarding certain state-level variables. Since information about the number of apprentices is missing in several states before 2004, I cannot include further data in my analyses. Hence, before the changes in government ideology, I include seven years (2004-2010) into my analyses for Baden-Wuerttemberg and six years (2004-2009) for North Rhine-Westphalia. My variable of interest is the state-level quota of apprentices for tax and financial officers to the number of firms which have to be audited each year. I use the number of apprentices since the capacities for a state's education program can be changed on a yearly basis. Therefore, if governments want to strengthen their tax administration and tax enforcement activities, they need to increase the number of apprentices. To create the synthetic Baden-Wuerttemberg and North Rhine-Westphalia, I use several control variables at the state level: GDP per capita, debt per capita, unemployment rate, consumer price index, number of firms to be audited, and a dummy indicating whether the state is a giver or taker of the fiscal equalisation scheme. Similar to Abadie, Diamond and Hainmueller (2010), I also include three years of the lagged quota of apprentices to the number of companies to make sure that no structural or state-level differences prior to the intervention event exist.

I use these control variables to make sure that the synthetic control groups are created from states which are economically very similar to Baden-Wuerttemberg and North Rhine-Westphalia before the intervention events. In order to guarantee a comparability and avoid that control states are biased from changes of government ideologies in their states, I exclude states in which there has been a change in the party of the Prime Minister in the relevant period of time (Berlin, Brandenburg, Bremen, Hamburg, Lower Saxony, Mecklenburg-Western Pomerania, Schleswig-Holstein, and Thuringia). Hence, my donor pool for creating the synthetic Baden-Wuerttemberg and North Rhine-Westphalia reduces to Bavaria, Hesse, Rhineland-Palatinate, Saarland, Saxony, and Saxony-Anhalt.³³ For more detailed information about the Synthetic Control Method and its underlying assumptions, see chapter 4, section 4.4.2.

3.8 Empirical Results

3.8.1 Competition in Tax Enforcement

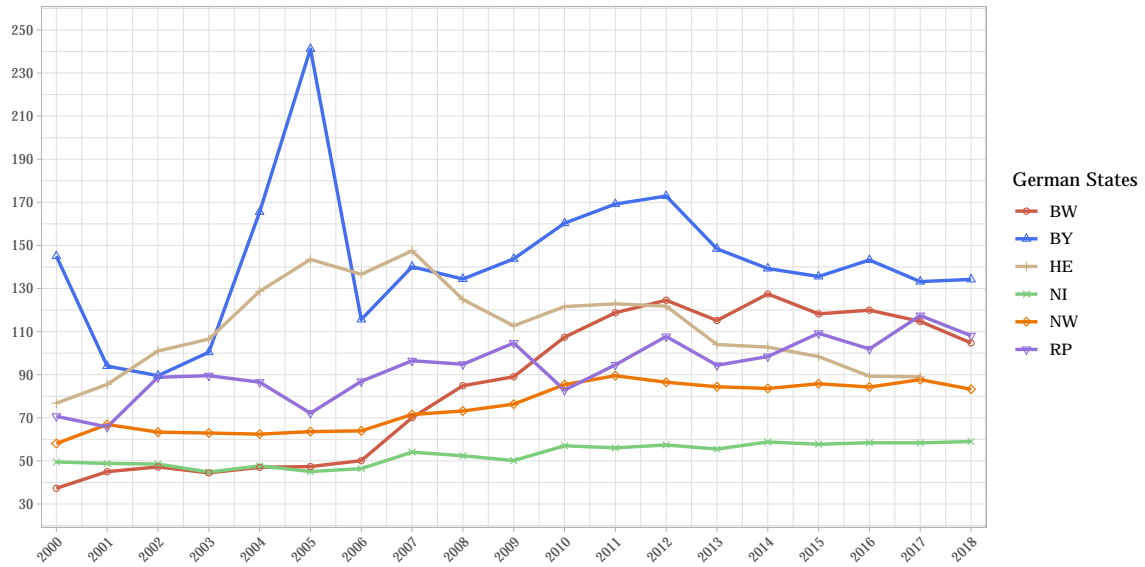
As described above, using tax enforcement as a tax policy tool for tax competition can be achieved by either less frequent audits or by less strict audits. I analyse the frequency of audits by comparing states' audit cycles for the different company size classes. However, it is more difficult to find an appropriate measure for the strength of audits, e.g., a more generous interpretation of tax issues. In order to proxy the strength of audits, I examine states' quotas of tax gain to GDP, and the tax gains raised from audits in relation to one Euro of reported profit.

First, I analyse states' audit cycles over time. Figures 3.8.1, 3.8.2, 3.8.3, and 3.8.4 show the audit cycles for the different company size classes for a sub-sample of German states for the years 2000 to 2018. For reasons of visualisation, I do not report audit cycles of all German states. Audit cycles for the remaining states are reported in the appendix in figures 3.A.3, 3.A.4, 3.A.5, and 3.A.6. As one can see in the illustration of the sub-sample, Bavaria nearly always has the highest audit cycles which are above average and significantly higher than in other states.

³³When constructing the synthetic control group for Baden-Wuerttemberg, I also exclude North Rhine-Westphalia and vice versa when constructing the control group for North Rhine-Westphalia I exclude Baden-Wuerttemberg.

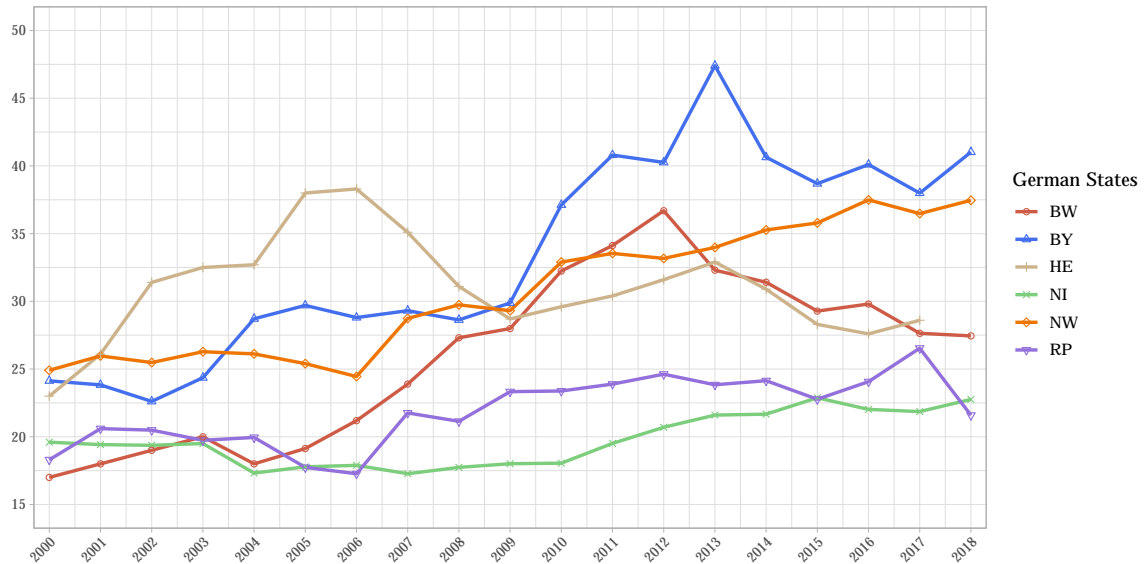
3.8. EMPIRICAL RESULTS

Figure 3.8.1: Audit Cycles VSC (in years)



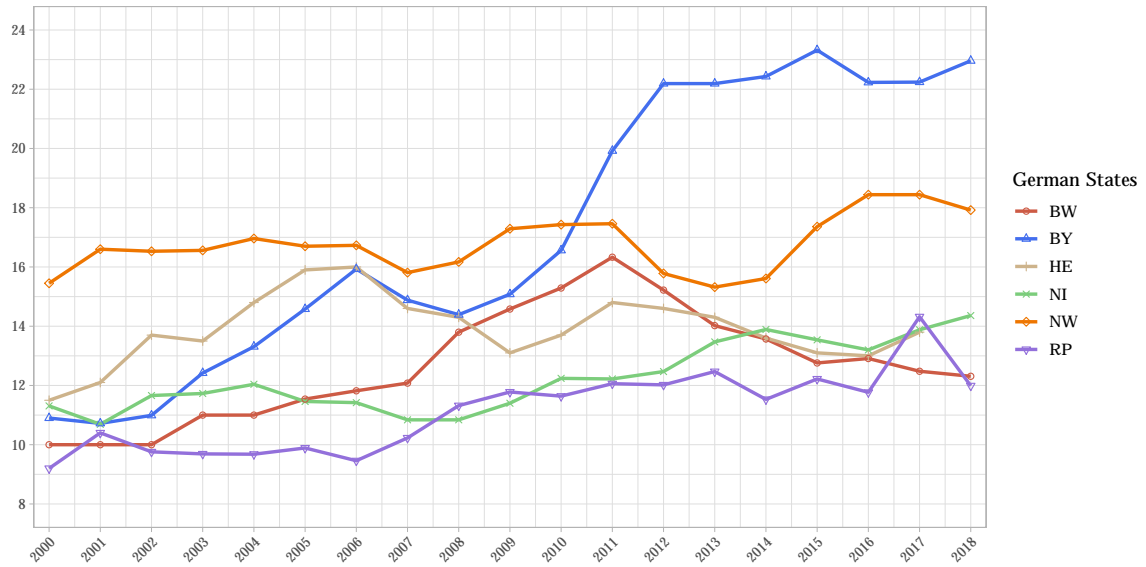
Notes: This figure shows the audit cycles (in years) for VSC for the years 2000 to 2018. Information are retrieved from my hand-collected data. BW=Baden-Wuerttemberg; BY=Bavaria; HE=Hesse; NI=Lower Saxony; NW=North Rhine-Westphalia; RP=Rhineland-Palatinate.

Figure 3.8.2: Audit Cycles SC (in years)



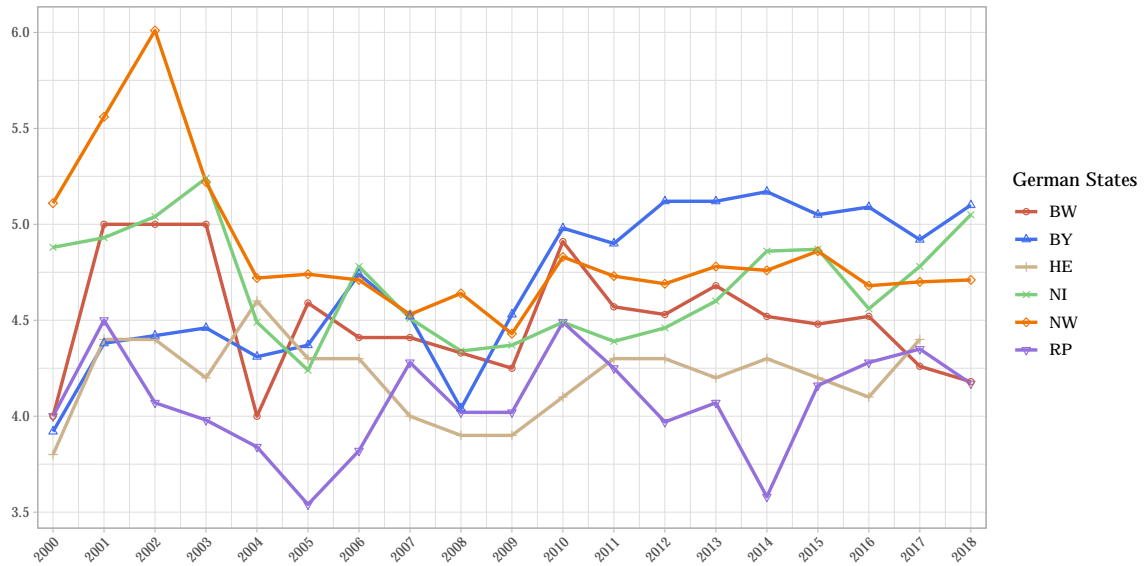
Notes: This figure shows the audit cycles (in years) for SC for the years 2000 to 2018. Information are retrieved from my hand-collected data. BW=Baden-Wuerttemberg; BY=Bavaria; HE=Hesse; NI=Lower Saxony; NW=North Rhine-Westphalia; RP=Rhineland-Palatinate.

Figure 3.8.3: Audit Cycles MC (in years)



Notes: This figure shows the audit cycles (in years) for MC for the years 2000 to 2018. Information are retrieved from my hand-collected data. BW=Baden-Wuerttemberg; BY=Bavaria; HE=Hesse; NI=Lower Saxony; NW=North Rhine-Westphalia; RP=Rhineland-Palatinate.

Figure 3.8.4: Audit Cycles LC (in years)



Notes: This figure shows the audit cycles (in years) for LC for the years 2000 to 2018. Information are retrieved from my hand-collected data. BW=Baden-Wuerttemberg; BY=Bavaria; HE=Hesse; NI=Lower Saxony; NW=North Rhine-Westphalia; RP=Rhineland-Palatinate.

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Furthermore, audit cycles of SC, MC, and LC are also increasing over time in Bavaria, e.g., the audit cycle of MC in Bavaria has increased from every 10.9 years in 2000 to every 22.96 years in 2018.³⁴ Generally, one can see that audit cycles have increased in nearly all states over the years from 2000 to 2018, and that especially VSC are audited very rarely. Although LC have to be continuously audited, one can still see differences in audit cycles for LC in the German states. Table 3.8.1 shows the average audit cycles from 2000 to 2018 for all German states. The states with the lowest and highest audit cycles are marked in bold. Once again, one can see huge differences in audit cycles between the states. Given the illustrations above, I find clear evidence of huge structural differences in states' audit cycles. Although it is impossible to make any causal conclusions from this descriptive evidence, there is reason to believe that these differences in audit cycles do not happen coincidentally but are used strategically for tax competition between the states which would support my first hypothesis.

Table 3.8.1: Average Audit Cycles

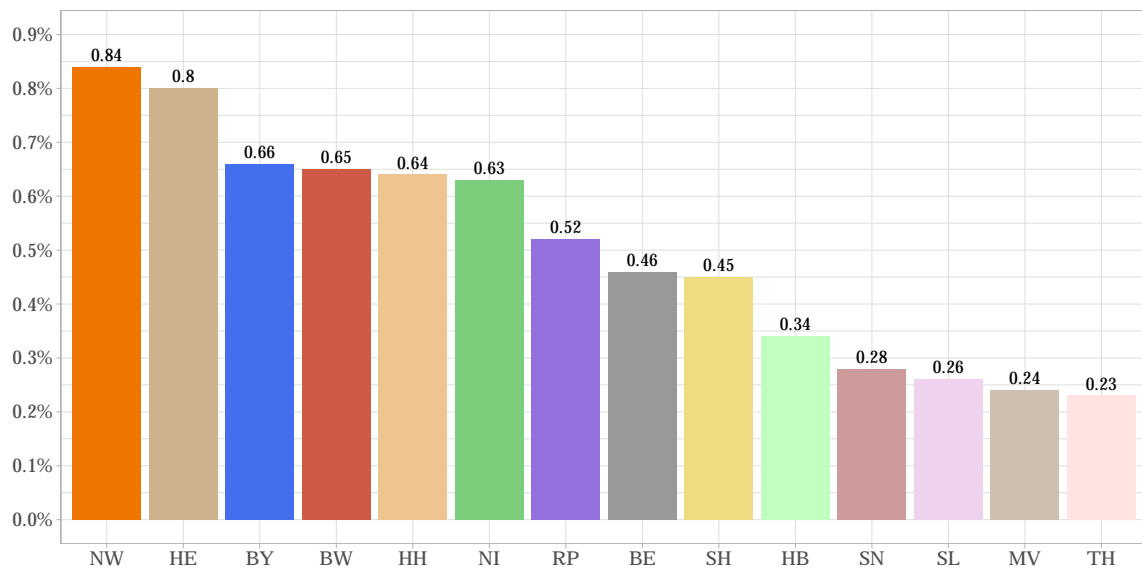
State	VSC	SC	MC	LC
Baden-Wuerttemberg	84.92	25.92	12.67	4.51
Bavaria	142.42	33.37	17.22	4.69
Berlin	104.23	21.33	10.86	4.05
Brandenburg	120.66	37.14	15.54	4.73
Bremen	113.44	33.27	15.06	4.82
Hamburg	79.10	22.88	13.04	4.87
Hesse	111.86	30.93	13.91	4.21
Lower Saxony	52.92	19.73	12.25	4.68
Mecklenburg-Western Pomerania	93.65	29.07	13.83	4.86
North Rhine-Westphalia	75.40	30.66	16.77	4.86
Rhineland-Palatinate	93.22	21.85	11.13	4.07
Saarland	155.41	28.20	15.05	4.81
Saxony	93.01	28.03	12.26	4.02
Saxony-Anhalt	61.91	19.35	10.71	4.38
Schleswig-Holstein	85.51	30.42	14.95	5.06
Thuringia	149.87	38.57	14.31	4.36

Notes: This table shows the average audit cycles (in years) for all company size classes in all German states for the time period from 2000 to 2018. Information are retrieved from my hand-collected data. Lowest and highest average audit cycles are marked in bold.

³⁴The Ministry of Finance in Bavaria did not react to my question how the huge outlier for VSC in 2005 can be explained.

Second, I examine whether there are differences in the strength of audits between the states. Figure 3.8.5 shows the quota of tax gains raised from audits in relation to GDP as an average for the years 2000 to 2018.³⁵ With 0.84% of its GDP, North Rhine-Westphalia has raised on average the highest tax gains in relation to its economic potential. At the other end of the scale, the quota of tax gains to GDP is only 0.23% in Thuringia which illustrates that there are big differences between the states. Again, it is impossible to draw any causal conclusions about the strength of the states' tax enforcement activities since these differences could also be caused by other factors for which I cannot control. Although the quota of tax gains to GDP is not a perfect measure for the strength of audits, it serves as a proxy and shows that there are big differences between the German states.

Figure 3.8.5: Quota of Tax Gain to GDP (in Percent)



Notes: This figure shows the ratio of tax gains raised from tax enforcement in relation to the moving average of GDP as an average for the years 2000 to 2018. Information are retrieved from my hand-collected data and the Federal Statistical Office. I do not include Brandenburg and Saxony-Anhalt since they did not report detailed information for the whole time period. HE=Hesse; NW=North Rhine-Westphalia; HH=Hamburg; BY=Bavaria; BW=Baden-Wuerttemberg; NI=Lower Saxony; RP=Rhineland-Palatinate; SH=Schleswig-Holstein; HB=Bremen; BE=Berlin; SL=Saarland; SN=Saxony; MV=Mecklenburg Western-Pomerania; TH=Thuringia.

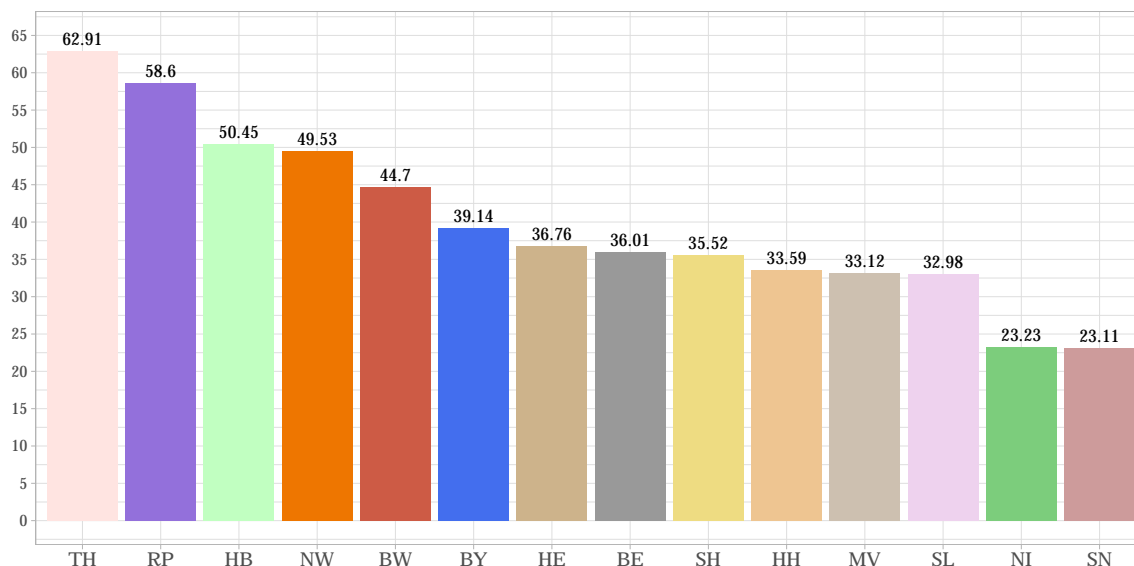
³⁵I control for the moving average of GDP since states have different economic and fiscal potentials which can influence their tax gains from audits. Additionally, states with a large number of companies to be audited and consequently also more audits per year will automatically raise more tax gains from audits than small states with few companies (see also section 3.6.1).

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Figures 3.8.6, 3.8.7, 3.8.8, and 3.8.9 show the tax gains raised from audits in relation to one Euro of reported profit for the different company size classes for the German states. Since I do not have more data available, the figures show the average for the years 2013, 2014, and 2015 (for further information see section 3.6.1 and the appendix 3.A). When analysing the tax gains from audits of the different firm size classes, it is important to control for their different economic potential. For this reason, I take the average reported profits of the different firm size classes to get a measure of how much tax gain was raised in relation to one Euro of reported profits in firms' Business Tax returns. Furthermore, there will also be a difference between the average firm sizes between the German states. LC in Bavaria or North Rhine-Westphalia will probably be larger with higher reported profits than LC in Mecklenburg-Western Pomerania which is why I control for the reported profits in each state.

For all different company size classes, one can see that there are huge differences between the German states which supports my first hypothesis. For VSC, Thuringia has with 62.91 Cents the highest tax gains per Euro of profit in comparison to Saxony with only 23.11 Cents per Euro of profit.

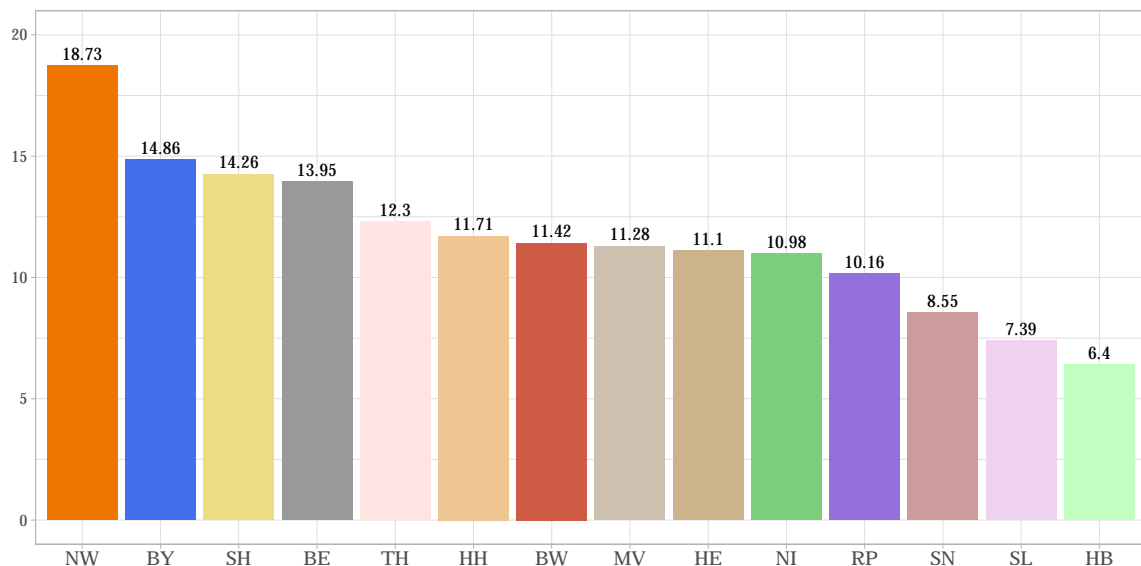
Figure 3.8.6: Tax Gain per Euro of Profit of VSC (in Cents)



Notes: This figure shows the tax gains (in Cents) from audits of VSC in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014. See figure 3.8.5 for the definition of the abbreviations.

When auditing SC, North Rhine-Westphalia raises approximately three times more relative tax gains than Bremen. These big differences also exist for MC and LC. There are two possible explanations for these differences: first, states with higher relative tax gains use stricter tax enforcement than states with lower relative tax gains; second, states with higher relative tax gains do not use stricter tax enforcement than states with lower relative tax gains but audited companies are less tax compliant in these states than audited companies in states with lower relative tax gains.

Figure 3.8.7: Tax Gain per Euro of Profit of SC (in Cents)

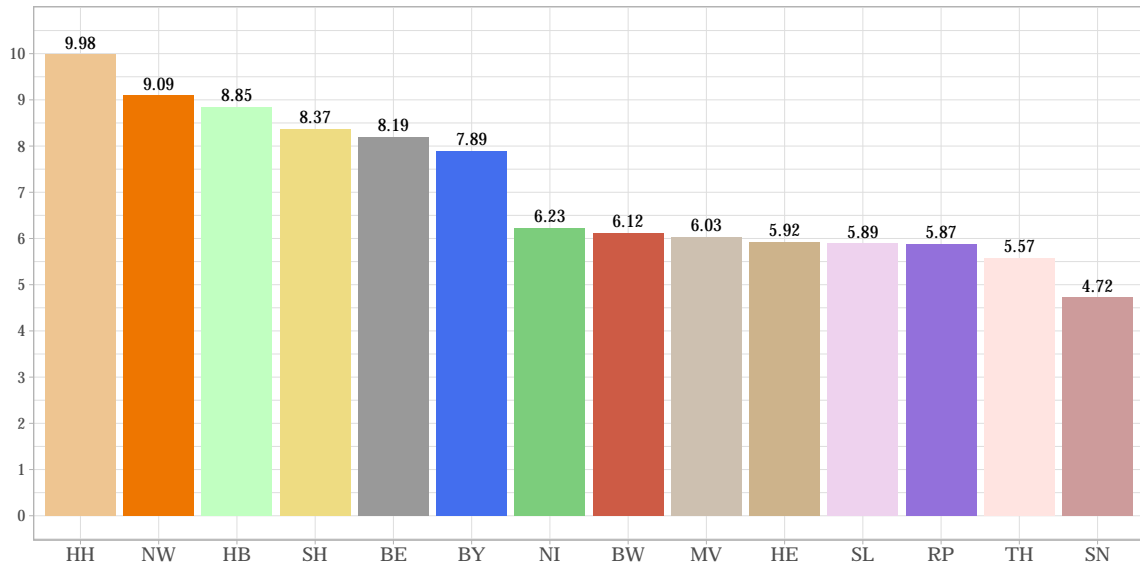


Notes: This figure shows the tax gains (in Cents) from audits of SC in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014. See figure 3.8.5 for the definition of the abbreviations.

Consequently, these differences in relative tax gains might be either driven by states' different strength of tax enforcement or firms' different tax compliance rates in the respective states. Unfortunately, my setting does not allow to disentangle and analyse these two different explanations. Interestingly, when the quota of tax gains to GDP is used, states with the highest nominal GDP (e.g., North Rhine-Westphalia, Hesse, Bavaria, and Baden-Wuerttemberg) show the highest quotas of relative tax gains although I control for the moving average of GDP. When tax gains in relation to one Euro of reported profit are used, this changes to some extent.

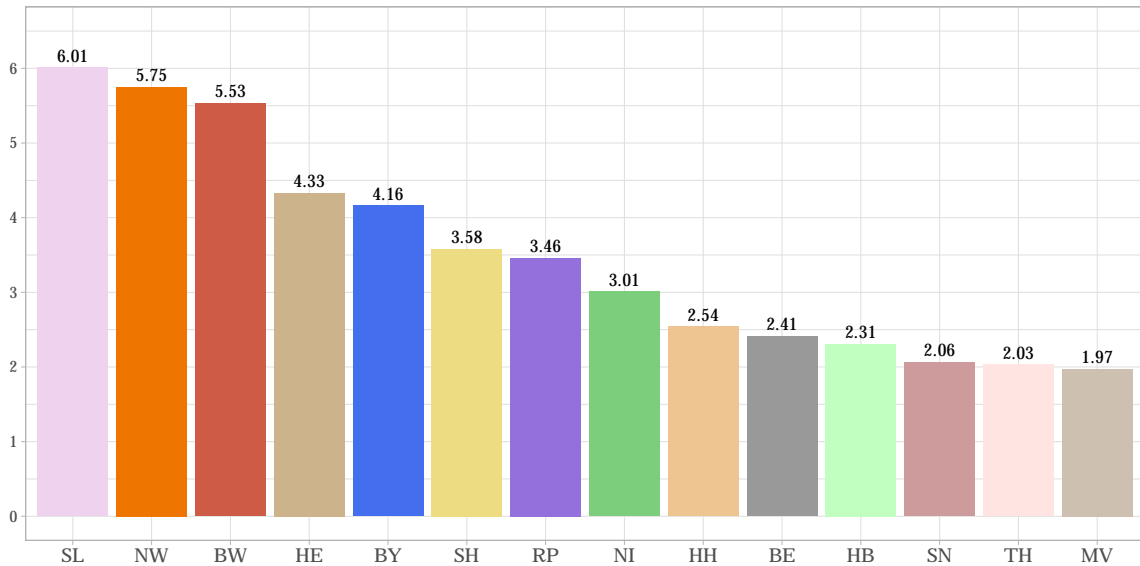
3.8. EMPIRICAL RESULTS

Figure 3.8.8: Tax Gain per Euro of Profit of MC (in Cents)



Notes: This figure shows the tax gains (in Cents) from audits of MC in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014. See figure 3.8.5 for the definition of the abbreviations.

Figure 3.8.9: Tax Gain per Euro of Profit of LC (in Cents)



Notes: This figure shows the tax gains (in Cents) from audits of LC in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014. See figure 3.8.5 for the definition of the abbreviations.

For example, Thuringia has the highest relative tax gains for VSC and Saarland for LC although these states have a below-average GDP and GDP per capita.³⁶ It would be interesting to further analyse these relationships and find a better measure of states' strictness of audits, but unfortunately I do not have such data. Again, I refrain from making any causal conclusions because I take average values and cannot control which firms have been audited. Additionally, I can only use tax gains of three years and not for the entire observation period so that outliers might bias my results. Nevertheless, the Business Tax statistics offer the best data source which is available and comprise all firms which have to pay Business tax. Consequently, my results show that there are significant differences in relative tax gains between states which indicates that these differences do not occur coincidentally.

Finally, I also use OLS regressions to examine possible differences between the German states. Results are reported in the appendix 3.A.

3.8.2 Fiscal Equalisation and Tax Enforcement

In order to analyse whether the fiscal equalisation scheme has an impact on states' tax enforcement activities or on their willingness to fully exploit their fiscal base, I also use my hand-collected data about tax enforcement activities in German states. Similarly to section 3.8.1, I analyse possible differences in tax enforcement by examining audit cycles, the quotas of tax gain to GDP, and the tax gains per Euro of reported profits. To do this, I use the average of all giver states (Baden-Wuerttemberg, Bavaria, Hamburg, and Hesse) and compare it with the average of all taker states (all remaining states) of the fiscal equalisation scheme.³⁷

First, I compare average audit cycles of giver and taker states. Figures 3.8.10, 3.8.11, 3.8.12, and 3.8.13 show the average audit cycles for the different company size classes for giver and taker states from 2000 to 2018.

Starting in 2004, one can see that average audit cycles for VSC, SC, and MC of giver states are above average audit cycles of taker states. However, for SC

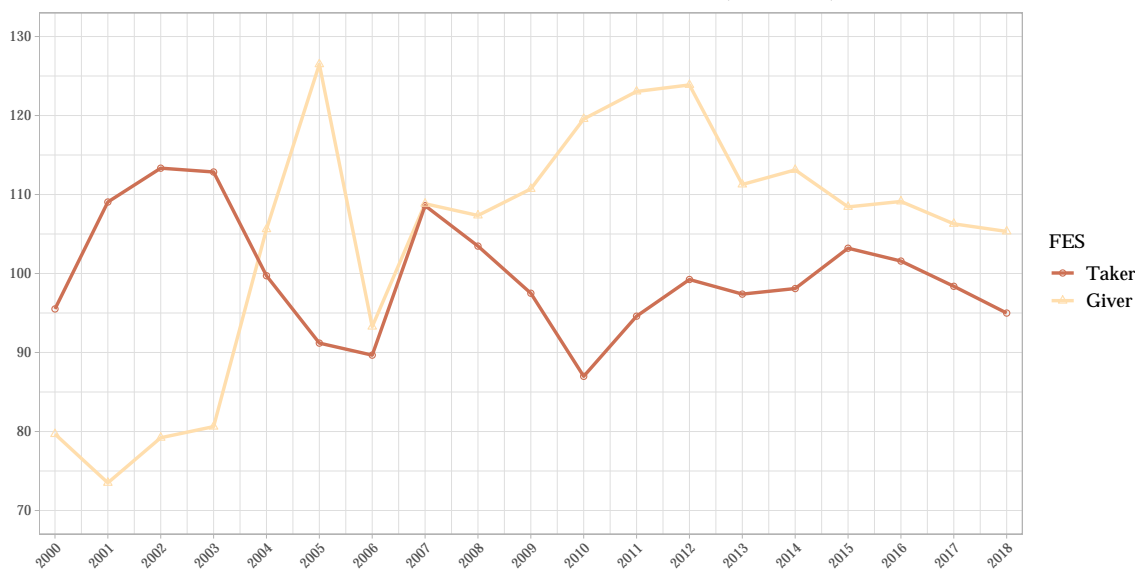
³⁶See, e.g., "Volkswirtschaftliche Gesamtrechnungen der Länder" from the Federal Statistical Office, <https://www-genesis.destatis.de/genesis/online> (March 28, 2022).

³⁷Although North Rhine-Westphalia has been both a giver and a taker state, I classify it as a taker state since overall North Rhine-Westphalia has received more equalising transfer payments than it had to pay during my observation period. However, I drop it in the robustness tests.

3.8. EMPIRICAL RESULTS

and MC this difference vanishes between 2015 and 2017. Average audit cycles for LC do not differ significantly between giver and taker states and are roughly identical, except for some years at the beginning and at the end of the time frame.

Figure 3.8.10: Audit Cycles of VSC (in years)



Notes: This figure shows the average audit cycles (in years) for VSC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme (FES). Information are retrieved from my hand-collected data.

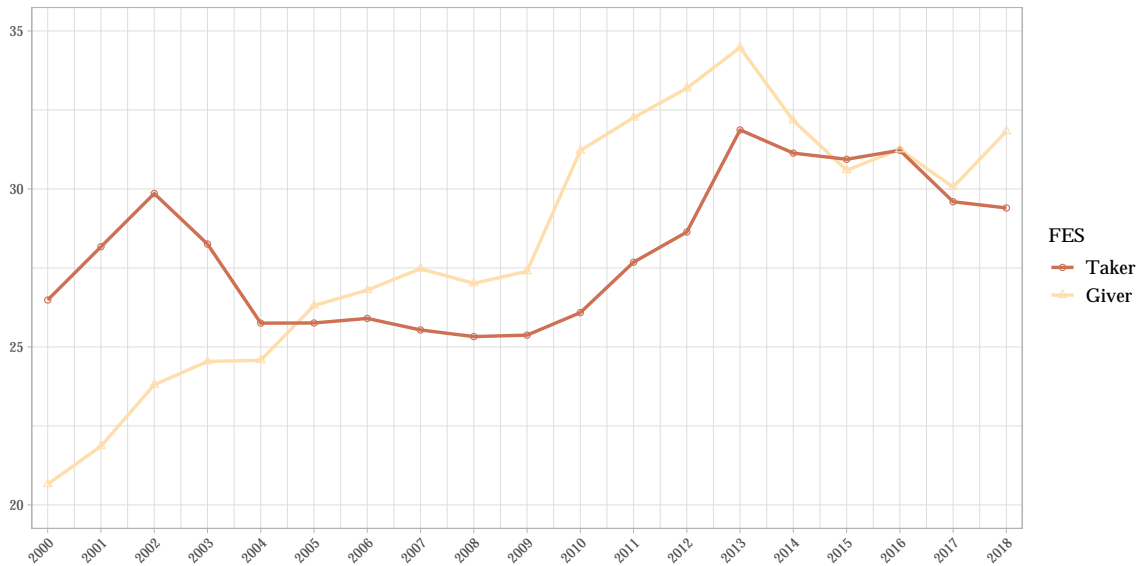
Table 3.8.2 shows the average audit cycles for the whole time period from 2000 to 2018. Although average audit cycles are always lower for taker than for giver states, this difference is only notable for VSC. For SC, MC, and LC, audit cycles are relatively similar. Therefore, I do not find evidence that the fiscal equalisation scheme causes a significant difference between giver and taker states' audit cycles which supports my second hypothesis.

Table 3.8.2: Average Audit Cycles for Giver and Taker States

	VSC	SC	MC	LC
Taker	99.76	28.05	13.52	4.56
Giver	104.49	28.29	14.25	4.58

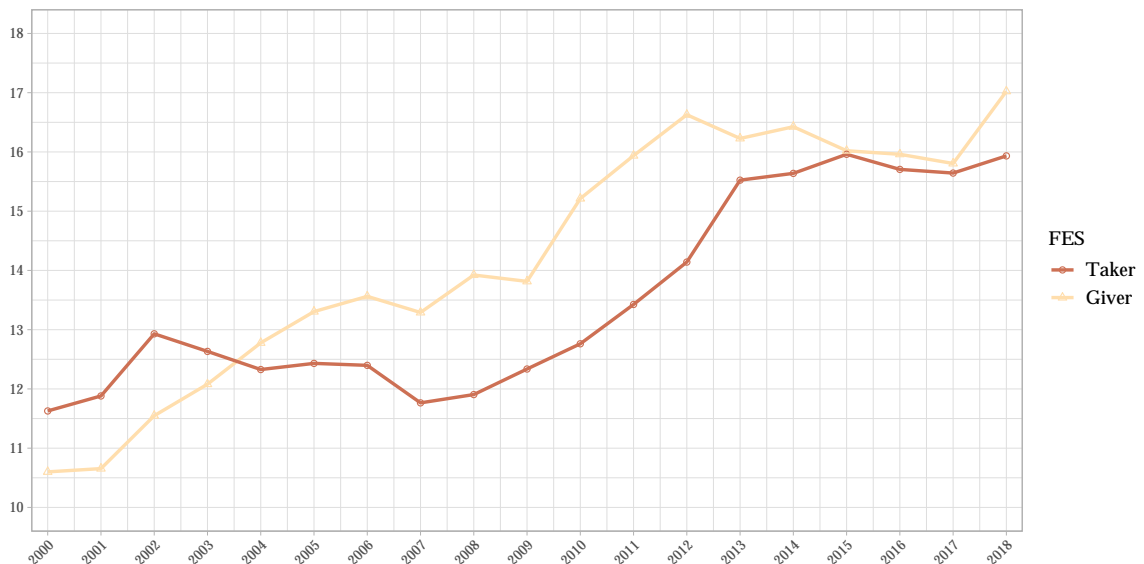
Notes: This table shows the average audit cycles (in years) for all company size classes for giver and taker states for the time period from 2000 to 2018. Information are retrieved from my hand-collected data.

Figure 3.8.11: Audit Cycles of SC (in years)



Notes: This figure shows the average audit cycles (in years) for SC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

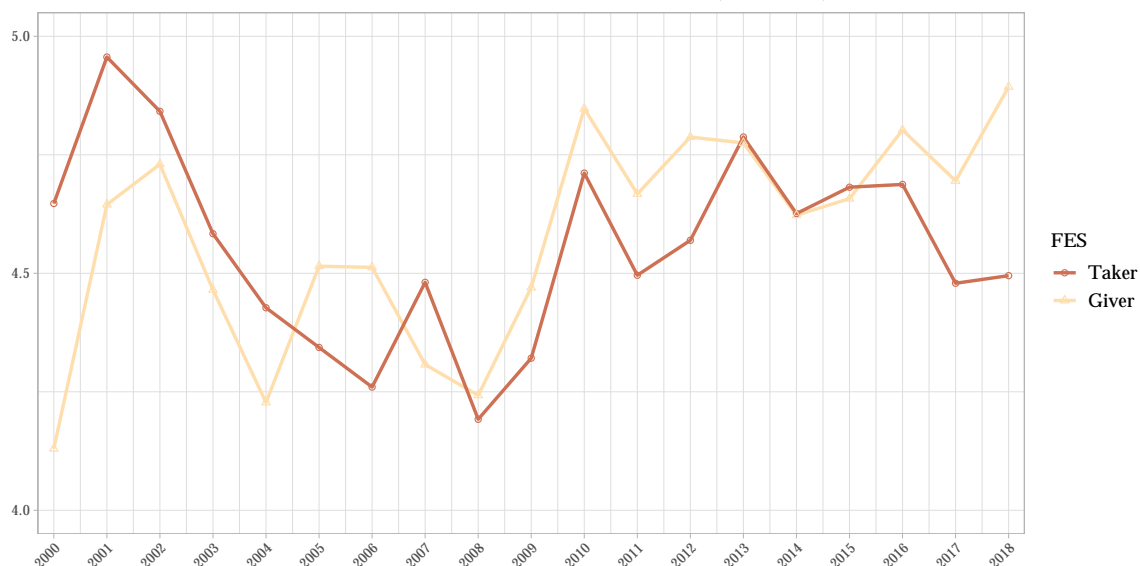
Figure 3.8.12: Audit Cycles of MC (in years)



Notes: This figure shows the average audit cycles (in years) for MC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

3.8. EMPIRICAL RESULTS

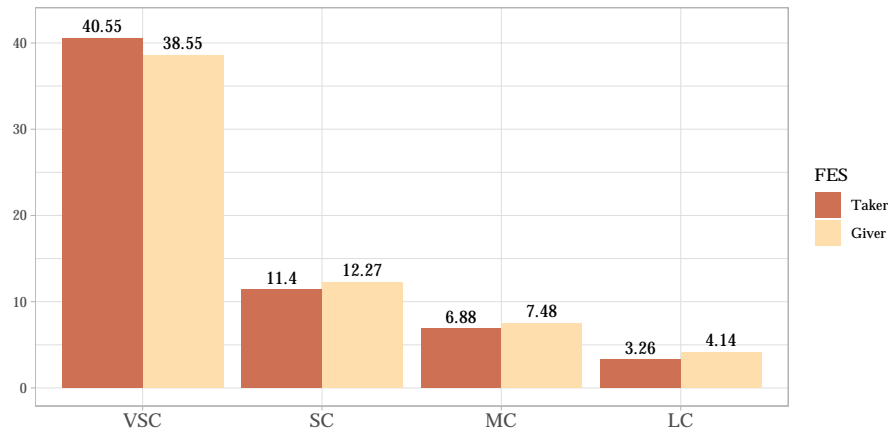
Figure 3.8.13: Audit Cycles of LC (in years)



Notes: This figure shows the average audit cycles (in years) for LC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

Next, I examine whether there are differences in the strength of audits between the states. On average, giver states raise 0.69% of their GDP from audits, whereas taker states only raise 0.43%. This difference seems to be more substantial than the slight differences in audit cycles. Figure 3.8.14 shows the tax gains raised from audits in relation to one Euro of profit for the different company size classes for giver and taker states. Although average tax gains per Euro of profit are a bit lower for giver states for VSC, they are slightly higher for SC, MC, and LC. While there are differences in the quotas of tax gains to GDP, relative tax gains per Euro of profit do not show a substantial difference. Assuming that there are no structural differences in firms' tax compliance rates in giver and taker states, my results indicate that the fiscal equalisation scheme does not have a remarkable impact on giver or taker states' strength of audits which supports my second hypothesis. However, similar to section 3.8.1, I refrain from making causal conclusion with regard to a possible distorting impact of the fiscal equalisation scheme on states' tax enforcement activities. While I do not find significant differences in my descriptive analyses, it might still be possible that the fiscal equalisation scheme has distorting impacts on states for which I cannot control.

Figure 3.8.14: Tax Gain per Euro of Profit (in Cents) for Giver and Taker States



Notes: This figure shows the tax gains (in Cents) from audits of giver and taker states in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014.

3.8.3 Government Ideology and Tax Enforcement

To analyse the possible influence of political orientation and government ideologies of sub-national governments in Germany on tax enforcement, I use Fixed-Effects regressions and the Synthetic Control Method.

First, I focus my analysis on the change in government ideologies in Baden-Wuerttemberg and North Rhine-Westphalia for which I use the Synthetic Control Method. Table 3.8.3 shows the composition of the synthetic Baden-Wuerttemberg and North Rhine-Westphalia.

Table 3.8.3: Composition of Synthetic Control Groups

Baden-Wuerttemberg		North Rhine-Westphalia	
State	Percent	State	Percent
Hesse	62.1 %	Bavaria	36.9 %
Bavaria	27.2 %	Rhineland-Palatinate	26.4 %
Saxony	10.7 %	Saxony-Anhalt	20.0 %
		Hesse	16.7 %

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Since the intervention event was the change in government ideology, I determine the election years as my intervention events. For this reason, the vertical black dotted lines appear in North Rhine-Westphalia in 2010 and in Baden-Wuerttemberg in 2011.³⁸ As one can see in figures 3.8.15 and 3.8.16, the quota of apprentices to number of companies to be audited increases in both states after the change from a rightwing to leftwing government in relation to their synthetic counterparts. The biggest differences between the real states and their synthetic counterparts appear at the end of my observation period.³⁹ One can argue that increasing the number of yearly apprentices to a greater extent might take several years since states usually have a limited number of educational possibilities at their stated-owned universities (e.g., “Hochschule für Öffentliche Verwaltung und Finanzen Baden-Württemberg”). Hence, it will probably take several years until these states can further increase the number of apprentices which can be trained at the stated-owned universities.

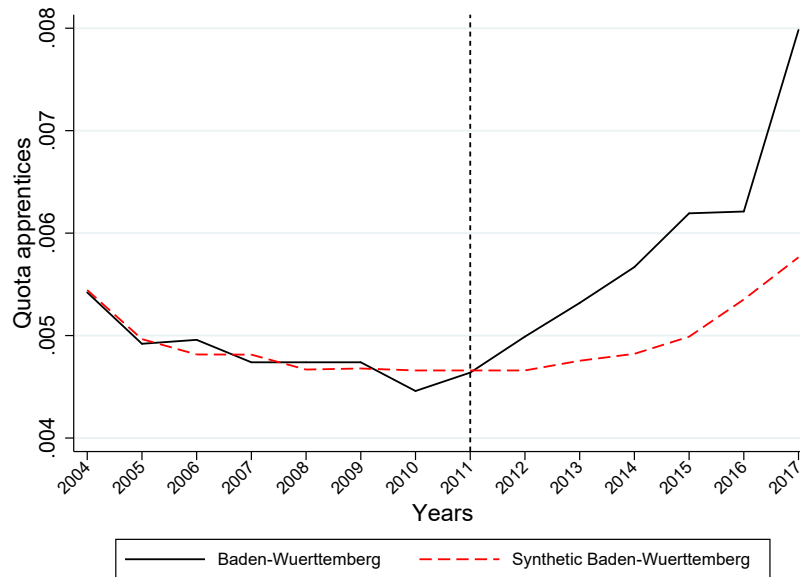
In Baden-Wuerttemberg, the increase in the quota of apprentices happened directly after the election in 2011 and the difference is more substantial than in North Rhine-Westphalia. This immediate increase corresponds to the promise of the leftwing finance minister Nils Schmid (SPD) to create 500 new jobs in tax administration, mainly in tax enforcement, and 500 new apprenticeships until the end of the legislative period.⁴⁰ After the rightwing government had cut jobs in tax administration and tax enforcement over several years, this recruitment initiative has strengthened tax administration capacities sustainably (see figure 3.8.15).

³⁸The Root Mean Squared Prediction Error amounts to 0.000105 for Baden-Wuerttemberg and to 0.000317 for North Rhine-Westphalia. Both values show that the standard deviation of the residuals is very small and therefore the synthetic Baden-Wuerttemberg and North Rhine-Westphalia are a very good fit to the real states.

³⁹I include the year 2017 for Baden-Wuerttemberg and the year 2018 for North Rhine-Westphalia although there were further elections in both North Rhine-Westphalia (in 2017) and Baden-Wuerttemberg (in 2016). I include these years since the decision to strengthen tax enforcement has been already taken in prior years, e.g., see <https://wm.baden-wuerttemberg.de/de/service/presse-und-oeffentlichkeitsarbeit/pressemitteilung/pid/mehr-steuergerechtigkeit-durch-wirksame-steuerfahndung-2/> (May 15, 2022).

⁴⁰See <https://wm.baden-wuerttemberg.de/de/service/presse-und-oeffentlichkeitsarbeit/pressemitteilung/pid/mehr-steuergerechtigkeit-durch-wirksame-steuerfahndung-2/> (May 15, 2022).

Figure 3.8.15: Synthetic Control Method for Baden-Wuerttemberg



Notes: This figure shows the quota of apprentices in relation to the number of companies to be audited for the years 2004 to 2017 in Baden-Wuerttemberg. The number of apprentices is retrieved from the state's budget plans and the number of companies to be audited through a parliamentary inquiry from a member of Baden-Wuerttemberg's parliament.

Moreover, the increasing number of apprentices and auditors led to an increase in audits for all company size classes (see figure 3.A.11 in the appendix). After a steady decrease in the number of audits before the change in government ideology, total number of audits was 26,921 in 2010 and increased to 29,526 until 2018.⁴¹ Consequently, one can see a strengthening of tax enforcement in Baden-Wuerttemberg by the increase in the number of audits which strengthens the deterrence and preventive effect of tax enforcement.

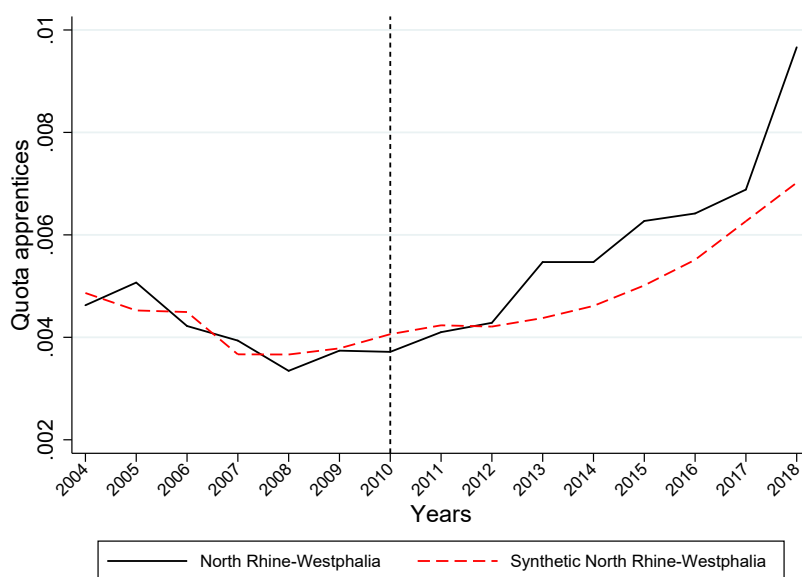
In North Rhine-Westphalia, the increase in apprentices does also correspond to what the leftwing government and especially the finance minister Norbert Walter-Borjans (SPD) had promised after the election. He promised to strengthen tax administration and tax enforcement and improve the compensations for auditors

⁴¹Since the number of LC had increased and they have to be continuously audited, Baden-Wuerttemberg had to allocate more resources to audit LC. Regarding VSC, SC, and MC, the highest relative increase in the number of audits happened for MC which shows again that tax administration in Baden-Wuerttemberg follows a risk-based approach regarding a shortfall in tax revenue for their audit case selection. Due to the demographic structure in tax administrations, the increase in apprentices and auditors had to compensate the increasing number of retirements in the last years (see figure 3.A.12 in the appendix).

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and tax investigators.⁴² Different to Baden-Wuerttemberg, one cannot see a constant increase in the number of auditors and the number of audits after the leftwing government took over office (see figure 3.A.13 in the appendix). In contrast, after a slight increase in 2012 and 2013, both numbers dropped below the initial values. Total number of audits was 43,695 in 2010 and decreased to 41,265 until 2018. Possible explanations could be that either audit intensity and length was increased so that less firms could be audited per year or the increase in apprentices was just on paper and the number of vacancies could not be filled with suitable applicants. Another explanation might be that the increase in apprentices and auditors was levelled out by an increasing number of retirements. Unfortunately, I do not have information to control for these factors.

Figure 3.8.16: Synthetic Control Method for North Rhine-Westphalia



Notes: This figure shows the quota of apprentices in relation to the number of companies to be audited for the years 2004 to 2018 in North Rhine-Westphalia. The number of apprentices is retrieved from the state's budget plans and the number of companies to be audited through a request according to the state's freedom of information act.

The comparison of Baden-Wuerttemberg and North Rhine-Westphalia with their synthetic counterparts indicate that the leftwing governments kept their electoral promises to strengthen their efforts towards equity of taxation by increasing the number of apprentices and employees in tax administration (see,

⁴²See <https://www.finanzeverwaltung.nrw.de/nrw-betriebspruefer-decken-steuerdefizite-vo-n-57-milliarden-euro-2014-auf> (May 15, 2022).

e.g., BÜNDNIS 90/DIE GRÜNEN and SPD, 2010, 2011). This would be in line with my third hypothesis. However, since it is impossible to control for other possibly confounding factors I refrain from making a causal conclusion.

Second, I use Fixed-Effects regressions with a dummy for leftwing governments. The results are shown in table 3.8.4. For regressions (1) and (2), dependent variable is the quota of tax gains raised from audits to GDP. For regressions (3) and (4), dependent variable is the quota of apprentices to the number of companies to be audited. For regression (1), all control variables are highly statistically significant and show the expected signs. GDP should have a positive impact since the higher the economic potential was in the past, the higher the tax gains from audits should be. If the level of debt increased in prior years, then tax enforcement might be used as a tool to collect additional tax revenue and consolidate the budget. Increasing unemployment rates in previous years usually correspond to a decreasing economic development which should have a negative impact on tax gains from audits. This is the same when a dummy for leftwing government is included in regression (2) but the coefficient for leftwing government is not statistically significant. When using the quota of apprentices to the number of companies as dependent variable, the coefficient for leftwing government is statistically significant at a 5% level implying that the quota is 0.0174 percentage points higher if a leftwing government is in power. Although I find statistical significance, it is questionable whether this also implies economic significance since the value is relatively low. However, the coefficient indicates that government ideology can have an impact on states' efforts towards their tax enforcement activities, which is in line with the findings of Young, Reksulak and Shughart (2001) and Pettersson-Lidbom (2008) who both find that government ideology has an impact on tax administration. Again, since I cannot control for other factors that might possibly impact tax enforcement as well, I refrain from interpreting this as a causal interference.

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Table 3.8.4: FE Regressions - For regressions (1) and (2), dependent variable is the quota of tax gains to GDP; for regressions (3) and (4), dependent variable is the quota of apprentices to the number of companies; Time period: 2000-2018

	(1)	(2)	(3)	(4)
	<i>FE</i>	<i>FE</i>	<i>FE</i>	<i>FE</i>
<i>MoveAvgGDP</i>	0.0276** (0.0115)	0.0270** (0.0115)	0.00481*** (0.00116)	0.00438*** (0.00115)
<i>MoveAvgDebtpc</i>	0.00499*** (0.00165)	0.00487*** (0.00166)	0.000821*** (0.000182)	0.000784*** (0.000181)
<i>MoveAvgUnempl</i>	-0.0640*** (0.0239)	-0.0677*** (0.0230)	-0.00318 (0.00303)	-0.00378 (0.00283)
<i>Leftwing Gov</i>		0.000708 (0.000626)		0.000174** (0.0000812)
<i>Constant</i>	-0.659** (0.299)	-0.644** (0.299)	-0.128*** (0.0303)	-0.117*** (0.0299)
<i>Year effects</i>	Yes	Yes	Yes	Yes
<i>State effects</i>	Yes	Yes	Yes	Yes
<i>Observations</i>	275	275	257	257
<i>R – squared</i>	0.9441	0.9444	0.7103	0.7197

Robust standard errors are clustered at the state level and are presented in parentheses.

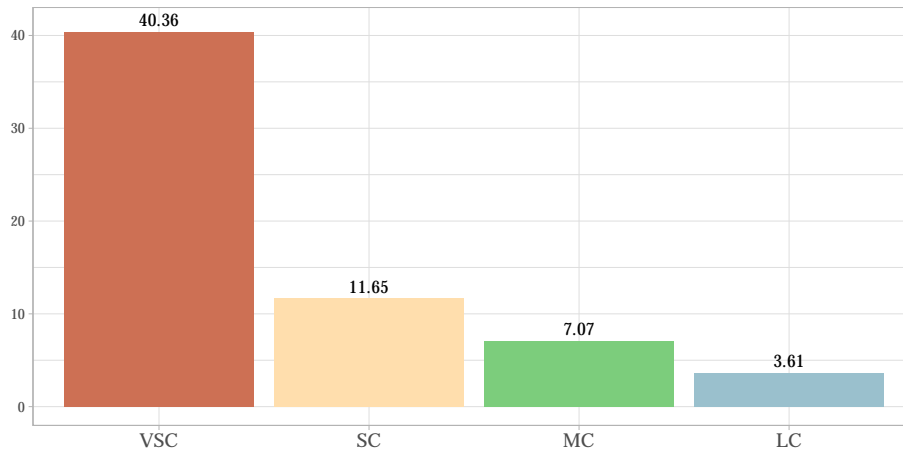
***, ** and * indicate significance at the 1%, 5% and 10% level respectively.

3.8.4 Tax Enforcement Strategy

As I have described in section 3.2.3, German states' tax administrations follow a risk-based approach for their audit case selection since they focus their audits on MC and LC where the risk of a shortfall in tax revenue is highest. However, German tax authorities have not yet presented any evidence that MC or LC are less tax compliant than VSC and SC relatively to their profits which would justify this strategy from both an efficiency and equity point of view. For these reasons, I analyse tax gains in relation to one Euro of reported profits for the different company size classes to examine whether the current tax enforcement strategy fulfills its legal obligation (see also sections 3.6.1 and 3.8.1).

First, I want to provide evidence that there are substantial differences in firms' relative tax gains depending on their company size classes. Figure 3.8.17 shows the average tax gains per Euro of profit for the different size classes. One can see that with 40.36 Cents, relative tax gains per Euro of profit are significantly higher for VSC than for SC (11.65 Cents), MC (7.07 Cents), and LC (3.61 Cents).

Figure 3.8.17: Tax Gain per Euro of Profit (in Cents) for Different Size Classes



Notes: This figure shows the tax gains (in Cents) from audits of the different company size classes in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014.

This huge difference cannot stem from the fact that VSC are audited by more experienced auditors. In contrast, auditors of VSC and SC (“Amtsbetriebsprüfung”) are on average less experienced and have a lower salary than auditors of MC and LC (“Betriebsprüfung”) (see section 3.2.3 and chapter 2, section 2.2.3 for further information). Consequently, tax enforcement intensity is rather lower than higher for VSC in comparison to larger firms. Additionally, the estimate for LC is probably rather high because I only take into account the profits of the last three fiscal years. Since LC have to be continuously audited and average audit cycle is every 4.6 years, audits of LC probably cover four or five fiscal years. Hence, relative tax gains for LC might even be lower than my estimate of 3.61 Cents.⁴³ It is also very unlikely that these differences are caused by different legal forms or firm types in the German states since their distribution is well-balanced in the states (see tables 2.A.5, 2.A.6, 2.A.7, and 2.A.8 in the appendix 2.A and

⁴³For VSC, SC, and LC, Section 4 (3) BPO prescribes that audits can only cover the last three fiscal years (see Klein and Rüsken, 2020).

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section 2.4.2 of chapter 2).⁴⁴

For these reasons, my results strongly indicate that the huge differences in relative tax gains between the different company size classes stem from firms' different tax compliance rates and their possibilities to evade taxes. Smaller firms have more possibilities than bigger firms to not report profits at all since the bigger a firm is, the more people have to be involved to evade taxes. While MC and LC can use transfer prices, patent boxes, or cross-border tax planning to lower their tax burden, it is nearly impossible for them to not report profits at all. My results are in line with the findings of Kleven et al. (2011) and Kleven, Kreiner and Saez (2016) who both find that tax evasion is correlated with firm size. Hence, my finding that smaller firms (especially VSC) in Germany are less tax compliant than larger firms is in line with the findings for Danish firms. Furthermore, my finding that relative tax gains are significantly higher for VSC than for SC, MC, and LC is identical in all states. In all 16 German states, relative tax gains are significantly higher for VSC than for the other company size classes (see table 3.A.3 in the appendix 3.A). My results are also identical when using average reported sales instead of average reported profits (see the robustness tests in section 3.9).

Second, I want to illustrate that there are not only differences between company size classes but also between the German states' tax enforcement activities. Tables 3.8.5 and 3.8.6 display the states with the lowest and highest relative tax gains and audit cycles for the different company size classes. Once again, one can see that there are significant differences between the states what I have already shown in section 3.8.1. For VSC and SC, the states with the highest relative tax gains raise approximately three times more tax gains per Euro of profit than the states with the lowest tax gains. With regard to audit cycles, VSC are audited every 53 years in Lower Saxony, while they are audited only every 155 years in Saarland which is a huge difference. For SC and MC, these differences are also very remarkable and only for LC the difference is very modest, which is due to the binding targets in Section 4 (2) BPO.

⁴⁴Although city states have a lower share of manufacturing firms and states in Eastern Germany show on average a slightly lower share of corporations than in Western Germany, overall distribution is well-balanced.

Table 3.8.5: Comparison of Lowest and Highest Tax Gains per Euro of Profit (in Cents)

	Lowest		Highest	
VSC	23.11	(Saxony)	62.91	(Thuringia)
SC	6.4	(Bremen)	18.73	(North Rhine-Westphalia)
MC	4.72	(Saxony)	9.98	(Hamburg)
LC	1.97	(Mecklenburg-Western Pomerania)	6.01	(Saarland)

Notes: This table shows an comparison of the lowest and highest tax gains per Euro of profit for the different company size classes. Tax gains per Euro of profit are expressed in Cents and calculated as an average for tax gains in the years 2013, 2014, and 2015. Information are retrieved from my hand-collected data and the statistics about the Business Tax returns.

This indicates that if German policymakers wanted to level out these substantial differences between the states, one would probably need more binding legal requirements for smaller firms. If VSC and SC are audited significantly less often than MC or LC, then tax enforcement has no preventive effect anymore and taxpayers' willingness to comply with the tax laws might decrease. Particularly, VSC might have incentives to cheat more since the probability of detection is very low. This can also be explained by the model of tax evasion since the decision to evade taxes depends on both the detection probability and the expected benefits and penalties (see the appendix 2.A of chapter 2). If detection probability is very low for VSC, then they might decide to evade more taxes and not report profits at all. These very low audit ratios of VSC could also be an explanation why relative tax gains for VSC are significantly higher than for the other firm types.

Table 3.8.6: Comparison of Lowest and Highest Audit Cycles (in years)

	Lowest		Highest	
VSC	52.92	(Lower Saxony)	155.41	(Saarland)
SC	19.35	(Saxony-Anhalt)	38.57	(Thuringia)
MC	10.71	(Saxony-Anhalt)	17.22	(Bavaria)
LC	4.02	(Saxony)	5.06	(Schleswig-Holstein)

Notes: This table shows an comparison of the lowest and highest audit cycles for the different company size classes. Audit cycles are expressed in years and calculated as an average for the period from 2000 to 2018. Information are retrieved from my hand-collected data.

While my data does not allow to draw any causal conclusions, it is up for further research to investigate how more frequent audits of VSC affect their tax compliance rates. Additionally, it would be interesting to know whether firms

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in states with more frequent audits are more tax compliant than in states with low audit ratios. While I do not make any causal conclusions about the reasons for these differences between states and firm types, my findings clearly indicate that the current tax enforcement strategy does not fulfill its legal mandate which supports my fourth hypothesis. If firms of comparable sizes in Saarland are audited significantly less often than in Lower Saxony, uniformity and equity of taxation are not guaranteed since comparable tax issues are not assessed and taxed identically. Moreover, if there are significant differences in firms' relative tax compliance rates, tax authorities should critically question whether their current tax enforcement strategy fulfills its legal obligation. My results are therefore of high importance to policymakers and tax authorities since it is their responsibility to guarantee that their tax enforcement strategies are in accordance with the German tax law and German Basic Law.

3.9 Robustness Tests

In order to test the robustness of my analyses, several robustness tests are done. To do this, I drop the city states Berlin, Bremen, and Hamburg as well as North Rhine-Westphalia from my sample to analyse whether my results regarding the possible impact of the fiscal equalisation scheme are robust. I drop the city states since the German fiscal equalisation scheme aims to equalise states' tax revenue weighted to their population. Since city states have, relatively to their city areas, lots of inhabitants, they have a relatively high factor for their inhabitants (see, e.g., Ministerium für Finanzen Baden-Württemberg, 2017). Therefore, I drop the city states to avoid any bias. I drop North Rhine-Westphalia since it was both a giver and taker state within my observation period.⁴⁵

Table 3.9.1 shows the average audit cycles for the whole time period. Yearly audit cycles for giver and taker states are presented in figures 3.A.14, 3.A.15, 3.A.16, and 3.A.17 in the appendix 3.A.

⁴⁵It has been a giver state from 2000 to 2007 and in 2009, while a taker state in 2008 and from 2010 to 2018.

Audit cycles are similar to those presented in section 3.8.2 but the difference for VSC is bigger when the city states and North Rhine-Westphalia are dropped.

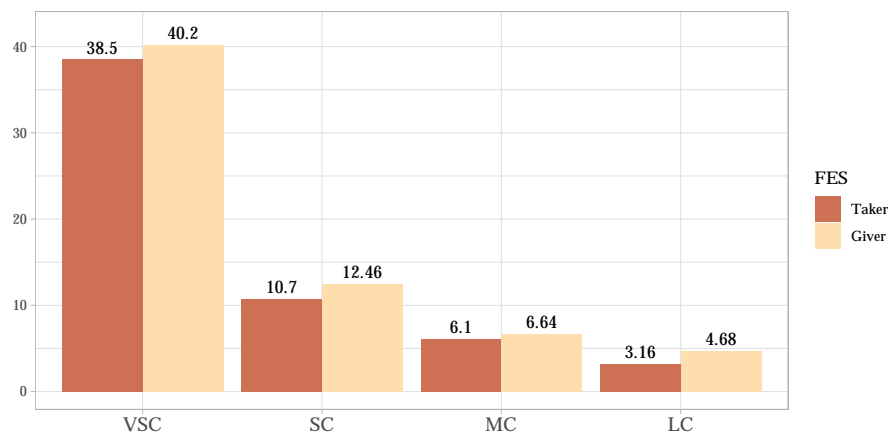
Table 3.9.1: Robustness Test - Audit Cycles for Giver and Taker States without City States

	VSC	SC	MC	LC
Taker	100.68	28.04	13.34	4.55
Giver	113.20	30.13	14.67	4.48

Notes: This table shows the average audit cycles (in years) for all company size classes for giver and taker states without the dropped states for the time period from 2000 to 2018. Information are retrieved from my hand-collected data.

With regard to the strengths of audits, giver states raise on average 0.70% of their GDP from audits, whereas taker states raise only 0.37% which is a bigger difference than before. Figure 3.9.1 shows the relative tax gains for giver and taker states.

Figure 3.9.1: Robustness Test: Tax Gain per Euro of Profit (in Cents) for Giver and Taker States



Notes: This figure shows the tax gains (in Cents) from audits of giver and taker states in relation to one Euro of profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014.

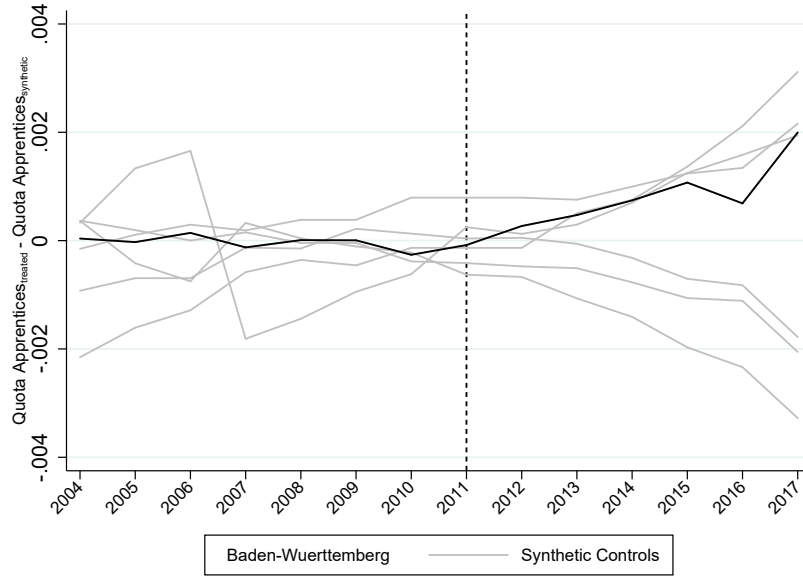
Although giver states raise slightly more relative tax gains than taker states, this difference does not seem to be substantial. Generally, I do not find convincing and coherent evidence that the fiscal equalisation scheme causes a significant difference between giver and taker states' tax enforcement activities which is similar to section 3.8.2. However, I do not rule out that the fiscal equalisation

3.9. ROBUSTNESS TESTS

scheme has impacts on both giver and taker states which I cannot identify in my analyses.

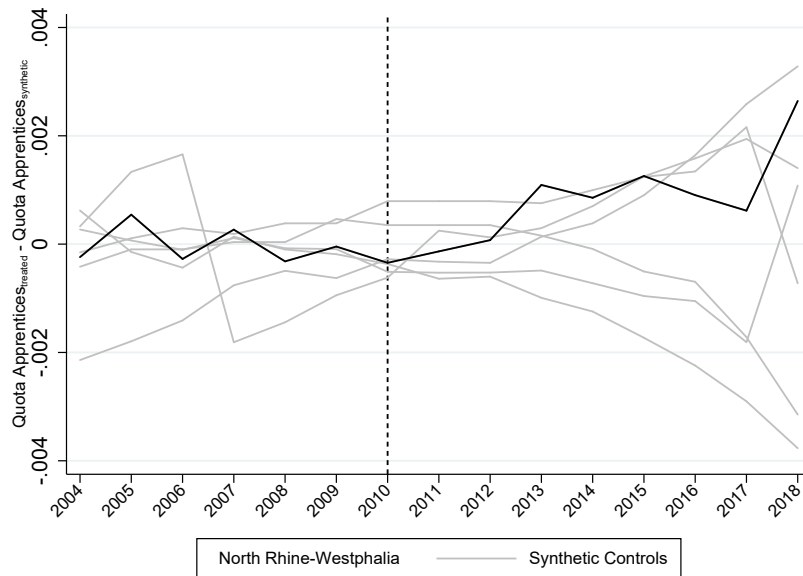
Figures 3.9.2 and 3.9.3 display the results of a placebo test conducted to confirm my findings in section 3.8.3. The idea of a placebo test is to apply the synthetic control method to each state within the control group (e.g. Abadie, Diamond and Hainmueller, 2010). Thereby, one assumes that the simulated state experiences a comparable change in government ideology as North Rhine-Westphalia (in 2010) and Baden-Wuerttemberg (in 2011) at the time of the intervention event even though in reality they did not. In turn, using the placebo studies allows me to conclude whether the effects observed in the treated states are significant compared to the respective control states. If the difference between the real and synthetically created states from the control groups are similar to the difference found in the foregoing analyses for Baden-Wuerttemberg and North Rhine-Westphalia, I cannot lead back the changes in tax administration and tax enforcement efforts to a changing government ideology. The black lines in figures 3.9.2 and 3.9.3 display the difference in the quota of apprentices in relation to the number of companies for real and synthetic states throughout my period of interest. Similarly, the grey lines show these differences for each state of the donor pool. One can see that there are states in both graphs that also show an increase in the quota of apprentices after the intervention events even though these states do not always show a difference of zero before the intervention event. Hence, the placebo tests do not entirely support my findings in section 3.8.3. One explanation could be that an increase in apprentices did not solely happen out of political reasons but was also necessary since an increasing number of employees has retired or is about to retire soon because of the so called baby boomer generations (see, e.g., figure 3.A.12 for Baden-Wuerttemberg in the appendix). Since I only have the number of yearly retirements for Baden-Wuerttemberg, I cannot control for this factor which might partly explain this development. Generally, my findings do not reliably indicate that changing government ideologies in Baden-Wuerttemberg and North Rhine-Westphalia had a causal impact on their efforts to strengthen their tax enforcement.

Figure 3.9.2: Robustness Test: Placebo Study for Synthetic Baden-Wuerttemberg



Notes: This figure shows the placebo study for the synthetic Baden-Wuerttemberg.

Figure 3.9.3: Robustness Test: Placebo Study for Synthetic North Rhine-Westphalia



Notes: This figure shows the placebo study for the synthetic North Rhine-Westphalia.

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Table 3.9.2 shows the robustness tests for the Fixed-Effects regressions in section 3.8.3. Instead of using a dummy which measures a change from leftwing to rightwing government, I use two other specifications to approximate political orientation. First, I use the political orientation of the states' finance minister instead of the entire government. Second, I use a dummy indicating not only a change from a leftwing to rightwing government, but also from a leftwing to center government. Finance ministers are classified as leftwing if they are a member of SPD, GRÜNE, LINKE or as rightwing if they are a member of CDU/CSU or FDP. Center governments consist of CDU/SPD, SPD/CDU, CDU/GRÜNE, CDU/SPD/GRÜNE, CDU/GRÜNE/FDP, and GRÜNE/CDU.

Table 3.9.2: Robustness Tests - FE Regressions. For regressions (1)-(3), dependent variable is the quota of tax gains to GDP; for regressions (4)-(6), dependent variable is the quota of apprentices to the number of companies; Time period: 2000-2018

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>FE</i>	<i>FE</i>	<i>FE</i>	<i>FE</i>	<i>FE</i>	<i>FE</i>
<i>MoveAvgGDP</i>	0.0296*** (0.0113)	0.0275** (0.0117)	0.0280** (0.0126)	0.00478*** (0.00119)	0.00412*** (0.00113)	0.00545*** (0.00123)
<i>MoveAvgDebtpc</i>	0.00521*** (0.00170)	0.00458*** (0.00163)	0.00544*** (0.00183)	0.000818*** (0.000183)	0.000817*** (0.000174)	0.000971*** (0.000184)
<i>MoveAvgUnempl</i>	-0.0603** (0.0235)	-0.0649*** (0.0234)	-0.0711*** (0.0262)	-0.00319 (0.00304)	-0.00503* (0.00277)	-0.00586* (0.00314)
<i>Leftwing FM</i>	-0.00103 (0.000818)			0.0000108 (0.0000720)		
<i>Center Gov</i>		-0.000452 (0.000718)			-0.000280*** (0.0000794)	
<i>Rightwing Gov</i>		-0.00133* (0.000801)			-0.000121* (0.0000713)	
<i>Leftwing Gov</i>			0.000429 (0.000688)			0.000146 (0.0000953)
<i>Constant</i>	-0.711** (0.294)	-0.653** (0.304)	-0.673** (0.325)	-0.127*** (0.0310)	-0.110*** (0.0293)	-0.145*** (0.0320)
<i>Year effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>State effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	275	275	216	257	257	201
<i>R – squared</i>	0.9446	0.9447	0.9480	0.7331	0.7104	0.7450

Robust standard errors are clustered at the state level and are presented in parentheses.

***, ** and * indicate significance at the 1%, 5% and 10% level respectively.

Third, I use the main regressions but drop election years in which there was a change in a state's government ideology since it might be difficult to determine the government ideology of a state if two different governments have been in power in the same year. When the quota of tax gain to GDP is the dependent variable, the dummies for a leftwing finance minister and a leftwing government are statistically insignificant in robustness tests (1) and (3), which is identical to the main regression (2) in which leftwing government is used as dummy variable. In robustness test (2), the dummy for a rightwing government is statistically significant on a 10% level and implies that the quota of tax gain to GDP is 0.133 percentage points lower if there is a rightwing government in power. The negative coefficient is consistent with the claims of some politicians that rightwing governments, unlike leftwing and center governments, would use lax tax enforcement as a tax policy tool for tax competition to protect their economies. When the quota of apprentices to the number of companies is the dependent variable, the coefficient of the dummy for a leftwing finance minister is statistically insignificant in robustness test (4), which is different to the regression result in regression (4) in which leftwing government is used. A possible explanation for this might be that a leftwing finance minister needs the support of the entire cabinet to provide financial means to increase the number of apprentices. If the coalition partners do not support this increase in apprentices, the finance minister cannot independently spend financial resources for a strengthening of the tax administration. The coefficients for center and rightwing governments are both negative and statistically significant. If a center government is in power, then the quota of apprentices is 0.028 percentage points lower. If a rightwing government is in power, the quota is 0.0121 percentage points lower.⁴⁶ Both coefficients are in line with the claims of some leftwing politicians, although one would expect that the coefficient for rightwing governments might be more negative than for center governments. However, when using the main regression (4) but dropping election years in which there was a change in government ideology, the coefficient for leftwing government is statistically insignificant. This in contrast to the statistical significance in the main regression (4).

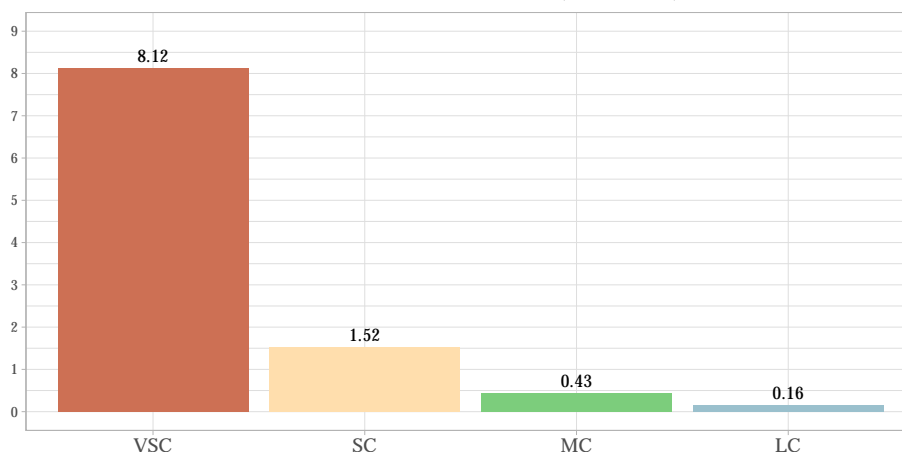
⁴⁶Both coefficients have to be interpreted in relation to leftwing governments.

3.9. ROBUSTNESS TESTS

Hence, the robustness tests do not consistently support the results of the main regressions. Robustness tests (2) and (5) are in accordance with the main results, whereas robustness test (6) does not imply that government ideology has an impact on states' tax enforcement activities. Again, these regressions do not indicate a causal impact but rather correlations since tax enforcement activities might be influenced by other factors for which I cannot control. Since the results are not consistent, I cannot reliably determine whether government ideology has an impact on states' tax enforcement activities.

Figure 3.9.4 shows the tax gains per Euro of reported sales for the different company size classes. As described in chapter 2, section 2.4, the statistics about firms' reported VAT returns contain only their periodic VAT returns and not their annual VAT returns. However, I use this data to test whether my findings of tax gains per Euro of reported profits are robust and plausible.

Figure 3.9.4: Average Tax Gain per Euro of Sales (in Cents) for Different Size Classes



Notes: This figure shows the average tax gain from audits of the different company size classes in relation to one Euro of sales. Information for tax gains are retrieved from my hand-collected data and information about average sales are retrieved from the statistics about the VAT for the years 2010 to 2014.

As one can see, relative tax gains per Euro of sales are significantly higher for VSC (8.12 Cents) than for SC (1.52 Cents), MC (0.43 Cents), and LC (0.16 Cents). Similar to when using reported profits, relative tax gains are significantly higher for VSC than for SC, MC, and LC. It is also realistic that relative tax gains are lower when using sales as a benchmark since firms' sales are usually always considerably higher than their profits. Consequently, my findings show that there are huge differences in relative tax gains both when profits and sales

are used as a benchmark which supports the results in section 3.8.4. Tax gains per Euro of reported sales for the different company size classes in the German states are reported in the appendix 3.A.

3.10 Limitations

As described in section 3.7.1, it is a challenge to empirically estimate causal effects of political, economic, and administrative impacts on tax enforcement. First, tax enforcement is influenced by several economic and political factors and it is nearly impossible to control for all confounding factors. Second, there is no generally accepted definition of lax or strict tax enforcement and how one can identify possible differences in tax enforcement. For these reasons, my empirical estimations do not describe a causal impact but rather a correlation since I do not have data to control for all factors that possibly influence tax enforcement. For my analyses, I partly rely on descriptive evidence since I do not have more detailed information to use more advanced estimation methods. Ideally, one would need identical firms in all 16 German states and then compare tax gains raised from an audit of these firms. Especially, this would be necessary to estimate the strength of tax enforcement in the German states. However, the combination of my hand-collected data with firms' Business Tax returns allows me to develop the best possible measure given the available data. Moreover, descriptive evidence is especially convincing to compare audit cycles at the state level since this data has never been released before. Additionally, I compare averages for giver and taker states of the fiscal equalisation scheme which does not allow me to disentangle the effect of single states. I cannot rule out that the fiscal equalisation scheme has any impacts on tax enforcement which I cannot identify in my setting. As already stated above, it is challenging in my setting to control for all confounding factors when analysing tax enforcement and the possible impact of the fiscal equalisation scheme or government ideology. Therefore, my data does not allow to reliably disentangle different effects that might influence tax enforcement activities of the German states. Furthermore, it might be critical to make general conclusions about government ideology for all German states

3.10. LIMITATIONS

since there might be differences in state governments' political party histories. Political party structure might be different in states in Eastern Germany than in Western Germany, hence making conclusions about government ideology at the federal level might be difficult. Generally, more detailed data is necessary to use more advanced empirical methods for the analyses of the possible impacts of fiscal equalisation and government ideology on tax enforcement. Particularly, this would be important to analyse in more detail the cost efficiency of audits. While tax gains are significantly higher from audits of LC, these audits usually require more time and human resources than auditing VSC and SC. Hence, it is impossible to evaluate the cost efficiency of audits without having more detailed information. In addition, using the information about the number of apprentices in states' budget plans might lead to some inaccuracies since I cannot control whether these vacancies are actually filled with apprentices or whether they are just included in states' budget plans. However, states have to allocate and provide financial means to create these vacancies in the budget plans, and therefore providing financial means for apprentices in states' budget plans can serve as a proxy for their efforts and willingness to strengthen tax administration. Since I do not have data about yearly retirements in tax enforcement in the German states, I cannot reliably disentangle whether an increase in apprentices happened out of political reasons or whether governments also had to react to an increasing number of retirements. Consequently, my results for the synthetic control method would be more reliable if I had this information. Finally, my estimates of relative tax gains for the different company size classes would be more precise if I had exact data about audited firms, their reported profits and tax gains raised from this audit. Since German tax authorities do not release such data, I combine my self-collected data with the Business Tax returns to estimate averages. Nevertheless, since the Business Tax statistics comprise all firms which have to pay Business Tax, my estimates are based on the best database which is publicly available.

3.11 Conclusion

In this study, I analyse tax enforcement in the German states and whether the current tax enforcement strategy fulfills its legal obligations. The unique contribution of my paper is that it is the first to use a self-collected database with information about tax enforcement in the German states which has never been collected or published in this detail and for such a period of time before. By combining this information with firms' Business Tax returns, I am able to develop a measure of relative tax gains in order to examine tax gains for the different size classes and states. I find that audit cycles differ significantly between the German states which might indicate that some states use low audit ratios as a strategic tool for tax competition. However, I find no evidence that the German fiscal equalisation scheme causes significant differences between states' tax enforcement activities. Although some findings indicate that there might be differences in rightwing and leftwing governments' tax enforcement efforts, I find no consistent evidence that government ideology has a significant impact on states' tax enforcement activities. Most importantly, I can show that there are huge differences in audit cycles between states and firms of different size classes and that smaller firms are less tax compliant than larger firms. Hence, my findings raise doubts as to whether the current tax enforcement strategy fulfills its legal mandate which is to guarantee uniformity and equity of taxation. If there are such big differences in audit cycles and relative tax gains between states and firms of different sizes, uniformity of taxation will be violated since tax-related issues are not treated and taxed equally.

My results have important implications for German policymakers and lawmakers. First, as stated above, significant differences in the frequency of audits and relative tax gains between German states and firms' of different size classes undermine the basic principles of taxation in Germany. Greater harmonisation in audit cycles between the states could be achieved through binding legal requirement as it is already the case for LC. Naturally, this would require a significant strengthening of tax administrations' staffing and auditors. A better organisation of the federal audit ("Bundesbetriebsprüfung") and more federal auditors might

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also help to reduce the existing differences.⁴⁷ German tax administrations should also gather more detailed data about tax enforcement in the German states and analyse this data scientifically. Second, a reform of the German fiscal equalisation scheme could also induce states to provide more financial and human resources for their tax administrations. If states can retain the entire amount of tax gains raised from audits, they might be more willing to invest in their tax enforcement activities. Ultimately, both increasing the number of auditors and reforming the fiscal equalisation scheme depend on the political will. While I refrain from making causal conclusions or concrete policy recommendations, my study and the self-collected data set lay the groundwork for further research about tax enforcement in Germany. Further research should analyse how a possible harmonisation and coordination of tax enforcement could level out the existing differences and how more frequent audits of smaller firms influence their tax compliance rates. Finally, future research should examine how tax enforcement can be designed in order to both use available resources efficiently and guarantee uniformity and equity of taxation.

⁴⁷There exists a federal audit (“Bundesbetriebsprüfung“) with federal auditors who work for the Federal Central Tax Office (“Bundeszentralamt für Steuern“) and are thought to support the states’ audits, especially of large companies and groups. Theoretically, the federal audit also has the right to initiate own audits but this happens very rarely in reality due to a shortage of auditors. Federal auditors participate only in 1% of all tax audits of large companies and groups (see Bundesrechnungshof, 2014).

3.A Appendix

3.A.1 Calculation of Quota of Tax Gains to Profits

In a first step, I calculate the numerator which is the average tax gain from audits per company size class. To do this, I use my hand-collected data about states' tax enforcement activities to calculate the average tax gains per company size class. This calculation is done both at the state level and at the federal level. In a second step, I calculate the denominator which is the sum of average profits reported in firms' Business Tax returns. For this calculation, I use the data about the statistics about the Business Tax of the Research Data Centre of the Federal Statistical Office and the Statistical Office for the German states.

I use all available observations in the data set to calculate the average profit per company size class. This calculation is also done both at the state level and at the federal level. Since the last three fiscal years are usually subject to an audit, I calculate the sum of average profits of the last three fiscal years per company size class. Table 3.A.1 gives an overview about the average profits and tax gains which are used for the calculations at the federal level. I take tax gains in 2013 and divide it by the sum of average profits from 2010 to 2012. As already explained, if an audit takes place in 2013, the last three fiscal years are subject to this audit, hence the years 2010, 2011, and 2012. I repeat this calculation for tax gains in 2014 and 2015 and divide these tax gains by the sum of average profits from 2011 to 2013 and from 2012 to 2014. Since the Business Tax return data is only available from 2010 to 2014, I cannot use tax gains in 2012 (2009 is missing) or in 2016 (2015 is missing). To get my final estimates, I take the averages of tax gains to profits of all available years.

3.A. APPENDIX

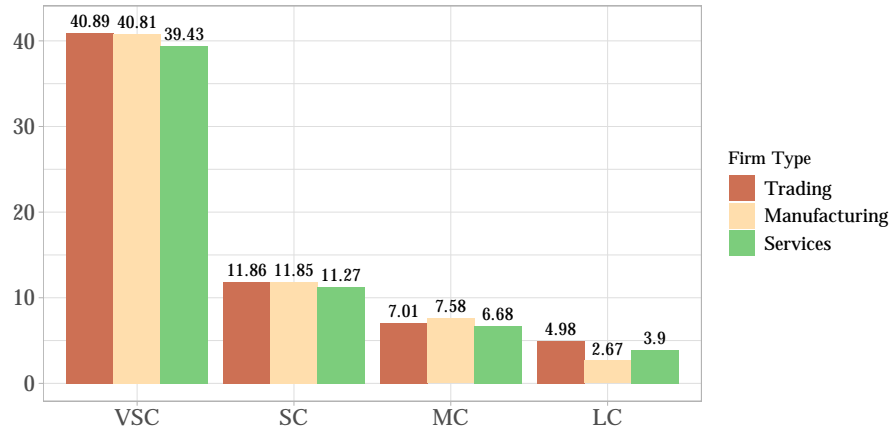
Table 3.A.1: Overview about Average Profits and Tax Gains at the Federal Level

		VSC	SC	MC	LC
Average Profit	2010	13,906	43,019	107,740	2,352,046
	2011	13,755	43,121	108,349	2,285,770
	2012	13,452	43,091	107,957	2,258,471
	2013	13,901	45,650	115,468	2,342,134
	2014	13,777	45,722	115,946	2,272,757
Total Profit	2010-2012	41,113	129,231	324,046	6,896,287
	2011-2013	41,109	131,861	331,774	6,886,375
	2012-2014	41,131	134,463	339,371	6,873,362
Tax Gain per Audit	2013	17,575	14,208	21,680	283,510
	2014	16,825	16,298	25,675	245,719
	2015	15,383	15,597	23,001	216,426
$\frac{\text{Tax Gain}_{2013}}{\text{Profit}_{2010-2012}}$		0.4275	0.1099	0.0669	0.0411
$\frac{\text{Tax Gain}_{2014}}{\text{Profit}_{2011-2013}}$		0.4093	0.1236	0.0774	0.0357
$\frac{\text{Tax Gain}_{2015}}{\text{Profit}_{2012-2014}}$		0.3740	0.1160	0.0678	0.0315
$\frac{\text{Tax Gain}}{\text{Profit}}$	Average	0.4036	0.1165	0.0707	0.0361

This table gives an overview about the average profits reported in the Business Tax returns for the different company size classes as well as the tax gains from audits per company size class. Profits and tax gains are reported in Euro.

3.A.2 Tax Gain per Euro of Profit per Firm Type

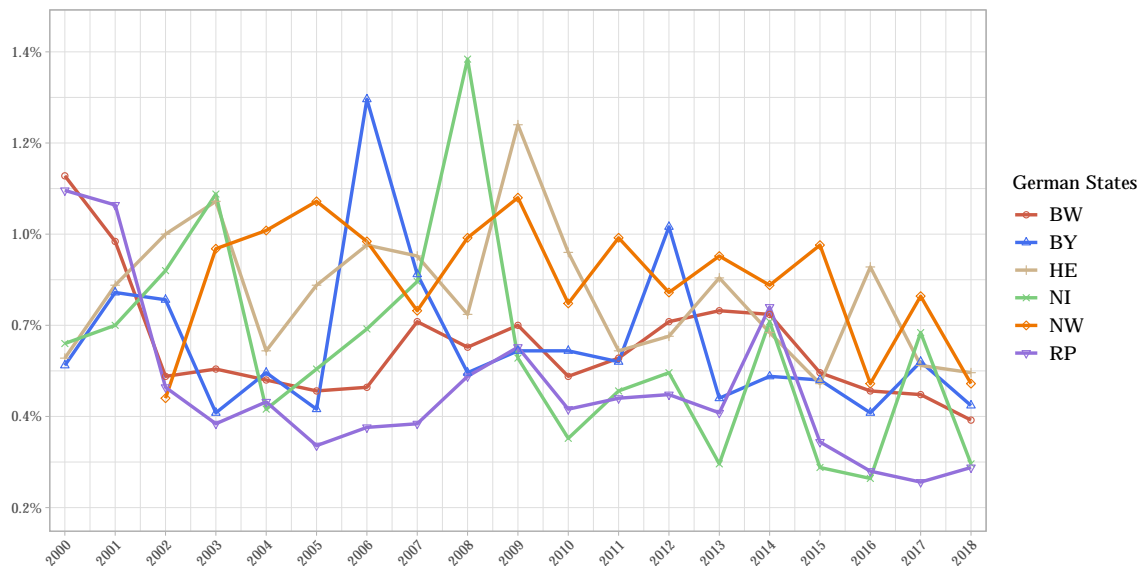
Figure 3.A.1: Robustness Test: Average Tax Gain per Euro of Average Profit (in Cents) for Different Firm Types



Notes: This figure shows the average tax gain from audits of the different firm types in relation to one Euro of average profit. Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014.

3.A.3 Quota of Tax Gain to GDP per Year

Figure 3.A.2: Quota of Tax Gain to GDP per Year (in Percent)

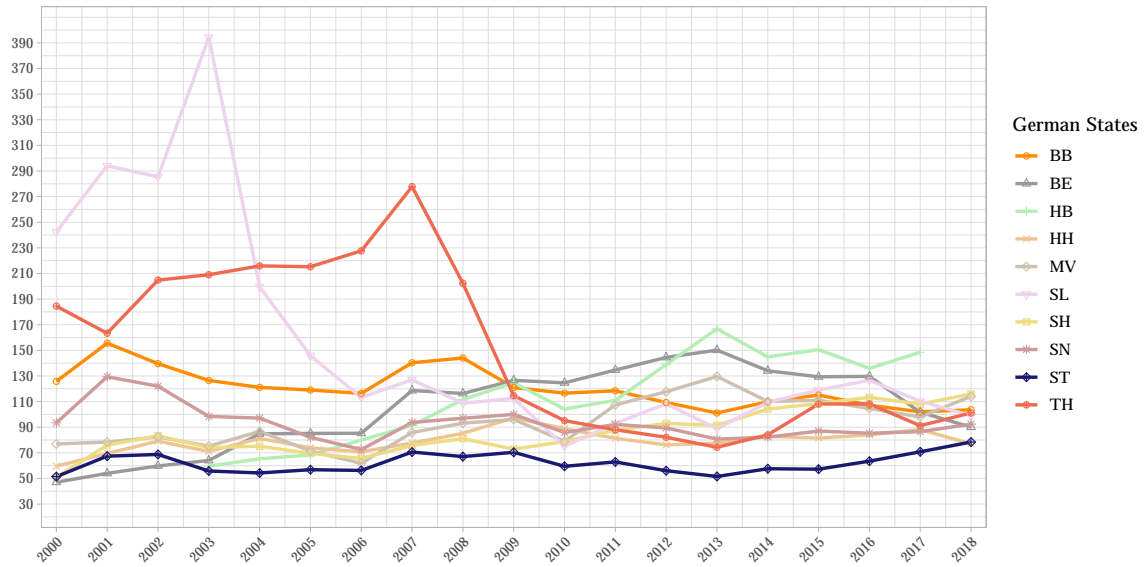


Notes: This figure shows the ratio of tax gains raised from tax enforcement in relation to the moving average of GDP for the years 2000 to 2018. Information are retrieved from my hand-collected data and the Federal Statistical Office.

3.A. APPENDIX

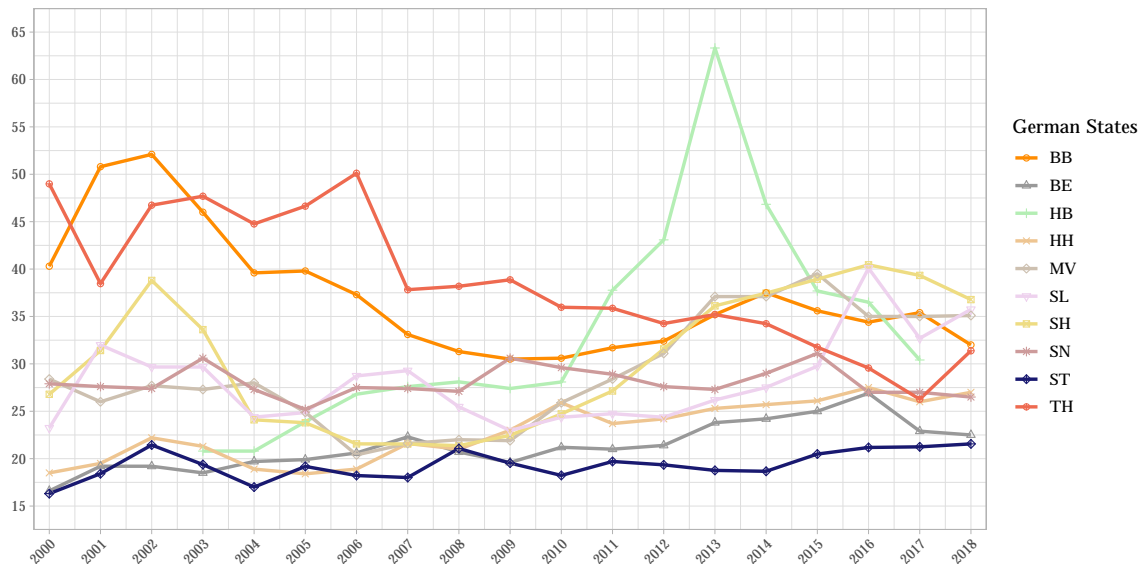
3.A.4 Audit Cycles for Different Company Size Classes

Figure 3.A.3: Audit Cycles VSC (in years)



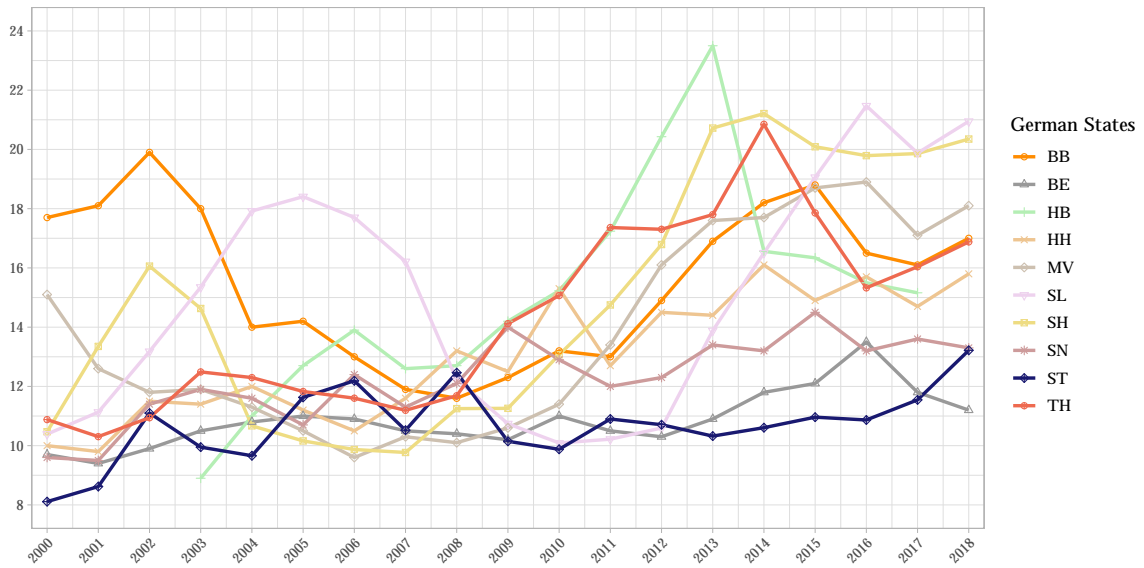
Notes: This figure shows the audit cycles (in years) for VSC for the years 2000 to 2018. Information are retrieved from my hand-collected data. BB=Brandenburg; BE=Berlin; HB=Bremen; HH=Hamburg; MV=Mecklenburg Western-Pomerania; SL=Saarland; SH=Schleswig-Holstein; SN=Saxony; ST=Saxony-Anhalt; TH=Thuringia.

Figure 3.A.4: Audit Cycles SC (in years)



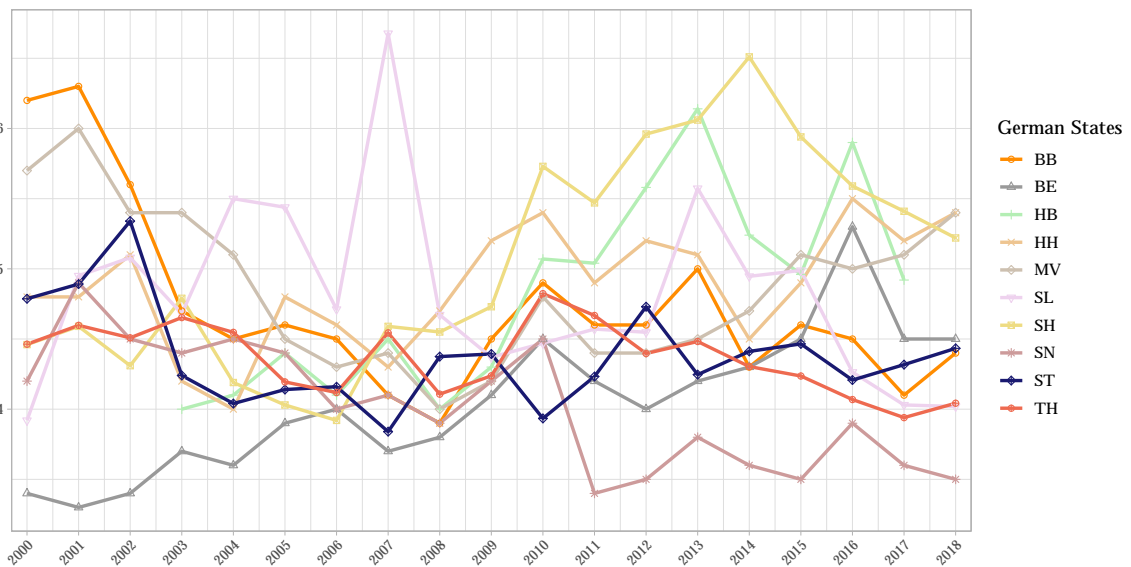
Notes: This figure shows the audit cycles (in years) for SC for the years 2000 to 2018. Information are retrieved from my hand-collected data. See figure 3.A.3 for the definition of the abbreviations.

Figure 3.A.5: Audit Cycles MC (in years)



Notes: This figure shows the audit cycles (in years) for MC for the years 2000 to 2018. Information are retrieved from my hand-collected data. See figure 3.A.3 for the definition of the abbreviations.

Figure 3.A.6: Audit Cycles LC (in years)



Notes: This figure shows the audit cycles (in years) for LC for the years 2000 to 2018. Information are retrieved from my hand-collected data. See figure 3.A.3 for the definition of the abbreviations.

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3.A.5 OLS Regressions

Table 3.A.2 shows OLS regression results for different dependent variables. Control variables are the state-level moving averages of GDP, debt per capita, and the unemployment rate. Moving averages for year t are calculated by taking the average of $t - 1$, $t - 2$, and $t - 3$ to take the economic situation of prior years into account when states decide about their tax enforcement strategies. I run the regressions both with and without state dummies to control for state-specific effects.

For regressions (1) and (2), dependent variable is the quota of tax gains raised from audits to GDP. For regressions (3) and (4), dependent variable is the quota of apprentices to the number of companies to be audited. In regression (1), the coefficients for moving average of GDP and debt per capita are highly significant and positive, whereas the coefficient of the unemployment rate is negative and statistically significant on a 10% level. All coefficients correspond to their theoretical and expected impact. Several state dummies show a statistically significant coefficient both in regression (2) and (4). My results are similar to the findings of Vandebussche, Crabbé and Janssen (2005) and Durán-Cabré, Esteller-Moré and Salvadori (2015) who find evidence for horizontal competition in tax enforcement. However, their setting differs in relation to data, empirical setting, and research designs, and therefore it is difficult to compare my results to other empirical studies. Although it is difficult to control for all confounding factors regarding the efforts of state governments' with regard to their tax enforcement activities, my findings indicate that there might be differences in some German states regarding their tax enforcement activities. However, my results represent rather a correlation than a causal effect.

Table 3.A.2: OLS Regressions - For regressions (1) & (2), dependent variable is the quota of tax gains to GDP; for regressions (3) & (4), dependent variable is the quota of apprentices to the number of companies. Time period: 2000-2018

	(1)	(2)	(3)	(4)
	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>	<i>OLS</i>
<i>MoveAvgGDP</i>	0.0157*** (0.000874)	0.0345*** (0.0111)	0.000123** (0.0000557)	0.00463* (0.00235)
<i>MoveAvgDebtpc</i>	0.00471*** (0.000903)	0.00461** (0.00195)	0.000402** (0.000139)	0.000945** (0.000407)
<i>MoveAvgUnempl</i>	-0.0387* (0.0185)	-0.0417 (0.0412)	-0.00138 (0.00285)	-0.00619 (0.00816)
<i>HH</i>		-0.00212 (0.00285)		-0.00129* (0.000593)
<i>NI</i>		-0.0220* (0.0120)		-0.00466* (0.00255)
<i>HB</i>		0.0180 (0.0105)		0.00415 (0.00234)
<i>NW</i>		-0.0414* (0.0223)		-0.00874* (0.00471)
<i>HE</i>		-0.0196 (0.0122)		-0.00440 (0.00264)
<i>RP</i>		-0.00827* (0.00435)		-0.00115 (0.000973)
<i>BW</i>		-0.0341* (0.0175)		-0.00701* (0.00382)
<i>BY</i>		-0.0360* (0.0191)		-0.00780* (0.00412)
<i>SL</i>		0.0124 (0.00984)		0.00418* (0.00209)
<i>BE</i>		-0.00718 (0.00466)		
<i>MV</i>		0.0144 (0.00871)		0.00445* (0.00206)
<i>SN</i>		-0.00463 (0.00487)		-0.0000754 (0.000933)
<i>TH</i>		0.00407 (0.00500)		0.00253* (0.00118)
<i>Year effects</i>	Yes	Yes	Yes	Yes
<i>State effects</i>	No	Yes	No	Yes
<i>Observations</i>	275	275	257	257
<i>R – squared</i>	0.9238	0.9441	0.4353	0.7103

Robust standard errors are clustered at the state level and are presented in parentheses.

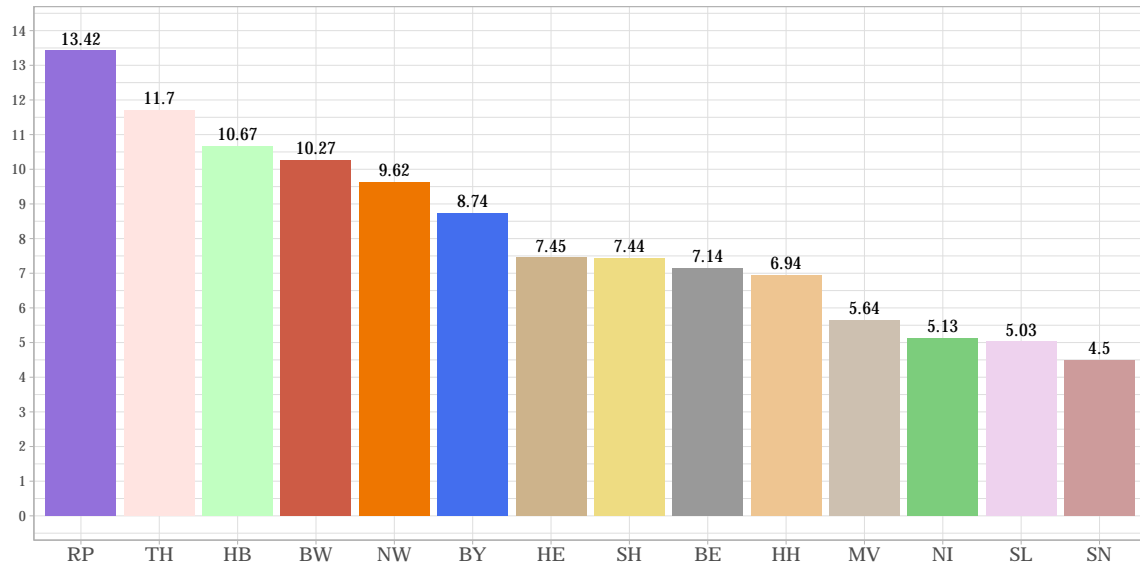
***, ** and * indicate significance at the 1%, 5% and 10% level respectively.

Berlin did not report information about the number of apprentices.

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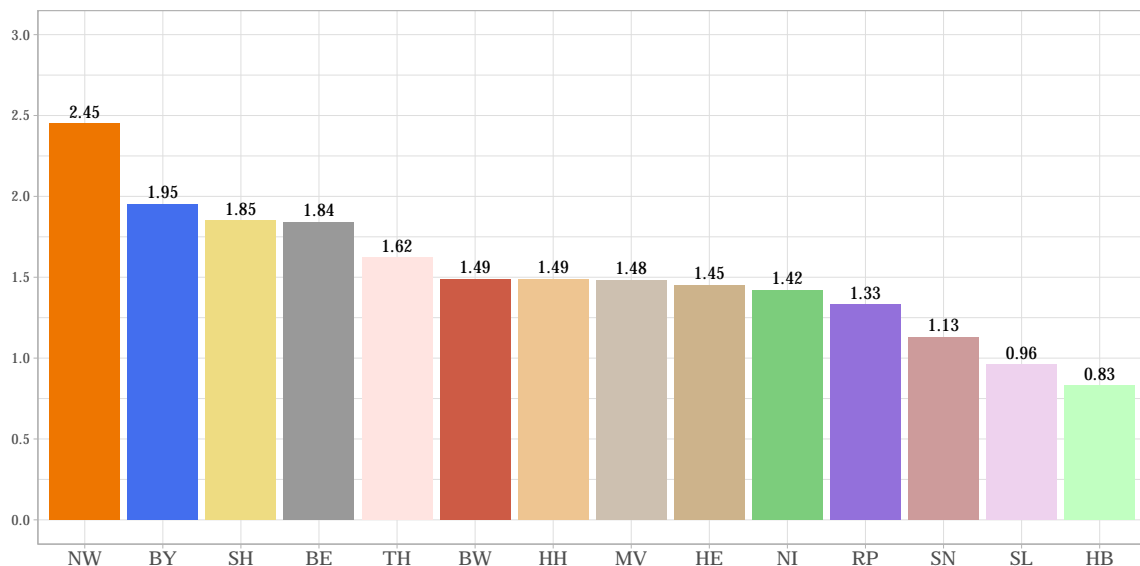
3.A.6 Tax Gains per Euro of Sales

Figure 3.A.7: Tax Gain per Euro of Sales of VSC (in Cents)



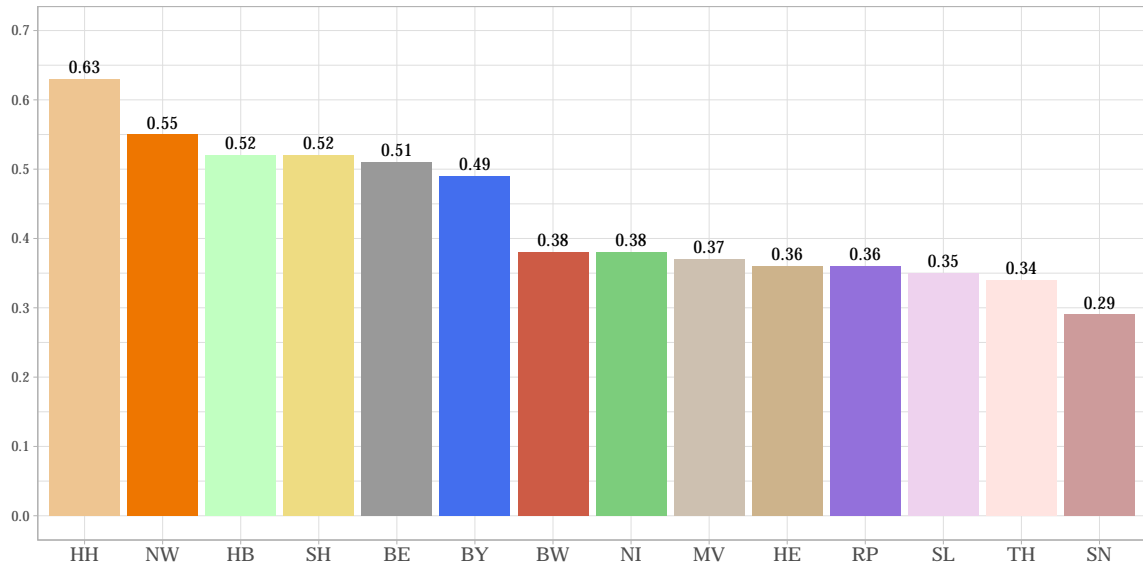
Notes: This figure shows the average tax gain from audits of VSC in relation to one Euro of average sales. Information for tax gains are retrieved from my hand-collected data and information about average sales are retrieved from the statistics about the VAT for the years 2010 to 2014.

Figure 3.A.8: Tax Gain per Euro of Sales of SC (in Cents)



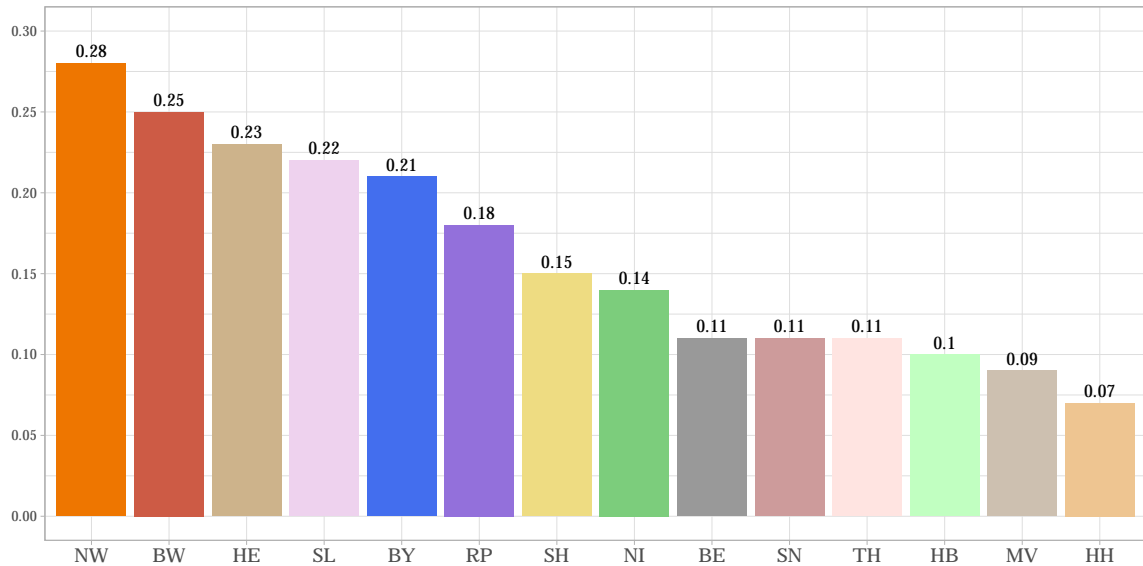
Notes: This figure shows the average tax gain from audits of SC in relation to one Euro of average sales. Information for tax gains are retrieved from my hand-collected data and information about average sales are retrieved from the statistics about the VAT for the years 2010 to 2014.

Figure 3.A.9: Tax Gain per Euro of Sales of MC (in Cents)



Notes: This figure shows the average tax gain from audits of MC in relation to one Euro of average sales. Information for tax gains are retrieved from my hand-collected data and information about average sales are retrieved from the statistics about the VAT for the years 2010 to 2014.

Figure 3.A.10: Tax Gain per Euro of Sales of LC (in Cents)



Notes: This figure shows the average tax gain from audits of LC in relation to one Euro of average sales. Information for tax gains are retrieved from my hand-collected data and information about average sales are retrieved from the statistics about the VAT for the years 2010 to 2014.

3.A. APPENDIX

3.A.7 Relative Tax Gain per Euro of Profit in the German States

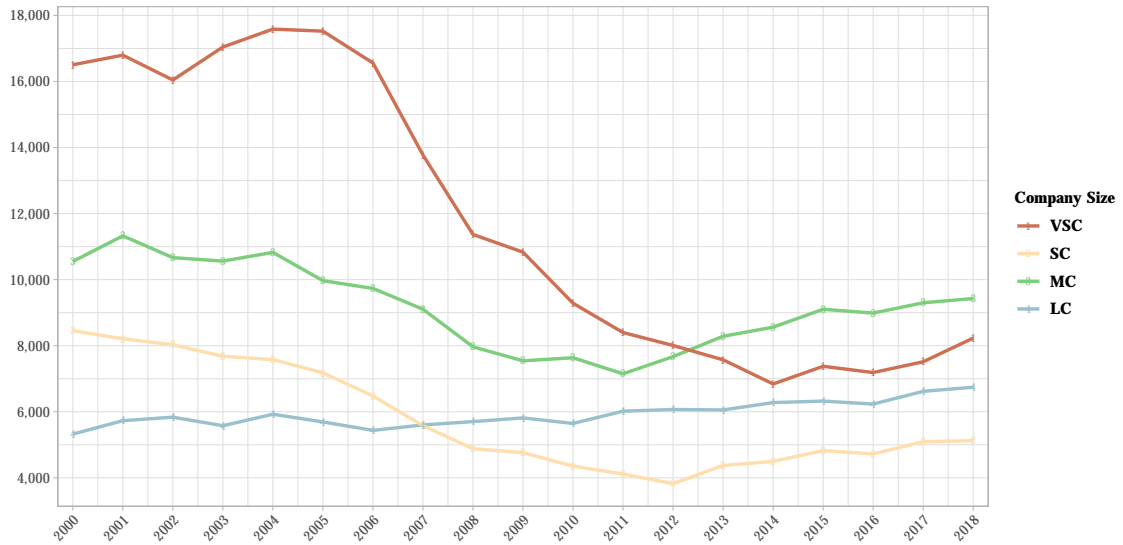
Table 3.A.3: Relative Tax Gain per Euro of Profit in the German States (in Cents)

State	VSC	SC	MC	LC
Baden-Wuerttemberg	44.70	11.42	6.12	5.53
Bavaria	39.14	14.86	7.89	4.16
Berlin	36.01	13.95	8.19	2.41
Bremen	50.45	6.40	8.85	2.31
Hamburg	33.59	11.71	9.98	2.54
Hesse	36.76	11.10	5.92	4.33
Lower Saxony	23.23	10.98	6.23	3.01
Mecklenburg-Western Pomerania	33.12	11.28	6.03	1.97
North Rhine-Westphalia	49.53	18.73	9.09	5.75
Rhineland-Palatinate	58.60	10.16	5.87	3.46
Saarland	32.98	7.39	5.89	6.01
Saxony	23.11	8.55	4.72	2.06
Schleswig-Holstein	35.52	14.26	8.37	3.58
Thuringia	62.91	12.30	5.57	2.03

Notes: This table shows the relative tax gains per Euro of reported profits in the German states for all company size classes (in Cents). Information for tax gains are retrieved from my hand-collected data and information about average profits are retrieved from the statistics about the Business Tax for the years 2010 to 2014.

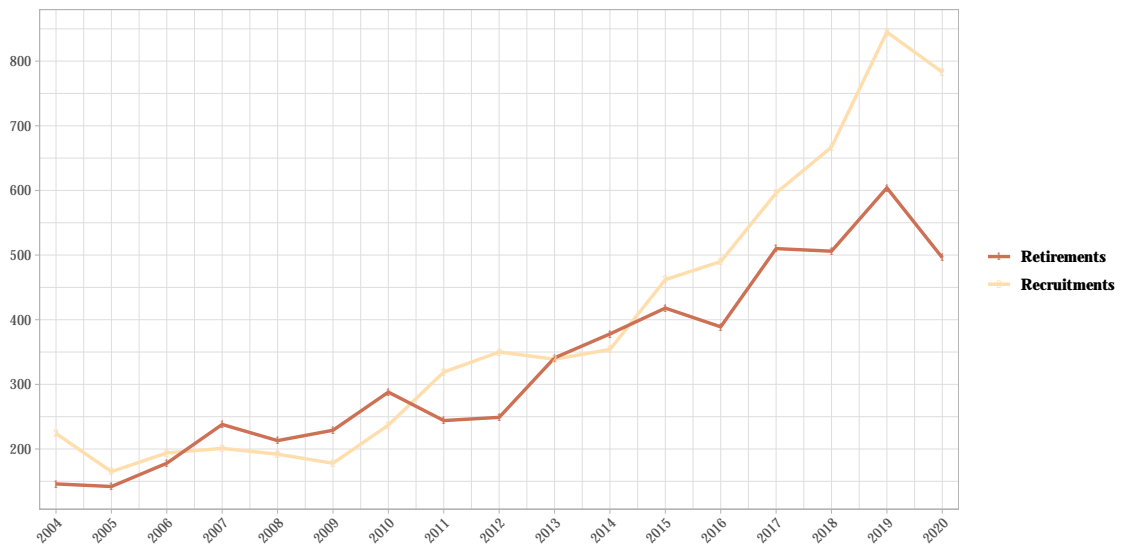
3.A.8 Additional Graphs for Baden-Wuerttemberg and North Rhine-Westphalia

Figure 3.A.11: Development of Audits in Baden-Wuerttemberg



Notes: This figure shows the development of the number of audits for the different company size classes in Baden-Wuerttemberg from 2000 to 2018. Data is retrieved from a parliamentary inquiry from a member of Baden-Wuerttemberg’s parliament.

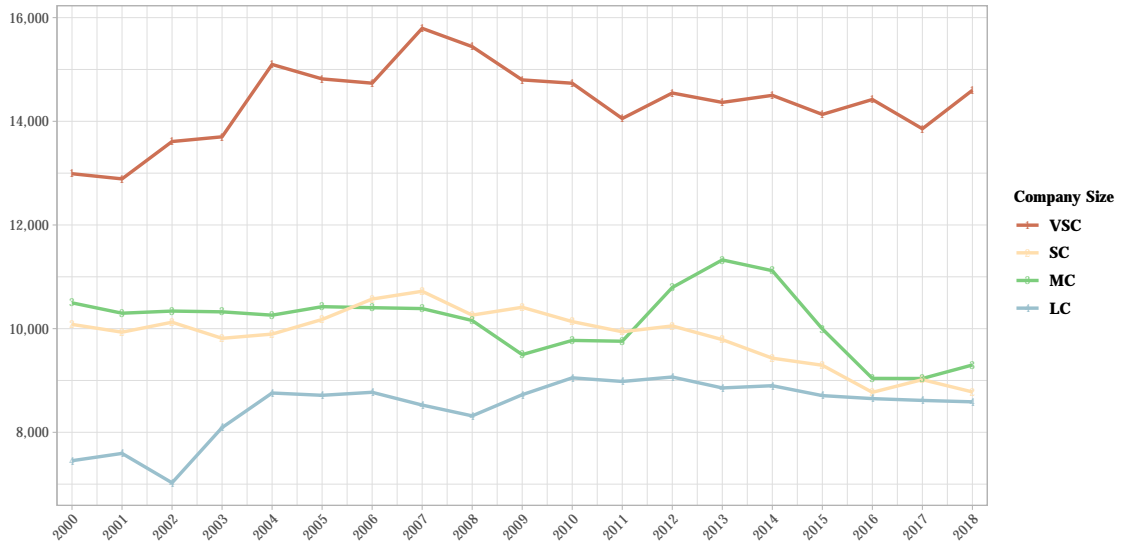
Figure 3.A.12: Development of Retirements and Recruitments in Tax Enforcement in Baden-Wuerttemberg



Notes: This figure shows the development of the number of retirements and recruitments in tax enforcement in Baden-Wuerttemberg from 2004 to 2020. Data is retrieved from a parliamentary inquiry from a member of Baden-Wuerttemberg’s parliament.

3.A. APPENDIX

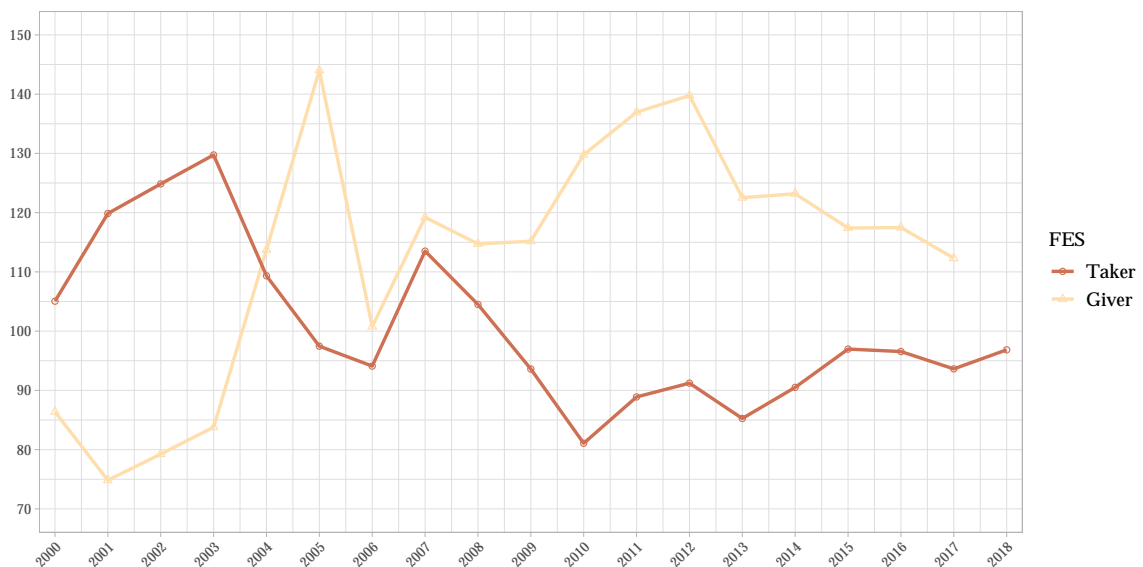
Figure 3.A.13: Development of Audits in North Rhine-Westphalia



Notes: This figure shows the development of the number of audits for the different company size classes in North Rhine-Westphalia from 2000 to 2018. Data is retrieved from a request according to the freedom of information act in North Rhine-Westphalia.

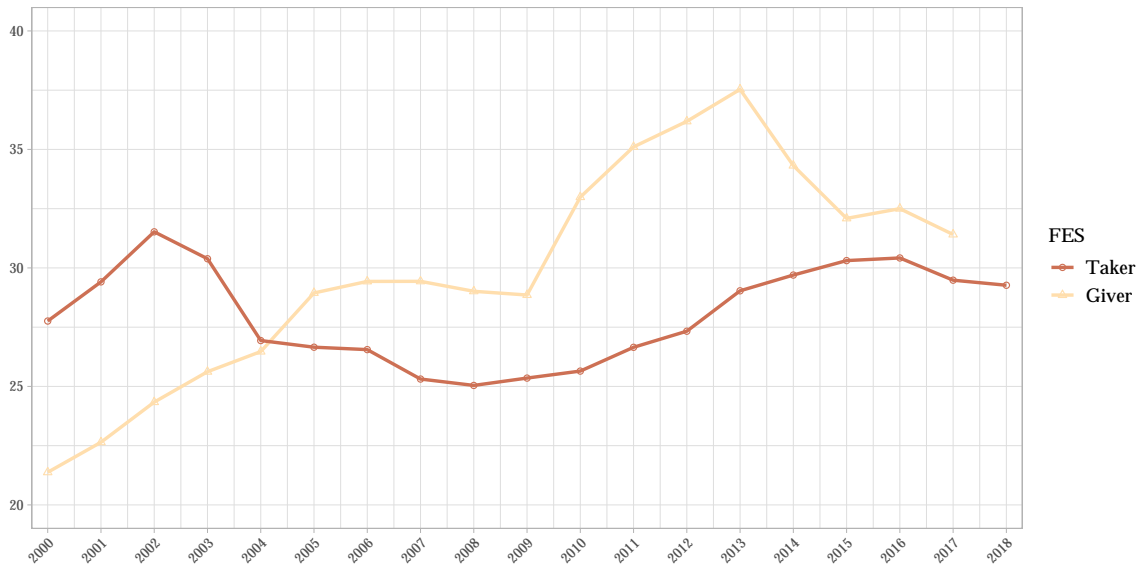
3.A.9 Robustness Tests: Audit Cycles for Giver and Taker States

Figure 3.A.14: Robustness Test - Audit Cycles of VSC (in years)



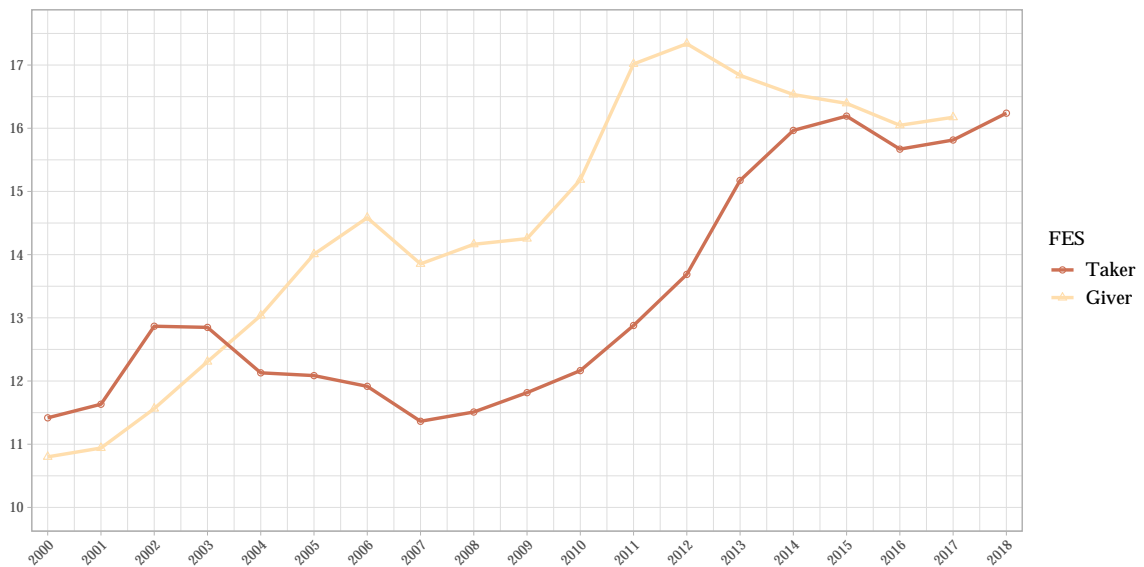
Notes: This figure shows the average audit cycles (in years) for VSC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

Figure 3.A.15: Robustness Test - Audit Cycles of SC (in years)



Notes: This figure shows the average audit cycles (in years) for SC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

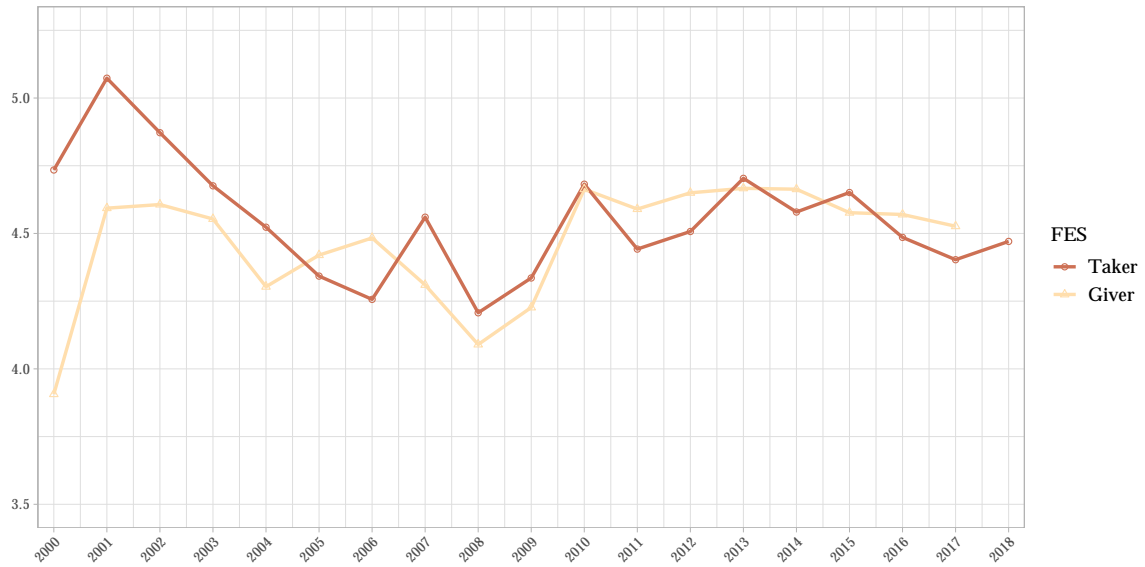
Figure 3.A.16: Robustness Test - Audit Cycles of MC (in years)



Notes: This figure shows the average audit cycles (in years) for MC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

3.A. APPENDIX

Figure 3.A.17: Robustness Test - Audit Cycles of LC (in years)



Notes: This figure shows the average audit cycles (in years) for LC for the years 2000 to 2018 for giver and taker states of the German fiscal equalisation scheme. Information are retrieved from my hand-collected data.

Chapter 4

The Effects of a Reform in Corporate Tax Law on Startup Investments¹

¹This paper is joint work with Laura Kristina Uhl.

4.1 Introduction

On March 29, 2017, the German Federal Constitutional Court (BVerfG) ruled that Section 8c German Corporate Income Tax Act (KStG) is incompatible with the constitution and must be adjusted. With the implementation of the new legislation, loss carry forwards can still be disclosed and thus losses can still be deducted from future earnings when firms sell large parts of their shares¹ in a short period of time. This deduction has been prohibited beforehand which ignores the principle of equality (Article 3 of the German Basic Law (GG)) between all firms. Anecdotal evidence underscores the importance of declaring loss carry forwards for firms. In 2016, roughly 47.6% of all firms reported a loss carry forward in their annual statements (Statistisches Bundesamt, 2021). Furthermore, to comply with the economic principle of investment neutrality, taxation must not influence investors' decisions. In this regard, immediate loss compensation or carrying losses forwards or backwards is necessary. With this tax reform, the German government strived to equalise the different treatment of losses compared to profits as well as the unequal treatment of firms with and without a change in the shareholder structure from a tax perspective. The introduction of Section 8d KStG in late 2016 was a first attempt to make losses useable when certain legal requirements are met.

We conduct an empirical study investigating the effects of the German tax reform in the Sections 8c/8d KStG in 2017.² Specifically, we analyse the effects on the investment behaviour of investors who support startups with new external financial capital. Anticipation effects are particularly important to consider when investigating the effects of a change in tax policy as “rational beliefs about changes in future tax rates [...] may result from proposed or anticipated legislation” (De Simone, Piotroski and Tomy, 2019, p. 3106). We use data on 5,200 startups with 8,251 investment rounds from the Thomson Reuters EIKON database and the “Bundesanzeiger”. The ruling of the BVerfG and the introduction of the Sections 8c/8d KStG as a fundamental public policy intervention

¹In this study, the term “sale of share” includes the sale of existing shares as well as the issuance of new equity capital.

²In this study, we summarise the changes in Sections 8c/8d KStG and refer to them as the tax reform in Sections 8c/8d KStG. For further information, see section 4.2.

4.1. INTRODUCTION

constitute a quasi-natural experiment. As taxation research has a significant influence on public policy making, we give insights into the relation between the fiscal treatment of startups' losses and investors' behaviour. By now, the effects of the structure of tax systems on startup investments have been insufficiently covered (Henrekson and Sanandaji, 2011). Cooper and Knittel (2006) find that a substantial number of small firms does not immediately subtract their losses from earnings but at a later time. Thus, to comply with the principle of investment neutrality, a tax system allowing the deductibility of losses in the future for all firms is necessary. The prohibition to deduct losses according to Section 8c KStG has been criticised for many years (Hans, 2007; Suchanek and Herbst, 2007) and tax experts have raised constitutional concerns regarding Section 8c KStG even before its introduction in 2008 (Hey, 2007; Wiese, 2007). Additionally, the tremendous number of tax consultants publicly discussing and questioning the effects of the tax reform in the Sections 8c/8d KStG on startup investments underscores the importance of this study.

Our results show a clear positive trend in the relation between startups' loss carry forward disclosed and the investment amount in German startups over time. Before 2017, the point estimates of the interaction terms indicate a negative correlation between these two variables. After the tax reform, the point estimates become positive. The positive correlation in 2018 and 2019 can be led back to the possibility to disclose loss carry forwards and deduct losses from earnings in future years due to the tax reform in the Sections 8c/8d KStG in 2017.

In the years before the reform, the total investment amount in German startups increased from 0.4 billion Euro in 2010 to 1.7 billion Euro in 2017. After the tax reform, the investment amount further increased to 2.6 billion Euro in 2019 which is equivalent to a 52.94% increase within two years. However, when using the synthetic control method, we do not find a significantly different investment behaviour in real versus synthetic Germany after the ruling of the BVerfG. A possible explanation might be investors' anticipations regarding the final implementation of Sections 8c/8d KStG in the short run and the remaining uncertainties for investors. This non-reaction of investors to the tax reform was probably fostered by imprecise wording of the respective tax law.

When applying the synthetic control method on startups' first investment rounds, we find a sharp decrease in the total investment sum in 2018 which reverses to a sharp increase in 2019. One reason might be that especially first-round investors changed their investment behaviour after it had been publicly announced on March 29, 2017 that Section 8c KStG must be reframed by the German government until January 1, 2019. Additionally, first round investments might have become more attractive for investors after the implementation of the new tax legislation. By increasing the threshold of the cumulative sale of shares up to which keeping loss carry forwards is allowed, investors are now able to acquire a larger proportion of shares while startups are still able to offset losses against future years' profits. As investments in early-stage startups usually imply higher risk for investors, the sharp increase in first-round investments in 2019 shows investors' increased risk appetite after the tax reform. One possible reason might be that investors' expected return on these investments is higher after the tax reform which provokes investors to focus on early-stage startups.

This study relates to different strands of literature. First, the study fills the gap in the research area on the relation between startups' loss carry forwards and startup investments. As startups usually incur exclusively high losses in the beginning of their operations, they are more affected by the non-deductibility of losses in future years (see, e.g., Cooper and Knittel, 2006; Haufler, Norbäck and Persson, 2014). Investigating the effects of the tax reform in the Sections 8c/8d KStG in Germany enhances the understanding of the interplay between both areas, which has been under-investigated to date.

We also relate to the tax literature which shows that startups are affected by the tax system in several ways. Overall, investors increase their investment activity with lower tax rates (Swenson, 1994) leading to higher firm growth and increased rates of success (Carroll et al., 2000). Several research papers as well as statements from institutions and politicians confirm that startup investments have gained in importance and size in the past decade. In general, investors perceive Germany as a favourable investment location but corporate taxation in Germany is a main disadvantage (EY, 2019). For governments, changing tax regulations seems to be an easy way to promote startup investments.

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Still, by now, little is known about changes in startup investments if the tax system is modified (Hellmann and Puri, 2002; Hanlon and Heitzman, 2010; Henrekson and Sanandaji, 2011). Due to limited data access, few existing studies use aggregate data, data following an IPO, or data on larger public firms (e.g., Guenther and Willenborg, 1999; Edwards and Todtenhaupt, 2020). Henrekson and Sanandaji (2011, p. 168) conclude that “simple cost of capital formulas have a tendency to underestimate the distortions caused by taxing entrepreneurial firms”.

Third, we relate to the principles of decision and investment neutrality which are the two basic concepts in tax policy making (Boadway and Bruce, 1984; Devereux and Freeman, 1991). This theoretical construct, which was originally developed on frictionless markets, is nowadays also of main importance in real life, i.e., incomplete markets (e.g., Deutscher Bundestag, 2007*b*). Decision neutrality describes the idea that taxes should not systematically influence economic decisions while investment neutrality refers to investment decisions in particular. Overall, taxes must not affect investors’ decisions.

Last, we contribute to the literature on startups’ access to external financing. In 2019, the yearly investment amount in German startups increased by 36% compared to the year before (EY, 2020). Still, almost 40% of startups face raising capital as one of their main challenges (Kollmann et al., 2019). In their early years after foundation, startups often lack internal monetary resources and thus rely on external financial support (Levine, 2005). However, as they are characterised by high uncertainty (e.g., McMullen and Shepherd, 2006) and lacking information on past performance (Gompers et al., 2020), they do not have access to traditional financing. Venture capitalists support startups with financial and non-financial resources which ultimately fosters countries’ economic development (Keuschnigg and Nielsen, 2004).

One main challenge of this paper comprises to single out the effects of the tax reform in the Sections 8c/8d KStG. To overcome this concern, we control for possible distorting factors, e.g., tax reforms in the control countries within the observation period. This procedure ensures that our results are not biased by other events which coincidentally occur at the same time.

Nonetheless, future research has to be conducted to confirm the effects found. Furthermore, the German startup environment might be special in certain aspects so that our results might not easily be transferable to other countries. This fact enables us to go into detail in our analyses for Germany but conclusions on investors' behaviour might not be applicable elsewhere. One also has to be aware of the fact that data in EIKON is probably not all-embracing. Hand-collected data as well as the fact that, e.g., the publication of the balance sheet is not mandatory for all startups in Germany, might make our database miss out on some investment events. However, we choose EIKON as it is widely recognised as one of the main information systems in entrepreneurial research. Furthermore, through the incorporation of the former venture capital database "Venture Xpert", EIKON is nowadays one of the largest databases containing information on startup investments. Still, these points of criticism call for future research to remove existing concerns and further fill the gap in the literature in this research area.

In the following section, we introduce the examined tax reform in the Sections 8c/8d KStG in Germany as well as our hypotheses and the literature related to tax effects and anticipation effects in entrepreneurship. In section 4.4, we describe the sample, the methodology and the research design before we discuss the empirical results in section 4.5. Section 4.6 tests the robustness of the results and section 4.7 presents the limitations and implications of this study for future research. This study closes with a discussion and conclusion of the findings in section 4.8.

4.2 Institutional Background

4.2.1 Changes in the German Tax Law in the Sections 8c/8d KStG

In 2007, the German government implemented a fundamental corporate tax reform with the aim to foster growth and employment and increase the attractiveness and competitiveness of Germany as an investment location for both national and international investors (Deutscher Bundestag, 2007*b*). Among others, they

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introduced Section 8c KStG.³ This regulation is based on the principle of equality and, following from this, the principles of the ability to pay and of net income (Thees and Zajons, 2017).⁴ Generally, it enables corporations to carry forward losses to reduce their tax payments in future years.⁵ However, Section 8c (1) KStG determines the partial non-useability of a firm’s loss carry forward if between 25% and 50% of the share capital is directly or indirectly transferred to an acquirer within a time period of five years. Furthermore, losses are completely non-usable in future years if more than 50% are sold. Thereby, Section 8c KStG ensures that future loss deductions are only possible if a corporation stays legally and economically unchanged (Thees and Zajons, 2017).⁶ German lawmakers’ intention of introducing Section 8c KStG was to restrict the use of losses in order to prevent the misuse of losses by certain forms of tax planning, e.g., “Mantelkauf” (see for further information Hey, 2007).

However, adding investors through venture capital (VC) and selling large parts of the company’s shares in a short period of time is a common way to grow in entrepreneurship (e.g., Deutscher Bundestag, 2016; Leibner and Dötsch, 2020). Therefore, Section 8c KStG particularly negatively affects startups which usually experience negative earnings in their early years. However, even though the German government already expressed this unequal treatment of firms with and without a change in firm structure before introducing Section 8c KStG in 2007 (Deutscher Bundestag, 2007a), the European Commission ex-ante stopped the idea of a differing treatment of firms (Europäische Kommission, 2009). Thus, this tax law was introduced with the goal of decreasing tax barriers to foster investments (Deutscher Bundestag, 2007a) but without considering startup-specific

³This tax reform, e.g., also contained a reduction in the corporate tax rate from 25% to 15% (Section 23 (1) KStG) and introduced the interest barrier (“Zinsschranke”, Section 8a KStG in conjunction with Section 4h EStG). For an overview on all changes, see Homburg (2007).

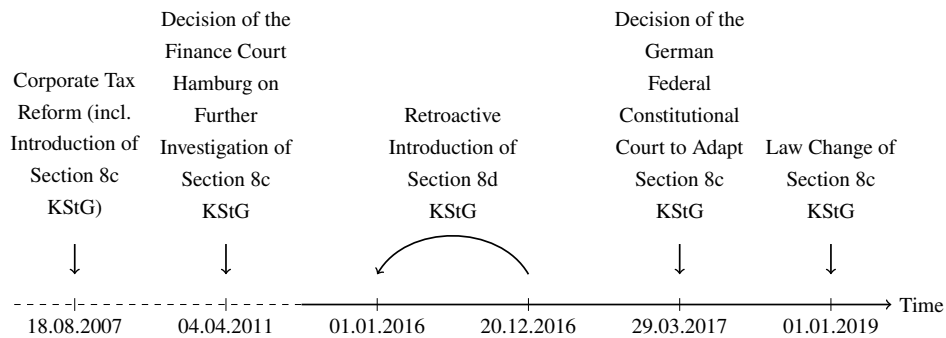
⁴One can argue that the German tax law regarding the treatment of losses does still not fully coincide with the principle of investment neutrality. E.g., interest calculations are not considered when looking at the effect of future loss deductions (Ernst, 2011). As public policymakers usually abstract from this theoretical construct (e.g., Sachverständigenrat, 2016), we also do in this study.

⁵According to Section 8 (1) KStG in conjunction with Section 10d (2) German Income Tax Act (EStG), losses in German corporations can generally be carried forward indefinitely.

⁶As soon as an individual investor owns more than 50% of a firm’s shares, he could change the fundamental orientation of the firm without considering the opinion of other investors or the firm’s focus in the past.

characteristics. In 2011, the Finance Court Hamburg decided the tax law from 2007 to be re-examined by the BVerfG due to its high relevance regarding the violation of the principle of equality (FG Hamburg, 2011).

Figure 4.2.1: Chronological Overview on the Sections 8c/8d KStG



Reacting to this decision, the German government introduced Section 8d KStG in December 2016 retroactively by January 1, 2016 to decrease the fiscal barriers for small corporations. Since then, firms can still disclose loss carry forwards in a separate position in their tax balance sheets even if Section 8c (1) KStG declares these losses as non-deductible.⁷

On March 29, 2017, the BVerfG ruled the unequal treatment of companies with no change in their shareholder structure compared to companies that have sold between 25% and 50% of their shares within the last five years as incompatible with the constitution (Bundesverfassungsgericht, 2017). One of the main justifications is based on the economic capacity of a firm which is decisive for taxation according to the principle of separation. Overall, they judge Section 8c (1) KStG as being too restrictive, especially affecting startups which commonly sell a high proportion of the company's shares. According to the court's decision, the taxation of profits compared to a non-deductibility of losses violates the principle of investment neutrality and the principle of equality.

The BVerfG thus requested the German government to change the tax law in this section accordingly by January 1, 2019. Otherwise, Section 8c KStG was supposed to be retrospectively declared as unconstitutional from January 1, 2008 (see Bundesverfassungsgericht, 2017). Figure 4.2.1 displays the chronological

⁷The firm has to meet certain legal requirements in order to be allowed to apply Section 8d KStG.

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order of events related to the introduction and subsequent changes in the Sections 8c/8d KStG. Meanwhile, Section 8d KStG remained in force so that startups and their investors were still able to deduct losses within this time period when they qualified for Section 8d KStG even if Section 8c KStG did not allow to deduct these losses. Additionally, investors and firms could rely on the ruling that the new tax legislation with a more generous loss deductibility had to be introduced by the beginning of 2019. Section 165 (1) No. 2 German Fiscal Code (AO) also allows to retrospectively change a firm's tax return in case the BVerfG requests the German lawmakers to legally modify an existing tax law. Hence, if firms sold between 25% and 50% of their shares after the ruling of the BVerfG but before the implementation of the new Section 8c KStG, they could still rely on the new tax law since their tax return could be changed (according to Section 165 (1) No. 2 AO as soon as the new legislation was introduced).⁸ This is also the reason why we refer to the tax reform in 2017 and not in 2016 or 2019 although the new Section 8c KStG was not introduced before January 1, 2019 (see also section 4.2.2 regarding the introduction of Section 8d KStG). With the new Section 8c (1) KStG, which was passed by the German parliament on December 14, 2018, the hurdle of a partial non-useability of losses in case of an owner change between 25% and 50% was repealed retrospectively for all years since 2008 and for all future years. From that point on, only in case of a sale of shares of more than 50% within five years, losses must not be deducted from future earnings anymore to reduce tax obligations.

Figure 4.2.2 shows the effects of the tax reform in the Sections 8c/8d KStG on a startup's loss carry forward disclosed if an outside investor purchases 40% of a startup's shares. We assume that two investors A and B own an equal proportion (50%) of shares of startup S which is created in the legal form of a corporation. Investor C now purchases 40% of these shares so that the proportion of A and B in S decreases to 30% per person. Before the tax reform in the Sections 8c/8d KStG in 2017, a proportionate amount of a hypothetical loss carry forward of 100,000 Euro which startup S disclosed in its preceding annual statement was

⁸This also held true for firms which did not qualify for Section 8d KStG which was introduced by German lawmakers in late 2016 so that firms could not rely on it before the beginning of 2017.

lost. Thus, these 40,000 Euro could not be deducted from subsequent earnings anymore which increased startup's tax obligations in future years. In contrast, since the tax reform in 2017, startup S is still allowed to disclose a loss carry forward of 100,000 Euro despite the sale of shares.

Figure 4.2.2: Example 1 on the Effects of the Tax Reform in the Sections 8c/8d KStG

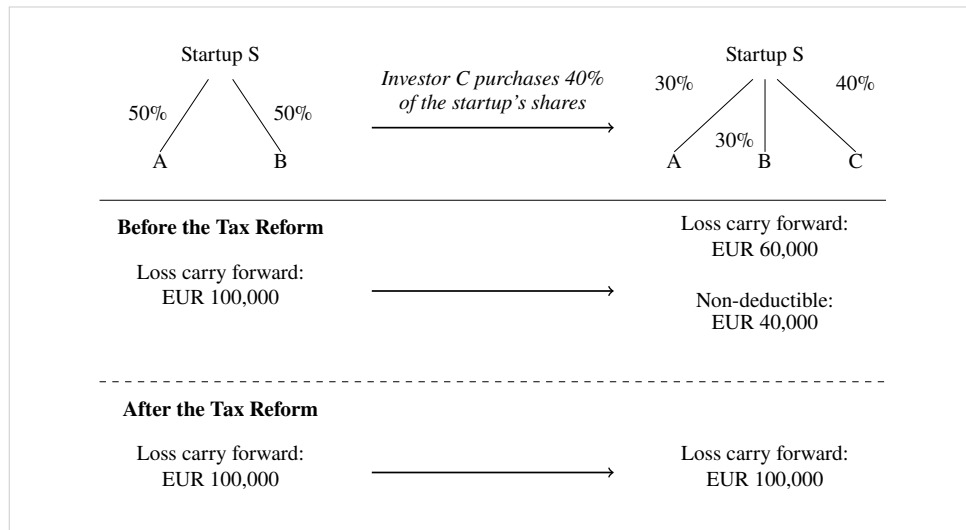
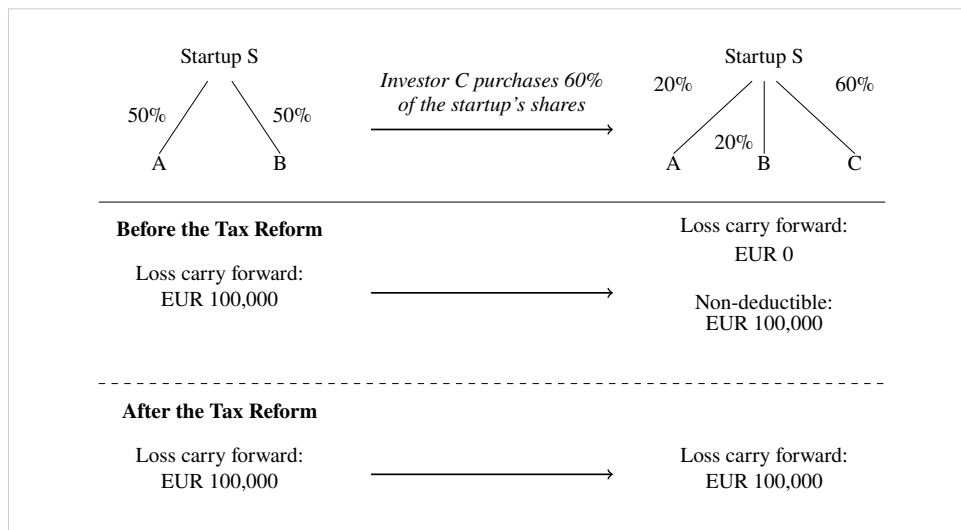


Figure 4.2.3 displays the effects on a startup's loss carry forward in case of a sale of shares amounting to 60% of a startup's shares. Again, two investors A and B initially own 50% of shares per person. Investor C now purchases 60% of these shares so that the proportion of A and B in S decreases to 20% per person. Before the tax reform in the Sections 8c/8d KStG in 2017, the entire loss carry forward of 100,000 Euro of startup S was lost and the startup would not have been able to decrease its future tax obligations. Since the tax reform in 2017, startups are now still allowed to disclose the former loss carry forward if Section 8d KStG applies. For an explanation of the applicability of Section 8d KStG, see section 4.2.2 of this paper. Figure 4.A.1 in the appendix displays the change in the shareholder structure and the effects on the disclosable loss carry forwards before and after the tax reform when new shares are issued (instead of a sale of shares).

⁹This example holds if Section 8d KStG applies. If Section 8d KStG does not apply at the time of the sale of shares or does not apply at any time within the three years thereafter (Section 8d (1) KStG), the loss carry forward of 100,000 Euro is completely non-deductible.

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Figure 4.2.3: Example 2 on the Effects of the Tax Reform in the Sections 8c/8d KStG⁹



4.2.2 The Role of Anticipations in Investment Behaviour

Anticipation effects regarding tax policy are “rational beliefs about changes in future tax rates that may result from proposed or anticipated legislation” (De Simone, Piotroski and Tomy, 2019, p. 3106). This statement underscores that investors adjust their activities based on their beliefs in order to take advantage of a possible but uncertain future tax benefit. Mertens and Ravn (2011) confirm that an anticipated tax cut results in a decline of economic activity of firms in the years between the announcement and implementation and an increase of the activity afterwards. However, the latter effect often seems to not occur immediately after the implementation of the reform but to lag behind approximately two years (Christofzik, Fuest and Jessen, 2020).

Hence, anticipation effects are crucial to consider when examining the effects of a change in tax policy. In the concrete case of this paper, new investors’ anticipation and ultimately their behaviour might have been influenced by numerous statements from experts in the field. Overall, they agree that tax law changes favouring startups are reasonable. However, the implementation of the new Section 8d KStG has been perceived as very strict regarding, e.g., the definition of when a firm’s business operations remain unchanged (Section 8d (2) KStG). Furthermore, the evaluation by the German tax authorities is based on qualitative

criteria which are not easily transparent to each investor. Tax consultants also questioned the idea of a constant business model as entrepreneurs often operate several businesses over time when developing new products. This would result in the non-applicability of the Section 8d KStG. Finally, tax experts criticised the different rules regarding the non-usability of losses in future years in Section 8c KStG compared to Section 8d KStG. Whereas the future deductibility of losses according to Section 8c (1) KStG is determined directly after the sale of shares, Section 8d (2) KStG might lead to a non-usability of losses retroactively within three years after the sale of shares (e.g., Engelen and Heider, 2020).

Besides these uncertainties, the development in Section 8d KStG has probably influenced investors' anticipations. As mentioned above, Section 8d KStG was put into force in December 2016. The first draft of this section was published in September 2016. Since then, investors could anticipate a new law to be passed but they did not know when exactly this would happen, how it would exactly look like and when it would come into force. Again, this is the reason why we use 2017 as the reference year for the tax reforms in Sections 8c/8d KStG (see also section 4.2.1). Once introduced, Section 8d KStG contained several imprecise passages regarding, e.g., what the named "qualitative criteria" in Section 8d (2) KStG are. To give the public a guide on the concrete interpretation, the Federal Ministry of Finance (BMF) needed about 3.5 years, until August 2020, to publish a draft letter specifying the applicability of this section (Bundesministerium der Finanzen, 2020). Additionally, if tax authorities apply a narrow interpretation of Section 8d KStG, this might still result in a disadvantageous situation for startups due to the new regulation (e.g., Bauernschmitt and Kraus, 2017). Summing up, between 2016 to 2019, investors remained (at least to a certain degree) unsure whether startups qualify at all or continuously maintain their qualification criteria for Section 8d KStG. Legal uncertainty had not been erased before March 18, 2021, when the BMF finally released the final version of the draft letter.¹⁰

The lengthy procedure in the implementation of the reform in Section 8c KStG has additionally influenced investors' anticipations and thus their behaviour.

¹⁰See https://www.bundesfinanzministerium.de/Content/DE/Downloads/BMF_Schreiben/Steuerarten/Koerperschaftsteuer_Umwandlungsteuer/2021-03-18-Fortfuehrungsgebundener-Verlustvortrag-Par-8d-KStG.pdf?__blob=publicationFile&v=2 (March 30, 2022).

4.3. HYPOTHESES DEVELOPMENT AND LITERATURE REVIEW

As described in section 4.2.2 of this paper, the lawsuit on Section 8c KStG was forwarded to the BVerfG in 2011. Thereafter, the BVerfG needed until March 29, 2017 to judge that Section 8c KStG has to be changed by January 1, 2019. Thus, between 2011 and 2017, investors could not be sure when the BVerfG would publish their judgement and how it exactly would look like. Furthermore, until the final implementation of the tax reform in the Section 8c KStG on January 1, 2019, investors could anticipate the tax reform to take place but they could again not be sure when and how exactly the German government would implement the new Section 8c KStG.¹¹ However, as described in section 4.2.1, investors and firms could rely on the ruling that the new tax legislation had to be introduced by the beginning of 2019. Moreover, Section 165 (1) No. 2 AO allows to retrospectively change a firm's tax return in case the BVerfG requests the German lawmakers to legally modify an existing tax law. Hence, firms and investors could assume that German lawmakers would abolish the old Section 8c KStG retrospectively from January 1, 2008, and introduce a tax law which does allow the partial useability of a firm's loss carry forward. Tax experts did also expect the abolition of the partial non-useability for the whole time period since 2008 (see, e.g., Dreßler, 2017). Nevertheless, since the exact wording of the new Section 8c KStG was not officially known before its introduction, a small uncertainty still remained for both firms and investors.

4.3 Hypotheses Development and Literature Review

Startups typically incur exclusively high losses in the beginning of their operations. One prominent international example is the ride-hailing company Uber, which was founded in 2009. It generated revenues of USD 14.14 billion in 2019. Yet, Uber still lacks in becoming profitable (Uber, 2020). In Germany, startups face the same situation. The N26 Group, a German FinTech and neobank operating throughout Europe reported a net loss of 73.15 million Euro in 2018 (N26,

¹¹Between March 2017 and January 2019, the old Section 8c KStG was still in place since the BVerfG did not specifically refer to years after 2016.

2019). While more mature firms can immediately offset these losses against existing profits, startups usually cannot. Thus, startups are more affected by the non-deductibility of losses and, in turn, higher tax duties (e.g., Cooper and Knittel, 2006; Mirrlees et al., 2011; Haufler, Norbäck and Persson, 2014). In the empirical literature, studies confirm that the deductibility of losses encourages business startups (Hansson, 2012) while not inducing them to lower their risk-taking in an inefficient way (Haufler, Norbäck and Persson, 2014). In its 2011 report, the German Expert Commission for Research and Innovation (EFI, 2020) describes the German tax policy regarding the possibilities to offset losses as hostile for innovation. The German tax law including Sections 8c/8d KStG and the non-usability of losses in case of a significant shareholder change, specifically negatively affected venture capital funded industries. In turn, it strongly impeded finding investors for young innovative companies (Haufler, Norbäck and Persson, 2014).

We strive to investigate the effect of higher loss carry forwards disclosed (or to be more precise, the still disclosable loss carry forwards instead of a forfeiture of these losses) on the development of additional external capital received.¹² As not only startups but also investors benefit from the tax reform through potentially higher payouts in future periods, we hypothesise:

Hypothesis 1: *Startups' loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c/8d KStG in 2017.*

According to the literature, taxes affect startups and entrepreneurs in many ways. Carroll et al. (2000) find tax rates to have a statistically significant influence on firm growth. Going further, Burman and Randolph (1994) observe that due to their effects on capital-gains realisations, tax changes directly affect shareholders' investment decisions. Specifically, Swenson (1994) confirms lower taxes to foster startup investments after the U.S. Tax Reform Act of 1986. Henrekson and Sanandaji (2011, p. 168) confirm that “a new entrepreneurial venture can rarely rely on external debt financing or on already taxed [...] equity to elimi-

¹²As we cannot observe the exact amount of shares which an existing shareholder owns, we cannot investigate the effects of the tax reform on their behaviour. Therefore, we focus on the behaviour of investors undertaking additional investments in startups.

4.3. HYPOTHESES DEVELOPMENT AND LITERATURE REVIEW

nate the costs of taxation”. Da Rin, Nicodano and Sembenelli (2006) show that decreased capital gains tax rates incentivise venture capitalists to invest in early-stage ventures, and Keuschnigg and Nielsen (2004) argue that tax reliefs induce venture capitalists to increase active engagement in startups, which increases startups’ probability of success. Recently, Bock and Watzinger (2019) find that higher capital gains tax rates result in fewer startups being able to secure venture capital funding.

Ideally, we would be able to estimate real effects of the tax reform using a comparable group of German startups in a difference-in-difference research design. However, as all German startups created as corporations according to Section 1 KStG are affected by the changes in the Sections 8c/8d KStG in 2017, this empirical method is not applicable in this study. Thus, we compare the development of startup investments in Germany to the development of investments in a synthetic control group made up of startup investments in comparable European countries. We hypothesise:

Hypothesis 2: *The tax reform in the Sections 8c/8d KStG in 2017 leads to a higher increase in the investment amount in startups in Germany than in its synthetic control group.*

Among all forms of external investments, venture capital plays a crucial role in startup development. Venture capitalists provide startups with financial as well as non-financial resources (Timmons and Bygrave, 1986; Hellmann and Puri, 2002). They often support highly successful new ventures which strongly fosters economic development (Sapienza, 1992; Keuschnigg and Nielsen, 2004). Nowadays, the typical investment proportion of a first round venture capital investment constitutes up to 25% of startups’ equity. About 15% of investors reach for a proportion larger than 25%, about half of them for more than half of the company’s equity (BVK, 2020; Honold et al., 2020). The European venture capital landscape is heavily dominated by the United Kingdom, Germany, and France (Teare and Kunthara, 2020). Especially Germany is becoming increasingly attractive for entrepreneurs and investors alike. Since 2012, the German venture capital market has experienced a positive trend (Gottschalk et al., 2016; Roberts and Naydenova, 2019; EY, 2020).

Undoubtedly, the risk of startup failure decreases with time or, put differently, with the number of preceding investment rounds. Several studies show that investors incorporate their anticipations on the potential risk taken into their investment decision-making (e.g., Fried and Hisrich, 1994; Virlics, 2013). The tax reform in the Sections 8c/8d KStG allows startups to disclose loss carry forwards and deduct them in future periods which decreases their tax obligations. In turn, it results in lower risk of losses (and in the extreme case, risk of default) especially for early-stage startups which still show a high probability of accumulating losses. We suppose that investors include these considerations into their decision-making so that their willingness to financially support early-stage startups increases after the tax reform. Thus, we hypothesise:

Hypothesis 3: *Investors' risk appetite increases after the tax reform in the Sections 8c/8d KStG in 2017.*

4.4 Data and Research Design

4.4.1 Data and Sample

In this study, we use data from the Thomson Reuters EIKON database (short: EIKON), specifically the section “Venture Capital Deals” as part of the section “Private Equity”.¹³ It contains over 30 years of firm data on investors and their investees. This part of the database originated from and is powered by “Venture Xpert”, a former database specialised on detailed information on venture capital investments both on startups’ and investors’ side. Therefore, using EIKON is highly reasonable as it provides reliable data on various startup characteristics, e.g., the firms’ location and financing rounds. Furthermore, we follow several researchers in entrepreneurship who have recently used this database as the foun-

¹³We refrain from including data on mergers and acquisitions into our analysis as EIKON enables us to explicitly concentrate on venture capital investments. Furthermore, startups face high losses and high default risks at the beginning of their operations (Cooper and Knittel, 2006; Haufler, Norbäck and Persson, 2014) and thus the tax reform in the Sections 8c/8d KStG affects early investment rounds more strongly. In contrast to that, M&As are one specific exit type which typically take place in later stages and after several funding rounds (Pisoni and Onetti, 2018).

4.4. DATA AND RESEARCH DESIGN

dation of their studies (e.g., Hornuf, Schmitt and Stenzhorn, 2018; Granier, Revest and Sapio, 2019).

For conducting analyses on investments in German startups, we manually complement data from EIKON with information from the startups' annual reports. Data is matched by the startups' full legal name and the respective year. Balance sheets from German startups falling under Section 1 KStG are available online through the "Bundesanzeiger". The website is managed by the German Federal Ministry of Justice, and responsible for publishing all financial statements required by German law. We manually extract the startups' fixed assets, current assets, equity capital, liabilities, and total assets.

The term "investment" in this study describes additional external financial resources startups receive from investors in several investment rounds throughout their lives, i.e., it does not include the capital contribution of owners and investors at startups' foundation. For our main specifications, we employ startup data from the years 2010 to 2019. This choice is based on the temporal proximity to the intervention event, i.e., the tax reform in the Sections 8c/8d KStG in 2017, as well as the idea of evaluating recent developments only, and not having biased coefficients due to few observations from years before 2010. We refrain from including startup investments from 2020 and 2021 into our main analyses due to the specificity of the COVID-19 pandemic. However, we include these years in our robustness checks to test the validity of our findings (see section 4.6). Third, we choose the decision of the BVerfG in 2017 as the intervention event for the synthetic control method in this study since firms and investors could rely on the introduction of a new and more generous loss deductibility rule due to the ruling of the BVerfG (see section 4.2.1). This highly affected investors' anticipations on their future profits and thus their investment decision. Specifically, investors could anticipate a change in the startups' treatment of losses and thus their taxation in the short run. Additionally, due to the high actuality of the topic, we lack data on several periods after the final implementation of Section 8c KStG in January 2019.

With the tax reform in the Sections 8c/8d KStG, the German government introduced a tax relief especially directed at startups. This public policy inter-

vention constitutes a quasi-natural experiment regarding investors' anticipations and ultimately the effects on their investment behaviour. It similarly affected all startups which enables us to exploit exogenous variation in the explanatory and dependent variables even though we do not observe a random assignment of startups to the treatment. Additionally, quasi-natural experiments in the real world usually "provide [...] relatively robust measures of the counterfactual" (Dean, 2016, p. 140) and thus allow enhanced generalisability and relevance for public policy and individual decision-making (Meyer, 1995). For analysing the effects of the German tax reform, we compare investors' behaviour in Germany with investors' behaviour in a synthetic control group made up of comparable startup investments in other European countries. This choice is based on the fact that there is no comparable group of startups in Germany that has not been affected by this intervention. Furthermore, the tax reform constitutes a macro-economic event which makes a matching procedure on macro-level more reasonable than on micro-level. Additionally, EIKON does neither provide a panel data structure nor sufficient firm-level variables.

The initial control sample in this process consists of those European countries¹⁴ which have not been affected by a similar tax event as Germany between 2000 and 2019. This excludes, e.g., Denmark and Spain from the sample. Additionally, we control for the following aspects. First, we assume that macroeconomic shocks within our observation period hit European countries similarly. In contrast to that, idiosyncratic shocks exclude those countries from the donor pool which affected our outcome of interest (= the investment sum in startups) in the given time period. This involves, e.g., Greece, which experienced an extraordinary government-debt crisis following the financial crisis of 2007/2008. Second, we restrict the control group to those European countries that show generally similar macroeconomic characteristics as Germany. Therefore, we exclude, e.g., all Eastern European countries from the donor pool as startups in these countries act under fairly disparate conditions. Additionally, donor pool countries

¹⁴For this study, the United States as the largest startup market are not suited as control group due to the Small Business Jobs Act in 2010. This tax reform introduced a full exemption from federal capital gains taxes when selling shares of small businesses. Hence, our effects would be biased and could not completely be led back to the tax reform in the Sections 8c/8d KStG in Germany.

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have to show a sufficiently high number of observations in our data set, including a sizeable number of pre-intervention periods since the credibility of the synthetic control method depends on how accurate the untreated donor pool can imitate the treated unit (= Germany) in the time period prior to the treatment event. This excludes, e.g., Austria from the control group. Summing up, our donor pool consists of observations from the following eight European countries: Finland, France, Ireland, Italy, the Netherlands, Sweden, Switzerland, and the United Kingdom.

We extract raw data on these countries from EIKON including startup information on 6,928 startups with 10,468 investment rounds. We exclude startups and their investment rounds (16 investment rounds) from the sample which do not fulfill the requirements for German corporations (Section 1 KStG). For observations from foreign countries, we manually search for the corporate legal forms in these countries and restrict our sample to those investment rounds which involve startups in a corporate legal form comparable to the legal form of a “corporation” in Germany.¹⁵ This procedure is necessary to ensure that sample startups are covered by the tax change in Sections 8c/8d KStG or, within the synthetic control group, are of similar nature as German corporations. Thereby, we are able to analyse investors’ behaviour before and after the reform and evaluate the effects of the German tax reform in the Sections 8c/8d KStG.¹⁶ We assume that subsidy programs for startups occur apart from law changes, throughout all sample countries and address all types of firms similarly. Additionally, they especially target firms in their very early stage which are usually not created as corporations (e.g., “INVES” introduced in Germany in 2013). Furthermore, we exclude outliers in terms of age from the sample resulting in including all startups with less than 25 years (excludes 1,749 investment rounds). By doing so, we ensure that, e.g., in EIKON wrongly classified VC investments in the original sense are excluded from the analysis and, at the same time, there are startups from all time periods within the development of the current tax system in our sample. Additionally, as “the financial instrument used by the majority of [startups re-

¹⁵A list of corporate legal forms in European countries relevant for this study and their German equivalent is displayed in table 4.A.6 in the appendix.

¹⁶A list of tax reforms in other European countries, which are all of minor importance and thus do not bias the results of this study, is displayed in table 4.A.5 in the appendix.

questing venture capital is] pure equity (70%)” (Bascha and Walz, 2007, p. 222), we exclude those investment rounds from the sample which name debt or similar investment types as the financing method (partially) employed (452 investment rounds). This results in our final sample of 8,251 investment rounds.

Table 4.4.1: Local and Temporal Distribution of Observations

Country	Investment Rounds		Year	Investment Rounds	
	N	%		N	%
Finland	323	3.91	2010	764	9.26
France	2,660	32.24	2011	750	9.09
Germany	1,002	12.14	2012	737	8.93
Ireland	289	3.5	2013	713	8.64
Italy	148	1.79	2014	749	9.08
Netherlands	247	2.99	2015	775	9.39
Sweden	328	3.98	2016	915	11.09
Switzerland	370	4.48	2017	964	11.68
United Kingdom	2,884	34.95	2018	926	11.22
			2019	958	11.61

This table displays the distribution of observations (= investment rounds) by country and year.

Table 4.4.1 displays the local and temporal distribution of observations. The majority of sample firms operates in France and the United Kingdom, followed by Germany. With approximately 80%, observations from these three countries form the main part of the sample. This bias towards two foreign countries and Germany does not appear to be a problem for this study as observations from foreign countries are weighted within the synthetic control method according to how similar countries develop compared to Germany before the intervention event in 2017.

4.4.2 Synthetic Control Group

The challenge in evaluating the impact of the tax reform in the Sections 8c/8d KStG on the investment sum provided to German startups is that there is no comparable group of startups in Germany that has not been affected by this intervention. In comparative studies, all observations within the sample act in

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the same macroeconomic environment, but only one group of observations has been hit by the change, e.g., a change in law, and all other observations remain untreated. This allows researchers to draw conclusions on the impact of the treatment. In our setting, all German startups in the legal form of a corporation have been affected by the changes in the German tax law through the Sections 8c/8d KStG in 2017. In turn, there is no untreated unit of German startups which could be used as comparison group in the following empirical analyses. Since we do not have panel data on startup-level, we cannot use Fixed-Effects and difference-in-differences regressions.¹⁷

To overcome this empirical challenge and evaluate the effects of this tax reform in Germany, we apply the synthetic control method. It was developed by Abadie and Gardeazabal (2003) and refined by Abadie, Diamond and Hainmueller (2010) and Abadie, Diamond and Hainmueller (2015). The synthetic control method is a systematic way to create a comparison group by selecting comparison variables in comparative observations. Ideally, the created synthetic control group behaves exactly the same as the treated unit before the intervention event so that any difference thereafter can be attributed to the intervention itself. In turn, the basic idea of this method is that a combination of control variables makes an untreated group of observations ex-ante comparable to the treated unit regarding certain characteristics. This method allows an accurate re-production of the treated observations by combining the characteristics of several untreated units. It provokes more enhanced empirical analyses than considering only one control unit or one control variable. Summing up, the synthetic control method offers the possibility to precisely specify quantitative inference without precluding qualitative concepts to the same data (Langenmayr, 2017; Dörr et al., 2019).

We construct the synthetic control group by using a weighted average of several European countries based on the countries' similarity to Germany in the years prior to the intervention event (2010-2016) regarding certain macroeconomic variables. For information on the countries included, see section 4.4.1 of this paper. Variables used for creating the synthetic Germany are the coun-

¹⁷We report the results of an OLS regression at the country level with year and country Fixed-Effects in table 4.A.7 in the appendix. Due to the limited number of observations, the results should be interpreted carefully.

tries' GDP, inflation, domestic credit given to the private sector, the Effective Average Tax Rate (EATR), countries' economic freedom, venture capital availability, capacity for innovation, entrepreneurs' fear of failure and their perceived opportunities. The first five variables account for the countries' general macroeconomic situation, followed by several variables assessing the countries' startup environment (access to finance, innovativeness, and existing hurdles) and people's openness to entrepreneurial activities. Data is retrieved from the World Bank¹⁸, a research study on corporate taxes around the world¹⁹, the World Economic Forum²⁰, the Heritage Foundation²¹ and the Global Entrepreneurship Research Association²². Following Abadie, Diamond and Hainmueller (2010), we complement these control variables by five years of the lagged total investment amount (2010, 2013-2016) to control for the fact that no structural or country-level differences exist prior to the intervention event. We include more years the closer they are to our intervention event. Table 4.A.4 in the appendix displays the definitions of all variables.

Formally, we construct the synthetic control group by calculating a (8 x 1) vector of weights \mathbf{W} for the countries in the donor pool. The calculation is based on the idea of obtaining the best match between the control group and Germany regarding these variables throughout all periods before the intervention event in 2017. The weights for each country j within the control group are calculated by minimising the Root Mean Squared Prediction Error () of the following function:

$$\begin{aligned} \arg \min_{\mathbf{w}} \quad & (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W}^*)' \mathbf{V} (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W}^*) \\ & \text{Subject to } \mathbf{w}_j \geq \mathbf{0} \text{ and } \sum_{j=1}^8 \mathbf{w}_j = \mathbf{1} \end{aligned} \quad (4.4.1)$$

¹⁸See "World Bank Database": Inflation (NY.GDP.DEFL.KD.ZG), GDP (NY.GDP.PCAP.CD), and Domestic Credit to Private Sector (FS.AST.PRVT.GD.ZS). Downloaded November 19, 2020 from <https://data.worldbank.org>.

¹⁹For the effective average tax rate for each country, see Steinmüller, Thuncke and Wamser (2019).

²⁰See "The Global Competitiveness Index (Version 20180226)": venture capital availability (EOSQ089), and capacity for innovation (EOSQ119). Downloaded November 19, 2020 from <https://www.weforum.org>.

²¹See "Index of Economic Freedom": Economic freedom (overall score). Downloaded November 19, 2020 from <https://www.heritage.org>.

²²See "Global Entrepreneurship Monitor": Perceived opportunities (column 4) and fear of failure (column 6). Downloaded November 19, 2020 from <https://www.gemconsortium.org>.

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In equation 4.4.1, \mathbf{X}_1 describes a (14 x 1) vector containing the value for each macroeconomic variable as well as the values of the dependent variable $\ln(InvestmentAmount)$ for the years 2010 and 2013-2016 for Germany. \mathbf{X}_0 describes a (14 x 8) matrix containing the values for the same variables for the eight potential control countries.

V describes a weighting matrix showing the predictive power of the variables included in \mathbf{X}_0 and \mathbf{X}_1 for the dependent variable $\ln(InvestmentAmount)$. The weights in \mathbf{V} affect the optimisation problem of equation 4.4.1 and thus the weighting vector of the countries \mathbf{W} . In line with Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010), we choose \mathbf{V} such that the RMSPE of the dependent variable $\ln(InvestmentAmount)$ is minimised for the pre-intervention period from 2010 to 2016.

A detailed explanation on the derivation and the construction of the synthetic control group from a theoretical perspective as well as the vectors are displayed in the appendix.

Table 4.4.2: Composition of the Synthetic Control Group

Country	Percent
United Kingdom	63.9%
Netherlands	36.1%

Table 4.4.2 displays the weighting of the different countries within the synthetic control group. After constructing the control group so that it behaves the most similar to Germany before the intervention event in 2017, we compare the development of the investment sum in German startups with the investment amount in startups from the synthetic European control group after the intervention event. Thereby, the control group approximates how startup investments in Germany would have evolved without the respective tax reform. In turn, we are able to reveal the effects of the change in the Sections 8c/8d KStG in Germany on startup investments.

4.4.3 Variables

Investment Amount

In their early lives, startups need external financial support to survive and grow (Gompers and Lerner, 1999; Hellmann and Puri, 2002). We measure the amount of financial resources which startups receive by the investment amount per year in logarithmic terms. This proxy is given for each startup through the variable “Equity raised” in the EIKON database. To deal with the heterogeneous distribution in the investment sum, we use the natural logarithm of this variable within our analysis. Thereby, outliers are balanced out more easily which secures normality and homoscedasticity in the distribution of this variable. Additionally, using the natural logarithm allows a convenient interpretation of the estimates as elasticities in percentage terms. This method is also frequently used in the literature (e.g., Kortum and Lerner, 2001; Hellmann and Puri, 2002).

Loss Carry Forward

The new Sections 8c/8d KStG allow startups to deduct losses from future earnings even if startups sell a large part of their shares to new investors. Accumulating losses is common among startups as they face high expenses to conduct research and development in their early lives (Achleitner and Braun, 2015). In Germany, firms’ loss carry forward is a mandatory position in the balance sheet (Section 266 (3) German Commercial Code (HGB)). We get access to this information through the “Bundesanzeiger” where firms’ annual reports are published.

Startup Controls

For evaluating the effects of startups’ loss carry forwards disclosed on the investment sum, we include several control variables measuring startup-specific characteristics in the analysis. First, we use startups’ age at financing (measured in the natural logarithm of the number of months since foundation) to control for startups’ maturity and their current situation.

Additionally, we include the investment round number as a proxy for the startups’ past success and investors’ risk when investing in a startup. We argue

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that if startups reach higher investment rounds, they must have shown (at least to a certain degree) success in the past which decreases the investment risk. The variable is measured in integers starting with one.

Last, we include two variables extracted from the startups' balance sheets into the regression. Startups' equity capital and their total assets serve as proxies for startups' internal financial resources as well as startup size (both included in form of the natural logarithm).

Further Variables of Interest

In *Hypothesis 3*, we look at investor decisions based on startup-specific characteristics. Of special interest in this study is investors' risk appetite. It is higher for investors investing in startups' earlier investment rounds due to the high risk of losses, and in turn potential failure of early-stage startups. For this part of our analysis, we use the weights from the synthetic control method and split the sample by the investment round number. Then, we investigate if there is a change in the investment sum after the tax reform in real versus synthetic Germany for early-stage investments.

4.4.4 Descriptive Statistics

Table 4.4.3 displays the summary statistics of the main variables on observation level. Throughout the whole observation period (2010-2019) and all countries, our sample consists of 8,251 observations. Before the tax reform in 2017, we include seven years into the analysis which results in 63 year-country-combinations. We find sample startups to be on average 5.61 years old.²³ This is in line with the typical startup age of less than ten years (Hellmann and Puri, 2002; Kollmann et al., 2019). Additionally, the average investment round number of 2.75 is consistent with the focus of venture capital investments on young and high-risk startups.

²³The variable age is measured in months since startups' foundation. We know that some might doubt that firms with 25 years of age (= 300 months) are still specified as "startups". As we use data from the section "Venture Capital Deals" in EIKON and venture capital investments typically focus on startup investments (e.g., Sahlman, 1990; Block et al., 2019; Gompers et al., 2020), one could argue to include all observations into the analyses. Still, we strive to exclude extreme outliers from the sample, and thus we restrict the analysis to firms with 25 years or younger which includes 97.40% of the observations.

Looking at the data on German startups retrieved from the “Bundesanzeiger”, we find startups in our sample to receive an investment amount per investment round starting at 1,967 Euro. The maximum amount sums up to 1.15 billion Euro which was collected by a startup from the communication infrastructure sector. The average investment amount per investment round is 10.70 million Euro. The average loss carry forward of German startups in our sample is 4.43 million Euro.

Table 4.4.3: Descriptive Statistics

	N	Mean	Std. Dev.	Min	Max
ln(Invest)	8,251	14.9	1.51	7.58	20.87
ln(Age)	439	3.72	0.62	0	4.95
ln(Equity)	439	8.9	6.82	0	19.74
Round	439	2.75	1.84	1	12
ln(LCF)	439	12.71	4	0	18.71
ln(Assets)	439	14.37	2.13	0	20.05
Macroeconomic level					
General macroeconomic situation					
EATR	63	0.2453	0.0504	0.1086	0.301
ln(GDP)	63	10.7	0.18	10.32	11.39
Credit	63	115.86	30.33	41.08	185.36
Freedom	63	71.93	6.29	58.8	82
Inflation	63	1.41	0.96	-1.14	3.86
Startup environment					
Innovation	63	5.26	0.42	3.74	6.16
Opportunities	61	39.01	10.19	17.34	81.56
Failure	61	37.47	4.4	23.76	57.68
Capital Availability	63	3.52	0.53	1.84	4.8

This table displays the descriptive statistics including all variables that are used in the analyses. N describes the number of observations which are included in the final sample. Throughout the whole observation period (2010-2019), we include 8,251 observations from all nine countries into the analyses. The sample decreases to 439 observations when investigating the effects in Germany, i.e., when looking at the correlation between startups’ loss carry forward and the investment amount (H1). To create a synthetic Germany (H2-H3), we weigh other countries’ observations based on several macroeconomic variables and their similarity in the investment amount to Germany in the years prior to the intervention event (2010-2016). Therefore, the number of observations of the control variables is lower compared to the full sample (63 different specifications as these variables are given by country and year). For Italy 2011 and France 2015, data is missing for startups’ fear of failure and startups’ perceived opportunities which results in 61 observations for these variables. Section 4.4.2 describes the creation of the synthetic control group. Table 4.A.4 in the appendix displays the definitions of all variables.

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On macroeconomic level, we observe EATRs between 10.86% and 30.10% with a mean of 24.53%. This is in line with the public observation of substantial differences in the European tax landscape (Europäische Kommission, 2020). In the startup environment, we observe the perceived opportunities by entrepreneurs to vary widely with results between 17.34 and 81.56 on a scale from 0 to 100. The venture capital availability is perceived as medium high throughout all countries within our sample with an average of 3.52 on a seven-point-scale. These findings are in line with the idea of the European venture capital market still being in an earlier stage of development compared to the U.S. market (Teare and Kunthara, 2020). Table 4.A.4 in the appendix displays the definitions of all variables.

Table 4.4.4: Investment Amount per Year and per Investor per Investment Round

Year	Absolute Amount (in million Euro)	Absolute Amount per Investor per Investment Round (in million Euro)
2010	415.82	1.72
2011	468.80	2.38
2012	681.03	4.03
2013	515.76	2.71
2014	1,278.92	4.47
2015	2,073.84	6.64
2016	1,367.80	4.91
2017	1,735.32	8.50
2018	1,762.09	5.93
2019	2,640.21	6.78

Several researchers show that startups depend on external financing in their early lives. Venture capital constitutes one of the main resource providing mechanisms in this context. The amount of investments depends, among others, on the given tax environment (Da Rin, Nicodano and Sembenelli, 2006; Bock and Watzinger, 2019). Table 4.4.4 presents the development of the yearly investment sum of all investors in German startup corporations from 2010 to 2019. Throughout the years before the tax reform, we find an (almost) constantly increasing investment amount. After the reform, we find a tremendous increase of 0.91 billion Euro (= 50%) from 2017 to 2019. These findings coincide with the introduction of the tax reform in Sections 8c/8d KStG. It underscores the timely

reaction of the market to changes in tax law. This is in line with the literature investigating the reaction of the financial market to changes in tax law or financial reporting (Shackelford, 2000; Li, Pincus and Rego, 2008) and also corresponds to the two-year gap (Christofzik, Fuest and Jessen, 2020) between the BVerfG’s decision in March 2017 and the observed increase in investments in 2019. However, using the increase in absolute investment amount as a benchmark to evaluate a tax reform and its causal effect on German startups without having a proper comparison group will lead to a bias. Hence, we employ the synthetic control method to overcome this obstacle. For explanations on the different events related to the tax reform in the Sections 8c/8d KStG, see section 4.2.1 of this paper.

To get an idea of the composition of our sample, we proxy the individual investor’s financial support by dividing the aforementioned total investment sum by the number of investors. Both figures are extracted from EIKON. We openly acknowledge that it might be doubtful that the investment sum throughout all investors is similarly high. However, with this approximation, we strive to give some insights into the composition of our data set and the average amount of financial resources that startups receive from investors. The third column of table 4.4.4 shows the development of the average investment amount per investor. We find that, between 2010 and 2019, the average investment sum increases from approximately 1.72 million Euro to more than 6.78 million Euro. This is equivalent to an increase of 394% within ten years.

These descriptive explanations point towards the increased favour of investors regarding startup investments in general and, especially, after the tax reform in 2017. In turn, they underscore the importance of this study as increasing the knowledge on the relationship of taxes and startup investments is not only of main interest for researchers but also public policymakers.

4.4.5 Research Design

4.4.5.1 Effects of Tax Reforms on Startup Investments

In this study, we strive to investigate the effects of a reform in tax law, in our case in the Sections 8c/8d KStG in Germany in 2017, on investors’ anticipations and their behaviour. Researchers in the past often used data either on larger firms or

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following an IPO (Guenther and Willenborg, 1999; Edwards and Todtenhaupt, 2020). In contrast to that, we combine startup data from EIKON with information extracted from the German “Bundesanzeiger”. This procedure enables us to match information provided by the startups themselves with objective data from the startups’ balance sheets. In turn, we can in detail evaluate the effects of a profound intervention in the tax environment of startups on investments.

First, we investigate if the effects observed can be directly led back to the loss carry forwards disclosed in the startups’ balance sheets. We hypothesise that startups’ loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c/8d KStG in 2017 (*Hypothesis 1*).

To test this hypothesis, we conduct the following OLS regression:

$$\begin{aligned} \ln(\text{InvestmentAmount})_{it} &= \alpha + \beta_1 \cdot \ln(\text{LCF})_{it} \\ &+ \beta_{2,t} \cdot \ln(\text{LCF})_{it} \cdot \text{Year}_t \\ &+ \text{StartupControls}_{it} + \rho_t + \theta_j + \epsilon_{it} \end{aligned} \quad (4.4.2)$$

$\ln(\text{InvestmentAmount})_{it}$ represents the proxy for the investment sum of all investors in startup i in year t and refers to the natural logarithms of the received financial resources. As main independent variable, we include an interaction term between the natural logarithm of startup’s i loss carry forward disclosed in year t ($\ln(\text{LCF})_{it}$) and the respective year t into the regression. $\beta_{2,t}$ captures this moderating effect using the year of the tax reform (2017) as our base year (*Hypothesis 1*).

To control for startups’ characteristics which might drive their responses, $\text{StartupControls}_{it}$ are included in the regression. They refer to a vector of variables regarding startup-specific characteristics (for explanations on the control variables, see section 4.4.3 of this paper). We additionally include year fixed effects (ρ_t) and industry fixed effects (θ_j with j for the different industries) into the regression. By including year and industry dummies as well as the interaction term, we are able to control for year and industry specific effects while simultaneously standardising the effects to the base year 2017 in which the tax reform in the Sections 8c/8d KStG took place.

4.4.5.2 Comparison to the Synthetic Control Group

As comparing the effects only within Germany would limit the explanatory power and external validity of this study, we subsequently compare the development of startup investments in Germany to the development of investments in a synthetic control group made up of a weighted group of observations from comparable European countries. This synthetic Germany matches the development of startup investments in real Germany as closely as possible before the intervention event and thus simulates the development of startup investment in Germany after the reform if the tax reform would not have occurred. Thus, we can lead back any difference in startup investments between real versus synthetic Germany after the tax reform to the tax reform itself. The synthetic control method enables us to deal with the empirical challenge of not having a control group of German startups which has not been affected by the changes in the German tax law. We hypothesise that tax reform in the Sections 8c/8d KStG in 2017 leads to a higher increase in the investment amount in startups in Germany than in its synthetic control group (*Hypothesis 2*).

4.4.5.3 Further Analyses in Germany

After investigating whether the tax reform in the Sections 8c/8d KStG fosters startup investments in general, we aim to further study the effects on different investor groups in Germany. We expect that investors' risk appetite increases after the tax reform in the Sections 8c/8d KStG in 2017 (*Hypothesis 3*) as early-stage startup investments imply higher risk than later-stage investments. We test this hypothesis by splitting the sample to provide evidence on the causes of the observed overall effects. We specify first round investments as high risk and investments within all following investment rounds as lower risk.

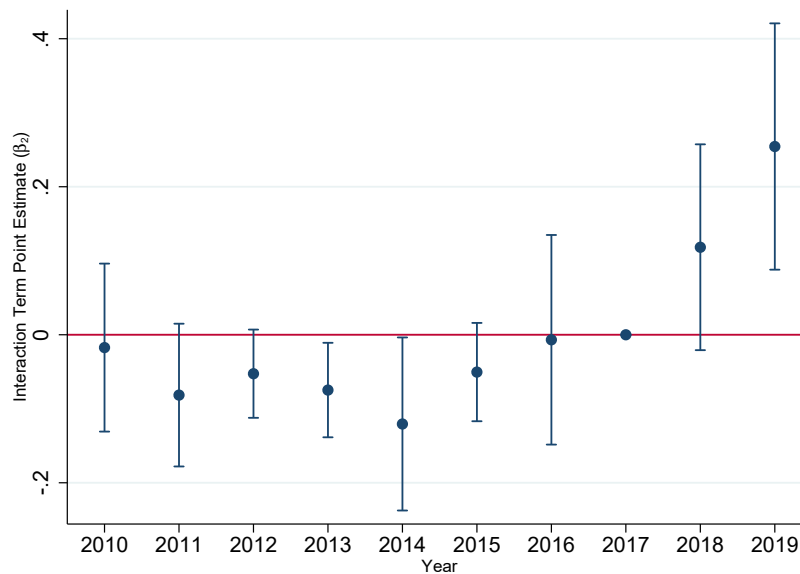
4.5 Empirical Results

4.5.1 Effect of Tax Reforms on Startup Investments

First, we look at the correlation between startups' loss carry forwards disclosed and the investment amount they receive throughout the years. *Hypothesis 1* suggests that startups' loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c/8d KStG in 2017. As due to size not all startups in our original sample are obligated to publish their annual statements and loss carry forwards (Sections 266 (1), 326 (2) HGB in conjunction with Section 267 (1) HGB), we are not able to collect this information from all startups. Thus, the number of startups decreases to 439 investment events for this analysis. We openly acknowledge the limited size of this sample which might reduce the external validity of the results. Nonetheless, the following analyses give valuable insights into the German startup market and related investments. In turn, our results are of main interest not only for researchers in entrepreneurship but also public policymakers to develop laws and regulations in the future that have the desired effect.

Figure 4.5.1 displays the joint development of startups' loss carry forward disclosed and the investment sum received from 2010 to 2019 with point estimates and 90% confidence intervals. Since more recent years have not yet been published in the "Bundesanzeiger", we cannot include 2020 and 2021 in this regression. We define 2017, the year of the tax reform, as the base year for the interaction terms. Thereby, we can compare startups' loss carry forward disclosed and their investment amount received in the years before and after the 2017's tax reform. Interestingly, in the years before the reform, we find a negative correlation (see also table 4.5.1). In the most extreme case, in 2014, a 1% increase in startups' loss carry forward disclosed correlates with a 0.12% decrease in the investment amount compared to the base year 2017. This effect is significant at the 10% level. In contrast to that, in 2019 a 1% increase in loss carry forward correlates with a 0.25% increase in the investment amount in startups compared to the base year 2017. This effect is statistically significant at the 5% level and also relatively large in its absolute size compared to the pre-intervention years.

Figure 4.5.1: Interaction between Startups' Loss Carry Forward Disclosed and the Investment Amount



This graph shows point estimates with 90% confidence intervals of the development of startups' disclosed loss carry forward and the investment amount received from 2010 to 2019 in Germany.

These figures indicate the relation between startups' loss carry forward disclosed and investors' financial support before and after the tax reform in the Sections 8c/8d KStG. A possible explanation might be investors' expectations on their earnings regarding the old versus the new tax legislation in the Sections 8c/8d KStG. Before 2017, investors were not willing to invest in startups as they would "pay" for loss carry forwards reported in the balance sheets which were not deductible from profits in future years. Thus, a loss carry forward reported in the balance sheet might rather have been a burden for startups since neither startups nor investors could use these losses if more than a certain proportion of shares was sold. Since the tax reform in 2017, losses can be used which decreases startups' future tax payments. Therefore, investors have been more attracted by startup investments and thus more willing to "pay" for future tax savings which enables startups to get access to additional external finances. Investors might now perceive loss carry forwards as an intangible financial asset as they can deduct losses against future profits.

4.5. EMPIRICAL RESULTS

Table 4.5.1: Effect of Loss Carry Forwards Disclosed on Startup Investments

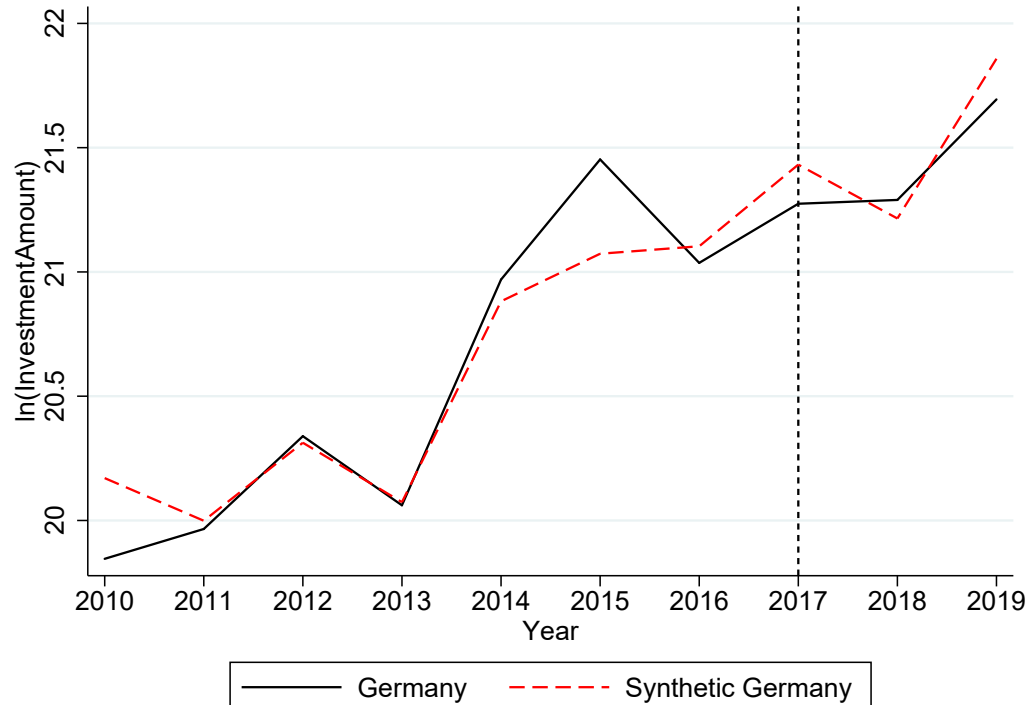
	<i>OLS</i>
$\ln(LCF)$	0.0652*** (0.0205)
<i>Round Number</i>	0.0572 (0.0432)
$\ln(Age)$	0.0426 (0.123)
$\ln(Equity)$	0.0212*** (0.00798)
$\ln(Assets)$	0.282*** (0.0616)
2006 · $\ln(LCF)$	-0.0869* (0.0478)
2007 · $\ln(LCF)$	-0.121* (0.0681)
2008 · $\ln(LCF)$	-0.104* (0.0569)
2009 · $\ln(LCF)$	0.0127 (0.0549)
2010 · $\ln(LCF)$	-0.0173 (0.0688)
2011 · $\ln(LCF)$	-0.0815 (0.0585)
2012 · $\ln(LCF)$	-0.0526 (0.0362)
2013 · $\ln(LCF)$	-0.0747* (0.0387)
2014 · $\ln(LCF)$	-0.121* (0.0709)
2015 · $\ln(LCF)$	-0.0504 (0.0403)
2016 · $\ln(LCF)$	-0.00678 (0.0859)
2018 · $\ln(LCF)$	0.118 (0.0843)
2019 · $\ln(LCF)$	0.254** (0.101)
<i>Constant</i>	10.21*** (0.963)
<i>Year effects</i>	Yes
<i>Industry effects</i>	Yes
<i>Observations</i>	439
<i>R – squared</i>	0.5180

This table displays the results of an OLS regression where the natural logarithm of the variable “investment amount” serves as the dependent variable. Robust standard errors are used and displayed in parentheses. In the interaction terms, 2017 is used as the base year. ***, **, and * indicate significance at the 1%, 5%, and the 10% levels, respectively.

4.5.2 Comparison to the Synthetic Control Group

We investigate the effects of the tax reform in the Sections 8c/8d KStG in Germany in 2017 by proxying the development of startup investments in Germany through a synthetic Germany where this tax reform did not happen. Figure 4.5.2 displays the results of the synthetic control method. The RMSPE amounts to 0.1940 which shows that our estimation of the synthetic Germany resembles closely to the real Germany. In contrast to our hypothesis, we do not find a significantly different increase in the total investment sum in German startups compared to the investment in startups in synthetic Germany. After the tax reform in 2017, we find investments in real Germany to be even slightly lower than investments in synthetic Germany. However, this difference is not significant. Summing up, we cannot confirm the positive effect of the tax reform on startup investments which we expected in *Hypothesis 2*.

Figure 4.5.2: Development of Startup Investments in Germany and the Synthetic Control Group



This figure shows the development of the investment amount in Germany and its synthetic counterpart from 2010 to 2019.

4.5. EMPIRICAL RESULTS

A possible explanation for this finding might be the legal uncertainty for investors regarding the applicability of Section 8d KStG after it had been put into force in December 2016. Due to their anticipation of the publication of an explanatory letter by the German government (which is usually published between one or two years after a tax law change), investors might have refrained from changing their investment behaviour immediately after the introduction. The same argumentation applies to Section 8c KStG. Although Section 165 (1) No. 2 AO allows to also retrospectively change a firm's tax return, and tax experts did also expect the abolition of the partial non-useability of losses for the whole time period since 2008, investors might have been hesitant to invest. Since there has still remained a small uncertainty regarding the exact wording of the new Section 8c KStG, investors might have been cautious and waited until they had entire legal certainty. In the literature, the idea of uncertainty increasing the option value of waiting is also not new (Bernanke, 1983). Furthermore, we know that new tax legislation fails to have the desired effects when lawmakers do not introduce tax laws with precise wording and practical application examples to ensure legal certainty (Bloom, Bond and van Reenen, 2007). As mentioned above, we restrict our analyses for the main specifications to the years 2010 to 2019 to avoid any bias caused by the COVID-19 pandemic. However, we employ robustness tests in section 4.6 including the years 2020 and 2021.

4.5.3 Further Analyses in Germany

Table 4.5.2 displays the weights of the synthetic control group for observations from startups' first investment rounds. Since our sample is restricted to startups' first investment rounds, the composition of the synthetic control group changes in comparison to the main analysis. A theoretical explanation on the derivation of the country weights is provided in section 4.4.2 of this paper and in the appendix. When searching for investment alternatives, investors unquestionably include the investment risk into consideration (Fried and Hisrich, 1994; Virlics, 2013). In this regard, first round investments represent investment alternatives with higher risk compared to later-stage investments. As the tax reform in the Sections 8c/8d KStG enables startups to deduct losses in future periods, investors might be more

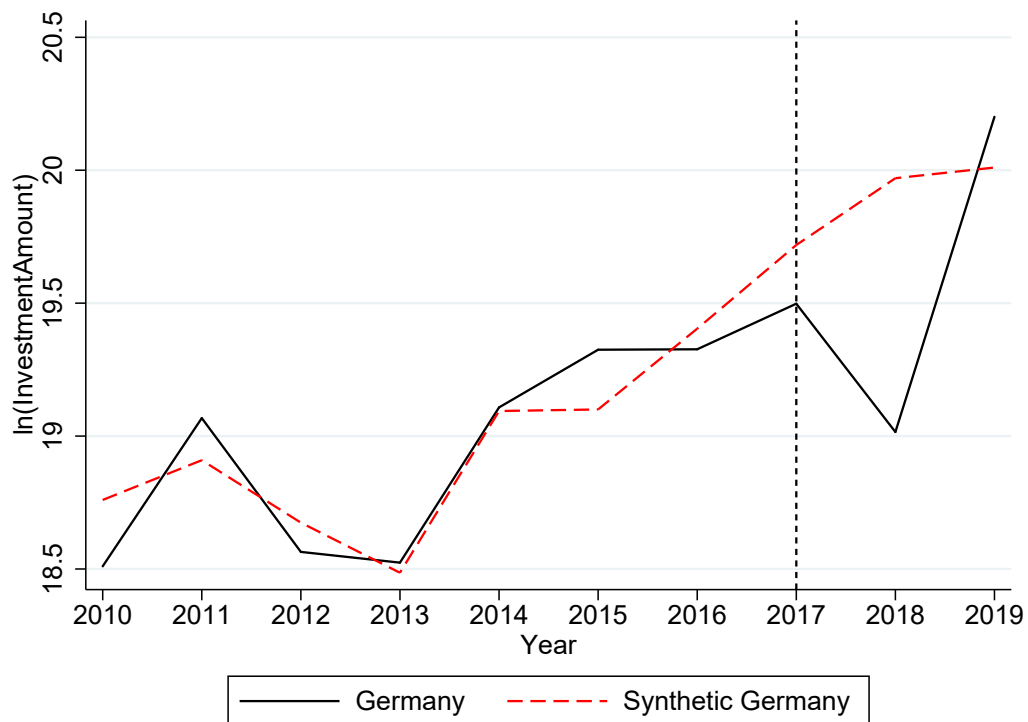
willing to invest in early-stage startups as this decreases startups' risk of failure. Therefore, *Hypothesis 3* suggests that investors' risk appetite increases after the tax reform in the Sections 8c/8d KStG in 2017.

Table 4.5.2: Composition of the Synthetic Control Group for First Investment Rounds

Country	Percent
United Kingdom	60.7%
Italy	20.6%
Ireland	9.6%
Netherlands	7.1%
Sweden	2.0%

Figure 4.5.3 displays the development of first-round startup investments throughout our observation period. The restricted sample consists of 4,034 investment rounds, and the RMSPE in this specification amounts to 0.150.

Figure 4.5.3: Startup Investments in Germany for First Investment Rounds



This figure shows the development of the investment amount in Germany and its synthetic counterpart from 2010 to 2019 for first investment rounds.

4.6. ROBUSTNESS TESTS

We find that early-stage startup investments in real Germany significantly decreased after the tax reform before strongly increasing in 2019. We relate this finding to investors' anticipations and the remaining legal uncertainty between the BVerfG's decision in March 2017 and the final introduction of the tax reform in Section 8c KStG by the German government in January 2019. In contrast, after the final introduction of the reform in the Section 8c KStG, investors engage more often in risky early-stage startups compared to later-stage startups which underscores their higher risk appetite after the tax reform. Moreover, it shows that the partial deductibility of losses according to the new Section 8c KStG is especially important for young startups with early investment rounds. Summing up, these findings are in line with *Hypothesis 3*.

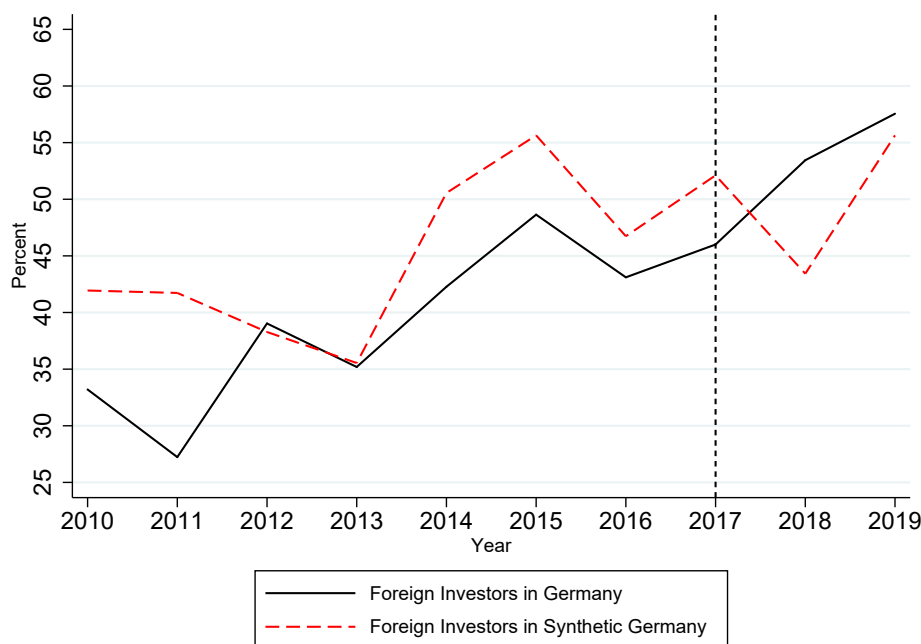
4.6 Robustness Tests

To test the robustness of our findings, we first investigate if results are driven by a different investment behaviour of foreign and domestic investors. Cumming and Dai (2010) show that VCs are strongly biased towards geographically proximate investments, since distance increases information asymmetry and the costs of monitoring. Schertler and Tykvová (2012) suggest that a country with an insufficient tax and legal environment for venture capital intermediation will have a lower gross inflow of venture capital than a country with a better environment for venture capital intermediation. Investigating the effects of cross border taxation on the extent of home bias for international equity flow, Mishra and Ratti (2013, p. 168) show that a “relatively high foreign tax rate that cannot be offset by tax credits is found to significantly increase home bias”. At the same time, domestic investors are much better informed about the current law changes in their home country. Therefore, it is ex-ante unclear whether foreign and domestic investors react similarly or differently to the tax reform in the Sections 8c/8d KStG. To rule out that our findings are driven by one of these investor groups, we first look at their proportions over time.

Figure 4.6.1 displays the share of foreign investors in Germany and the synthetic control group over time. We measure the proportion of foreign investors

as the number of foreign investors divided by the number of all investors. This choice is based on the idea that we refrain from the approximation of the individual investment sum via the share of the absolute investment sum (in Euro). The reason is that this calculation would base on the underlying assumption that every investor invests the same absolute amount of equity capital in a startup. Within this part of the analysis, the composition of synthetic Germany corresponds to the weights determined for the full sample (see section 4.4.2 of this paper for further details). We find that after the tax reform in 2017, investments in German startups by foreign investors (and inversely by domestic investors) do not significantly differ between the real development and the approximation through the synthetic control group. This underscores that our findings are not driven by differences in the investment behaviour stemming from differing investors' origins.

Figure 4.6.1: Share of Foreign Investors in German Startups



This figure shows the development of the share of foreign investors in German startups and its synthetic counterpart from 2010 to 2019.

In a second robustness test, we look at differently organised investor groups. Independent Venture Capitalists (IVCs) professionally manage funds and therefore place substantial importance on the economic potential of a startup (Block et al., 2019). Thus, IVCs are mainly interested in financial gains. In contrast

4.6. ROBUSTNESS TESTS

to that, Corporate Venture Capitalists (CVCs) usually fund startups on behalf of a corporate parent, aiming at realising synergies with their main business (Hellmann and Puri, 2002). As the third main group of investors, Governmental Venture Capitalists (GVCs) are “funds that are managed by a company that is entirely possessed by governmental bodies” (Grilli and Murtinu, 2014, p. 1524). Their main goal is to support the growth of the local VC market.

Figure 4.6.2: Share of IVC Investors in German Startups



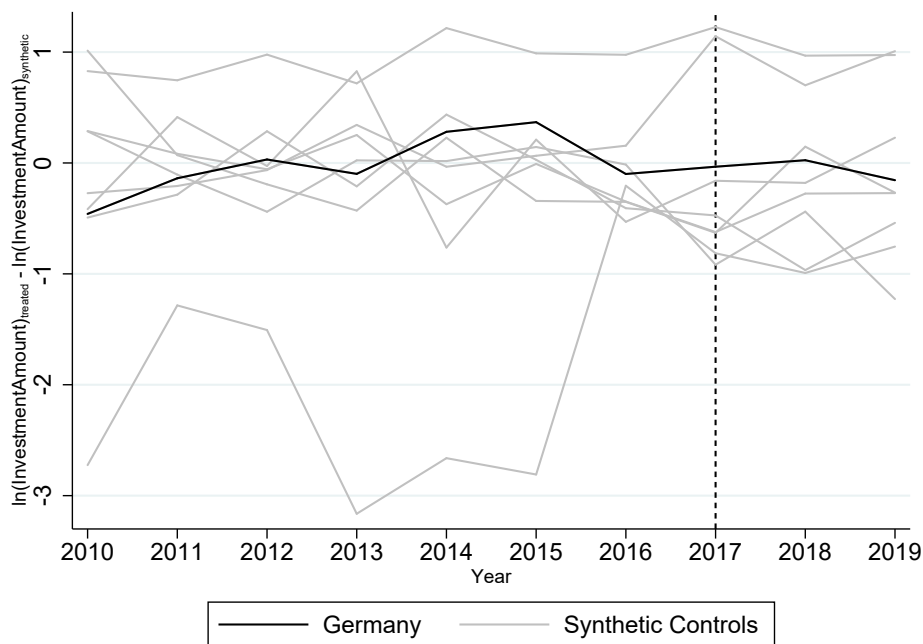
This figure shows the development of the share of IVC investors in German startups and its synthetic counterpart from 2010 to 2019.

As the tax reform led to higher expected gains for investors through lower future tax obligations for startups, with this robustness check, we strive to rule out that our results are biased due to different reactions to the tax reform by IVCs versus other investor groups. Figure 4.6.2 displays the proportion of IVC investors in startups in real versus synthetic Germany throughout our observation period. As above, we measure the share of IVC investors as the number of IVC investors divided by the number of all investors. Unreported evidence shows that IVCs make up for the largest share of investors which is in line with the report on global corporate venture research data (Eckblad, Gutmann and Lindener, 2019). As displayed in figure 4.6.2, the proportion increases from 42.86% in 2010 to

50.52% in 2019 in our sample. After the tax reform, we find a slightly different development between the proportion of IVC investors in real versus synthetic Germany. While the control group shows a quite constant trend over time, the tax reform led to an increase in IVC investments from 2017 to 2018 in real Germany. However, IVC investors in real and synthetic Germany develop quite similarly again in 2019 which shows that the short-term reaction of IVC investors in 2018 diminishes in the short run. Additionally, the graph shows some noise which does not allow to draw definite conclusions on a different behaviour of IVCs compared to other investor groups.

Figure 4.6.3 displays the results of a placebo test conducted to detect hidden biases in our results. The idea of a placebo test is to apply the synthetic control method to each country within the control group (Abadie, Diamond and Hainmueller, 2010).

Figure 4.6.3: Placebo Study



This figure shows the placebo study for Germany and all other European countries of the donor pool for the construction of the synthetic control group from 2010 to 2019.

Thereby, one assumes that the simulated country experiences a comparable tax reform as Germany at the time of the intervention event (2017) even though in reality it did not. In turn, we are able to conclude whether the effects observed

4.6. ROBUSTNESS TESTS

in Germany are significant compared to the respective control country. If the difference between the real and synthetically created countries from the control group is similar to the difference found in the foregoing analyses for Germany, we cannot lead back the changes in investors' behaviour to the German tax reform.

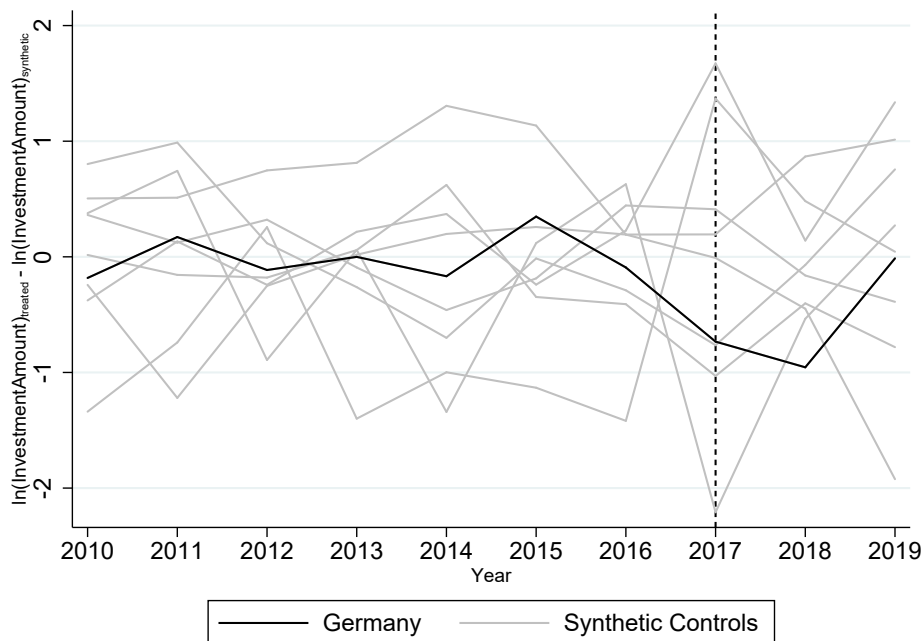
The black line in figure 4.6.3 displays the difference in the investment amount for real and synthetic Germany throughout our period of interest. Similarly, the grey lines show these differences for each country of the donor pool. Considering that our dependent variable is measured as the difference between two natural logarithms in the startups' investment sums, we find that the difference in Germany develops quite constantly around zero and similarly it does for the control countries. In turn, our findings in the preceding sections of this paper seem to be robust as there is no country within the synthetic control group which shows a significantly changing behaviour after 2017.²⁴

Figure 4.6.4 shows the placebo study including only the first investment rounds for our sample startups.

In this specification, we find the difference in the investment sum between real and synthetic Germany to be stable around zero before the tax reform in 2017 but quite strongly deviating from zero thereafter. In contrast to that, in other countries the difference seems to stay positive or negative at any time or just randomly jumping from positive to negative and vice versa throughout the observation period. Thus, we can conclude that first-round investments in our sample startups develop significantly different due to the tax reform compared to a situation without. This confirms the effect displayed above regarding first startups' investment rounds.

²⁴The lowest grey line represents the development of investment in real versus synthetic Italy. As there are only few observations from Italian startups within our sample, the synthetic control method does not allow a precise replication of investments there.

Figure 4.6.4: Placebo Study for First Investment Rounds



This figure shows the placebo study for Germany and all other European countries of the donor pool for the construction of the synthetic control group for first round investments from 2010 to 2019.

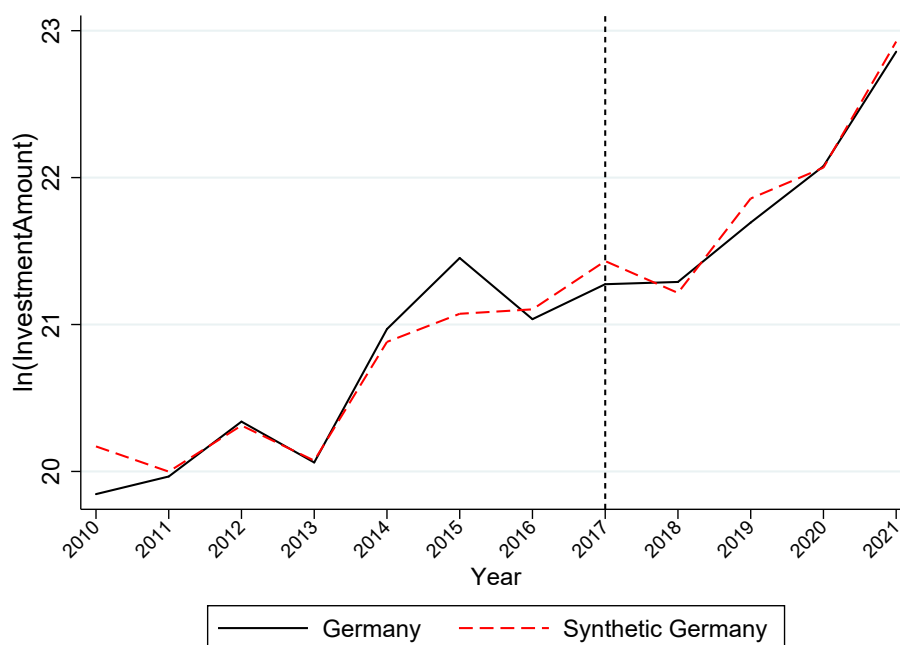
As described in section 4.4.1, we do not include the years 2020 and 2021 in our main specification due to the COVID-19 pandemic. Although the global pandemic has hit all countries in our sample similarly, we cannot entirely exclude the possibility that some countries have been affected differently than others. Furthermore, countries have put in place different financial and taxable reliefs for firms which could bias our results. Nevertheless, we include the years 2020 and 2021 in our robustness checks to confirm the validity of our results in section 4.5.2.

Figure 4.6.5 shows the results for the synthetic control method when the years 2020 and 2021 are included. The composition of the synthetic Germany and the RMSPE are identical to section 4.5.2. The graph confirms our main results since there is no increase in the investment amount in real Germany in comparison to the synthetic Germany. In both real and synthetic Germany, investment amounts increase in 2020 and 2021 but one cannot see any impact of the tax reform in Sections 8c/8d KStG in real Germany. One possible explanation could be that investors have generally been rather restrained from investing high amounts in

4.6. ROBUSTNESS TESTS

startups during economically unstable times. Another explanation could be that the partial non-deductibility of losses according to Sections 8c/8d KStG has not been as much of an obstacle to invest into startups as expected. However, it is impossible to make any clear conclusions since we do not have more observation periods after the change in tax law.

Figure 4.6.5: Robustness Check for Full Sample including 2020 and 2021

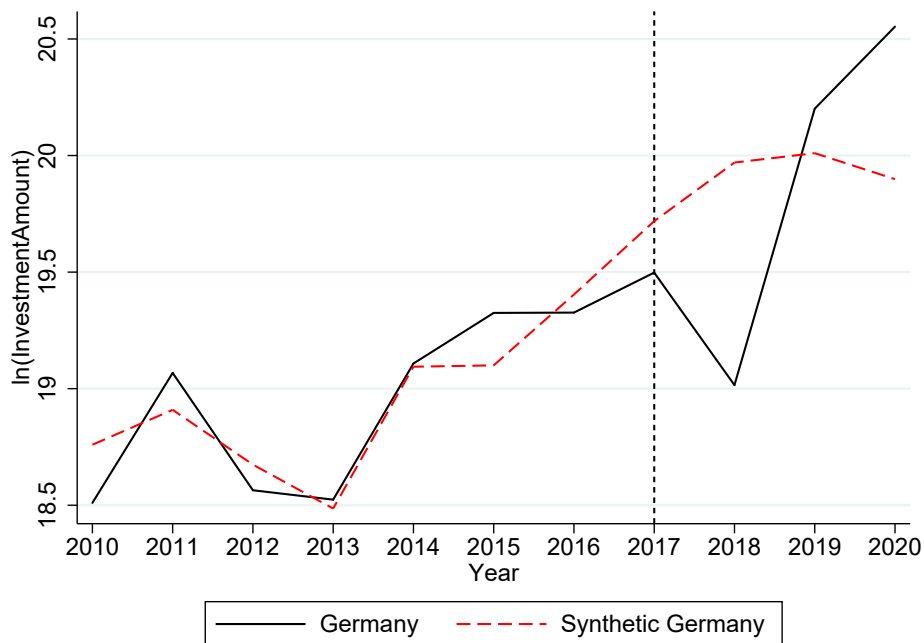


This figure displays information for real and synthetic Germany. Data corresponds to figure 4.5.2, including additionally the years 2020 and 2021 to the analysis.

Figure 4.6.6 shows the robustness test for first round investment when the year 2020 is included in the analysis. Since the variable definition for startups' age in EIKON changes, it is not possible to include this information for the year 2021. As one can see in the graph, first round investment amount in German startups increases significantly in 2020 in relation to the synthetic Germany. This might be explained by investors' higher risk appetite and the new Section 8c KStG which is especially important for early-stage startups. Usually, early-stage startups have not yet taken part in several investment rounds, and therefore there is no risk to exceed the relevant threshold of 50% according to Section 8c KStG. The sharp increase in 2020 highlights that the restrictive treatment of losses before the tax reform might have been a major obstacle for early-stage startups to obtain

external financing. The result also shows the heterogeneous impact of the new Section 8c KStG depending on startups' age and investment rounds. Hence, not all startups might benefit equally from the more generous loss carry forward regulation in the short term. However, since we cannot control for confounding effects due to the COVID-19 pandemic and states' financial aid measures, the development for 2020 should be interpreted cautiously.

Figure 4.6.6: Robustness Check for First Investment Rounds including 2020



This figure displays information for real and synthetic Germany for first investment rounds. Data corresponds to figure 4.5.3, including additionally the years 2020 to the analysis.

In the last robustness check, we also include the years 2020 and 2021 in our sample but use 2019 as the reference year for our intervention. Since the new Section 8c KStG was not officially legally binding before January 1, 2019, investors might have been hesitant although they could rely on a more generous loss carry forward regulation (see section 4.2.1). For this reason, we use 2019 as the reference year for the intervention to test the validity of our findings in section 4.5.2. Table 4.6.1 shows the composition of the synthetic Germany which differs to the synthetic control group for our main specification (see section 4.5.2).

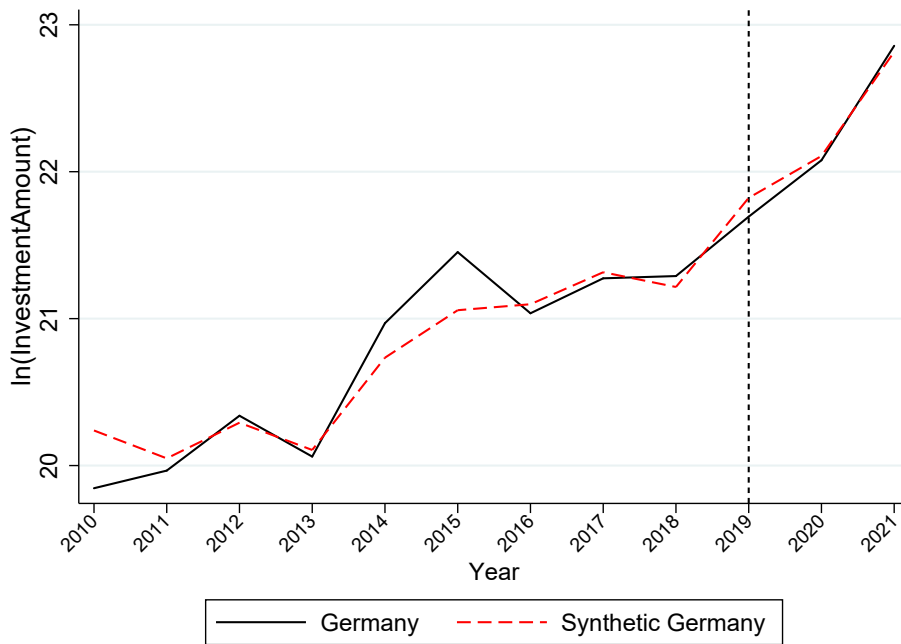
4.6. ROBUSTNESS TESTS

Table 4.6.1: Composition of the Synthetic Control Group with Years 2020 and 2021 and Treatment in 2019

Country	Percent
United Kingdom	45.6%
Netherlands	30.2%
France	24.2%

Figure 4.6.7 shows the result when 2019 is used as the reference year for the intervention. The result is identical to figures 4.5.2 and 4.6.5. Hence, using 2019 as reference year does not change our results and confirms our main findings in section 4.5.2.

Figure 4.6.7: Robustness Check for Full Sample including 2020 and 2021 and Treatment in 2019



This figure shows the development of the investment amount in Germany and its synthetic counterpart from 2010 to 2021 when treatment is assumed to have happened in 2019.

4.7 Limitations

This study describes the effects of a tax reform on startup investments which is of main interest for researchers and public policymakers. Nonetheless, there are some challenges remaining related to the data set as well as the empirical setting. This study tries to fill the gap in the literature on entrepreneurship and taxes, but we acknowledge that it shows some limitations which call for future research.

First, there might be issues regarding the data included in EIKON. Due to the nature of startups, it is very likely that not all investments in all countries considered within our analyses are listed in the database. There might be deals which have been arranged privately or startup-specific characteristics, e.g., size, increase or decrease the probability of an investment round being included in the data set. Thus, we might miss out on some investment events that took place within our observation period. Furthermore, we cannot control for the fact that a certain investment amount enables investors to purchase the same amount of shares in every sample startup. Shares from different firms are usually sold at different prices. Thus, investigating the effects on the overall investment sum per year allows to proxy the development of startup investments in total but does not allow to draw conclusions on the equity proportion which one single investor acquires in a startup. Therefore, we cannot control for or even exploit the situation when critical thresholds, e.g., in case of a sale of shares of 50%, are exceeded.

Additionally, first-hand information by EIKON employees confirms that the data set combines data from different sources. This includes, e.g., government filings, public news releases or surveys of private equity firms. As there is manual work involved, the information in EIKON might be incomplete or even contain errors so that one has to be careful with the interpretation of the results. Still, we choose EIKON as it incorporates data from the former venture capital specific database “Venture Xpert” which has been recognised as one of the main databases in entrepreneurial research. Thus, EIKON is nowadays one of the largest databases containing information on startup investments and widely used in empirical studies. In the regression analyses, missing data on startups’ bal-

4.7. LIMITATIONS

ance sheets decreases the number of investment events included in the analyses for Germany. However, combining data from EIKON and the “Bundesanzeiger” allows us to analyse effects which usually remain under-investigated due to limited data access. Thus, we believe that the smaller sample is not a major issue for the purpose of this study as EIKON and the “Bundesanzeiger” contain the most important venture capital deals and related startup information. This allows us to evaluate the main effects of a tax reform on startup investments. Furthermore, comparing investments in real versus synthetic German startups allows us to meet this criticism as the bias is equaled out over all countries. Another concern might be that the tax reform is not the only factor driving the investment amount in startups, thus, potential endogeneity must be taken into consideration. Among others, external circumstances, e.g., labour frictions, also affect the amount of venture capital provided by investors (e.g., Bosworth and Burtless, 1992; Gompers and Lerner, 1999). For the U.S. market, Kopp et al. (2019) confirm that only some part of the increase in investments can be led back to tax reliefs in the Tax Cuts and Jobs Act of 2017. We alleviate this concern by using the synthetic control method, i.e., comparing the development of startup investments between real and a synthetic Germany.

Another disadvantage of the data set relates to the fact that we do not have panel data on startup-level. Thus, we cannot investigate the effects of the tax reform splitting the sample, e.g., by age. We address this concern by analysing the effects on startup investments looking at startups’ first investment rounds. In our case, this method seems to be even more appropriate than splitting, e.g., by age, as one cannot assume that all startups enter their first (and also the following) investment rounds at the same time after foundation. However, not having panel data leads to, e.g., the impossibility of an analysis on firm-level. Missing panel data, a missing control group within Germany and missing information on the exact proportion which an investor acquires results in the non-usability of the empirical method of difference-in-difference and regression discontinuity design. The synthetic control method mitigates these issues, similarly to the issues of not being able to control for startups’ capital contribution at the time of foundation and the time span between two investment rounds.

Moreover, it is impossible to reliably disentangle the different effects of Sections 8c and 8d KStG as well as possible time confounding effects during the time between the ruling of the BVerfG and the introduction of the Sections 8c KStG on January 1, 2019.

In future research, temporary timing effects of startups' loss carry forward disclosed and the investments received should be considered. On the one hand, capital gains through lower tax payments are realised at a later point in time when tax rates might have changed. Additionally, Burman and Randolph (1994) show that the immediate reaction to temporary tax changes is higher compared to changes due to a permanent tax reform. Therefore, future research should concentrate on analysing the effects of a tax relief which is introduced only for a limited period of time.

Summing up, these points of criticism call for future research and replications to validate the findings of the analysis above. Specifically, other researchers could conduct similar analyses with data from other databases or in other countries. Nonetheless, this study provides first ideas to shed light on the relationship between taxes and startup investments in Germany. Thus, it complements existing studies and serves as a solid base for future research.

4.8 Conclusion

In this study, we investigate whether the corporate tax reform in the Sections 8c/8d KStG leads to higher investments in startups. Specifically, we examine whether investors change their anticipations and investment behaviour when the treatment of corporate losses becomes more generous from a tax perspective. The literature shows that startups heavily rely on external capital (Levine, 2005; Beck and Demirgüç-Kunt, 2006). However, tax obligations are a major restriction for startup investments by venture capitalists and also startup growth (Carroll et al., 2000; Da Rin, Nicodano and Sembenelli, 2006). Our study contributes to the literature by combining data from the Thomson Reuters EIKON database with startups' balance sheet data from the "Bundesanzeiger". Using data on 5,200 startups and 8,251 investment rounds, we complement existing studies which

4.8. CONCLUSION

mainly focus on IPOs or larger public firms.

First, we take a closer look at the relation of startups' loss carry forward disclosed and the investment amount in Germany. We find that before the tax reform, loss carry forwards showed a negative correlation with the investment amount in startups which reverses to positive after the tax reform in Sections 8c/8d KStG in 2017. In 2019, this effect is statistically significant on a 5% level and also relatively large in its absolute size in comparison to the pre-intervention years. One possible reason for this change could be that after the tax reform, investors perceive losses as an intangible financial asset as losses can be offset against profits in future years. In contrast, before 2017, losses were not usable when a certain amount of shares was sold which made losses financially worthless in terms of taxation. As startups rely on external financial sources, the strict limitation of the usage of losses was a financial investment barrier for startups which underscores the high importance of this study investigating the effects of a tax reform on startup investments.

Second, we analyse whether the investment amount in German startups has increased after the tax reform in comparison to a synthetic control group. We use the synthetic control method to compare the development in the investment amount in Germany to a synthetic Germany which consists of comparable European countries. In contrast to our expectations, we do not find a significantly higher increase in the investment amount in startups in real Germany after the tax reform. A possible explanation for this result might be investors' insecurity on the concrete applicability of Section 8d KStG as this section did not consider the different stages in startups' development. Additionally, investors might have anticipated and awaited the final implementation of Section 8c KStG by the German government before undertaking their investments. Existing studies show that investors adjust their activities based on their beliefs in order to take advantage of a possible but uncertain future tax benefit.

When restricting the sample to first round investments, we see an increase in the investment amount in Germany in comparison to synthetic Germany after the implementation of the new Section 8c KStG. This prompt increase in the investment amount after the tax reform in 2019 shows investors' higher risk

appetite. They now value first round investments higher despite the higher risk of losses compared to later-stage investments. Hence, the new Section 8c KStG seems especially beneficial for startups which have not yet taken part in several investment rounds. It underscores the idea that the restrictive treatment of losses before the tax reform had been a major obstacle for early-stage startups to obtain external financing.

With this study, we show that tax policy has a significant influence on the anticipations and decisions of investors which influences startups' access to external financial resources. Our analysis reveals that not every tax reform shows the expected effect if lawmakers do not carefully consider the wording of the tax law and its applicability in practice. Additionally, legal uncertainty through court decisions might drive investors to act more cautiously than ex-ante expected. In an economic environment where old business models are neither profitable nor sustainable anymore, startups can significantly contribute to a renewal of the innovative capability of a country. By developing technological business models and shaping the economic future, startups foster countries' future growth and prosperity. For this reason, further research should investigate which tools in tax policy-making are suitable to create legal frameworks promoting startup investments.

4.A Appendix

4.A.1 Further Examples for Issuance of Shares

Figure 4.A.1: Example on the Effects of the Tax Reform in the Sections 8c/8d KStG if the Startup issues New Shares (instead of a sale of shares)

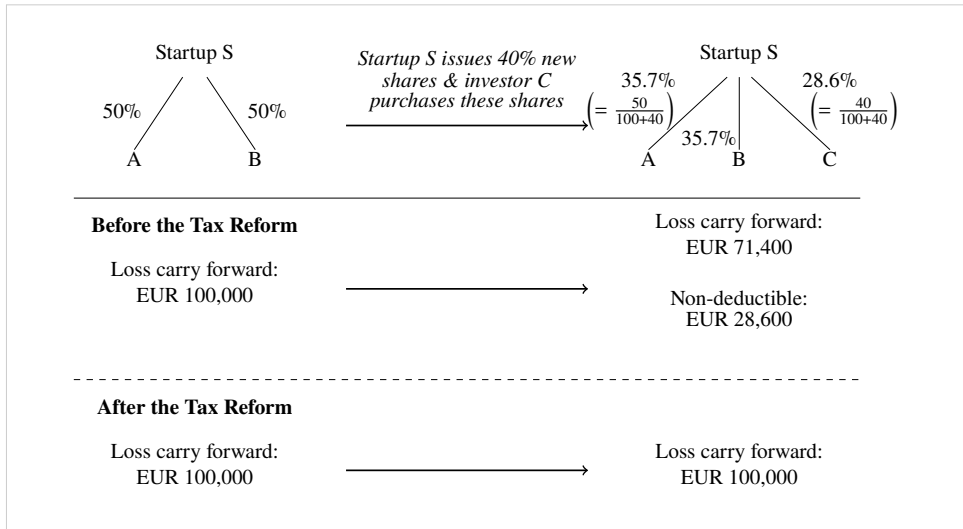
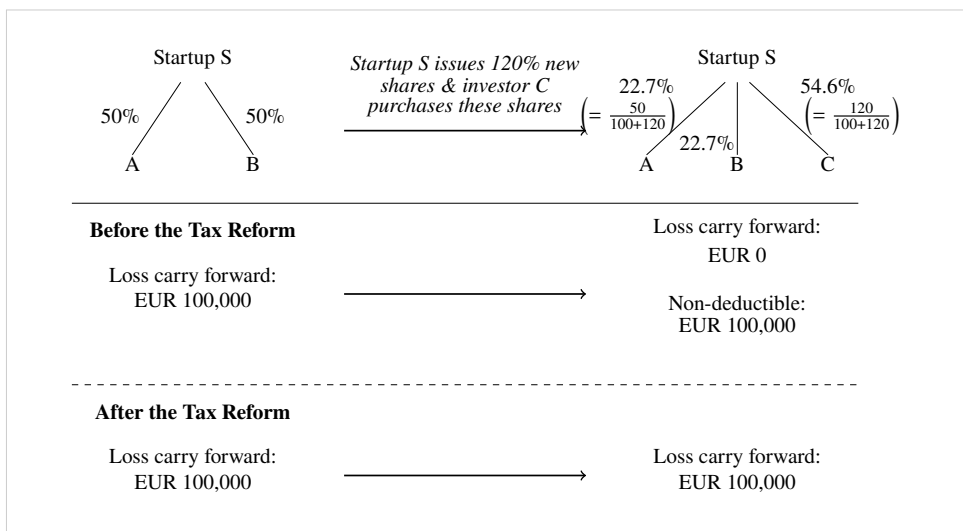


Figure 4.A.2: Example 2 on the Effects of the Tax Reform in the Sections 8c/8d KStG if the Startup issues New Shares (instead of a Sale of Shares) and if Section 8d KStG applies²⁵



4.A.2 Derivation of the Creation of the Synthetic Control Group

This part displays the technique used for creating the synthetic control group. It is adapted from (Abadie and Gardeazabal, 2003; Abadie, Diamond and Hainmueller, 2010; Abadie, 2021). For a definition on the variables, see table 4.A.4 of the appendix.

A synthetic control group is defined as the weighted average of the units in the donor pool which matches the development of the dependent variable the best before the intervention event so that any difference thereafter can be led back to the intervention itself. In this study, the synthetic control group describes a weighted average of eight European countries which matches the development of the investment sum in Germany before the tax reform the best. In turn, we can lead back the difference between the development of the investment sum in real Germany (with the tax reform) versus synthetic Germany (simulated Germany without the tax reform) after the intervention event to the tax reform itself.

In order to compare the development of the investment sum in German startups after the reform, countries are matched based on certain control variables.

Let \mathbf{X}_1 be a (14 x 1) vector containing the values for each macroeconomic variable (GDP and inflation, the effective average tax rate, domestic credit to the private sector, countries' economic freedom, venture capital availability, capacity for innovation, entrepreneurs' fear of failure and their perceived opportunities) throughout the pre-intervention periods as well as the values of the dependent variable $\ln(InvestmentAmount)$ for the years 2010, 2013, 2014, 2015 and 2016 for Germany. Each macroeconomic variable is averaged over the entire pre-observation period (2010-2016) and thus included once within the vector \mathbf{X}_1 . To include former periods of the dependent variable in the vector \mathbf{X}_1 controls for the fact that no structural or country-level differences exist prior to the intervention event.

²⁵If Section 8d KStG does not apply at all or does not apply anymore, the loss carry forward of 100,000 Euro is completely lost.

4.A. APPENDIX

\mathbf{X}_0 describes a (14 x 8) matrix containing the values for the same variables as contained in \mathbf{X}_1 for the eight potential control countries (Finland, France, Ireland, Italy, Netherlands, Sweden, Switzerland and United Kingdom).

\mathbf{W} describes a (8 x 1) vector of weights for the countries within the synthetic control group.

Then, $(\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W})$ describes a vector containing the differences between Germany and its synthetic counterpart for the given variables before the intervention event. This difference is aimed to be minimised with respect to the countries' weights \mathbf{W} . Thus, the optimization problem to solve is

$$\min_{\mathbf{w}} (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W})' \mathbf{V} (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W})$$

Subject to $\mathbf{w}_j \geq \mathbf{0}$ and $\sum_{j=1}^8 \mathbf{w}_j = \mathbf{1}$ to avoid extrapolation (with \mathbf{j} being a running number for the eight potential control countries).

The optimal vector of weights \mathbf{W}^* depends on the matrix \mathbf{V} . It gives higher weights to variables with a larger predictive power for the dependent variable $\ln(InvestmentAmount)$. \mathbf{V} is a diagonal positive semidefinite matrix such that the mean squared prediction error of the dependent variable $\ln(InvestmentAmount)$ is minimised within the pre-treatment periods.

Let \mathbf{Z}_1 be a (7 x 1) vector containing the $\ln(InvestmentAmount)$ for Germany during the pre-intervention period 2010-2016. Let \mathbf{Z}_0 be a similar (7 x 8) matrix containing the values for the same variable for the eight potential control countries before the intervention event. The optimisation problem to solve is

$$\min_{\mathbf{v}} (\mathbf{Z}_1 - \mathbf{Z}_0 * \mathbf{W}(\mathbf{V}))' (\mathbf{Z}_1 - \mathbf{Z}_0 * \mathbf{W}(\mathbf{V}))$$

Subject to $\mathbf{v}_i \geq \mathbf{0}$ and $\sum_{i=1}^{14} \mathbf{v}_i = \mathbf{1}$ (with i being a running number for the macroeconomic and other control variables). $\mathbf{V} \in \mathbf{v}$ is a set of all non-negative diagonal (14 x 14) matrices containing the weights on the diagonal which fulfill the minimisation problem.

The weights for the countries in the synthetic control group for Germany (depending on \mathbf{V}) are then given by

$$\mathbf{W}^*(\mathbf{V}) = \arg \min_{\mathbf{w}} (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W})' \mathbf{V} (\mathbf{X}_1 - \mathbf{X}_0 * \mathbf{W})$$

Restricting the synthetic control weights to be non-negative and summing up to one generates synthetic controls that are weighted averages of the outcomes of units in the donor pool with weights that are typically sparse. This implies that only a small number of units in the donor pool contribute to the estimate of the counterfactual (in our case, synthetic Germany). However, these estimates are particularly transparent. It is in line with the findings by Sharpe (1999) on the optimal portfolio composition.

The weights for the macroeconomic variables and other control variables are then given by

$$\mathbf{V}^* = \arg \min_{\mathbf{v}} (\mathbf{Z}_1 - \mathbf{Z}_0 * \mathbf{W}^*(\mathbf{V}))' (\mathbf{Z}_1 - \mathbf{Z}_0 * \mathbf{W}^*(\mathbf{V}))$$

describes the weights of the (macroeconomic and other) variables in \mathbf{X}_0 and \mathbf{X}_1 . The weights for the countries are then given by $\mathbf{W}^*(\mathbf{V}^*)$ and the difference between the real development of the investment sum in Germany (with the tax reform) and the development in synthetic Germany (without the tax reform) can be calculated by

$$\hat{\tau}_t = \mathbf{Z}_1 - \mathbf{W} * \mathbf{Z}_0$$

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4.A.3 Matrices

For this study, the matrices look as follows:

$$X_1 = \begin{bmatrix} GDP_{DE} \\ Inflation_{DE} \\ Domestic\ credit_{DE} \\ EATR_{DE} \\ Economic\ freedom_{DE} \\ VC\ availability_{DE} \\ Capacity\ for\ innovation_{DE} \\ Fear\ of\ failure_{DE} \\ Perceived\ opportunities_{DE} \\ \\ ln(InvAm)_{DE,2010} \\ ln(InvAm)_{DE,2013} \\ ln(InvAm)_{DE,2014} \\ ln(InvAm)_{DE,2015} \\ ln(InvAm)_{DE,2016} \end{bmatrix}$$

$$X_0 = \begin{bmatrix} GDP_{FI} & GDP_{FR} & GDP_{IE} & GDP_{IT} & GDP_{NL} & GDP_{SE} & GDP_{CH} & GDP_{UK} \\ Inflation_{FI} & Inflation_{FR} & Inflation_{IE} & Inflation_{IT} & Inflation_{NL} & Inflation_{SE} & Inflation_{CH} & Inflation_{UK} \\ Domestic\ credit_{FI} & Domestic\ credit_{FR} & Domestic\ credit_{IE} & Domestic\ credit_{IT} & Domestic\ credit_{NL} & Domestic\ credit_{SE} & Domestic\ credit_{CH} & Domestic\ credit_{UK} \\ EATR_{FI} & EATR_{FR} & EATR_{IE} & EATR_{IT} & EATR_{NL} & EATR_{SE} & EATR_{CH} & EATR_{UK} \\ Economic\ freedom_{FI} & Economic\ freedom_{FR} & Economic\ freedom_{IE} & Economic\ freedom_{IT} & Economic\ freedom_{NL} & Economic\ freedom_{SE} & Economic\ freedom_{CH} & Economic\ freedom_{UK} \\ VC & VC & VC & VC & VC & VC & VC & VC \\ availability_{FI} & availability_{FR} & availability_{IE} & availability_{IT} & availability_{NL} & availability_{SE} & availability_{CH} & availability_{UK} \\ Capacity\ for\ innovation_{FI} & Capacity\ for\ innovation_{FR} & Capacity\ for\ innovation_{IE} & Capacity\ for\ innovation_{IT} & Capacity\ for\ innovation_{NL} & Capacity\ for\ innovation_{SE} & Capacity\ for\ innovation_{CH} & Capacity\ for\ innovation_{UK} \\ Fear\ of\ failure_{FI} & Fear\ of\ failure_{FR} & Fear\ of\ failure_{IE} & Fear\ of\ failure_{IT} & Fear\ of\ failure_{NL} & Fear\ of\ failure_{SE} & Fear\ of\ failure_{CH} & Fear\ of\ failure_{UK} \\ Perceived\ opportunities_{FI} & Perceived\ opportunities_{FR} & Perceived\ opportunities_{IE} & Perceived\ opportunities_{IT} & Perceived\ opportunities_{NL} & Perceived\ opportunities_{SE} & Perceived\ opportunities_{CH} & Perceived\ opportunities_{UK} \\ ln(InvAm)_{FI,2010} & ln(InvAm)_{FR,2010} & ln(InvAm)_{IE,2010} & ln(InvAm)_{IT,2010} & ln(InvAm)_{NL,2010} & ln(InvAm)_{SE,2010} & ln(InvAm)_{CH,2010} & ln(InvAm)_{UK,2010} \\ ln(InvAm)_{FI,2013} & ln(InvAm)_{FR,2013} & ln(InvAm)_{IE,2013} & ln(InvAm)_{IT,2013} & ln(InvAm)_{NL,2013} & ln(InvAm)_{SE,2013} & ln(InvAm)_{CH,2013} & ln(InvAm)_{UK,2013} \\ ln(InvAm)_{FI,2014} & ln(InvAm)_{FR,2014} & ln(InvAm)_{IE,2014} & ln(InvAm)_{IT,2014} & ln(InvAm)_{NL,2014} & ln(InvAm)_{SE,2014} & ln(InvAm)_{CH,2014} & ln(InvAm)_{UK,2014} \\ ln(InvAm)_{FI,2015} & ln(InvAm)_{FR,2015} & ln(InvAm)_{IE,2015} & ln(InvAm)_{IT,2015} & ln(InvAm)_{NL,2015} & ln(InvAm)_{SE,2015} & ln(InvAm)_{CH,2015} & ln(InvAm)_{UK,2015} \\ ln(InvAm)_{FI,2016} & ln(InvAm)_{FR,2016} & ln(InvAm)_{IE,2016} & ln(InvAm)_{IT,2016} & ln(InvAm)_{NL,2016} & ln(InvAm)_{SE,2016} & ln(InvAm)_{CH,2016} & ln(InvAm)_{UK,2016} \end{bmatrix}$$

$$W = \begin{bmatrix} w_{FI} \\ w_{FR} \\ w_{IE} \\ w_{IT} \\ w_{NL} \\ w_{SE} \\ w_{CH} \\ w_{UK} \end{bmatrix}$$

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$$V = \begin{bmatrix} v_{GDP} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & v_{Inflation} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & v_{Dom.cred} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & v_{EATR} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & v_{Econ.freedom} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & v_{VCavald.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & v_{Cap.f.innov.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Failure} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Opp.} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Inv.Am.2010} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Inv.Am.2013} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Inv.Am.2014} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Inv.Am.2015} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Inv.Am.2016} \end{bmatrix}$$

$$Z_1 = \begin{bmatrix} \ln(Investment\ Amount)_{DE,2010} \\ \ln(Investment\ Amount)_{DE,2011} \\ \ln(Investment\ Amount)_{DE,2012} \\ \ln(Investment\ Amount)_{DE,2013} \\ \ln(Investment\ Amount)_{DE,2014} \\ \ln(Investment\ Amount)_{DE,2015} \\ \ln(Investment\ Amount)_{DE,2016} \end{bmatrix}$$

$$Z_0 = \begin{bmatrix} \ln(InvAm)_{FI,2010} & \ln(InvAm)_{FR,2010} & \ln(InvAm)_{IE,2010} & \ln(InvAm)_{IT,2010} & \ln(InvAm)_{NL,2010} & \ln(InvAm)_{SE,2010} & \ln(InvAm)_{CH,2010} & \ln(InvAm)_{UK,2010} \\ \ln(InvAm)_{FI,2011} & \ln(InvAm)_{FR,2011} & \ln(InvAm)_{IE,2011} & \ln(InvAm)_{IT,2011} & \ln(InvAm)_{NL,2011} & \ln(InvAm)_{SE,2011} & \ln(InvAm)_{CH,2011} & \ln(InvAm)_{UK,2011} \\ \ln(InvAm)_{FI,2012} & \ln(InvAm)_{FR,2012} & \ln(InvAm)_{IE,2012} & \ln(InvAm)_{IT,2012} & \ln(InvAm)_{NL,2012} & \ln(InvAm)_{SE,2012} & \ln(InvAm)_{CH,2012} & \ln(InvAm)_{UK,2012} \\ \ln(InvAm)_{FI,2013} & \ln(InvAm)_{FR,2013} & \ln(InvAm)_{IE,2013} & \ln(InvAm)_{IT,2013} & \ln(InvAm)_{NL,2013} & \ln(InvAm)_{SE,2013} & \ln(InvAm)_{CH,2013} & \ln(InvAm)_{UK,2013} \\ \ln(InvAm)_{FI,2014} & \ln(InvAm)_{FR,2014} & \ln(InvAm)_{IE,2014} & \ln(InvAm)_{IT,2014} & \ln(InvAm)_{NL,2014} & \ln(InvAm)_{SE,2014} & \ln(InvAm)_{CH,2014} & \ln(InvAm)_{UK,2014} \\ \ln(InvAm)_{FI,2015} & \ln(InvAm)_{FR,2015} & \ln(InvAm)_{IE,2015} & \ln(InvAm)_{IT,2015} & \ln(InvAm)_{NL,2015} & \ln(InvAm)_{SE,2015} & \ln(InvAm)_{CH,2015} & \ln(InvAm)_{UK,2015} \\ \ln(InvAm)_{FI,2016} & \ln(InvAm)_{FR,2016} & \ln(InvAm)_{IE,2016} & \ln(InvAm)_{IT,2016} & \ln(InvAm)_{NL,2016} & \ln(InvAm)_{SE,2016} & \ln(InvAm)_{CH,2016} & \ln(InvAm)_{UK,2016} \end{bmatrix}$$

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4.A.4 Further Information about the Investment Amount

Table 4.A.1: Investment Amount in Real and Synthetic Germany between 2010 and 2019

	(1)		(2)		(3)		(4)	
	Real Germany	Synthetic Germany	Real Germany	Synthetic Germany	Real Germany	Synthetic Germany	Real Germany	Synthetic Germany
2010	19.85	20.17	18.51	18.76	33.20	41.94	42.86	51.97
2011	19.97	20.00	19.07	18.91	27.24	41.73	39.43	54.96
2012	20.34	20.31	18.56	18.67	39.04	38.28	40.35	52.16
2013	20.06	20.07	18.52	18.49	35.19	35.54	45.92	53.00
2014	20.97	20.88	19.11	19.09	42.27	50.55	50.44	53.54
2015	21.45	21.07	19.32	19.10	48.64	55.64	39.25	53.59
2016	21.04	21.10	19.33	19.40	43.11	46.74	48.37	51.89
2017	21.27	21.43	19.50	19.72	46.01	52.11	45.45	51.47
2018	21.29	21.22	19.02	19.97	53.45	43.43	54.89	55.05
2019	21.69	21.86	20.20	20.01	57.55	55.64	50.52	51.67

This table displays information for real and synthetic Germany. (1) corresponds to figure 4.5.2 and describes the natural logarithm of the total absolute investment amount (independent of the investment round). (2) corresponds to figure 4.5.3 and describes the natural logarithm of the total absolute investment amount in the first investment round. (3) corresponds to figure 4.6.1 and describes the share of foreign investors of all investors (in percent of investors). (4) corresponds to figure 4.6.2 and describes the share of IVC investors of all investors (in percent of investors).

4.A.5 Further Information about the Placebo Studies

Table 4.A.2: Placebo Study Full Sample

Year	Finland	France	Germany	Ireland	Italy	Netherlands	Sweden	Switzerland	United Kingdom
2010	-0.42	0.29	-0.46	0.29	-2.72	-0.49	1.01	-0.27	0.83
2011	0.41	0.08	-0.14	-0.11	-1.28	-0.29	0.07	-0.21	0.75
2012	-0.03	-0.06	0.03	-0.44	-1.51	0.29	-0.19	-0.06	0.98
2013	0.83	0.25	-0.10	0.02	-3.16	-0.21	-0.43	0.34	0.72
2014	-0.76	-0.37	0.28	0.02	-2.66	0.44	0.23	-0.03	1.22
2015	0.21	-0.01	0.37	0.14	-2.81	0.03	-0.34	0.06	0.99
2016	-0.53	-0.35	-0.10	-0.01	-0.21	-0.41	-0.35	0.16	0.98
2017	-0.16	-0.62	-0.03	-0.92	-0.81	-0.47	-0.63	1.14	1.23
2018	-0.18	-0.28	0.02	-0.44	-0.99	-0.97	0.15	0.70	0.97
2019	0.23	-0.27	-0.16	-1.23	-0.75	-0.54	-0.27	1.01	0.97

This table displays information on the differences between the real development in the respective country and the development of its synthetic control group. I.e., it shows for each country: $\ln(InvestmentAmount)_{treated} - \ln(InvestmentAmount)_{synthetic}$. This table corresponds to figure 4.6.3 and describes the difference of the natural logarithm of the total absolute investment amount in the treated minus the synthetic country.

Table 4.A.3: Placebo Study First Investment Round

Year	Finland	France	Germany	Ireland	Italy	Nether-lands	Sweden	Switzer-land	United King- dom
2010	0.80	0.36	-0.18	0.38	-1.34	-0.24	0.02	-0.38	0.50
2011	0.99	0.12	0.17	0.74	-0.74	-1.22	-0.16	0.13	0.51
2012	0.12	0.32	-0.11	-0.89	0.26	-0.25	-0.18	-0.24	0.75
2013	-0.26	-0.09	0.00	0.06	-1.40	0.02	0.06	0.22	0.81
2014	-0.70	-0.46	-0.17	-1.34	-1.00	0.20	0.62	0.37	1.31
2015	-0.01	-0.19	0.35	0.12	-1.13	0.26	-0.35	-0.24	1.14
2016	-0.29	0.44	-0.09	0.63	-1.42	0.19	-0.41	0.23	0.19
2017	-0.76	0.41	-0.73	-2.21	1.37	-0.01	-1.03	1.67	0.19
2018	-0.07	-0.16	-0.96	-0.54	0.48	-0.45	-0.40	0.14	0.87
2019	0.76	-0.39	-0.01	0.27	0.04	-1.92	-0.78	1.34	1.01

This table displays information on the differences between the real development in the respective country and the development of its synthetic control group. I.e., it shows for each country: $\ln(InvestmentAmount)_{treated} - \ln(InvestmentAmount)_{synthetic}$. This table corresponds to figure 4.6.4 and describes the difference of the natural logarithm of the total absolute investment amount in the treated minus the synthetic country for all first investment rounds.

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4.A.6 Variable Definitions

Table 4.A.4: Variable Definitions

<i>Startup Level</i>	
Variable	Definition
$\ln(\text{AgeAtFinancing})$	Variable for measuring startups' maturity. It is measured in months since startups' foundation. This variable is extracted from the Thomson Reuters EIKON database. The natural logarithm serves for dealing with outliers and not giving them too much weight in the regression analyses.
$\ln(\text{EquityCapital})$	Variable for measuring startups' internal financial endowment. Equity capital describes the capital that a company receives from selling shares to investors. It is extracted from the startups' balance sheets. The natural logarithm serves for dealing with outliers and not giving them too much weight in the regression analyses.
$\ln(\text{InvestmentAmount})$	Variable for measuring the sum of how much financial resources investors provide to startups. It is extracted from the Thomson Reuters EIKON database (variable "equity raised"). The natural logarithm serves for dealing with outliers.
InvestmentRoundNumber	Variable for measuring startups' past performance and risk of investment. It is measured in integers starting with 1. This variable is extracted from the Thomson Reuters EIKON database.
$\ln(\text{LossCarryForward})$	Variable for measuring startups' loss carry forward disclosed. It is extracted from the startups' balance sheets as the loss carry forward is a position in the startups' balance sheets if they faced losses in the past. Section 8 (1) KStG in conjunction with Section 10d (2) EStG allows to transmit losses to future years to decrease earnings, and thus tax payments. The natural logarithm serves for dealing with outliers.
$\ln(\text{TotalAssets})$	Variable for measuring startup size. Total assets describe the sum of fixed assets and current assets. It is extracted from the startups' balance sheets. The natural logarithm serves for dealing with outliers.

Macroeconomic Level	
Variable	Definition
Capacity for Innovation	Variable for measuring countries' capability to innovate. It includes the categories "diversity and collaboration", "research and development" and "commercialisation". This variable is based on an Executive Opinion Survey by the World Economic Forum and is scaled from 1 to 7, with one denoting very low approval and 7 denoting very high approval regarding the statement. The variable is retrieved from the World Competitiveness Index by the World Economic Forum.
Effective Average Tax Rate	Variable for measuring the average tax burden of an investment project. It ranges from 0 to 1, with the decimals corresponding to tax rates in percentage terms. The variable is retrieved from Steinmueller et al. (2019).
GDP	Variable for measuring the GDP per capita in (current) USD. It is retrieved from the World Bank Database (Variable Code NY.GDP.PCAP.CD).
Domestic Credit to the Private Sector	Variable for measuring the financial resources which are provided to the private sector by financial corporations (through loans, purchases of non-equity securities, trade credits and other accounts receivable). It is measured in percentage of the country's GDP. The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations. It is retrieved from the World Bank Database (Variable Code FS.AST.PRVT.GD.ZS).
Economic Freedom	Variable for measuring countries' overall economic freedom with an index ranging from 0 to 100, where 0 denotes virtually no economic freedom and 100 denotes the highest economic freedom possible. The index is composed of equally weighted scores for rule of law, government size, regulatory efficiency and market openness and is retrieved from the Heritage Foundation.
Inflation	Variable for measuring the annual growth rate of the GDP implicit deflator in percent and indicates the rate of price change in the economy. The variable is retrieved from the World Bank Database (Variable Code NY.GDP.DEFL.KD.ZG).
Perceived Opportunities	Variable for measuring the percentage of the population between 18 and 64 years that agrees to see good opportunities to start a business in the area where they live. It is retrieved from the Global Entrepreneurship Monitor.
Fear of Failure	Variable for measuring the percentage of the population between 18 and 64 years that agrees that they see good opportunities but would not start a business for fear it might fail. It is retrieved from the Global Entrepreneurship Monitor.
Venture Capital Availability	Variable for measuring the difficulty of obtaining equity funding for start-up entrepreneurs with innovative but risky projects on a scale from 1 to 7, where 1 denotes "extremely difficult" and 7 denotes "extremely easy". This variable is based on an Executive Opinion Survey by the World Economic Forum and retrieved from the World Competitiveness Index by the World Economic Forum.

This table displays the definitions of all explanatory, dependent and control variables included in the foregoing analysis.

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4.A.7 Tax Law Changes in Other Countries

Table 4.A.5: Tax Law Changes in other European Countries

Country	Tax Law Change	Year	Reference
Belgium	Fundamental reform of Belgian corporate law	2019	Imfeld, G. 2019. Grundlegende Reform des belgischen Gesellschaftsrechts. https://www.daniel-hagelskamp.de/standpunkte/grundlegende-reform-des-belgischen-gesellschaftsrechts . Accessed 25.03.2021.
	Reduction of the corporate tax rate from 33% to 29% (fiscal year 2019) and 25% (fiscal year 2021); reduced tax rate of 20% on the first 100,000 Euro of taxable profit of SMEs, as well as other tax benefits	2019	Ebner Stolz 2018. Belgien: Reform der Körperschaftsteuer. https://www.ebnerstolz.de/de/belgien-reform-koerperschaftsteuer-161767.html . Accessed 25.03.2021.
Finland	Reform of corporate tax system: Increased taxation of dividends	2005	Kari, S., Karikallio, H., Pirtillä, J. 2008. Anticipating Tax Changes: Evidence from the Finnish Corporate Income Tax Reform of 2005. CESifo Working Paper No. 2201.
France	Reduction in corporate tax rate (no change for small companies)	2019	Ebner Stolz 2018. Frankreich: Senkung des Körperschaftsteuersatzes. https://www.ebnerstolz.de/de/frankreich-senkt-koerperschaftsteuersatz-161400.html . Accessed 25.03.2021.
	Simplified company foundation starting 2021; reform of inheritance tax; new regulations on the appointment of auditors/ (certified public) accountants	2019	Rejano L., Kühl, C., Tresarrieu, L.-A. 2019. Newsletter 3.19 Französisches Wirtschaftsrecht: I. Gesellschaftsrecht. https://www.qivive.com/sites/default/files/NL%2003.19%20franzoesisches%20Wirtschaftsrecht.pdf . Accessed 25.03.2021.
	Increase of the tax rate for high income level	2012	AFP, dpa, Reuters 2012. Frankreichs Sozialisten kassieren bei Millionären. https://www.zeit.de/politik/ausland/2012-07/frankreich-vermoegensteuer-mehrwertsteuer . Accessed 25.03.2021.
(Republic of) Ireland	Fundamental reform of Irish corporate law	2015	Friedrich Graf von Westphalen & Partner mbB 2015. Neues Gesellschaftsrecht in Irland. https://www.fgvw.de/neues/archiv-2015/neues-gesellschaftsrecht-in-irland#:~:text=Mit%20dem%20Inkrafttreten%20des%20irischen,den%20irischen%20gesellschaftsrechtlichen%20Rahmen%20bilden . Accessed 25.03.2021.
Italy	Increase in tax deductions for startup investments (based on the startuup law of 2012)	2017	Schindelhelm. Schindhelm. Steuerliche Erleichterungen für innovative Startup-Unternehmen. https://it.schindhelm.com/news-jusful/news/steuerliche-erleichterungen-fuer-innovative-startup-unternehmen . Accessed 25.03.2021.
	Elimination of the annual payment to the Chamber of Commerce and other administrative fees for startups	2014	EBAN 2017. Compendium of Fiscal Incentives: Tax Outlook in Europe 2017 - Business Angels Perspective.
	Fundamental reform of Italian corporate law, in particular concerning corporations (including substantial redesign of the s.r.l., amendment of applicable company agreements as well as effects under commercial and accounting law)	2004	Buenger, F. 2004. Die Reform des italienischen Gesellschaftsrechts. Recht der internationalen Wirtschaft, 249.

Netherlands	Amendment of the Dutch law on limited liability companies (B.V.)	2012	Germany Trade & Invest. Gesellschaftsformen. https://www.gtai.de/gtai-de/trade/recht/portal-21/niederlande/gesellschaftsformen-92494 . Accessed 25.03.2021.
Sweden	-	-	-
Switzerland	Reform of corporate tax law; No preferential treatment for MNCs and reduced tax rates starting 2020	2019	De Hoon, I. 2019. Switzerland will adopt new corporate tax rules. https://nomoretax.eu/switzerland-new-corporate-tax/ . Accessed 25.03.2021.
	Fundamental reform of Swiss corporate law	2008	Senn, S., Betschart, M. 2008. Schweizerisches Gesellschaftsrecht: Reform zum 1.1.08 in Kraft getreten. https://www.iww.de/pistb/archiv/schweiz-schweizerisches-gesellschaftsrecht-reform-zum-1108-in-kraft-getreten-f43492 . Accessed 25.03.2021.
United Kingdom	-	-	-

4.A.8 Corporate Legal Forms in Other Countries

Table 4.A.6: Corporate Legal Forms in other European Countries and their German Equivalents

<i>Country</i>	<i>Legal Form in the Country</i>	<i>Most Similar to the German Legal Form</i>	<i>Theoretical Applicability of Sections 1, 8c, 8d KStG</i>
Belgium	yksityinen osakeyhtiö/privat aktiebolag (oy)	AG / GmbH	Yes
	julkinen osakeyhtiö/publikt aktiebolag (oyj)	AG	Yes
	Kommandittiyhtiö	KG	No
	Avoim Ightiö	OHG	No
France	Société à responsabilité limitée (S.A.R.L.)	GmbH	Yes
	Société anonyme (S.A.)	AG	Yes
	Société par actions simplifiée (S.A.S.)	AG	Yes
	Société en commandite simple (SCS)	KG	No
	Société en commandite par actions (SCA)	KGaA	Yes
	Société en nom collectif (SNC)	OHG	No
	Société civile (SC)	GbR	No
	Entreprise Unipersonnelle à Responsabilité Limitée (E.U.R.L.)	GmbH	Yes
	Entrepreneur individuel à responsabilité limitée (E.I.R.L.)	e.K. (with limited liability)	Yes

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(Republic of) Ireland	Private Company Limited by Shares (LTD) / Teoranta (TEO)	GmbH	Yes
	Company Limited by Guarantee (CLG) / Cuideachta faoi theoraimm ráthaíochta (CTR)	GmbH	Yes
	Designated activity company (DAC) / Cuideachta Ghníomhaíochta Ainmnithe (CGA)	GmbH	Yes
	Public limited company (PLC) / Cuideachta phoiblí theoranta (CPT)	AG	Yes
	Unlimited Company (UC) / Cuideachta neamhtheoranta (CN)	GmbH (with unlimited liability)	Yes
Italy	Società semplice (S.s.)	OHG / KG	No
	Società in nome collettivo (S.n.c.)	OHG	No
	Società in accomandita semplice (S.a.s.)	KG	No
	Società a responsabilità limitata (S.r.l.)	GmbH	Yes
	Società per azioni (S.p.A.)	AG	Yes
	Società a responsabilità limitata semplificata (S.r.l.s.)	GmbH	Yes
	Società a responsabilità limitata a capitale minimo o ridotto (S.r.l.c.r.)	GmbH	Yes
	Società in accomandita per azioni (S.a.p.A.)	AG	Yes
Netherlands	Besloten Vennootschap met beperkte aansprakelijkheid (BV)	GmbH	Yes
	Naamloze Vennootschap (NV)	AG	Yes
	Commanditaire Vennootschap op Andelen (CVoA)	KGaA	Yes
	Commanditaire Vennootschap (CV)	KG	No
	Vennootschap onder Firma (VoF)	OHG	No
	Maatschap	GbR	No
Sweden	publikt Aktiebolag (AB)	AG	Yes
	privat Aktiebolag (AB)	GmbH	Yes
	Handelsbolag (HB)	OHG	No
	Kommanditbolag (KB)	KG	No
	Enkelt bolag	GbR	No
Switzerland	Gesellschaft mit beschränkter Haftung (GmbH)	GmbH	Yes
	Aktiengesellschaft (AG/SA)	AG	Yes
	Kommanditaktiengesellschaft	KGaA	Yes
	Kommanditgesellschaft (KG)	KG	No
	Einfache Gesellschaft	GbR	No
	Kollektivgesellschaft	OHG	No
United Kingdom	Private company limited by shares (Ltd.)	GmbH	Yes
	Public company limited by shares (p.l.c.)	AG	Yes
	Limited Partnership	KG	No
	Partnership	OHG	No
	(Privat) Unlimited company	GbR	No
	Limited Liability Partnership	KG (without general partner)	No

This table displays the different legal forms that firms can be created as in the relevant European countries for this study.

4.A.9 OLS Regressions at Country Level

Table 4.A.7: OLS Regression - Dependent variable is the logarithm of investment amount aggregated at the country level

	<i>OLS</i>
<i>Inflation</i>	-0.107 (0.108)
<i>GDPpc</i>	-2.497 (1.963)
<i>Economic Freedom</i>	0.0686 (0.0975)
<i>RiskFailure</i>	0.000132 (0.0182)
<i>EATR</i>	3.898 (6.135)
<i>Domestic Credit</i>	-0.0118 (0.0123)
<i>France</i>	1.849 (1.088)
<i>Germany</i>	1.324** (0.556)
<i>Ireland</i>	0.111 (0.401)
<i>Italy</i>	-1.206 (0.899)
<i>Netherlands</i>	0.567* (0.259)
<i>Sweden</i>	1.030 (0.813)
<i>Switzerland</i>	2.418 (1.374)
<i>United Kingdom</i>	2.902*** (0.324)
<i>Year effects</i>	Yes
<i>Country effects</i>	Yes
<i>Observations</i>	80
<i>R – squared</i>	0.9076

Robust standard errors are clustered at state-level and are presented in parentheses.

***, ** and * indicate significance at the 1%, 5% and 10% level respectively.

Chapter 5

Conclusion and Outlook

The goal of this dissertation was to provide a better understanding of how different tax policy instruments can impact efficiency and equity of taxation, how firms respond to them, and how taxes influence investments.

Chapter 2 explored different size-dependent tax administrative thresholds in Germany and whether and how firms react to these thresholds. By using the bunching estimation method, the results showed that frictions in tax administrative regulations can cause behavioural responses of firms to bunch below certain thresholds. Additionally, the study could show that there is heterogeneity in firms' bunching responses depending on the design and complexity of the thresholds. Hence, policymakers and tax administrations can influence behavioural firm responses by designing more or less complex thresholds depending on the political and economic intention.

In chapter 3, the self-collected data about tax enforcement in Germany was analysed in order to examine how tax enforcement is implemented in the sub-national states. It was found that audit cycles differ significantly between the German states which might indicate that some states use low audit ratios as a strategic tool for tax competition. However, no consistent evidence was found that the German fiscal equalisation scheme causes a significant difference between states' tax enforcement activities, or that there are differences in states' tax enforcement efforts depending on their government ideologies. Most importantly, by developing a measure of relative tax gains, which has never been done before for German firms, it was shown that smaller firms are less tax compliant than

larger firms and that huge differences between states' tax enforcement activities exist. The findings illustrated that audit cycles and relative tax gains differ significantly between the states and the different company size classes which raises doubts as to whether tax enforcement in Germany fulfills its legal obligations.

In chapter 4, which is joint work with Laura Kristina Uhl, we analysed whether a tax reform led to a significant increase in startup investments in Germany. We exploited the tax reform in Sections 8c/8d KStG which has improved firms' possibilities to carry forward losses and deduct these losses from future profits. By creating a synthetic Germany out of other European countries, we examined whether investments in German startups have increased significantly more than in the synthetic Germany. While we did not find a significant increase in investments for all startups, we could show that especially early-stage startups with their first investment rounds benefit from this tax reform.

In conclusion, this dissertation has shown that tax policy instruments such as tax incentives or size-dependent regulations can impact taxpayers' profit reporting and investment behaviour. Policymakers and tax administrations should be aware that these tax policy instruments can have great impacts on taxpayers' behaviour. Therefore, these tax policy instruments should be designed carefully in order to avoid that unintended frictions occur. Additionally, if policymakers want to foster investments in specific firms, e.g., startups, they should also be aware that firms and investors need reliable and clear tax laws and institutional frameworks. If there is legal uncertainty, tax laws will not have the desired effects since firms and investors might not be able to rely on the application of the tax law. Moreover, if policymakers want to better understand firms' and investors' behaviours, they should further analyse which characteristics of tax policy instruments mainly drive their behavioural responses. The results have shown that tax enforcement activities vary considerably in the different German states. If tax laws are harmonised but sub-national states are responsible for tax collection and enforcement, it might be difficult for lawmakers to guarantee that the principles of taxation are applied equally across the sub-national states. While I refrain from making concrete policy recommendations, the significant differences between states' tax enforcement activities do not guarantee the legal obligation

of tax enforcement in Germany. It depends on the political will and public awareness whether and how policymakers will react to the existing differences that have been illustrated in this work.

My self-collected data has opened avenues for further research about tax enforcement in Germany. Future research should analyse in more detail which parameters influence states' tax enforcement activities and how the existing differences can be levelled out. Ultimately, if policymakers and tax administrations want to analyse in more detail how tax policies affect efficiency and equity of taxation as well as taxpayers' investment behaviours, they should exploit the precious data which tax authorities already have and analyse it scientifically. The foundation of an empirical tax research institute at the Federal Ministry of Finance could be a first step towards a better and scientific use of tax administrative data.¹

¹See "Kleine Anfrage der FDP vom 22.09.2021", <https://www.fdpbt.de/sites/default/files/2021-10/1932541.pdf> (June 9, 2022).

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