THE USE OF TAX HAVENS BY FIRMS IN BUSINESS CLUSTERS

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THESIS SUMMARY

The use of tax havens is pervasive in international business, thereby impacting on the world economy at large. Business clusters also play a prominent role in the value chain and have a significant effect on economic activity. There is empirical evidence suggesting that cluster membership exerts a strong effect on firm internationalisation through access to collaborative networks and resources. However, the effect of business clusters on MNEs' tax haven activity has so far received little academic attention.

This thesis contributes to the understanding of the use of tax havens by firms in business clusters versus their non-cluster counterparts. Employing firm-level data from ORBIS by Bureau van Dijk and regional-level data from Federal Statistical Office of Germany (DESTATIS), this thesis is comprised of three empirical chapters.

The first empirical study is based on firm-level analysis from five countries (Austria, Belgium, France, Germany, and UK) and investigates the use of tax havens by multinational enterprises (MNEs) who are part of a business cluster. This study finds that MNEs who are located in a business cluster are more tax aggressive (via the use of tax havens) than a set of MNEs who are not identified as being part of a business cluster. The chapter provides evidence that knowledge environment is a cluster-specific factor that encourages firms located in business clusters to be more likely than their non-cluster counterparts to undertake tax haven activity. Additional insights suggest that technological sophistication, firm age, and firm size have significant impact on the magnitude of the relationship between MNEs located in business clusters and their tax haven activity.

The second empirical study addresses the impact of local business tax rates on the use of tax havens by German MNEs located in business clusters. The chapter provides evidence that local business tax rates significantly affect the use of tax havens by MNEs. Hence, we are able to conclude that a higher local tax rate is one of the cluster-specific determinants that affect MNEs' tax haven usage. The findings of the chapter also highlight that MNEs who are part of a business cluster are more likely to establish a higher number of foreign subsidiaries in tax havens compared to their non-cluster counterparts. Moreover, industrial agglomeration acts as a moderator to enhance the relationship between local tax rates and the use of tax havens.

The third empirical study focuses on the domestic profit-shifting activities of firms inside Germany. This chapter highlights that firms' profit-shifting activities take place not only internationally but also domestically. The findings reveal a positive relationship between local business tax rates and domestic profit-shifting inside the country. We provide evidence that firms located in high-tax municipalities are likely to establish their subsidiaries in low-tax municipalities. The findings also reveal the moderating effect of some firm-specific covariates that include intangible assets and pre-tax profits on the magnitude of the relationship between local business tax rates and firms' domestic investment relocations

Key words: tax havens, profit-shifting, business clusters, knowledge-spill overs, local business tax rates, tax avoidance, firms' location choices, international finance and taxation.

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PRESENTATIONS AT CONFERENCES

Conferences	Empirical chapters
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Annual meeting Academy of International Business (AIB World), June 2020, Michigan State University (Competitive Session) (Virtual conference due to Covid-19).	The first empirical chapter (Chapter 4)
48th Annual meeting Academy of International Business (AIB-UKI), April 2021, Greenwich University (Competitive Sessions) (Virtual conference due to Covid-19).	The first, second and third empirical chapters (Chapters 4, 5 and 6)
Annual meeting Academy of International Business (AIB-World), June 2021, Michigan State University (Interactive Sessions) (Virtual conference due to Covid-19).	The second and third empirical chapters (Chapters 5 and 6)
81st Annual meeting Academy of Management (AoM), August 2021(Virtual conference due to Covid-19).	The first empirical chapter (Chapter 4)
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BOOK CHAPTER INVITATION

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS

MNEs	Multinational Enterprises
IB	International Business
BvD	Bureau van Dijk
DESTATIS	Federal Statistical Office of Germany
EVA	Economic value added
FDI	Foreign direct investment
GDP	Gross domestic product
GVA	Gross value added
NACE	Statistical classification of economic activities in the European Community
OECD	Organization for Economic Co-operation and Development
PwC	PricewaterhouseCoopers
R&D	Research and Development
UK	United Kingdom
US	United States
UNCTAD	United Nations Conference on Trade and Development
EU	European Union

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Research context

The purpose of this thesis is to investigate the use of tax havens by firms in business clusters versus their non-cluster counterparts. In recent decades, tax havens have become a defining feature of the global financial system (Eden, 1998; Dyreng, Hanlon & Maydew, 2008; Blanco & Rogers, 2011; Barker, Asare & Brickman, 2017). Territories such as Andorra, Bahamas, British Virgin Islands, Bermuda, Cayman Islands, Jordan, and Liechtenstein have become important locations for multinational firms due to their low rates of corporate tax, and a level of secrecy that allows firms to shift profits out of high tax jurisdictions (Eden, 1998). There is significant evidence that a large share of outward foreign direct investment (FDI) is directed towards a small number of specific tax havens and offshore financial centres (Zucman, 2015; Buckley et al., 2015; Tax Justice Network, 2018). Thanks to tax havens, multinational enterprises (MNEs) can use various schemes to avoid paying taxes in countries where they make profits (Eden, 1998), and many of them do so; it is estimated that a third of international trade happens across national boundaries within the same MNEs rather than between separate corporate entities (Tax Justice Network, 2019). According to the Organization for Economic Co-operation and Development (OECD) (2020), around US$ 420 billion in corporate profits is shifted out of 79 countries every year. Recent media coverage of the tax affairs of some of the world's most notable MNEs has led to considerable public concerns. For example, Apple has taken advantage of the difference between the rules in the US and Ireland to establish two subsidiaries in Ireland (Bowers, 2017). By assigning to these two subsidiaries the majority of the company's non-US sales income, the firm has benefitted from huge tax deductions. Amazon offers another example, having created a system of internal transfers that takes advantage of the generous US tax credit system (O'Leary, 2021). By transferring losses from

its international segment back to the US, the company ends up paying very little or no tax. This is against the background of a critical surge in the number of tax abuse cases, highlighting many loopholes in the current corporation tax legislation.

At the same time, business clusters have played an increasing role in the economy, becoming a central feature of many national economies (Porter, 1998; Porter & Miranda, 2009; Staber, 2010; Zamparini & Lurati, 2012; De Propris & Driffield, 2016). The competitive advantages of a specific nation are not evenly distributed across its economy (Porter & Miranda, 2009). Business clusters act as economic hubs that extensively promote regional and national growth (Almeida & Kogut, 1999; Bottazzi & Gragnolati, 2015; McDonald el al., 2018; Du & Vanino, 2020). For example, the UK has a number of major business clusters, as seen in industries such as the financial services in London and Edinburgh; chemicals in Liverpool and Preston; oil and gas in Aberdeen; aerospace in Bristol, South Gloucestershire, and Taunton; high-tech/ICT in Bristol and Bath; pharmaceuticals and biotechnology in Cambridge, Oxford, and London. More importantly, it is well documented that the UK's 31 clusters contain just 8 percent of its businesses but nevertheless contribute 20 percent of the national gross value added (GVA) (Sainsbury, 2014). According to the Office for National Statistics (ONS) (2014), the top 10 clusters in the UK generate approximately £200 billion in GVA to the national economy annually. Moreover, the clusters employ approximately four million people - one in seven of the working population, and offer average salaries that are typically higher than those in the surrounding regions (Sainsbury, 2014). Business clusters constitute a critical mass of economic activity; their investments in research and development (R&D) and business-support institutions enable firms to not only promote their level of productivity (Du & Temouri, 2015), but also enhance their ongoing ability to compete, cooperate, and innovate (Porter, 2000; Du & Vanino, 2020). This makes the cluster regions distinctive in a way that distant rivals can

rarely match. Furthermore, clusters are recognised to be highly attractive locations that draw attention from a large number of companies, especially MNEs (Driffield & Munday, 2000).

Returning to the issue of taxation, the impact of this on business clusters has become more critical (Porter & Miranda, 2009). A relatively large literature reveals that businesses belonging to a cluster gain can significant benefit from the tax breaks or tax exemptions that are implemented by local governments specifically in order to attract firms to their region (Porter, 2000; Porter & Miranda, 2009; Tung & Cho, 2001; Magdalena & Jakub, 2017; Medrano, 2018; Oquero, 2019). This contrasts with recent studies suggesting that the tax rates in business clusters may in fact be higher than elsewhere, due to the excessive economic rents (Hill, 2008; Crabbé & Bruyne, 2013; Ko, Riedel & Böhm, 2013; Fréret & Maguain, 2017; Chen, Li & Liu, 2018). These studies examine different types of local tax rates, including property tax rate (Hill, 2008), local business tax rates (Becker, Egger & Merlo, 2012; Ko, Riedel & Böhm, 2013; Fréret & Maguain, 2017), and effective tax rates (Crabbé & Bruyne, 2013; Chen, Li & Liu, 2018). Overall, they uncover the rent-taxing behaviour by local governments, and the positive effect of agglomeration economies on local tax rates. The conflicting evidence of preferential tax rates accorded to business clusters as revealed by earlier studies highlights the need to better understand the taxation of firms that are part of a business cluster, and these firms' tax behaviours. In addition, a recent working paper by Martin, Parenti, and Toubal (2020) finds that tax avoidance by large corporations has contributed to a 25 percent increase in the concentration of US firms'business activities in specific regions since the mid-1990s. Amdam et al. (2020, p.1) also highlight that clustering creates "insidership" by improving access to knowledge and resources; this provides an impetus that shapes the motivation of firms to internationalise. Therefore, it is important to investigate the potential relationship between firms located in business clusters and their use of tax havens. Academic insight into the tax

behaviour of firms located in business clusters has thus far remained fairly limited, and the evidence of earlier studies is conflicting. We therefore approach the problem in a manner that is distinct from previous studies by exploring the use of tax havens by firms who are located in business clusters, relative to firms who are not.

1.2 Research questions

The research questions we put forward in this thesis are as follows:

1. **Does being located in a business cluster impact upon tax haven use?**

2. **Do local tax rates in business clusters impact on the tax haven activities of MNEs, and if so, to what extent?**

3. **What are the cluster-specific determinants that drive firms to engage in the use of tax havens?**

4. **What are the firm-specific factors that moderate the relationship between business clusters and the use of tax havens by firms?**

5. **Does profit-shifting take place internally via a domestic tax havens network?**

1.3 Brief overview of methodology and data

In order to investigate the research topic, we have conducted three empirical studies that utilise secondary data and econometric analysis. The thesis formulates a number of hypotheses, which are subsequently tested in the empirical analysis on firm-level data from the ORBIS database,

and regional level data derived from the German official statistical office (Statistisches Bundesamt, known as DESTATIS).

ORBIS is a firm-level dataset provided by Bureau van Dijk, a leading electronic publisher of annual accounts information for firms across the globe. It provides a wealth of data on, inter alia, the finance, ownership, and location of firms, from which the datasets in this thesis are derived. DESTATIS is a federal authority of Germany, responsible for collecting, processing, presenting, and analysing statistical information. We draw sub-national level data on local tax rates and regional economic indicators from this database.

In terms of the use of tax havens, we measure a firm's likelihood to use tax havens by using information on the location of subsidiaries owned by each parent company from ORBIS. Thus, we are able to track firms' subsidiaries, including those located in tax havens. For the construction of business clusters, it is important to note that the classification of business clusters has been painstakingly derived from prior knowledge on business clusters gathered from government websites and the literature on business clusters. In particular, we use pre-existing published lists of business clusters from government websites. After that, we base on the definition of a business cluster suggested by Porter (1990, 1998, 2000); Audretsch and Feldman (1996); Porter and Miranda (2009) with two dimensions, including geographical proximity and industrial classification. As a result, we combine the variable location (cities) and the variable industry specialization (NACE industry codes) from ORBIS with business cluster maps and lists we collected from government websites to identify firms who are part of a business cluster and firms who are not.

A host of control variables that are defined as determinants of firms' location decisions and tax haven use are included in our econometric models. Following Jones and Temouri (2016) and Jones, Temouri and Cobham (2018), these determinants are firm-specific (firm age, firm size, technological sophistication, cash flow, long-term debt, etc.). As suggested Markusen (2002); Markusen and Maskus (2002); Navaretti and Venables (2004); Becker, Egger and Merlo, (2020), these determinants are region-specific (employment, population, gross domestic product, economic value added, etc.).

Empirically, our analysis utilises Probit analysis of tax haven dummy variables with marginal effects, Poisson regression of the number of tax haven subsidiaries, instrumental variable models, and multilevel mixed- effect models to test a number of our hypotheses about the use of tax havens by firms in business clusters. In addition, our econometric models include a number of interaction terms to investigate the moderating effects.

1.4 Brief overview of the findings

The first empirical chapter (Chapter 4) is based on data for five OECD countries (Austria, Belgium, Germany, France, and UK). The rationales for this are as follows. First, our choice of countries is based on the availability of all variables that are needed for our analysis; ORBIS covers the location and financial variables of these particular five countries very well. Second, we are able to access the business cluster maps and lists from government websites for these countries; we can thus identify each nation's recognised business clusters. Hence, we are able to use data on geographical proximity (reference cities) and industry classification (NACE industry codes) from ORBIS to classify cluster and non-cluster firms. The unbalanced firm-level dataset contains 50,710 MNE observations during the years 2009-2017. The findings of this chapter indicate that MNEs who are part of a business cluster have 31.0 to 33.9 percent

higher likelihood of engaging in tax haven activity compared to MNEs who are not part of a business cluster. We therefore show evidence that industry clusters generate favourable conditions for knowledge sharing and knowledge spillovers; these are a core driver of tax haven use. Furthermore, we show that firm-specific factors, such as technological sophistication, firm age, and firm size positively moderate the impact of being located in a business cluster.

In the second empirical chapter (Chapter 5), Germany is chosen as the empirical setting. The rationale for this is the huge variation in local business tax rates throughout the country, deriving in part from the autonomy of local authorities to freely set municipal multipliers. The second reason is that a critical rise in money laundering activities has been reported in Germany, increasing pressure on policy makers to take action to create an effective system of tax reform. The unbalanced firm-level dataset for this study holds 31,125 observations over the period 2008-2018. Our first result reveals that local business tax acts as a key driver for MNEs to set up subsidiaries in tax havens. A one percent increase in the municipal business tax rate leads to a 4.97 percent increase in an MNE's number of tax haven subsidiaries. This finding implies that higher local tax rates are one of the characteristics of business clusters that drives MNEs to go offshore via the establishment of tax haven subsidiaries. Furthermore, in the context of Germany, the average local business tax rate that increases the likelihood that an MNE will own tax haven subsidiaries is 11.27 percent (or the municipal multiplier of 322). We then look at the relationship between firms in business clusters and their tax haven use. This chapter's second result confirms that German MNEs who are part of a business cluster have a higher likelihood of owning tax haven subsidiaries than German MNEs who are not part of a business cluster. With regards to the magnitude of the effects, the empirical results indicate that being located in business clusters increases the number of tax haven subsidiaries of an MNE by 10.83 percent on average. Our third result shows that agglomeration effect can

moderate the relationship between local tax rates and MNEs' tax haven use. In particular, the effect of local business tax on the use of tax havens is enhanced by 7.67 percent when a firm is located in a business cluster.

In the third empirical chapter (Chapter 6), we find evidence that profit-shifting does take place within Germany via a network of domestic tax havens. The unbalanced firm-level dataset holds 30,226 observations over the period 2011-2018. In particular, we find that a one percent increase in the local business tax rate leads to a 5.21 to 6.31 percent increase in the likelihood of owning domestic subsidiaries in low-tax municipalities. Furthermore, we highlight that factors such as intangible assets and pre-tax profits can moderate the relationship between local tax rates and firms' domestic profit-shifting activity. In particular, as the level of intangible assets and pre-tax profits rise, their effect on firms in high-tax locations increases steadily, whereas the effect for firms in low-tax locations decreases significantly.

1.5 Research contribution

This thesis closely analyses the relationships between tax havens and business clusters in three empirical chapters to make five important contributions to the international business (IB) literature.

First, we contribute to the existing (limited) number of empirical studies that examine the agglomeration effect on firms' tax haven usage. Few attempts have been made to address the link between tax and agglomeration economies. Chen, Li, and Liu (2018), whose study is one of the notable exceptions to look at the positive and significant relationship between tax rates and agglomeration, admit that one of the limitations in their research is that they do not address the issue of tax avoidance. Using actual tax rates, they argue that tax avoidance could distort

the validity of the underlying tax rate data in their study; they therefore suggest that future research should pay attention to tax avoidance to provide an alternative explanation for the positive relationship between tax and agglomeration. This thesis will be the first work to focus on the effect of business clusters on MNE's tax haven usage to contribute a fuller understanding of the topic of tax avoidance. We also focus our attention on two important cluster-specific factors: (i) knowledge environment via industrial agglomeration, and (ii) higher local tax rates. Thus, we examine the research question related to the characteristics of business clusters that drive firms to engage in the use of tax havens. Our analysis generates a number of fascinating key insights, which will kick-start a debate in this under-researched topic and develop further analysis in this intriguing field.

Second, the findings in this thesis contribute to a number of existing literature gaps. We demonstrate that business clusters have a significant impact on firms' tax haven usage, both internationally and domestically. This association continues to hold while controlling for other important factors that drive tax haven FDI. The thesis empirically highlights that the effect of industry cluster is not homogeneous on all firms. It varies with the degree of firm-specific determinants (technological sophistication, firm age, firm size, intangible assets, and pre-tax profits) and regional factors (local business tax rates). Moreover, our investigation covers various sectors as defined by Eurostar: High technology manufacturing, High/Medium technology manufacturing, Medium/Low technology manufacturing, Low technology manufacturing, Knowledge-intensive services, and Less knowledge-intensive services. This is noteworthy because it allows for the exploration of the effects of different sectors on the use of tax havens by firms.

Third, the extensive literature on business clusters is primarily based on case studies that have discussed at length the internal dynamics and external relationships behind successful clusters around the world (Porter, 2000, 1998, 2000; Nadvi & Schmitz, 1999). Much of the evidence is, however, anecdotal in nature, generally explaining success by one or more key factors. These might be vertical or horizontal cooperation amongst firms, government support, industry–university relationships, or an enhancement in firms' intellectual capital, entrepreneurial drive, knowledge management, and performance (Porter, 1998, 2000). The literature's quantitative evidence for these assertions is rather more limited; a gap that these thesis closes. We construct an agglomeration measure by relying on pre-existing published lists of business clusters from government websites. The lists of business clusters provide information related to cities/ locations where business clusters are identified, and industries in which companies operate. Thereafter, we draw on the cluster literature (Porter, 1990; Audretsch & Feldman, 1996; Porter, 1998; Porter, 2000; Porter & Miranda, 2009) that considers geographical location and industry as two main components that determine whether a firm is part of a business cluster. We then take two variables (reference cities and NACE industry codes) from the firm-level database ORBIS. Reference cities are cities where business clusters are identified from the pre-existing lists. This method can capture the presence of firms who are part of business clusters and distinguish them from their non-cluster counterparts; hence we can quantify the effect of business clusters on the use of tax havens.

Fourth, the unavailability of firm-level data means that most prior work on agglomeration economies is restricted to aggregated data at country level (Garretsen & Peeters, 2007; Hansson & Olofsdotter, 2013), region level (Andersson & Forslid, 2003), or county level (Hill, 2008). Our project utilises a big set of firm-panel data to investigate the effect of business clusters on the use of tax havens by cluster actors and their non-cluster counterparts. The disaggregated

and novel nature of the ORBIS database records can help researchers minimise endogeneity concerns in econometric analysis.

Last but not least, the important findings in this research have significant policy implications, particularly when considering the policy landscape in terms of tax reform. The massive revenues lost to tax avoidance activities highlights the need for further research in this literature strand. Similarly, the propensity of businesses to create clusters remains at the forefront of regional development policies. Business clusters have a significant impact on levels of economic competitiveness, not only within countries but also across national borders (De Propris & Driffield, 2016). Effective policies and procedures for managing and controlling firms in business clusters play an increasingly vital role. Thus, this research highlights how the use of tax havens and business clusters can offer important implications for (i) promoting regional and national growth, (ii) enhancing international tax planning, and (iii) minimising tax avoidance abuses. These contributions are particularly timely, given that governments over the world are striving to tackle international tax avoidance and evasion via improvements to the international tax regime.

1.6 Structure of the thesis

This thesis is structured into 7 chapters as follows:

Chapter 2 gives an overview of the conceptual framework and elaborates on the theory and empirical evidence on the potential link between the use of tax havens and business clusters.

Chapter 3 outlines the data sources, how tax havens and business clusters are measured, and the steps undertaken to construct a panel dataset suitable for this research.

Chapter 4 explores the interplay between the effects of industrial clusters and the likelihood of owning tax haven subsidiaries by MNEs.

Chapter 5 focuses on the central question of whether local tax rates, industrial clusters, and their interaction have significant impact on the tax haven activities of German MNEs.

Chapter 6 investigates whether, and to what extent, higher local tax rates lead to the establishment of domestic subsidiaries in low-tax jurisdictions via a network of domestic tax havens.

Chapter 7 concludes and offers a number of policy-related implications based on the empirical results of the thesis. The limitations of the research are identified, together with suggestions for future research. References and Appendices are provided at the end of the thesis.

CHAPTER 2: BRIEF OVERVIEW OF CONCEPTUAL FRAMEWORK, MAIN THEORETICAL EXPLANATIONS AND EMPIRICAL EVIDENCE

This chapter provides an overview of the two main concepts in this thesis, namely tax havens and business clusters. We will also discuss a selection of theories regarding the use of tax havens and business clusters. As each of the empirical chapters contains its own specific empirical literature review, this chapter briefly explains the overarching theoretical framework utilised in this thesis, reviewing the relevant literature and identifying the gaps in the literature that this research addresses.

2.1 Conceptual framework

2.1.1 Tax havens

Until the 2008 financial crisis, tax havens were generally seen as exotic sideshows to the global economy (Shaxson, 2019). Although tax haven is a well-known expression and frequently used, the term tax haven "lacks a clear definition and its application is often controversial and contested" (Sharman, 2006, p.21). Miranda and Dias (2020) reached the same conclusion that there are no defined criteria that determine whether or not a location is a tax haven.

In terms of economic literature, Hines and Rice (1994, p.175) argue that the lack of a clear definition makes the process of classifying tax havens countries "somewhat arbitrary". The authors propose two main lists of tax havens: dot tax havens (such as Andorra, Bahrain, Grenada, Jordan, Malta) and the Big 7 (which includes Hong Kong, Ireland, Lebanon, Liberia). The dot tax havens are defined as notably small island economies, whereas the Big 7 have sizeable populations and significant economic activity.

Palan, Murphy, and Chavagneux (2010, p.8) devote a whole chapter of their book "Tax Havens: How Globalisation Really Works" to defining tax havens. They summarise their discussion, as follows: "[tax havens are] places or countries that have sufficient autonomy to write their own tax, finance, and other laws and regulations. They all take advantage of this autonomy to create legislation designed to assist non-resident persons or corporations to avoid the regulatory obligations imposed on them in the places where those non-resident people or corporations undertake the substance of their economic transaction." Hence, there are three main characteristics of a tax haven. First, tax havens have zero or close to zero rates of taxation for non-resident companies. Second, most tax havens share an environment of secrecy that allows users of the structures created under local law to do so either completely anonymously, or largely so. However, information about the effect of secrecy is often lacking. The third common characteristic of a tax haven is the ease and affordability of gaining access to the entities incorporated in the territory. That being said, it is challenging to classify jurisdictions using the above definition without specific measures. In addition, different tax haven countries offer different bundles of laws, exemptions, and regulatory practices. These bundles tend to change over time, and the raising of international pressure against tax havens has accelerated these changes.

Looking beyond the economics and economic geography literatures, the term "tax haven" is often used as a synonym for "offshore financial centre" (OFC) and "secrecy jurisdiction"; unsurprisingly, neither of these terms has an accepted definition (Schjelderup, 2016) although the International Monetary Fund (IMF) proposes a specific and measurable definition of offshore financial centre (OFC). It defines an OFC as "a country or jurisdiction that provides financial services to non-residents on a scale that is incommensurate with the size and the financing of its domestic economy" (Zoromé, 2007, p.7). Despite this, there is inconsistency

in the use of the term, with a tendency to exclude important centres such as the City of London (Palan, 1998). Importantly, being a tax haven or an OFC is not an absolute categorisation, but rather a matter of degree. By differentiating between the degrees, jurisdictions can be considered as "conduits" or "sinks" (Garcia-Bernando et al., 2017, p.2). The sinks include "all of the small island countries that attract and retain foreign capital", such as the British Virgin Islands, the Cayman Islands, Cyprus, Bermuda, Mauritius, and Malta (Garcia-Bernando et al., 2017, p.2). The conduits include "countries that are widely perceived as attractive intermediate destinations in the routing of investments" such as the Netherlands and Ireland (Garcia-Bernando et al., 2017, p.2). These jurisdictions typically impose low or nil taxes on the transfer of capital to other countries, whether this be via interest payments, royalties, dividends, or "profit repatriation" (which relies on a well-developed legal system and an extensive network of tax treaties). Hence, to some degree, the sink/conduit distinction mirrors the dot/big tax haven distinction identified by Hines and Rice (1994).

Secrecy jurisdiction is another key synonym for tax haven. The term is defined and promoted by Murphy (2008). A secrecy jurisdiction allows non-residents to utilise favourable features in the jurisdiction's legal framework with confidence that they will not run afoul of the legal system in their place of residence. There are two key characteristics that define a secrecy jurisdiction: (1) "the secrecy jurisdiction creates regulation that they know is primarily of benefit and use to those not resident in their geographical domain" (Murphy, 2008, p.6); and (2) "the creation of a deliberate, and a legally backed, veil of secrecy that ensures that those from outside the jurisdiction taking advantage of its regulation cannot be identified to be doing so" (Murphy, 2008, p.6). The term has increasingly gained use over time. The Tax Justice Network adopts the definition of secrecy jurisdiction, and introduces a number of Financial Secrecy Index (FSI) reports to identify which locations can be used by MNEs to aggressively

avoid tax. The concept of the secrecy jurisdiction relies, above all, on an assessment of what makes the jurisdictions in question attractive. In effect, this indicates a dependence on regulatory arbitrage (potentially, but not necessarily, including tax regulation). The lists of secrecy jurisdictions are normally based on independently verifiable criteria. However, they can be subject to significant political pressure, rendering them liable to bias by including smaller jurisdictions. These various considerations give weight to the argument for using relative measures rather than absolute lists for assessing countries as tax havens.

In reality, profit-shifting, treaty shopping, and 'double Irish with a Dutch sandwich' are among the most common existing practices of tax haven use (Miranda & Dias, 2020). Profit-shifting is a practice where income is reported in a different low-tax jurisdiction, thereby increasing the complexity of company operations and diminishing the transparency of accounting information (Miranda & Dias, 2020). For instance, high-tax jurisdiction corporations can purchase goods or services from low-tax jurisdiction subsidiaries at high prices, triggering high expenses for the high-tax jurisdiction multinationals (Eden, 1998). On the other hand, high-tax jurisdiction MNEs can sell goods or services to subsidiaries in low-tax jurisdictions at cheaper prices, leading to low revenues for MNEs in the high-tax jurisdictions, but high revenues in low-tax jurisdictions (Eden, 1998). Treaty shopping occurs where multinational firms exploit the differences in tax codes from different jurisdictions. Instead of investing directly in the host country, they redirect their investment through a third country to benefit from double tax treaties that may not exist between the host and the investor's country of origin (Miranda & Dias, 2020). These treaties enable multinationals to avoid the double taxation of corporate income and stimulate mutual foreign direct investment, thereby significantly reducing the multinational tax burden. According to Riet and Lejour (2018), treaty shopping leads to a potential decrease of 6 percent of the tax burden in dividend repatriation on average. With

regards to the 'double Irish with a Dutch sandwich' technique, this method relies on the Irish law that establishes that taxation is applied where the firm is functionally managed, not necessarily where it is based (cited in Jones, Temouri & Cobham, 2018). For this, two or more interconnected Irish firms are necessary and one of them must be located in a tax haven country, such as Bermuda or Cayman Island. Profits are sent to an Irish firm, then to a Dutch firm, and finally to a second Irish company headquartered in a tax haven. The tax haven company is classified as a holding that manages the Irish firm, which means that taxation occurs in that tax haven (territorial taxation). The Dutch firm is used as a shield to shift income within the European Union without being subject to tax payments (Lee, 2017). A large number of software companies with intellectual property, such as Apple, Microsoft, and Google, habitually use this technique to minimise taxation by shifting income from a high tax country to a low or nil tax jurisdiction (Chen, Hepfer & Quinn 2018).

2.1.2 Business clusters

The underlying idea of business clusters stems from Marshall (1920) in his Principles of Economics, and it is related to agglomeration economies. Marshall (1920) identified intermediate inputs, a skilled labour force, and technology spillovers as the three key characteristics of agglomeration economies that benefit firms that work near each other. Hence, the concept of business clusters has been given many labels, such as industrial complexes (Czamanski, 1976; Piore & Sabel, 1984), industry clusters (Porter, 1990), regional agglomeration (Krugman, 1991), innovative milieu (Crevoisier, O., & Maillat, 1991), and social networks (Longhi, 1999). Clusters are considered a striking feature of state, territorial, national or jurisdictional economies, that encompass an array of highly skilled employees, suppliers of specialized inputs, channels and customers, better physical infrastructures, governmental and other institutions (Garretsen & Peeters, 2007; Porter & Miranda, 2009). The

role of clusters in the European economy is inevitably significant. It is estimated that there are around 3,000 business clusters in Europe, accounting for nearly 55 million jobs in the region (Bottazzi & Gragnolati, 2015). Strong business clusters have shown resilience since the 2008 economic crisis (Bottazzi & Gragnolati, 2015).

The concept has emerged as a cornerstone of economic development in recent years, generating a vast academic literature and significant interest from academics, politicians, and practitioners (Porter, 1990; Krugman, 1991; Jacobs & Deman, 1996; Hannan & Freeman; 1977; Audretsch & Feldman, 1996; Porter, 1998; Bergman & Feser, 1999; Porter & Miranda, 2001; Baldwin et al., 2001; Porter & Miranda, 2009; Delgado, Porter, & Stern, 2014; Kelchtermans, Neuicu & Teirlinck, 2020; Du & Vanino, 2020; Amdam et al., 2020). However, there appears to be no consistency in the literature when it comes to identifying business clusters, with researchers tending to explore different aspects of business clusters according to their own specific needs and interests (Jacobs & De Man, 1996; Porter, 2000). Jacobs and DeMan (1996, p.428) argue that "there is not one correct definition of the cluster concept...different dimensions are of interest".

Among the relatively early studies, Michael Porter's book "The Competitive Advantage of Nations" (1990) first popularised the concept of industry clusters and many of his ideas have become mainstream in recent decades. Porter (1990, p.30) defined clusters as "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions in a particular field". According to this definition, industry clusters can be defined simply as groups of related industries located in the same region. Thus, the industry cluster consists of two core elements that stress the roles played by the functional dimension and geographical proximity. However, it is very challenging to

develop criteria to identify the functional dimension of a cluster and there is no clear agreement as to the geographical limits of a business cluster. Furthermore, as Boschma (2010, p.64-70) points out, there are different forms of proximity, including cognitive proximity, organisational proximity, and geographical proximity, all of which can exist in clusters (Boschma, 22010, p.64-70). Porter (1990, 2000) also highlights that the geographic scale can take varying forms, depending on the depth and sophistication of its concern.

Jacobs and DeMan (1996) expand Porter's definition of industry clusters to specify the key dimensions that may be used to define them. These include a number of dimensions, such as the geographic or spatial clustering of economic activity, horizontal and vertical relationships among industry sectors, use of common technologies, the presence of a central actor, and the quality of the firm network. Enright (1996, p.191) extends the definition of an industry cluster beyond geographical concentration and explains that "firms are bound together through buyer-supplier relationships, or common technologies, common buyers or distribution channels, or common labour pools".

A further development of Porter's (1998) business cluster definition refers to factor conditions, demand conditions, related industries, and inter-firm rivalry as the drivers of growth in clusters. These favour innovation, competitiveness, and productivity gains at the local level. Porter (2000) extended his concept of business clusters to two types, namely vertically integrated clusters and horizontally integrated clusters. He explains that vertical clusters are made up of backward–forward linkages through buyer–seller relationships, whereas horizontal clusters share a common output market, a given technology, a homogeneously skilled labour force, and the utilisation of similar natural resources as inputs into the production process. Most researchers would broadly recognise a cluster from Porter's (1990, 1998) definition; however,

without specific measures it is hard to identify business clusters with precision (Martin & Sunley, 2003).

In a nutshell, the multidimensionality and vagueness of the concept pose problems for rigorous theoretical and empirical definition, and therefore for methodological investigation also. These shortcomings plague empirical studies in these disciplines. In spite of the interest that clusters have sparked in academics and practitioners alike, the actual concept of clusters remains problematic. Despite this, it has ascended rapidly to the status of orthodoxy.

2.2 Theoretical framework

The pervasiveness of tax haven activities has led to the development of a number of theoretical models. Running parallel to this, the growth of business clusters has given rise to a large variety of theoretical perspectives. In this thesis, we have drawn on traditional tax competition theory, the new economic geography theory, and the knowledge-based theory as our main theoretical underpinnings to explain the assumptions that guide this research. This section first adopts the traditional tax competition theory (Oates, 1972; Wilson, 1991, 1999) to review the tax haven literature from the perspective of the race-to-the-bottom in tax rates. In particular, the theory highlights that all else being equal, firms will move their capital to locations that have low tax rates. The new economic geography theory (Krugman, 1991, 1998; Baldwin & Krugman, 2004; Baldwin et al., 2005) takes a different view, explaining how governments behave strategically when setting capital tax rates and noting that the presence of clusters leads to rent-taxing behaviours by local governments. The theory emphasises the role played by clustering forces in creating an uneven distribution of economic activity across space. Finally, the knowledge-based theory (Grant, 1996; Hoskisson et al., 1999; Maskell, 2001; Wiklund & Shepherd, 2003; Lazzeretti & Cinti, 2006) will be used to explain how firms in business

clusters may respond to policy makers by working together to lower the effective tax rates, such that a tax avoidance industry develops.

2.2.1 Traditional tax competition theory

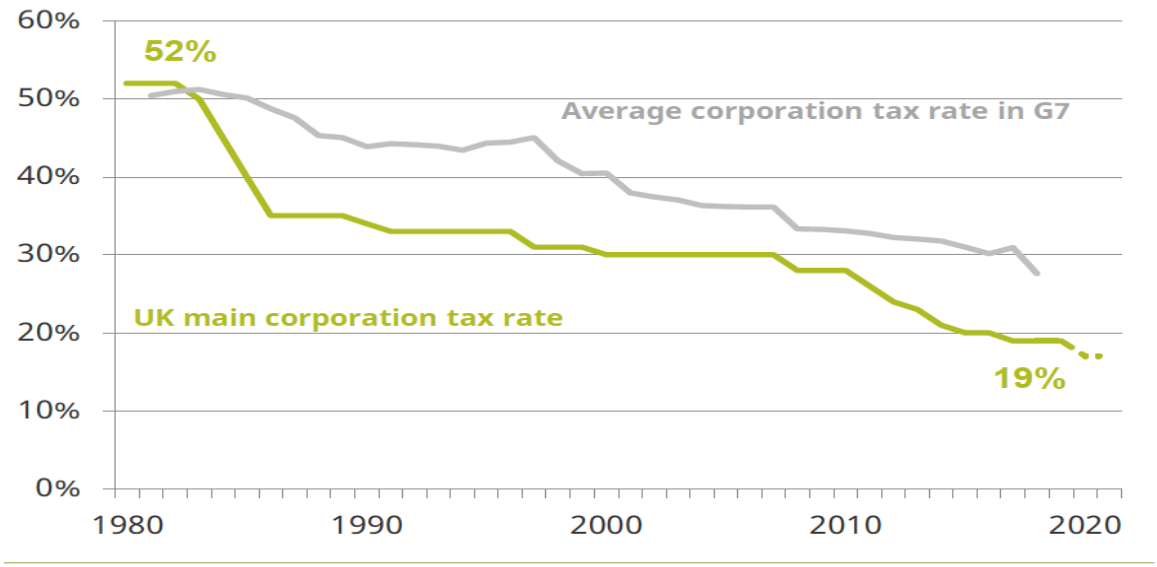
This thesis adopts the traditional tax competition theory as one of the theoretical lenses for explaining firms' location choices, most specifically regarding the relocation of their mobile capital to tax advantaged jurisdictions. The traditional tax competition view goes back to Oates (1972), who proposed that governments start from identical tax rates, which they are then inclined to reduce to attract an inflow of mobile capital. Increases in international capital mobility provide multinational firms with yet more location choices, and this forces governments to offer attractive conditions (Bucovetsky, 1991). In addition, a capital outflow from one country represents a beneficial inflow for other countries, creating positive fiscal externality (Wilson, 2014). This drives tax rates ever lower, leading to a race-to-the-bottom in tax rates among governments.

In an extension to the standard tax competition literature, Wilson (1991) introduced the tax haven model, which is based on asymmetric endowments. The basic model assumes a system of identical countries, with each country taxing mobile capital to finance public goods. Accordingly, capital is assumed to be fixed for the entire system of countries. Smaller countries often take advantage of the situation of mobile capital and levy lower capital tax rates to compete for a fixed level of capital, thereby luring capital into their jurisdictions (Wilson, 1999). At the same time, the increasing capital mobility encourages MNEs to invest in tax havens to minimise or even evade the higher income taxes in their home countries (Wilson, 2014). In this setting, increased capital mobility intensifies tax competition among governments.

Literature on a race-to-the-bottom in tax rates

A growing body of literature indicates that competition among governments in setting tax rates has become a common phenomenon, as firms seek out a more cost-effective environment. The basic mechanism of the traditional tax competition can be seen in cross-country and within-country contexts. In terms of cross-country competition, the negative correlation between taxes and firm entry encourages nations to lower their corporate taxes in order to attract firms. De Mooij and Ederveen (2003) conducted a meta-study of 25 empirical studies and indicated that a decrease in the corporate tax rate of one percent point leads to an increase in FDI by 3.3 percent. Additionally, the evidence of intensified tax competition is, at least to some extent, supported by the actual development of the most obvious and readily available measure of corporate income taxes: statutory tax rates. It is recorded that many OECD country has reduced its statutory tax rates in recent decades. For example, the average statutory rates of corporation tax in OECD countries fell from around 50 percent in the early 1980s to less than 35 percent in 2001 (Devereux & Griffith, 2003). A similar picture can be seen in the EU15, where corporate tax rates have declined from an average of 38 percent in 1995 to an average of 29 percent in 2009 (Hansson & Olofsdotter, 2013). Likewise, according to the latest report by the Institute for Fiscal Studies, average corporate tax rate in the G7 has declined considerably from 50 percent in 1981 to below 28 percent in 2019 (IFS, 2019) (**Figure 2.1**). A similar picture can be seen in the UK, where corporate tax rates fell from 52 percent in 1981 to 19 percent in 2019 (IFS, 2019).

Figure 2.1 Corporate tax rates have been declining



Source: Institute for Fiscal Studies, 2019

Like cross-country tax competition, evidence has shown that within-country tax competition exists at local level. A large number of studies confirm the positive relation between lower tax rates and the allocation of capital (investment) in different regions within individual countries (Medrano, 2018; Saeedy, 2018; Oquero, 2019). This is mostly due to the fact that local jurisdictions have autonomy and can grant tax exemptions or reductions to attract firms to locate in their regions (Ko et al., 2013; Chen, Li & Liu, 2018). In reality, there is a difference between actual tax rates and statutory tax rates. Although statutory tax rates are uniform across a country, local authorities can often find ways to lower local tax rates to compete with other localities for mobile factors. For instance, a study by Tung and Cho (2001) is among the extensive literature which highlights within-country tax competition between local jurisdictions in a single country to attract firms. These authors examine 43 investment incentive zones and cities in China where lower or even zero tax rates are levied on firms, to explore whether tax rates and tax incentives are determinants for the location decisions of MNEs. They uncovered two main findings: (i) lower tax rates and greater tax incentives lead to a significant

increase in the magnitude of investment flowing into the regions, and (ii) favourable tax rates and tax incentives are determinants to attract mobile capital. Becker, Egger and Merlo (2012) measure the number of foreign MNEs, MNE employment, and MNE fixed assets, and find that higher business tax rates have a negative effect on MNE activity in Germany. Another striking example can be seen in the study by Jasiniak and Kozinski (2017), who investigate 14 Special Economic Zones in Poland. Their findings reveal that tax incentives are one of the most attractive factors for newly established companies. In addition, tax credits (an exemption for entrepreneurs from local taxes or income taxes) are one of the most important factors for investors. Therefore, tax incentives play a crucial role in the decision process for locating investment in the regions. In another study, Medrano (2018) investigated seven Special Economic Zones with special tax regimes in Mexico and revealed that special tax regimes lead to a considerable rise in investment, especially in foreign direct investment, thereby offering Mexico significant opportunities for regional development. Putting it another way, the results of these studies suggest a negative correlation between tax rates and business activity, as firms often look for a more cost-effective environment.

Literature on the use of tax havens

Intense globalisation and financial deregulation have enabled MNEs to make greater use of tax havens over the years (Eden, 1998). As discussed above, tax havens provide MNEs with many opportunities for profit-shifting, allowing them to maintain a presence in countries with high taxes while shifting their profits to low or nil tax jurisdictions (Janský & Prats, 2015). Clearly, very low or nil tax rates in tax havens help firms significantly reduce their tax obligations (Jones & Temouri, 2016). In addition, the secrecy offered by tax havens (e.g., a lack of tax information exchange among jurisdictions) combines with banking secrecy to allow taxpayers to remain hidden from other countries' tax authorities, and to engage in tax evasion and

avoidance practices (Tax Justice Networks, 2018). Importantly, many tax havens are located in small economy islands dispersed through different time zones, but most tax havens are politically and economically connected to the majority of OECD states (Miranda & Dias, 2020). According to Dharmapala and Hines (2009), approximately 15 percent of countries over the world are tax havens, and small countries are more likely to become tax havens (Slemrod & Wilson, 2009; Dharmapala & Hines, 2009).

Multidisciplinary literature on the impact of tax havens can be split into two broad streams (Driffield et al., 2021). The first stream focuses on estimating the total amount of profit-shifting undertaken by MNEs in the world economy. The use of tax havens is the most common tax-saving activity; such use not only reduces a firm's tax obligations but also has a positive effect on firm value, motivating firms and individuals to shift revenue out of high tax jurisdictions (Miranda & Dias, 2020). Substantial evidence shows that firms tend to use tax havens to establish shell companies that can shield their income from higher tax liabilities at home (Hines & Rice 1994; Graham & Tucker 2006; Dyreng & Lindsey 2009; Dyreng, Lindsey, & Thornock 2013; Jones & Temouri, 2016; Jones, Temouri & Cobham, 2018; Bennedsen & Zeume, 2018). With the beginning of the global financial crisis in 2008 and the exposure of several financial scandals, the true extent of tax evasion enabled by tax havens was revealed. Despite this, evidence shows that the amount of money that is held offshore continues to increase substantially. According to OECD (2007), approximately US$ 5-7 trillion was held offshore in 2007. This number is speculated to have drastically increased to around US$ 21-32 trillion in 2012 (PwC, 2012). In 2014, the Luxembourg Tax Leak illuminated that almost 400 large international companies had private arrangements with the Luxembourg tax authority for paying less than one percent in tax, despite the official Luxembourg corporate tax rate being 29 percent. According to Citizens for Tax Justice (2015), around 75 percent of the Fortune 500

firms are active in tax havens. The Panama Papers in 2016 exposed the details of thousands of previously anonymous companies. Tørsløv, Weir, and Zucman (2018 cited in Driffield et al. 2021) find that close to 40 percent of MNE profits are shifted to tax havens each year, while Cobham, Janský, and Meinzer (2015) estimate that global tax revenue losses may amount to US$130 billion annually.

The use of tax havens by MNEs from both the developed countries and the emerging markets is now being recognised as a significant aspect of international business activity and outward FDI strategy (Chari & Acikgoz, 2016, Jones & Temouri, 2016, Jones et al., 2018, Kemme et al., 2020; Driffield et al., 2021). While investments made in tax havens by the developed economies are usually motivated by traditional factors, such as market demand, knowledge, resources, or strategic assets, the investments made in tax havens by emerging countries are instead driven by the low taxes in the host countries and the institutional fragility of the home country (Chari & Acikgoz, 2016). According to UNCTAD (2015), foreign subsidiaries contribute approximately US$ 730 billion annually to government budgets in emerging countries. However, developing countries lose significant revenues due to tax avoidance strategies, including tax haven investments by MNEs (via both domestic and foreign subsidiaries) (UNCTAD, 2015).

The second stream of research investigates the underlying country-specific or firm-specific factors that determine tax haven use by MNEs across a number of domains (Akamah, Hope & Thomas, 2018, Jones & Temouri, 2016, Jones, Temouri & Cobham, 2018). In terms of country-specific factors, Jones and Temouri (2016) found that the variety of capitalism in an MNEs' home location has a significant effect on its use of tax havens. Specifically, MNEs incorporated in Coordinated Market Economies have a lower likelihood of investing in tax

havens than the MNEs from Liberal Market Economies. On the other hand, the host country-specific advantages accessible in tax haven locations minimises the impact of OECD corporate tax liberalisation on the likelihood of an MNE owning a subsidiary in a tax haven (Jones and Temouri, 2016). With regards to firm-specific factors, Akamah, Hope and Thomas (2018) uncover a strong association between the use of tax havens and disclosure aggregation. The relationship is more severe for firms with higher political costs, and for firms in natural-resources or retail industries, or with low competition. Another firm-specific covariate that significantly affects the propensity to use tax havens is the use of intangible assets (Taylor, Richardson & Lanis, 2015). Jones and Temouri (2016) argue that the use of patents that allow copyright protection for a period of time is likely to create advantages for a firm over its domestic and foreign rivals, who are also less likely to use tax havens. The literature highlights that firms who spend more on R&D are more likely to avoid paying high tax (Desai, Foley & Hines, 2006; Dyreng, Hanlon & Maydew, 2008). Jones and Temouri (2016) reach the similar conclusion that MNEs in technologically intensive manufacturing and services, with highly valued intangible assets, are more likely to own a tax haven subsidiary compared with MNEs that are less technologically intensive. Furthermore, in recent years, increasing evidence has uncovered the role played by in-house tax specialists and lawyers in creating complex tax arrangements across a firm's global operations (Frank, Lynch & Rego, 2009). Luxleaks reveals that one of the Big 4 accountancy firms assisted their multinational client to make legal tax decisions that helped them channel billions of dollars—which originated from activities that took place in other jurisdictions—through Luxembourg in the period 2002–2010, thereby minimising their tax payments (Hudson et al., 2014). Jones, Temouri, and Cobham (2018) present empirical evidence for a strong correlation between the tax haven network and the use of the Big 4 accountancy firms; they also reveal that auditors have a significant impact on multinational tax avoidance behaviours.

The literature in the area of tax haven use is voluminous. However, it mainly focuses on firm-level factors and country-level factors. One novelty of our study is to focus on cluster-specific factors in relation to tax havens. This thesis seeks to extend this literature strand by specifically analysing the use of tax havens by firms in business clusters.

2.2.2 New economic geography theory

Another theoretical lens adopted in this research is the new economic geography theory, which explains how policy makers set taxes on firms. The new economic theory is the first field in economics to provide a detailed description of the spatial inequalities in economic performance (Krugman, 1991). The theory was introduced by Krugman (1991) with a simple model based on the division of the United States into the manufacturing belt and the farm belt in the nineteenth century. Applying a two-sector/two-region model, Krugman built up a core-periphery structure, in which the manufacturing sector is in the core and the agricultural sector is in the periphery. One factor is regionally immobile and is used as an input in the agricultural sector. The other is regionally mobile and is used as input in the industrial sector. The new economic geography theory has been enriched to deal with multiple sectors that extend far beyond the original agricultural non-skilled sector and manufacturing skilled sector. Krugman (1998) then extended the model from country-level (i.e., the United States) to the global market, indicating that the core-periphery structure exists in the international trade.

Agglomeration forces

The new economic geography theory refers to unbalanced competition among actors in the market (Krugman, 1991, 1998; Baldwin & Krugman, 2004; Baldwin et al., 2005). The key new ingredient is "agglomeration forces" that lead to spatial concentrations of firms and turn mobile factors into quasi-fixed factors (Baldwin et al., 2005, p.380). The world economy is currently

dominated by business clusters that amount to critical masses in specific locations, having unusual competitive success in particular fields (Porter, 1998). It is highlighted that firms within a business cluster gain success more easily since they do so as a group (Maskell, 2001). Local clusters of industries are envisioned with centripetal forces that pull firms towards a centre of economic activity (Marshall, 1920; Krugman, 1991; Krugman & Venables, 1996). Different models developed in the new economic geography literature discuss linkages in agglomeration economies. According to the Krugman Model (1991), the main agglomeration force is market access; these are comprised of the so-called firm-consumer (backward) linkages. The closer a firm is to the centre of economic activity, the better its access to a market where it can sell its goods. On the other hand, according to the Venables Model (1996), the main agglomeration force is rather the spatial distance to other firms; these are the so-called firm-firm (forward) linkages. If a firm is a final producer, it prefers to be close to its intermediate suppliers so it can buy its inputs at a lower price. but if a firm is an intermediate supplier, it prefers to be close to the final producers in order to obtain a higher price for its products. Centripetal forces generated either from backward linkages or forward linkages pull firms towards a centre of economic activity and turn mobile factors into quasi-fixed factors (Krugman, 1999). That creates a source of competitive advantages, and these advantages give rise to endogenous regional asymmetries, the emergence of regional disparities, and the origins of international inequalities (Porter & Miranda, 2009).

The literature has summarised six types of advantage sources that may be viewed as the effects of business clusters. First, demand-side effects are suggested by Krugman (1991) as one source of advantage, where the presence of firms in a focal industry facilitates local access to a large market. Second, the proximity of buyers reduces the transaction costs arising from vertical disintegration, generating transaction-cost effects in business clusters (Baldwin & Krugman,

2004). Third, agglomerated regions offer greater communicational advantages as firms develop better knowledge of each other, lowering the search costs for entrepreneurs who need to find and be found by buyers (Almeida & Kogut, 1999). Fourth, business clusters offer lower exit barriers for under-performing entrepreneurs so that they find it easier to leave the industry or seek alternative employment (Porter, 2000). Simultaneously, lower exit barriers lead to an increase in the average performance of the firms remaining in the business clusters. Fifth, a higher degree of rivalry contributes to a higher level of innovation and performance among neighbouring agglomerated firms (Porter, 2000). Sixth, knowledge flows between local firms through social interactions that trigger knowledge spillovers, thereby facilitating the formation and transmission of social capital (Audretsch & Feldman, 1996). According to Bell and Zaheer (2007), social capital extensively enhances trust and the ability to share vital information among members of a network. Agglomeration advantages result in a very uneven distribution of economic activity between the core and the periphery (Gaspar, 2018, 2021). Recent research shows that in terms of the distribution of FDI, being situated on the periphery tends to have a negative effect on a city's FDI, while this effect is positively moderated by proximity to the core cities that are key locations for MNEs (McDonald et al., 2018). In addition, thanks to the advantages enjoyed by agglomerated areas, capital (investment) earns a higher reward when it is located there, compared to the periphery (Baldwin & Krugman, 2004; Baldwin et al., 2005). Porter (2000) highlights that regional economic performance is strongly influenced by the strength of local clusters. Business clusters provide favourable conditions that promote growth, enhance efficiency, and develop productivity, thereby generating concrete advantages for cluster companies (Porter & Miranda, 2009).

Agglomeration with Taxation

The implication of agglomeration economies for strategic tax setting was first discussed by Baldwin and Krugman (2001). The new economic geography theory qualifies the race-to-the-

bottom in tax rates by indicating that some forces can reverse the effects of tax competition. Thus, the new economic geography theory proposes a race-to-the-top in tax rates, which runs as follows. Due to asymmetries between two different groups of nations, wealthier nations often impose higher corporate tax rates than the poorer nations (Baldwin et al., 2012). Wealthy nations are already attractive locations for capital because they offer advantages such as an excellent infrastructure, established customer and supplier bases, and an experienced workforce (Porter & Miranda, 2009). These advantageous conditions at the core of wealthy nations enable them to hold on to mobile factors of production despite higher tax rates. The periphery of poorer nations vies for the core's industrial bases by levying low tax rates. However, because the core has a range of advantages, even lower tax rates or zero tax rates in the periphery may not be enough to attract firms (Baldwin & Krugman, 2001). Non-core regions thus decide to abandon their attempts to compete head-to-head for the core and choose to set their tax rates according to criteria that are unrelated to tax competition.

In terms of local tax setting, tax policies vary significantly among different local authorities (Baldwin et al., 2005). With the presence of business clusters, agglomeration economies lessen capital's mobility, pulling most capital to locate in the business clusters. Hence, agglomeration forces can offset differences in taxes to attenuate tax competition. Baldwin et al. (2001, 2005) point out that when tax rates in the core are higher (up to a certain threshold) than those in the periphery, the higher tax rates do not lead to an outflow of capital from the core to the periphery. In other words, as long as agglomeration rents exceed tax differentials, a core region can allow itself to have local tax rates that are higher than those of a peripheral region. The theoretical work in economic geography explains that agglomeration-hosting authorities are inclined to set local tax rates on firms that are higher than those imposed by authorities in the periphery (Baldwin et al., 2012). Due to the agglomeration forces and the associated economic

rents generated, these locations are natural targets for local governments looking to generate tax revenue.

Literature review on new economic geography theory and taxation

The existing literature has provided evidence for the new economic geography theory (Hansson & Olofsdotter, 2005; Garretsen & Peeters, 2007; Brülhart & Jametti, Schmidheiny, 2012; Becker, Egger & Merlo, 2012; Crabbé & Bruyne, 2013; Rohlin, Rosenthal & Ross, 2014). It has been noted that besides centripetal forces, agglomeration forces also reflect centrifugal forces (Marshall, 1920; Krugman 1991; Venables 1996). In particular, some evidence indicates that concentrations of economic activity generate increased demand for local land, driving up land rents. In other words, agglomeration forces can be thought of as creating location-specific rents. These rents can be taxed up to a degree without affecting location of capital. Taking the financial services industry as an example, we ask why this is concentrated in London? The answer is two-fold: London's sheer size makes it an attractive place to do business, and the fact that the financial industry is already concentrated there means that many clients and ancillary services are likewise there, making it a thick market for special skills. This begs the question of why don't all financial businesses concentrate in London? The answer is partly because renting office space in London is very expensive (Porter, 2000).

At country level, some studies use aggregate data to examine the relationship between agglomeration and taxation. Hansson and Olofsdotter (2005) used country-level data for OECD countries and pointed out that agglomeration raises corporate income tax rates. In addition, the countries hosting agglomerations may find it optimal to levy a source-based tax on capital income. Another empirical research carried out by Garretsen and Peeters (2007) for 19 OECD countries reveals that core countries have higher corporate tax rates. These authors come to a

noteworthy conclusion related to the difference in strategic tax setting among different jurisdictions. Particularly, governments with strong agglomeration economies reduce their tax rate by 0.4 percent in response to a one percent reduction in the tax rate of neighbouring governments. However, governments with low-agglomeration regimes reduce their tax rate by 0.6 percent in the same situation.

From the year 2012, several empirical studies started to utilise firm-level data to tackle the impact of agglomeration on the location decision of firms (Brülhart, Jametti & Schmidheiny, 2012; Becker, Egger & Merlo, 2012; Crabbé & Bruyne, 2013; Rohlin, Rosenthal & Ross, 2014). These studies found that agglomeration economies have a positive influence on business tax rates, and that authorities in agglomerated regions keep a proportion of the business rates that are paid locally, confirming the rent-taxing behaviour of attractive jurisdictions. A recent study on this correlation has been carried out by Chen, Li, and Liu (2018). These authors detected that across China, the lower quartile of firms pays almost no tax, whereas the upper quartile pays the full tax rate of 33 percent. They suggest that a driver of this phenomenon is heterogeneous agglomeration. The findings confirm that more agglomerated regions generally collect tax at higher rates. More importantly, firms are willing to accept a higher tax rate in order to benefit from agglomeration economies (Chen, Li & Liu, 2018).

Combining the insights of both centripetal forces and centrifugal forces shows that agglomeration forces generate benefits and costs for firms located in the cluster regions. Firms seem to accept the cost of clusters (agglomeration rents) when they take location advantages of such regions. However, that is unlikely to be the whole story. Higher costs in one form can be offset by lower costs in other forms (Eden, 1998), and the nature of business should urge firms to find ways to compensate for the costs of clusters. Rather than simply leaving this to

chance, companies might deal with agglomeration rents in business clusters by opting for strategic solutions to offset the cost. In such knife-edge configurations, agglomeration economies seem rather to exacerbate the intensity of tax competition, in that firms who have expanded their businesses can choose to locate their foreign subsidiaries in tax havens. The use of tax havens can be seen as a powerful vehicle for MNEs in business clusters to balance the cost of using the market (agglomeration economies) in their home countries, against gains made from the lower tax rates or zero tax rates in tax haven host countries. In this thesis, we equate the cost of locating in a business cluster to taxable rents that might drive firms to establish their subsidiaries in locations with lower tax rates. We analyse the use of tax havens in the context of agglomeration economies to explore why firms act against their business nature by accepting higher tax rates in agglomerated areas, thereby addressing the gap in this strand of literature. We investigate possible alternative explanations for this, related to tax haven use. In addition, we demonstrate that higher local tax rates are one of the characteristics of business clusters that encourage firms to establish foreign subsidiaries in tax havens.

2.2.3 Knowledge-based theory

Our final theoretical lens is the knowledge-based theory. This offers a useful explanation of why the firms located in business clusters are more likely than their non-cluster counterparts to engage in tax avoidance behaviour. The knowledge-based theory considers knowledge to be an organisation's most important strategic resource (Grant, 1996; Hoskisson et al., 1999; Maskell, 2001; Wiklund & Shepherd, 2003; Lazzeretti & Cinti, 2006). Knowledge resources ensure that organisations can enjoy sustainable differentiation and competitive advantages because they are resources that are very difficult to imitate (Wiklund & Shepherd, 2003). In terms of business clusters, the knowledge environment is the very nature of a business cluster, and it is thus a cluster-specific factor (Porter & Miranda, 2009).

Component knowledge and architectural knowledge

One of the characteristics of a business cluster is its tight geographical boundedness (Tallman et al., 2004) that brings location-based comparative advantage (Dunning, 1998). In Porter's (1990, 1998, 2000) development of the business cluster concept, he pointed out that firms with a common geographical background share knowledge resources among a particular group. A cluster contains stocks of knowledge, and knowledge flows in and among a cluster's firms. The literature has defined two main types of knowledge and cluster-specific effects; these are "component knowledge" and "architectural knowledge" (Tallman et al., 2004, pp.263-267). Component knowledge consists of the specific knowledge resources, skills, and technologies that closely relate to specific industries or sectors. For instance, the component knowledge of technology-oriented industries normally includes scientific, technical, engineering, and design skills. Consumer industries require knowledge of promotion, consumer behaviour, marketing, and sales. Knowledge of production, acting, or cinematography are examples of the component knowledge of the motion picture industries (Tallman et al., 2004). Component knowledge ranges from straightforward technical (codified, tangible, explicit) know-how, such as blue-prints, product patents, and step-by-step operations, through to highly systemic (tacit, intangible, complex) scientific knowledge, such as scientific theories and complex process patents (McGaughey, 2002). Malmberg and Power (2005) show that firms who share experience and conditions are more likely to have mutual absorptive capabilities and engage more easily in mutual transfers of component knowledge. In fact, cluster members operate in similar or related activities in the cluster network and there are frequent interactions, common suppliers, and constant movement between organisations (Franco, Esteves & Rodrigues, 2020). Component knowledge is spread between cluster actors and is combined with their firm-specific knowledge. Therefore, firms in business clusters are subject to spillovers or leakages

of component knowledge to other firms. This type of knowledge therefore becomes available through spillovers to all the members of a business cluster (Franco, Esteves & Rodrigues, 2020).

Architectural knowledge, on the other hand, involves complex, intangible, tacit, and private knowledge that is highly organisation-specific (Matusik & Hill, 1998). Architectural knowledge evolves endogenously as an inseparable part of an organisation. Unlike component knowledge, architectural knowledge is non-transparent and causally ambiguous. Clearly, just as no two companies have identical histories, no two companies possess identical architectural knowledge. Since architectural knowledge arises from unique experience, it is inclined to remain private (Matusik & Hill, 1998). Architectural knowledge also limits the ability of the firm to absorb knowledge from other firms. However, in the context of business clusters, there can be a degree of similar architectural knowledge thanks to the similar conditions and activities of the network. This similar architectural knowledge improves organisations' absorptive capacity, and their adaptation and application of what amounts to cluster-level architectural knowledge. Cook and Brown (1999, cited in Tallman et al., 2004) propose that constant interactions among cluster entities significantly promote cluster-level communal understanding of the industrial atmosphere. The network of a business cluster is the basis for information exchange and hence, it offers access to the resources and capabilities of other cluster entities (Gulati, 1999). Moreover, cluster-level architectural knowledge, though common to cluster members, remains unavailable to non-members (Tallman et al., 2004). An interfirm or cluster-specific stock of architectural knowledge is then facilitated inside the network, and importantly, restricts the movement of knowledge flows out of cluster boundaries. Architectural knowledge in a cluster network therefore becomes quasi-private to

all cluster members. In other words, it is this type of knowledge that distinguishes a business cluster from the rest of its industry.

Knowledge creation inside business clusters

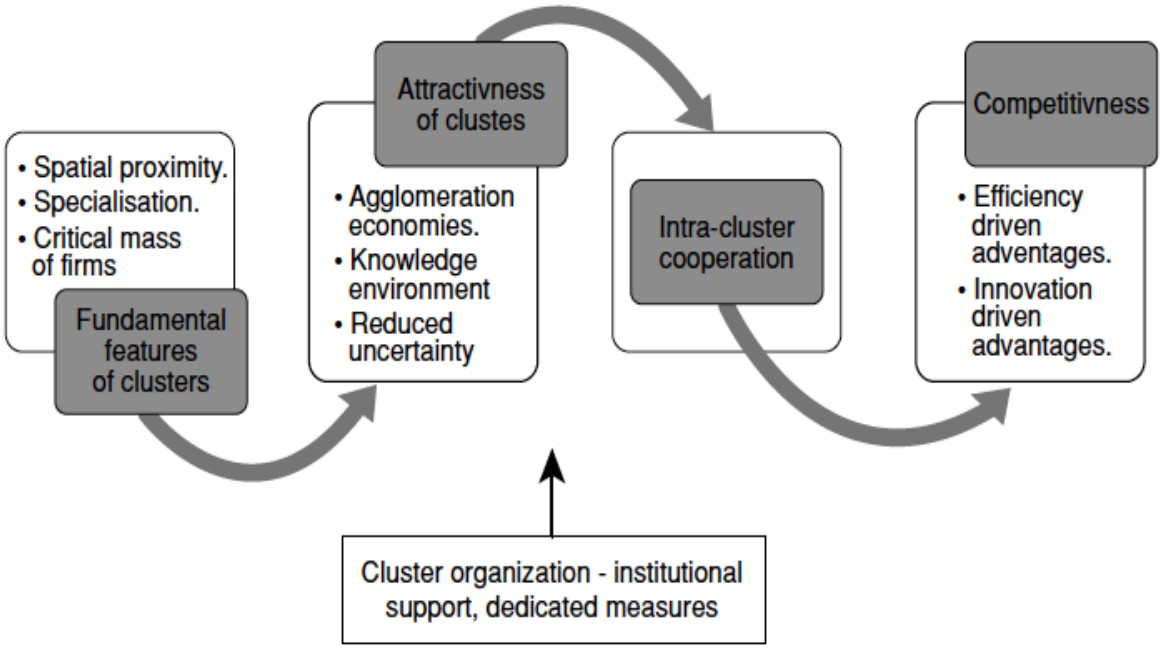
There are three main ways knowledge is created in clusters. This can be through (1) increased competition and intensified rivalry; (2) local inter-organisational collaborative interaction; and (3) spill-over effects from local mobility and sociability of individuals (Malmberg & Power, 2005). First, knowledge in clusters is created through increased competition and intensified rivalry. According to Porter (1998, 2000), domestic rivalry is an essential part of cluster dynamics and the most important element of a nation's competitive advantage. Malmberg and Power (2005, p.418) highlight that localised rivalry is "a cognitive and social dimension" underlying action in competitive business environments. The high level of competition in those areas increases the standard firms need to reach in order to stay in business clusters (Li & Bathel, 2018). More importantly, such competition forces motivate cluster entities to improve and enhance their performance (Du & Vanino, 2020).

Second, knowledge creation in clusters is promoted by local inter-organisational collaborative interaction. In business clusters, multiple linkages play a facilitating role in promoting competitiveness among cluster members. The local interaction within clusters is facilitated by two localised phenomena: inter-firm cooperative transactions and cooperation partnerships with nearby R&D institutes, universities, and the like. Cluster actors cooperate to take complementary actions in interdependent relationships to achieve mutual outcomes. The interdependent development between co-located firms within related industries promotes their ability to create knowledge, and the intra-cluster cooperation in business clusters brings favourable conditions for cluster entities to promote knowledge spillovers (Fritsch & Lukas,

1999; Cole, 2007; Abukabarr & Mitra, 2017). In addition, the cooperation among cluster actors can take place between people, organisations, and the environment. Thus, the scope of co-operative constellations in clusters is diversified and rich.

The competitive advantages of cluster entities are generated both from the competition and collaboration that coexist in business clusters, leading to vivid localised interactions inside the network (Porter, 1998, 2000). Jankowska, Götz, and Główka (2017) propose that the success of a business cluster is enhanced when cluster firms can transcend pure rivalry and reach intra-cluster cooperation. Thanks to key idiosyncratic features such as proximity, critical mass, and specialisation, business clusters by their very nature normally offer an environment that is conducive to cooperation.

Figure 2.2 Inter-firm cooperation and competitive advantages in business clusters



Source: Jankowska, Götz and Główka, 2017

Third, knowledge in business clusters is created through spill-overs via the local mobility and sociability of individuals. It has been demonstrated that informal social networks play a vital

role in the functioning of actors in business clusters. Important knowledge exchange and knowledge transference take place in business clusters through inter-firm transfer of labour, community and networks, and informal interactions (Grabher, 2001, 2002). Within a business cluster, a superior knowledge base allows cluster entities to regularly process parallel experimentation and testing of a range of approaches and activities, leading to significant improvement over time (Maskell, 2001; Curado, 2006; Franco, Esteves & Rodrigues, 2020). Clusters can thus be considered to be a mechanism of the inter-organisation relationship via the local mobility and sociability of individuals, which fosters the sharing of knowledge and innovation.

Literature review on the knowledge-based theory and taxation

A large literature on business clusters has emphasised that the knowledge environment creates distinctive conditions for cluster-located MNEs compared to non-cluster MNEs (Porter, 1998; Porter, 2000; De Propris & Driffield, 2006; Porter & Miranda, 2009; Malik et al., 2018; Du & Vanino, 2020). Thanks to a superior knowledge base, firms located within industry clusters are better able to draw from a pool of highly-skilled workers. Many engineers, IT professionals, and those working in R&D may base their career decisions on their ability to move into a relevant industry cluster (Porter, 1998; Porter, 2000; De Propris & Driffield, 2006; Porter & Miranda, 2009). Firms located within clusters are shown to be more resilient in periods of economic growth as well as during recession (Delgado et al., 2014; Lengnick-Hall et al., 2011). The resilience of business clusters is empirically demonstrated to be linked to the knowledge spillovers available within them (Malik et al., 2018). While a number of different business cluster themes have been investigated in the literature, the effect of business clusters on firms' tax behaviours remains under-researched.

In recent years, some empirical evidence suggests that cluster membership has a significant effect on firm internationalisation through access to collaborative networks and resources (Porter, 1998; Zucchella, Palamara, & Denicolai, 2007; Amdam et al., 2020). Furthermore, Du and Vanino (2020) reveal that inter-clustering is considered to be a network of learning via knowledge spillovers, leading to increased performance in the network. This prompts a reconsideration of the effect of business clusters in the context of firm internationalisation, especially via the establishment of foreign subsidiaries in tax havens. Within a business cluster, as mentioned above, interactions occur not only among firms, but also among R&D institutions, business-support organisations, and local or regional government (Krugman & Venables, 1996; Porter, 1998, 2000). In particular and more importantly, the literature has highlighted the role played by the Big4 and the Magic Circle of law firms in firms' tax avoidance activities. In particular, Jones, Temouri and Cobham (2018) highlight that the Big 4 accountancy firms play a singularly important role, not only terms of the accountancy services they provide to multinational enterprises, but also through their expansive tax advice offering. Their experience and influence allow their clients to reduce their effective tax rate. The use of internal specialists, who may be recruited through the leading accountancy firms, can internalise this knowledge and help the MNE to efficiently escape the exogenous market imperfections (Rugman, 1980, 1981) caused by regulation, which in this context, would be corporate tax. The question we put forward in this thesis is whether knowledge spillovers inside business clusters create peer effects that encourage cluster members to engage in profit-shifting via tax havens. We postulate that intra-cluster cooperation incentivises firms in business clusters to respond to policy makers by working together to minimise tax burdens. We then explore the interplay between the effects of industrial clusters and the likelihood of owning tax haven subsidiaries by multinational enterprises. By thus applying the knowledge-based theory to issues of taxation, we are able to address the gap in the literature.

This thesis is devoted to expanding the three aforementioned theoretical frameworks and to closing the tax and cluster-related gaps in the literature. We will therefore be setting research questions that deal with (i) the relationship between the use of tax havens and the effect of business clusters, (ii) the effect of local business tax rates/agglomeration effect on the use of tax havens, and (iii) the effect of local business tax rates on the likelihood to establish domestic subsidiaries in low-tax jurisdictions.

CHAPTER 3: INTRODUCTION TO DATA

This chapter outlines the datasets used for the empirical analysis. All data in this research is secondary in nature. The first empirical chapter uses the firm-level dataset from ORBIS published by Bureau van Dijk. The second and third empirical chapters combine ORBIS with regional level data from the Federal Statistical Office of Germany (DESTATIS). The methods for measuring tax havens and business clusters will be discussed in this chapter, which then goes on to present how we managed and cleaned the datasets.

3.1 Data sources

3.1.1 Firm-level data: ORBIS

The commercial firm-level database ORBIS, published by Bureau van Dijk, is one of the world's leading comparable data sources of financial information. The ORBIS database is essentially an international collection of national-based administrative data sources, focusing on firm-level variables (Kalemli-Ozcan et al., 2015). The database captures and treats data from more than 170 separate providers and hundreds of its own sources. It is one of the most powerful comparable data resources for both private and listed companies (Kalemli-Ozcan et al., 2015). It is estimated that the database has detailed annual basic information for more than 400 million companies worldwide (Bajgar, 2020). A large dataset like ORBIS helps ensure a higher level of representativeness across firm size, ownership, regional, and industry lines. Even though the data is slightly biased towards larger firms, the coverage of small to medium sized firms has increased in recent years across various countries. Importantly, ORBIS remains one of the most popular cross-country firm-level datasets, and its data has wide coverage and high representativeness (Bajgar, 2020).

In the empirical part of this thesis we use subsets of the dataset for different settings of the three empirical chapters. For the first empirical chapter, data are collected for MNEs from five OECD countries (Austria, Belgium, France, Germany, and UK). We use a conventional definition of MNE suggested by UNCTAD (2013) as a firm that owns at least 10 percent of at least one subsidiary located abroad. For the second empirical chapter, data are collected for MNEs from Germany, while for the third empirical chapter, data are collected for German firms (including domestic firms and MNEs). As explained in the introduction section, the rationales for the chosen settings in the three empirical chapters mainly relate to the availability of all variables that are needed for our analysis; the access to the business cluster maps and lists from government websites for these countries; and the huge variation in local business tax rates in Germany for the context of the second and third empirical chapters. The richness of our various firm-level data, such as financial information, location, firm characteristics, ownership, and subsidiaries enables us to examine our research questions and hypotheses.

Ownership and subsidiary information

The ownership information from ORBIS provides us with details on owner and subsidiary worldwide. ORBIS indicates a link between two entities even when the percentage of ownership is very small (less than one per cent) or unknown. It also lists all subsidiaries of a given parent firm, together with their percentage of ownership. Each ownership link has a unique identification number, and it provides the name and nationality of the subsidiary and the direct or total (or both) percentage of ownership in the subsidiary. This information is utilised as evidence that a company is either an MNE (if it has one or more foreign subsidiaries) or a non-MNE (if it does not have any foreign subsidiaries). It is important to note that by collecting the history of each MNE's subsidiary ownership, we have been able to construct the

time variant number of tax haven subsidiaries. This offers an ideal test bed for analysing the relationship between firms located in business clusters and their tax haven networks.

Location information

Our dataset gives the precise location of firm operation. It allows us to identify the location of parent firms and the location of all their individual subsidiaries, both domestically and internationally. We base our tax haven classification on various different tax haven lists from the literature to identify whether the subsidiaries are located in tax havens. We can also track the whole network of tax haven subsidiaries across firms and time periods.

As regards business cluster data, we draw on the pre-existing business cluster maps and lists recognized by the governments, and the definition of a business cluster that gives geographical proximity and industrial classification as its main dimensions (Porter, 1990; Audretsch & Feldman, 1996; Porter, 1998; Porter, 2000; Porter & Miranda, 2009). The ORBIS dataset provides us with information on the reference cities in which firms are located, thereby providing the geographical proximity variable. We then combine this with data on the NACE industry codes of each parent firm for the industrial classification dimension of a business cluster; this enables us to identify the presence of firms inside and outside business clusters.

3.1.2 Measuring tax havens

It must be noted that identifying the countries and jurisdictions that can be considered to be tax havens is not a trivial task. Different research questions around the topic of tax havens will have a different focus and will therefore require different criteria to be used. There are any number of lists that classify countries as tax havens (Hines & Rice, 1994; Desai, Foley & Hines, 2006; Dharmapala & Hines, 2006; Jones & Temouri, 2016; Jones, Temouri, & Cobham, 2018)

and these generally fall into one of three categories: dot vs. Big 7, OECD/IMF, and the Financial Secrecy Index.

The first category was created by Hines and Rice (1994) and Desai, Foley, and Hines (2006). These authors combined the lists of tax havens published by the Internal Revenue Service and other organisations with some ad hoc decisions concerned with a country's scale of finance to distinguish between what are known as "dot tax havens" (Andorra, Antigua & Barbuda, Bahamas, Cayman Islands, etc.) (see **Table 3.1**) and the Big 7 (Hong Kong, Ireland, Lebanon, Liberia, Panama, Singapore, and Switzerland) (see **Table 3.1**). Dot tax havens are notably small island economies, while the Big 7 have populations that in 2013 exceeded 2 million. Dharmapala and Hines (2006) have noted that the likelihood of being a tax haven increases from 24 percent for a country with more than one million inhabitants, to 63 percent for a country with a population under one million.

The second category came from international organisations' classifications of tax havens. In the early 2000s, the OECD developed a list of such jurisdictions and the IMF also provided a list of offshore financial centres (OFC) (cited in Zoromé, 2007). Many of these lists are somewhat arbitrary. Furthermore, they are subject to heavy political pressure and typically include only small countries (hence they might be systematically biased). Therefore, this thesis does not rely on these lists.

The final approach is that adopted by the Tax Justice Network. In recent years, this organisation's Financial Secrecy Index (FSI) has replaced the previous binary division of tax havens (tax havens versus all others) with the notion of a secrecy spectrum on which jurisdictions sit (see Cobham, Janský, & Meinzer, 2015). By focusing on a jurisdiction's

secrecy and transparency, it becomes much easier to empirically determine its attitude to tax or other regulatory aspects. Furthermore, it is generally not that difficult to observe transparency when it is properly enforced, rendering a comparative evaluation of a jurisdiction's policies much more feasible (Jones, Temouri & Cobham, 2018). The FSI combines two measures. The first is a global scale weighting, which reflects how important a jurisdiction's provision of financial services to non-residents is to its economy (Tax Justice Network, 2017). The second is a secrecy score based on 15 indicators that draw on nearly 50 variables that largely derive from the work of international organisations. These capture a range of issues from bank secrecy to the transparency of company accounts and ownership, and from administrative cooperation to international exchange of financial information. The 15 indicators are aggregated into a single secrecy score, which places each jurisdiction on a spectrum from zero (complete financial transparency) to 100 (complete secrecy). In the list for 2018, there is a natural cut-off equal to 60, above which almost all haven locations appear to be situated. Jones, Temouri, and Cobham (2018) take advantage of this cut-off with their definition of 52 countries as tax haven locations (see **Table 3.1**).

It is worth noting that whatever list is adopted, there remains an issue related to the locations of specific subsidiaries. It is important to distinguish whether these subsidiaries add real economic activity or if they were created solely for tax purposes.

For the first empirical chapter (Chapter 4), we take a conservative approach, and adopt the comprehensive list suggested by Jones, Temouri, and Cobham (2018). This list includes the dot tax havens and Big 7 tax havens of Hines and Rice (1994), which ensures that important haven locations such as Switzerland and Hong Kong are not excluded. It also draws on the Tax Justice Network's Financial Secrecy Index (FSI). We take the view that secrecy is one of

the most important characteristics of tax havens. Objectively verifiable measures of secrecy and/or of income shifting are likely to provide the most useful ways forward for more rigorous and robustly comparable research in international business studies.

For the first empirical chapter (Chapter 4), our list of tax havens, therefore, contains the following 52 countries: Andorra, Anguilla, Antigua, Aruba, Bahamas, Bahrain, Barbados, Barbuda, Belize, Bermuda, Botswana, British Virgin Islands, Brunei Darussalam, Cayman Islands, Cook Islands, Curacao, Cyprus, Dominica, Ghana, Gibraltar, Grenada, Guatemala, Guernsey, Hong Kong, Isle of Man, Jersey, Lebanon, Liberia, Liechtenstein, Luxembourg, Macao, Macedonia, Malaysia, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Samoa, San Marino, Seychelles, Singapore, Switzerland, Turks and Caicos Islands, UAE, Uruguay, and Vanuatu.

For the second empirical chapter (Chapter 5), we take an even more conservative approach and, as suggested by Jones and Temouri (2016), adopt only the dot tax havens. Additionally, we draw on the literature to classify the subsidiary locations that are most commonly considered to be tax havens of Germany (Tax Justice Network, 2018, 2019). The list includes some important German tax havens such as Cyprus, Luxembourg, and Malta, as highlighted in the literature.[1] [2] [3]This more conservative approach helps us to narrow the list of tax havens for the setting of Germany, and to capture more accurately the use of tax havens by German

[1] Tax Justice Network. 2018. Why is Germany siding with the tax havens against corporate transparency. Available from: https://taxjustice.net/2018/07/13/why-is-germany-siding-with-the-tax-havens-against-corporate-transparency/

[2] Row ignites after Germany slams "tax haven" Malta. Available from: https://www.dw.com/en/row-ignites-after-germany-slams-tax-haven-malta/a-38802713

[3] Luxembourg: the EU's top tax haven. Available from: https://www.dw.com/en/luxembourg-the-eus-top-tax-haven/a-16729339

incorporated MNEs. Our list for the second empirical chapter, therefore, contains 28 jurisdictions as follows: Andorra, Anguilla, Antigua, Barbados, Bahrain, Bermuda, Bahamas, Belize, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Isle of Man, Jersey, Gibraltar, Grenada, Guernsey, Liechtenstein, Luxembourg, Macao, Malta, Monaco, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Seychelles, Turks and Caicos Islands.

We acknowledge that this methodology is somewhat arbitrary but it does improve on the ad hoc lists created in the public economics literature while also avoiding some of the pitfalls associated with the adoption of the OECD or IMF lists. In practice, our approach is fairly scientific in that it combines the different approaches utilised in the literature. As can be seen from the lists below (see **Table 3.1**), the countries included do not differ substantially from those used in the existing literature so we are confident that the exclusion or inclusion of various jurisdictions should not bias our results in any systematic way.

Table 3.1 Tax havens lists by different definitions

Jones & Temouri 2016	Jones & Temouri 2018	Hines & Rice Dots	Hines & Rice Big 7	FSI 2018 Dots Top 20 (FSI 20)
Andorra	Andorra	Andorra		
Antigua	Antigua	Antigua		
Anguilla	Anguilla	Cayman Islands		
	Aruba			
Barbados	Barbados	Barbados		
Bahamas	Bahamas	Bahamas		Bahamas
Bahrain	Bahrain	Bahrain		Bahrain
	Barbuda	Barbuda		
Belize	Belize	Belize		
Bermuda	Bermuda	Bermuda		Bermuda
British Virgin Islands	British Virgin Islands	Cote d'Ivoire		British Virgin Islands
	Botswana			
	Brunei Darussalam			
Cayman Islands	Cayman Islands			Cayman Islands
Cook Islands	Cook Islands			
	Curacao			
Cyprus	Cyprus	Cyprus		Cyprus
	Dominica	Dominica		
	Ghana			
Gibraltar	Gibraltar	Gibraltar		
Grenada	Grenada	Grenada		
Guernsey	Guernsey			Guernsey
	Guatemala			
	Hong Kong		Hong Kong	Hong Kong

			Ireland	
Isle of Man	Isle of Man			Macao
Jersey	Jersey			Jersey
		Jordan		
		Kiribati		Kenya
	Lebanon		Lebanon	Lebanon
	Liberia		Liberia	Liberia
Liechtenstein	Liechtenstein	Liechtenstein		
Luxembourg	Luxembourg	Luxembourg		
Macao	Macao	Macao		Saudi Arabia
Malta		Malta		Malta
		Mauritania		
	Macedonia			
	Malaysia			Malaysia
	Marshall Islands			Marshall Islands
	Mauritius			
Monaco	Monaco			
	Montserrat			
	Nauru	Nauru		
Netherlands Antilles	Netherlands Antilles	Netherland Antilles		
	Panama		Panama	Panama
Saint Kitts and Nevis	Saint Kitts and Nevis	Saint Kitts and Nevis		
Saint Lucia	Saint Lucia	Saint Lucia		
Saint Vincent	Saint Vincent	Saint Vincent		
	Samoa			
	San Marino			
Seychelles	Seychelles			
	Singapore		Singapore	Singapore

			Switzerland	
				Thailand
Turks and Caicos Islands	Turks and Caicos Islands			
	UAE			
	Uruguay			
	Vanuatu	Vanuatu		

3.1.3 Measuring business clusters

Attempts have been made to develop empirical methods for capturing the presence of business clusters in an extensive literature. There are various ways of measuring business clusters. One of the popular methods is the location quotient which is an analytical statistic that measures a region's industrial specialization relative to a larger geographic unit (usually the nation) (Bureau of Economics Analysis, 2008). It takes the form of an index based on a particular formula. Common examples are as follows: Local employment ($industry_i$) / Total employment ($industry_i$) (Gini coefficient) (Krugman, 1991); No. of firms in a local area/ Local population (Ellison-Glaeser index) (Ellison & Glaeser 1997); Local employment in an industry/ Local population (Maggioni, 2002). However, the usefulness of the location quotient is commonly doubted as it is difficult to obtain an objective cut-off value to identify the presence of agglomeration for a particular industry in a specific region (Tian, 2013). The choice of the threshold also varies in different settings (e.g., different industries). In addition, rather than offering options for identifying firms in clusters, the method studies whether industries are geographically concentrated, from which the strength of the business clusters may be assessed (Tian, 2013). Furthermore, there are also problems related to the availability of data, especially data on employment.

There are alternative mathematical measures used in the literature to classify business clusters. In particular, Brülhart, Jametti, and Schmidheiny (2012) base their method on the number of new firms in particular regions. Anderson and Forslid (2003) rely on regional sales to classify the areas as clusters (irrespective of the number of firms or employees). Fréret and Maguain (2017) propose a local urbanisation index by dividing salaried employment by the area (km^2) for particular locations. This method has problems similar to the location quotient method discussed above.

Alternatively, graphical analysis is commonly used to identify business clusters. This measure is based on the calculation of Density Based Spatial Clustering Algorithm with Noise (DBSCAN) (National Institute of Economic and Social Research, 2017). By this method, peripheral nodes and core nodes are identified on a graph. The central nodes are defined as firms that have at least n other companies belonging to the same sector within a radius of eps km. Eps specifies the distance between two points for them to be considered as a cluster. Peripheral nodes are firms that have fewer than n companies belonging to the same sector within a radius of eps km. Such firms do not qualify as central nodes but are within the radius of at least one central node. Noise nodes are unimportant nodes and do not qualify as either core nodes or peripheral nodes. Even though the algorithm of this method performs particularly well in detecting spatial concentrations of units with arbitrary shape within large databases, the method has shortcomings akin to those of the location quotient method.

In this thesis, we adopt a different approach to measure business clusters by drawing on the pre-existing published lists of business cluster from government websites and the definition of business cluster suggested by Porter (1990, 1998, 2000) to identify firms who are located in a business cluster relative to firms who are not located in a business cluster. Accordingly, the method is based on two main dimensions: geographical proximity and industry specialisation. This method is increasingly attracting attention from academics and researchers as it offers an intuitive perspective for classifying business clusters. The two-dimension method has been empirically applied in studies by Temouri (2012), Kelchtermans, Neuicu, and Teirlinck (2019), and Du and Vanino, (2020). Specifically, Temouri (2012) combines city-level data with NACE codes. Kelchtermans, Neuicu and Teirlinck (2019) rely on NIS-code (municipality) and SIC, along with NACE for industrial specialisation. Du and Vanino (2020) utilise NUTS-2 region and SIC2 (Standard Industrial Classification).

As Martin and Sunley (2003) point out, the first core element of Porter's definition of the industrial cluster stresses the role of geographical proximity in facilitating the formation and maintenance of vertical and horizontal linkages between the companies within it. According to Porter (1990), industries are not spread out in space but agglomerate in certain locations. Hence, the presence of clusters is related to the geographic concentration of industries (Porter, 1998). The second element of Porter's definition is related to the concept of industrial specialisation. This can be construed as being related to the functional dimension of a cluster, as clusters are "comprised of interconnected companies and associated institutions linked by commonalities and complementarities" (Porter, 1998, p.78). Additionally, the main activity of firms in the cluster should be consistent with the local business cluster's dominant specialisation, or with the group of industries that identifies the cluster's main economic activity (Porter, 2000). Hence, the method offers a feasible option for identifying cluster firms.

It has been noted that prior knowledge of the location and industry of clusters is very important in defining business clusters (Temouri, 2012). The lack of comprehensive lists of recognised business clusters in specific countries or jurisdictions therefore plagues the empirical studies in this literature strand (Martin & Sunley, 2003). To tackle this problem, we collect from the government websites of five western European countries all the available cluster maps and lists. The maps and lists contain information of location and industry on every business cluster that has been recognised by our five sampled countries. Using these country-level lists, we adopt the two-dimension method, using the city level as the reference unit for territorial analysis (geographical proximity), and the NACE industry code as the unit for industrial specialisation. This research follows up on study by Temouri (2012) to combines city-level data with NACE codes to identify cluster firms and non-cluster firms. The information on

reference cities and NACE industry codes for individual firms are available from the ORBIS database. [4]

To specify, Austria has 71 business clusters throughout the country (Federal Ministry of Austria, 2021). Principal clusters are specialised in industry groups such as Automotive, railway, traffic, aerospace; Materials, packaging; Timber, furniture, accommodation, building construction; Health, life sciences, wellness; Food technology; Mechatronics, electronics, informatics, sensor technology; Renewable energy, environmental technology; Human resources, design, multimedia; Information, communication, processes, logistics (**see Graph B1 – Appendix B**).

Belgium's strong international standing in terms of economic growth lies in its 56 business clusters that specialise in a variety of industries, such as Business services; Blue Growth; Aqua culture, wind energy; Chemical; Digital; Biotechnology; Environmental industry; etc. (**see Graph B2 – Appendix B**).

In France, 400 business and innovation clusters contribute most to the nation's competitive advantages. The clusters specialise in industries such as Agriculture, wine growing, forestry; Automotive, railway, logistics; Tourism, sport, leisure; Energy, eco-energies; Health, biotechnologies; Information, communication, ICT; etc. (**see Graph B3 – Appendix B**).

[4] It is important to note that the classification of business clusters has been painstakingly derived from the literature on business clusters and information gathered from governments' websites.

In Germany, the competitiveness of the nation lies in 89 business clusters in Aviation, aerospace; Information and communication; Technology; Digitalization; Automotive/ Transport Tech; Medical/ Health; etc. (**see Graph B4 – Appendix B**).

In the UK, 31 business clusters significantly contribute to the national economic growth. The UK's business clusters mainly specialise in Financial services; Industrial manufacturing; High-tech/ICT; Aerospace; Electronics, etc. (see **Graph B5 – Appendix B**).

3.1.4 Regional level data of the Federal Statistical Office (DESTATIS)

The German official statistical office (*Statistisches Bundesamt*, shortened to DESTATIS) is a federal authority of Germany that provides the country's official statistical information. The Federal Statistical Office reports to the Federal Ministry of the Interior. The Office is responsible for collecting, processing, presenting, and analysing statistical information on the country's taxation, economy, society, and environment. There are a number of services offered, including visual statistics, open data, experimental data, information services, library, and address book (DESTATIS, 2021). Official statistics in Germany are decentralised and are provided by 16 regional statistical offices, although The Federal Statistical Office is the correspondence and contact centre. Hence, the Office is responsible for procurement of the available information from the 16 Statistical Offices of the German states (*Länder*) in the database Regionaldatenbank Deutschland (DESTATIS, 2021).[5]

[5] It took us around 4 months to receive the datasets for regional-level variables on municipal multipliers, property tax B, regional GDP, regional EVA, regional employment, and regional population from the Federal Statistical Office of Germany.

German local tax rates

After the Second World War, German's attempts to set up a central tax administration were thwarted by fierce opposition from Allied powers. This created a fragmented tax administration accountable to 16 sub-national states (Tax Justice Network, 2018). Under the country's decentralised structure, municipal authorities enjoyed almost complete autonomy in how they determined local business tax rates. In Germany, business profits are subject to two types of taxes, namely corporation tax (*Körperschaftsteuer)* and trade tax (*Gewerbesteuer*) (PwC, 2021). Corporation tax is levied at a uniform rate of 15 percent, which is then subject to a solidarity surcharge; in 2021 this was 5.5 percent resulting in a total tax rate of 15.825 percent. The trade tax (known as local business tax) is determined by two components. There is a tax base rate of 3.5 percent (*Gewerbesteuermesszahl*) defined by federal tax law, and a multiplier (*Hebesatz*) that is set at will by the local authorities (WWKN, 2020). As a result, a business's multiplier depends directly on its location. In 2021, municipalities levied trade tax at rates that ranged between 8.75 percent (*Hebesatz* of 250) and 20.3 percent (*Hebesatz* of 580) (Deloitte, 2021). The overall tax burden on corporate profits would therefore be between 24.575 percent and 36.125 percent in the year 2021.

In addition, German firms are recognised to be major foreign investors, so their use of tax havens to avoid taxes is very important (Gumpert, Hines & Schnitzer, 2016). According to the Tax Justice Network (2021), German companies are among the world's leading tax avoiders. Evidence has shown that German companies are just as aggressive as the often-criticised US tech giants (Apple, Amazon, and Facebook) in their avoidance of tax. Fresenius, for example, is one of German's top 30 companies in terms of market capitalisation and it is included in Germany's leading index, the DAX. Fresenius has avoided paying up to €2.9 billion in taxes worldwide through its aggressive tax planning, and €8 billion of the group's untaxed profits

are held in offshore accounts (European Public Service, 2021). Fresenius is represented in almost every well-known tax haven around the world, including the Cayman Islands, the British Virgin Islands, Hong Kong, Delaware, Singapore, and Panama, through which it can shift its profits and avoid higher corporate taxes in Germany and other countries (European Public Service, 2021). By way of example, in 2017 the two Irish Fresenius subsidiaries made a profit of €47 million, despite having no employees, simply by granting loans to group companies in Spain and the United States. The Tax Justice Network (2018) reveals that Germany may lose more revenue to European tax havens than any other EU country because of this profit-shifting.

This research will be based on the trade (local business) tax rates, which vary significantly among municipalities. Evidence has shown that there is huge discrepancy in local business tax rates across municipalities (Germany Trade & Invest, 2020) which can be exemplified by comparing Hambourg, a major city, which imposes a local business tax rate of 16.45 percent (the statutory rate of 3.5 percent and a municipal multiplier of 490) with Grünwald, a tiny municipality, which imposes a local business tax rate of 9.1 percent (the statutory rate of 3.5 percent and a municipal multiplier of 260). In a nutshell, the variation in local business tax rates comes from the differentiation in municipal multipliers. **Graph B6** (**Appendix B**) shows the map of multipliers across municipalities in 2019. We have used data from DESTATIS to collect a dataset with the time-variant variable of municipal multipliers. This allows us to test the impact of local business tax rates on the use of tax havens by firms in Germany, internationally and domestically.

Previous studies in this research area have been challenged for a lack of information about micro-regional data (Becker, Egger & Merlo, 2012; Koh, Riedel & Bohm, 2013). Our time

variant sub-national dataset distributed from DESTATIS covers ten consecutive years from 2008 to 2018. In total, we collected a comprehensive dataset on the municipal multipliers of 12,232 municipalities over the time period 2008-2018. We also collected other region-level variables from the DESTATIS database, including property tax B (used as an instrumental variable for the local business tax rates variable), regional population, regional employment, economic value added, and regional gross domestic product.

3.2 Cleaning procedures and limitations

The downloaded data is thoroughly cleaned with a number of steps and procedures.

First, the dataset ORBIS is usually accessed online. While it contains the financial information for firms going back to a maximum of ten years, ownership and subsidiary information is given for the current financial year only. As the purpose of this thesis relates to the use of tax havens, it was necessary to obtain access to previous versions of the database in order to be able to create a detailed ownership structure and subsidiary information for every year of the sample period. We then needed to trace changes in ownership and subsidiaries for the entire period by using earlier releases of ORBIS retrieved from historical discs. Related to the above point, it is important to note that the coverage of firms increases over time. A number of firms enter the dataset in a specific year, having not been previously recorded. Therefore, those firms have only the current year's ownership and subsidiary information and cannot be traced back. In those circumstances, we rely on the assumption made by the studies of Konings and Murphy (2006) that the latest ownership and subsidiaries information is valid for every year of the sample period.

Second, for Chapters 4 and 5 as mentioned above, an MNE is defined conventionally, namely as a firm that owns at least 10 percent of a subsidiary located abroad (UNCTAD, 2013). We used this criterion to clean downloaded data from ORBIS. Hence, MNEs with less than 10 percent of a foreign subsidiary are excluded from the datasets for Chapter 4 and Chapter 5. For the third empirical chapter, we confined our number of firms to those with domestic subsidiaries inside Germany to investigate the domestic profit-shifting of German companies across the country's domestic tax havens network.

Third, we drop unusual changes to exclude possible outliers in observations that seemed to be "key punch errors", such as negative values for employment figures, assets, and sales. In practice, outliers can cause problems with certain types of model. For instance, for regression models, outliers make the models less robust. We then filtered unwanted outliers to improve the econometric models' performance. However, this was done very cautiously. In particular, we do not remove an outlier simply because it is a big number. For example, when we summarised data for parent age in our dataset, we noticed that there are some very big numbers; indeed, the maximum number for firm age is 790, indicating that the company has been operating for several centuries. In such circumstances, we check the company name in the dataset and verify the information by other sources. In other words, we check the accuracy of all big numbers before deciding whether to exclude them from our dataset.

Fourth, all monetary values are deflated using the United States gross domestic product (GDP) Deflator to take account of inflation (Trading Economics, 2020). All financial data in our dataset is in 000s of dollars, which is how ORBIS measures financial data. This contrasts with DESTATIS, which measures in 000 000s of euros (this is particularly relevant to the second and third empirical chapters, where financial data on regional economic value added (EVA)

and regional GDP are taken from DESTATIS). We therefore use the average annual exchange rates from Trading Economics (2020) to convert from euros to dollars to make currencies consistent inside the dataset. Thus, we can remove inconsistencies when multiple sources of data are being pulled into one dataset, and ensure that all financial data in our datasets are consistently in 000s of dollars.

Fifth, for the second and third empirical chapters (Chapters 5 and 6) about profit-shifting of German firms internationally and domestically, the data on local business tax rate and property tax B from DESTATIS are merged with the master dataset from ORBIS using the criteria of reference municipalities. However, data on regional population, regional employment, regional economic value added, and regional gross domestic product from DESTATIS are merged using the criteria of NUTS3.

Sixth and last, due to variations in national reporting requirements, a significant number of firms have limited or even no financial information. As a result, there are a number of missing observations for variables considered in the analysis. This is due to gaps in reports when the data is not made available by the firms either in accordance with or violation of the national laws. Thus, firms with such limited information are not included in the sample data for each of the empirical chapters of this thesis. The empirical results of this thesis, however, are not sensitive to this, being based on observations over long periods (8 years for Chapter 4, 10 years for Chapter 5, and 7 years for Chapter 6) to evidently capture the trend or phenomenon.

3.3 Conclusion

This chapter describes the datasets that will be used in the next three empirical chapters. It introduces the sources of the datasets (ORBIS and DESTATIS). It also explains the ways we

propose measuring the two main concepts of this thesis, namely tax havens and business clusters. The datasets are unbalanced and unsuitable for regression analysis; hence they were cleaned and managed, as described in this chapter.

Because of the aims and scope of the thesis, we use only a small number of variables from the ORBIS and DESTATIS datasets. A large amount of information from the firm-level and regional-level datasets has not been explored (e.g., M&A, shareholders, R&D, patents, etc). Such data might help us investigate the effect of other business-cluster determinants on firms' location choice and tax haven use. Future research could make use of these variables to extend current theories and suggest alternative explanations with regard to the use of tax havens, tax avoidance, profit-shifting, and agglomeration effect.

CHAPTER 4: THE USE OF TAX HAVENS BY MULTINATIONAL ENTERPRISES IN BUSINESS CLUSTERS: A CROSS-COUNTRY AND FIRM-LEVEL ANALYSIS

4.1 Introduction

It is widely demonstrated that location remains fundamental to competition, and firms are likely to move their capital to tax-advantage locations. Profit-shifting therefore remains an unparalleled emphasis of the international tax community. It is estimated that approximately US$ 467 billion worth of corporate profit is shifted by MNEs into tax havens annually, with associated corporate tax losses of about US$ 117 billion (OECD, 2020). Due to the complexity of the international tax regime, MNEs are able to take advantage and exploit mismatches of the tax treatment of instruments, entities or transfers across countries in order to artificially shift profits into locations where little or no real economic activity takes place (Eden, 1998; Rohlin, Rosenthal & Ross, 2014).

In parallel with a critical rise in profit-shifting activities, the topic of business clusters is receiving increased attention from policy makers and researchers (Porter, 1998; Porter & Miranda, 2009; Staber, 2010; Zamparini & Lurati, 2012; De Prospris & Driffield, 2016; Du & Vanino, 2020). Much print has been devoted to describing clusters as a spatial network with the concentration of core industries (Poter, 1999; Porter, 2000; Porter & Miranda, 2009; Delgado & Porter, 2014). For instance, in America, many leading U.S. advertising agencies are concentrated on Madison Avenue in New York City. The leading computer manufacturers of the country such as Control Data, Cray Research, Burroughs and Honeywell are all headquartered in or near Minneapolis, Minnesota. Large-scale pharmaceutical and related companies such as SmithKline, Merck, Squibb, American Cyanamid, Becton-Dickinson, and C.R. Bard, are based in the Philadelphia/ New Jersey. In addition, business clusters play a

decisive role in economic prosperity among the regions of US and Europe (Sölvell, 2008). The role of agglomeration economies in determining locational choices of investment has been highlighted (Iammarino, 2011). In many cases, the effect of locations on firm's investment decisions dominates other factors. As stated by Dodwell, head of tax policy at the global accountancy firm Deloitte "Tax is one of the things firms look at, but not the only. More important can be the availability of local expertise and suppliers, which tends to lead businesses to cluster in particular locations". Agglomerated economies play a prominent part of the value chain and have a significant impact upon economic activity (Porter, 1998). In addition, extant literature suggests the value of cluster membership through access to knowledge and resources (Bell & Zaheer, 2007; Amdam et al., 2020). Cluster insidership has a significant effect on firm internationalization through access to collaborative networks and resources (Porter, 1998; Bertolini & Givannetti, 2006; Zucchella, Palamara, & Denicolai, 2007; Amdam et al., 2020). However, there is little literature that seek to uncover the effect of business clusters on MNEs' tax haven activity.

In this chapter, we investigate whether MNEs who are located in a business cluster are more tax aggressive (via the use of tax havens) relative to a set of MNEs who are not classified as being part of a business cluster. We adopt the knowledge-based theory (Grant, 1996; Hoskisson et al., 1999; Maskell, 2001; Wiklund & Shepherd, 2003; Lazzeretti & Cinti, 2006) to explain why firms in business clusters are better placed to use tax havens compared with firms from outside business clusters. The intra-cluster cooperation in localization regions spreads knowledge among cluster firms, resulting in learning and demonstration effects (Anderson & Narus, 1990; Jankowska, Götz & Główka, 2017; Du & Vanino, 2020). We argue that cooperation, which manifests itself in networking, fosters knowledge exchange and knowledge

creation among cluster members. As a result, firms who are part of a cluster can rapidly learn from each other about tax haven investments specifically and internationalization generally.

For the construction of the agglomeration measure, we draw on the pre-existing lists of business clusters published on government websites, and the cluster literature (Audretsch & Feldman, 1996, Porter, 1998; Porter & Miranda, 2009), which considers geographical location and industry specialization to determine whether a MNE is part of a business cluster. The intersection of the two dimensions provides an intuitive perspective on peer groups (Baptista, 2000). In terms of tax haven use, we measure a firm's likelihood to use tax havens by tracking MNEs' subsidiaries, including ones located in tax havens (Lee, Dobiyanski, & Minton, 2015). The disaggregated firm-level data from ORBIS provides information on location and industry of every parent MNE, thereby enabling us to identify a firm's presence inside or outside a business cluster. The dataset also allows us to detect the whole network of subsidiaries, owned and used by each MNE on an annual basis.

Utilising a large dataset of 50,710 observations of MNEs from five countries (Austria, Belgium, Germany, France and UK) during the years 2009-2017, we find that MNEs who are part of a business cluster have 31.0 to 33.9 percent higher likelihood of engaging in tax haven activity compared to MNEs who are not part of a business cluster. In addition, we show that factors such as technological sophistication, firm age and firm size can positively impact the relationship between business clustering and tax haven utilization.

This chapter contributes new evidence to the literature in several dimensions. First, to the best of our knowledge, this chapter is among the first of its kind to examine the link between MNEs in business clusters and their tax haven activity. The finding complements knowledge- based

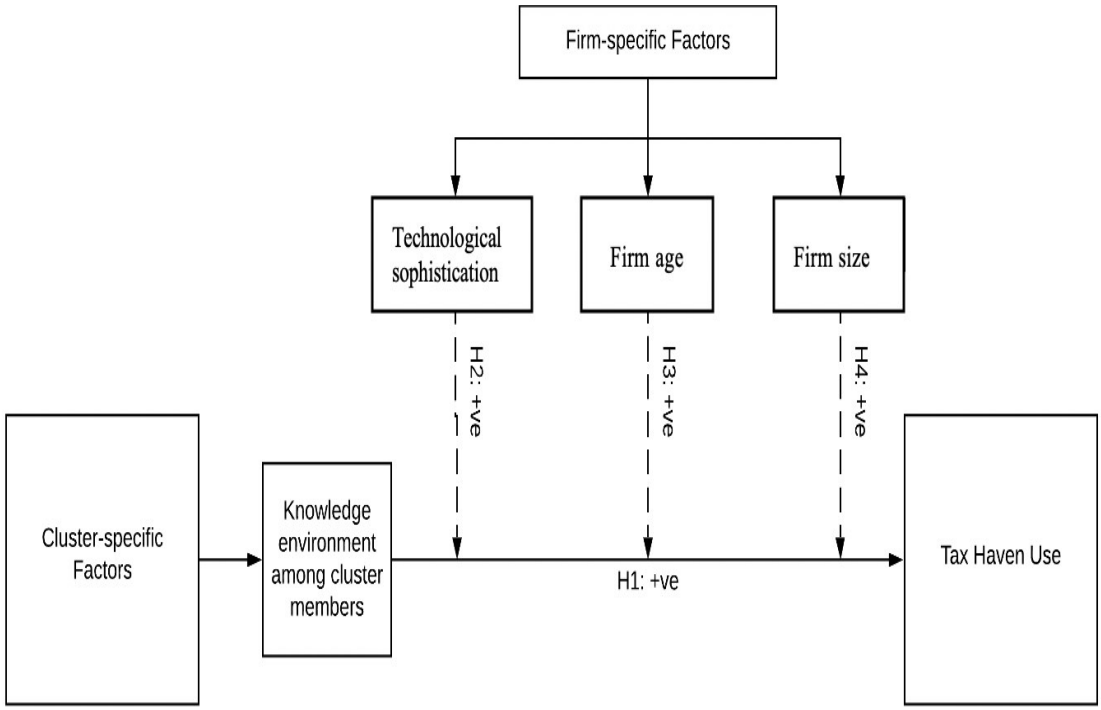
theory, pointing out the facilitating role of geographical proximity for knowledge access among firms operated in similar industrial sectors. Then, it brings more favourable conditions for cluster firms to engage in tax haven use, compared with non-cluster firms. Second, we exploit an exhaustive and large-scale sample of MNEs from a group of five countries. This will add richness and robustness to our findings and bring more comprehensive generalization. Third, research on key trends of companies in business clusters and investment decisions of clustered firms could be very crucial for efforts to forge a new framework for business clusters' development.

The remainder of this chapter is set out as follows. In the next section, we will discuss theory and hypotheses. In Section 3, information on data, variables and empirical models will be described. The empirical results will then be presented in Section 4. Finally, we provide the concluding remarks to this empirical chapter.

4.2 Theoretical framework and hypotheses

The knowledge-based theory (Grant, 1996; Hoskisson et al., 1999; Maskell, 2001; Wiklund & Shepherd, 2003; Lazzeretti & Cinti, 2006) considers knowledge as the most crucial strategic resource to ensure sustainable differentiation and competitive advantages of organizations. According to Porter and Miranda (2009), knowledge environment is the nature of a business cluster and is one of the cluster-specific factors. We utilise the knowledge-based theory and extend it to derive our hypotheses related to business clusters and tax haven use. We speculate that knowledge environment forms distinctive conditions for MNEs that are part of a business cluster compared to MNEs that are not part of a business cluster. Besides, the existing literature highlights firm-specific factors such as level of technology (Desai, Foley & Hines, 2006; Dyreng, Hanlon & Maydew, 2008; Taylor, Richardson & Lanis, 2015; Jones & Temouri, 2016), firm age and firm size (Jones & Temouri, 2017), which are important in explaining tax avoidance activities via tax havens. We focus on these three factors to examine whether those factors can moderate the relationship between the effect of business clusters and MNEs' tax haven use. That will reveal specific types of firms in business clusters who are more likely to establish tax havens subsidiaries. The theoretical framework we use for this empirical chapter is presented in **Figure 4.1**.

Figure 4. 1 Theoretical framework chapter 4



The following sub-sections present our main theoretical contributions, which focus on the cluster-specific factor (knowledge environment via industrial agglomeration) and some moderating factors (technological sophistication, fim age and firm size).

4.2.1 Toward knowledge-based theory of the geographical cluster

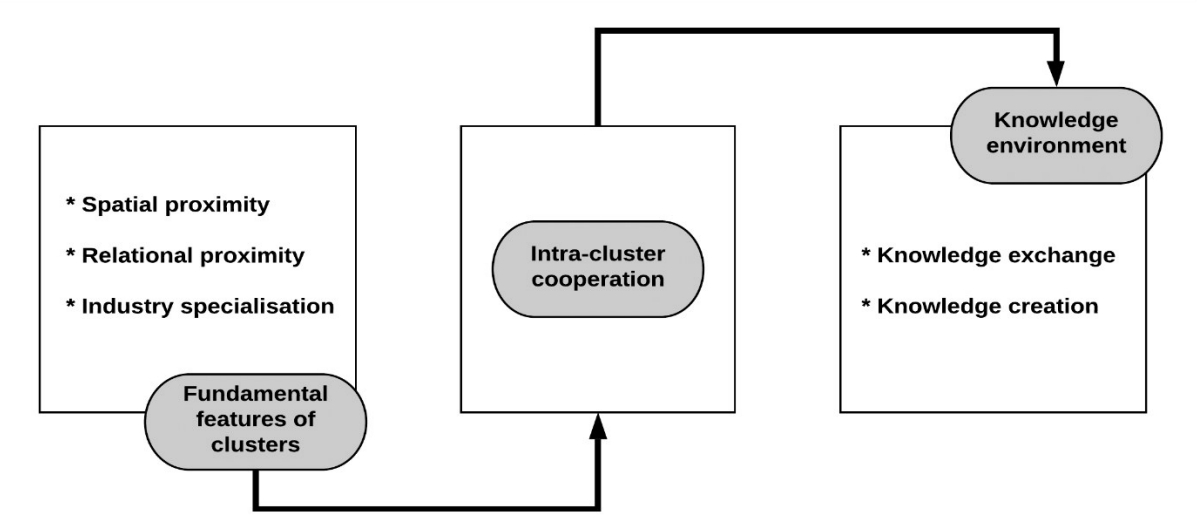
Industry clusters are "geographically proximate groups of inter-connected firms and associated institutions in a particular field, linked by commonalities and complementarities" (Porter, 2000, p. 254). One of the distinguishing features of a business cluster is the co-existence of competitive relations and cooperative relations between cluster actors (Porter, 1998). Firms in clusters are often confronted with intensive competition, forcing them to engage in learning processes and to continuously enhance their performance (Porter &

Miranda, 2009). However, it is difficult for co-located firms to maintain any secrecy for long, as they are born and raised in the same "schools" (Rosenfeld, 1997, p.20). That creates a general climate of understanding and trust (Swann & Prevezer, 1996; De Prospris & Driffield, 2016). Competing firms in business clusters then collaborate with each other for common goals, and function as networks within a particular geographical space (Archibugi & Pianta, 1992; Gulati, 1999; Jankowska, Götz & Główka, 2017).

The intra-cluster cooperation in business clusters brings favourable conditions for cluster entities to promote knowledge spillovers (Fritsch & Lukas, 1999; Abukabarr & Mitra, 2017). According to Jankowska, Götz & Główka (2017, p.187), there are two critical dimensions of a business cluster, including "spatial proximity" and "relational proximity". The spatial dimension favours contacts and fosters cluster entities to interact in both formal and informal settings (Nam, Manchanda, & Chintagunta, 2007; Isaksson, Simeth & Seifert, 2016). The relational dimension allows co-located firms to exchange information, especially uncodified knowledge (Du & Vanino, 2020). These two dimensions foster social capital in business clusters, and then reinforce agglomeration externalities, mainly through imitation, cooperation, competition and personnel relations (Almeida & Kogut, 1999; Debruyne & Reibstein, 2005; Gort & Konakayama, 1982; Leary & Roberts, 2014; Laursen, Masciarelli & Reichstein, 2016). Furthermore, two critical dimensions of a business cluster form a basis for the effective creation of new knowledge among cluster entities. In particular, the process of knowledge creation emerges from the effective exchange and sharing of knowledge resources among members (Jabbour & Mucchielli, 2007; Li & Bathelt, 2018). Asymmetrical knowledge is exchanged in business clusters, the process of sharing ideas and knowledge is facilitated. Firms are prompted to learn from other actors, leading to the creation of new knowledge over time. A truly operating cluster enhances its knowledge base in the long run, thereby enabling cluster

members to possess higher strategic flexibility and faster response to market changes compared to outsiders (Curado, 2006). Put it another way, companies outside clusters are less likely to have a supportive environment to transfer information and create new knowledge quickly and freely compared to their cluster counterparts.

Figure 4. 2 Intra-cluster cooperation and knowledge environment in business clusters



Source: Authors' proposal based on the literature review

4.2.2 Tacit knowledge in business clusters

Thanks to similar and related economic activity, one of the main distinguishing features of business clusters is that they provide opportunities for "the transmission of sticky, non-articulated, tacit forms of knowledge" between cluster members (Bathelt, Malmberg & Maskell, 2004, p.32). Tacit knowledge is defined as "a high degree of personal experiential knowledge that forms in the long-term accumulation in practice, difficult to express in words, difficult to spread and share, it comes from the people's experience, insight and understanding, usually presents the experience, skills, inspiration, insight, expertise, intuition, mental models, predictability, values, beliefs, spirit of teamwork and organizational culture" (Bathelt,

Malmberg & Maskell, 2004, p.31). Knowledge with a more tacit dimension is difficult to manage and represents a more important strategic asset than explicit knowledge. Unlike formal knowledge that is not tied to place or to a particular cluster, the tacit knowledge is embedded locally and plays an irreplaceable role to build a business and the competitive advantage of industrial clusters.

When this locally embedded knowledge is combined in novel ways with codified and accessible external knowledge, new value can be created (O'Connor, 2004). As tacit knowledge is often spread through face to face communication, geographic proximity of business cluster is conducive to sustained, high-intensity, fast switching of knowledge (Cong and Weng, 2011). A local culture, with shared values, norms and institutions facilitates the diffusion and adoption of tacit knowledge between firms. Similarly, Forsman and Solitander (2003) propose that the tacit knowledge can be seen as a central component for localized knowledge.

It has been argued that knowledge can be transferred, but it depends on the absorptive capacity of the actors receiving the knowledge whether the transfer is completed (successfully) or not (Nonaka & Teece, 2001). Absorptive capacity is the ability of the receiver to assimilate, value and use the knowledge transferred. According to Cohen and Levinthal (1990, p.129) "...the notion of absorptive capacity is that the organization needs prior related knowledge to assimilate and use new knowledge". A business cluster enables an enhanced understanding of the firm and its knowledge transfer through its addition and emphasis on a socio-cultural, institutional and spatial context and environment. O'Connor (2004) reveals that only by being in the same local environment, and by meeting repeatedly in person, can and will such more subtle forms of information be exchanged. This has been proposed as the main mechanism that

makes it beneficial for a firm to be located in a spatial cluster, surrounded by other similar and related firms. Overall, the shared knowledge basis enables cluster firms to continuously combine and re-combine similar and non-similar resources to produce new knowledge and innovations (Maskell and Malmberg, 1999). This stimulates economic specialization within the cluster and results in the development of localized capabilities which are available to cluster firms. This line of reasoning makes us suspect that industrial cluster provides establish a good platform for the generation, dissemination and absorption of tacit knowledge, and hence possibly converting the tacit knowledge such as the use of tax hanves into explicit knowledge that is available for cluster members.

4.2.3 Cluster membership and firm internationalization

In recent years, some empirical evidence suggests that cluster membership has a significant effect on firm internationalisation through access to collaborative networks and resources (Porter, 1998; Zucchella, Palamara, & Denicolai, 2007; Amdam et al., 2020). Furthermore, the intra-cluster cooperation in economic agglomerations facilitates knowledge sharing among co-locating firms, and firms are inclined to learn from better-performing companies operating within same regions and related sectors (Anderson & Narus, 1990; Jankowska, Götz & Główka, 2017; Du & Vanino, 2020). Du and Vanino (2020) reveal that inter-clustering is considered to be a network of learning via knowledge spillovers, leading to increased performance in the network. Besides, social interaction from a geographical region leads to the imitation behaviour for decisions (Swann & Prevezer, 1996). For example, Kelchtermans, Neicu and Teirlinck (2020) reveal that spatially agglomerated firms are likely to rely on the choices of their peers to make their own decisions with regard to R&D tax exemptions.

Moreover, within a business cluster, as mentioned above, interactions occur not only among firms, but also among R&D institutions, business-support organisations, and local or regional

government (Krugman & Venables, 1996; Porter, 1998, 2000). In particular and more importantly, the literature has highlighted the role played by the Big4 and the Magic Circle of law firms in firms' tax avoidance activities. In particular, Jones, Temouri and Cobham (2018) highlight that the Big 4 accountancy firms play a singularly important role, not only terms of the accountancy services they provide to multinational enterprises, but also through their expansive tax advice offering. Their experience and influence allow their clients to reduce their effective tax rate. The use of internal specialists, who may be recruited through the leading accountancy firms, can internalise this knowledge and help the MNE to efficiently escape the exogenous market imperfections (Rugman, 1980, 1981) caused by regulation, which in this context, would be corporate tax. This prompts a reconsideration of the effect of business clusters in the context of firm internationalisation, especially via the establishment of foreign subsidiaries in tax havens.

In the context of business clusters and the use of tax havens, we contend that the intra - cluster cooperation of business clusters spreads knowledge (including tacit knowledge such as tax haven use) among cluster members, and they can learn quickly about double benefits from business clusters and tax havens. Cluster entities are offered multi-cluster advantages such as flexibility advantages (high mobility of labour and other resources), efficiency advantages (lower costs, including transaction costs), and innovation advantages (knowledge spill overs) (Porter & Miranda, 2009). Tax havens enable MNEs to receive massive reduction in tax liabilities (Eden, 1998; Jones & Temouri, 2016; Jasiniak & Kozinski, 2017). The knowledge environment in business clusters allows cluster members to perceive that it is in their best interest to combine spatially transferable intermediate production generated in business clusters with at least some immobile factor endowments in tax havens (low tax rates or a zero tax rate). This leads to our first hypothesis of this empirical chapters:

Hypothesis 1. MNEs who are part of a business cluster are more likely to own a tax haven subsidiary compared to MNEs who are not part of a business cluster.

4.2.4 Factors moderating the effect of business clusters

Level of technological sophistication

A large part of the success of business clusters is usually attributed to high level of technology and innovation (Porter & Miranda, 2009). Porter (1998) highlights that technology and innovation form the heart of a business cluster. In this empirical chapter, we propose that there is a big gap in the likelihood of owning tax haven subsidiaries between technological intensive MNEs in business clusters and those with lower level of technology, and the gap for cluster MNEs is significantly bigger than that for non-cluster MNEs. This is for the following reasons.

First, MNEs with high level of technology are the highest-potential members in business clusters to engage in tax haven activities, as they possess high levels of intangible assets such as rights, trademarks, patents, licences and sub-licenses (Dyreng, Hanlon & Maydew, 2008; Jones & Temouri, 2016). Many studies are devoted to demonstrating that there are strong incentives for high technology firms to engage in profit-shifting via tax haven subsidiaries (Desai, Foley & Hines, 2006; Dischinger & Riedel, 2011; Taylor, Richardson & Lanis, 2015). Desai, Foley & Hines (2006) find that the demand for tax haven operations is likely to grow for US companies with high R&D to sales ratios. Dischinger and Riedel (2011) reveal that subsidiary locations with lower level of corporate tax rates have higher level of intangible assets. Taylor, Richardson and Lanis (2015) point out that intangible assets are key drivers for firms to obtain tax benefits via profit-shifting aggressiveness. In other words, MNEs possessing valuable intangible assets are ideal candidates for profit-shifting via tax havens.

Second, the role of hierarchical position in a business cluster allows technological firms to be able to more easily recognize their capacity to engage in tax haven use, compared to members with lower level of technology. In business clusters, the cooperative constellation is intensified as the cooperation takes place not only among firms, but also among R&D institutions, support organisations, and regional government (Boschma, 2005; Johannessen, 2009). It should require less effort for firms with high technological sophistication to absorb knowledge outcomes from other members. Moreover, business clusters exert highest effects on firms with high technology and innovativeness as they are the core part of the network (Tether, 2002; Simmie, 2002). Regarding the geographical proximity dimension, Porter (1998) argues that innovation dynamics in clusters are stimulated by local competition and peer pressure among firms, suggesting that firms within clusters are aware of their peers' activity, and, by extension, initiatives. Storper and Venables (2004) highlight the facilitating role of location for knowledge access in such a bounded geographical setting. As a result, firms with high technological sophistication are likely the first members in business clusters to access information and engage in knowledge spillovers (Pittiglio & Reganati, 2015). Hence, technological intensive MNEs are aware of their suitability to own tax haven subsidiaries in their operation. They then quickly learn the internationalisation practice and financial strategies from other cluster members, right after the knowledge transfer takes place. Put it another way, cluster firms with higher level of technology and innovation are normally in a more advantageous position than cluster firms with lower level of technology and innovation to use transfer prices to channel profits to low tax jurisdictions.

In sum, we argue that technological sophistication is one of the factors impacting the magnitude of the relationship between business clusters and tax havens. As such, we have:

Hypothesis 2. The effect of business clusters on the use of tax havens is stronger for MNEs with higher level of technological sophistication than MNEs with lower level of technological sophistication.

Firm age and firm size

Evidence has shown that firm age has significant effect on the degree of internationalization (Marco & Francesco, 1997; Segaro, Larimo & Jones, 2014; Galvagno & Garraffo, 2016). Furthermore, the literature widely recognizes the important role of large enterprises in the growth of business clusters (Hansen, 1992; Porter & Miranda, 2009, Du & Vanino, 2020). Coincidentally, some evidence has shown that old enterprises play a very important role in the growth of business clusters (Hansen, 1992; Porter & Miranda, 2009). Large firms in business clusters have advantages on enhanced learning that leads to a non-random improvement in performance (Maskell, 2001). In this empirical chapter, we argue that there is a big gap in the likelihood of using tax havens between older and larger MNEs compared to younger and smaller MNEs in business clusters, and the gap for cluster members is larger than that for MNEs outside business clusters. This is for the following reasons.

First, older and larger firms are much more experienced than younger and smaller firms to engage in activities for minimising tax liabilities. The growth in business clusters often challenges young and small firms as they have to compete with both existing players and new firms (Wennberg & Lindqvist, 2010; Fontagne et al., 2013). Cluster entities are also subject to strong competition from other places due to the fact that business clusters grow into international markets (Porter & Miranda, 2009). Wever and Stam (1998) point out that business clusters evolve over time through adaptation to market fluctuations. Thus, firms in business clusters are required to continuously adapt to broader changes. In addition, younger and smaller

firms are often kept far away from formal cluster governance arrangements, thereby limiting their role in business clusters (Porter & Miranda, 2009). Instead, mature and large MNEs or giants are at the core of the network, who actively engage in a majority of cluster operation (Maskell, 2001). A study conducted by the Université Pierre-Mendès-France and the Reverdy Associés consultancy (cited in Hilber & Voicu, 2013) reveals that less mature and small firms in business clusters often find it challenging to involve in cluster projects. As a result, there is a possibility that younger and smaller firms in business clusters do not acquire information and knowledge as much as older and larger firms do. The fierce competition, broader changes and hierarchical position in business clusters help older and larger firms to accumulate more experience, but likely to refrain younger and smaller firms from taking risks to use aggressive strategies, especially in the initial phase.

Second, a common barrier to young and small firms in business clusters is "lack of seed capital" (Porter & Miranda, 2009, p.16). For example, young and small businesses often face major problems in securing long-term external finance (Porter, 1998, 2000). Empirical evidence has shown that external financiers such as banks, building societies or venture capital companies often find it more uncertain to finance young and small companies than to old and large companies, driving up the costs of handling the financial transaction for small organizations (Williamson, 1981; Nooteboom, 1993). The increases in the financial cost also imply that financiers will be exposed to higher levels of risks (Freixanet & Renart, 2020). The consequences of the high risks and the high costs can cause financiers restrain from supporting young and small businesses (Winborg & Landström, 2001). The lack of capital hence makes young and small firms in agglomerated regions more challenging to develop and grow, compared to large firms. In addition, financial capital plays a crucial role in firms' internationalization process (Freixanet & Renart, 2020). Due to financial burdens, it is much

more difficult for younger and smaller enterprises than larger establishments to gather sufficient resources to build operational capability, especially for the international one (Capello & Nijkamp, 2009). Younger and smaller entities in business clusters therefore prioritize to establish their businesses rather than engaging in tax haven utilization which normally costs a huge amount of funds.

For these reasons, we propose that firm age and firm size play a role in the association between MNEs in business clusters and their use of tax havens. As such, we propose hypotheses 3 and 4 of this empirical chapter as follows:

Hypothesis 3: The effect of business clusters on the use of tax havens is higher for older MNEs than for younger MNEs

Hypothesis 4: The effect of business clusters on the use of tax havens is higher for larger MNEs than for smaller MNEs

4.3 Data, variables and empirical models

4.3.1 Data

All data in this research is secondary in nature and collected from the commercial firm-level database ORBIS. This database provides the richness of various data such as financial information, location and subsidiaries at the company level. This allows us to identify every MNE's foreign subsidiaries, including tax haven locations. Furthermore, this dataset enables us to identify location and industrial classification for each parent MNE. As a result, we can track the presence of MNEs, who are part of business clusters, and their counterparts outside business clusters. The unbalanced firm-level dataset holds 50,710 observations of MNEs from five OECD countries (Austria, Belgium, Germany, France and UK) during the years 2009-

2017. The rationales behind the choice of the five research sites mainly relates to the high coverage of data on location, financial data, business cluster maps/ lists, etc.

Dependent variable: classifying tax havens

Our dependent variable is a binary variable, equals 1 if a MNE has at least one subsidiary located in a tax haven, and 0 otherwise. In the literature, there are a number of different lists available to define which jurisdictions are denoted as tax havens (Hines & Rice, 1994; Desai, Foley & Hines, 2016; Jones & Temouri, 2016; Tax Justice Network, 2018). We take a conservative approach in classifying tax havens and focus on the list of tax havens as suggested by Jones, Temouri & Cobham (2018). Those tax havens are mainly "dot tax havens" where the use of them is mostly to do with tax avoidance. Some important tax havens such as Switzerland is also included in the list. For this reason, the list of tax haven locations utilized in this chapter consists of 52 jurisdictions. For the full list of tax haven locations, see **Table 4.1.**

Independent variable: Identifying business clusters

Our independent variable is a binary variable, equals 1 if an MNE is located in a recognized business cluster, and 0 otherwise. We rely on the pre-existing published lists of business clusters from government websites and consider the definition of industry clusters with two main dimensions, including geographical proximity and industry specialization (Porter, 1990; Audretsch & Feldman, 1996; Porter, 1998; Porter, 2000; Porter & Miranda, 2009).

Based on the business cluster maps and lists available from government websites of the five countries **(Appendix B)**, we establish a three-stage procedure to identify business cluster firms. First, we detect reference cities for each business cluster. Second, we match NACE industrial

codes (industrial activity classification as defined by Eurostat) for industry specialization of each business cluster. Third, we combine reference cities and NACE codes to obtain a list of cluster firms. After that, we are able to detect non-cluster firms in the dataset. This way is compatible with quantitative econometric analysis developed therein.

Explanatory variables

The explanatory variables in our analysis are obtained from annual accounts data in ORBIS for each multinational to capture firm age, firm size (measured by turnover as proposed by Graham & Tucker, 2006), technological sophistication (measured by the ratio of intangible assets over total assets (IATA) as proposed by Jones & Temouri, 2017), number of foreign subsidiaries, and cashflow. Those variables are discussed in the work by Jones and Temouri (2016) as determinants of tax haven FDI. We adopt the conventional way of defining a MNE, namely as a company that owns at least 10 percent of a subsidiary located abroad (UNCTAD, 2019). Furthermore, we base on the NACE two-digit industry codes which are defined by Eurostat to identify the industrial sectors in which each multinational operates.

Table 4. 1 Variables and measures chapter 4

Variable name	Measures	Source
Tax haven definitions		
Tax havens	Andorra, Anguilla, Antigua, Aruba, Bahamas, Bahrain, Barbados, Barbuda, Belize, Bermuda, Botswana, British Virgin Islands, Brunei Darussalam, Cayman Islands, Cook Islands, Curacao, Cyprus, Dominica, Ghana, Gibraltar, Grenada, Guatemala, Guernsey, Hong Kong, Isle of Man, Jersey, Lebanon, Liberia, Liechtenstein, Luxembourg, Macao, Macedonia, Malaysia, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Samoa, San Marino, Seychelles, Singapore, Switzerland, Turks and Caicos Islands, UAE, Uruguay, and Vanuatu.	ORBIS
Business clusters definitions		
Cluster firms	Dummy variable (equals 1) indicating that a MNE is located in a recognized business cluster.	ORBIS
Non-cluster firms	Dummy variable (equals 0) indicating that a MNE is not located in any recognized business cluster.	ORBIS
Firm characteristics		
Log Turnover	The natural log of turnover. Turnover is listed in the Balance Sheet account and defined as Total Operating Revenue.	ORBIS
Age	The age of a firm calculated since the year the company was incorporated.	ORBIS

Intangible fixed assets	Intangible assets are listed in the Balance Sheet account.	ORBIS
Total assets	Total assets refer to total amount of assets owned by companies.	ORBIS
Log Cashflow	The natural log of cash flow. Cash flow is a financial variable listed in cash flow statement. It equals to the net amount of cash and cash-equivalents.	ORBIS
Number of Foreign subsidiaries	The total number of foreign subsidiaries identified for the parent firm.	ORBIS
Industry activity classification		Eurostat
High technology manufacturing	Nace 2-digit codes: 21, 26.	
Medium/High technology manufacturing	Nace 2-digit codes: 20, 27, 28, 29, 30.	
Medium/Low technology manufacturing	Nace 2-digit codes: 19, 22, 23, 24, 25, 33.	
Low technology manufacturing	Nace 2-digit codes: 10, 11, 12, 13, 14, 15, 16, 17, 18, 31, 32.	
Knowledge Intensive services	Nace 2-digit codes: 50, 51, 58, 59, 60, 61, 62, 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 78, 80, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93.	
Less knowledge intensive services	Nace 2-digit codes: 45, 46, 47, 49, 52, 53, 55, 56, 68, 77, 79, 81, 82, 94, 95, 96, 97, 98, 99.	
Time	Year of sample period: 2009-2017.	ORBIS

4.3.2 Descriptive statistics

Table 4.2 gives information of a breakdown of MNEs' countries of origin. In total there are 21,389 MNEs from five countries in our dataset for the first empirical chapter, in which 3,194 MNEs are located in business clusters. UK holds the largest percentage of cluster MNEs. Specifically, of the 4,825 MNEs from the UK, 43.92 percent of MNEs locate in identified business clusters. Whilst, the smallest proportion belongs to Austria where only 4.79 percent of MNEs locates in identified business clusters. This compares with 13.28 percent in Germany, 15.47 percent in Belgium, and 22.54 percent in France. In the dataset, 5,188 MNEs out of 21,389 MNEs have at least one subsidiary in a tax haven. UK has the biggest number of MNEs with tax haven subsidiaries, taking up 29.73 percent of the sample, followed by France, occupying 29.08 percent of the sample. The figures for Austria, Germany and Belgium are 3.61 percent, 17.98 percent, and 19.60 percent respectively. The overlap of "number of MNEs business clusters" and "number of MNEs with tax havens" show that there are 60 MNES (around 3.19% of sample MNEs) in Australia who have foreign subsidiaries in tax havens and are part of business clusters. The overlap figures for Germany, Belgium, France and the UK are 308 (19.39%), 336 (17.99%), 461 (24.53%) and 714 (27.99%), respectively.

Table 4. 2 MNEs' country of origin chapter 4

Country	Number of MNEs	% of sample	Number of MNEs in business clusters	% of sample	Number of MNEs with tax havens	% of sample	Number of MNEs in business clusters and with tax havens	% of sample
Austria	1,421	6.64	153	4.79	187	3.61	60	3.19
Belgium	3,713	17.36	494	15.47	1,017	19.60	336	17.88
France	5,999	28.05	720	22.54	1,509	29.08	461	24.53
Germany	5,431	25.39	424	13.28	933	17.98	308	16.39
United Kingdom	4,824	22.55	1,403	43.92	1,542	29.73	714	37.99
Total	**21,388**	**100**	**3,194**	**100.00**	**5,188**	**100.00**	**1879**	**100.00**

Table 4.3 provides descriptive statistics for variables included in our analysis. The panel data holds 50,710 observations of an unbalanced panel of firms for the period 2009-2017. As indicated, about 15.41 percent of the firm year observations are identified in business clusters. With regard to the tax haven dummy variable, 26.16 percent of the firm year observations are set equal to 1. As for firm age, the average age of each firm is 37.32 years with a standard deviation of 31.84 years. In terms of firm size, as proxied for by turnover, the average firm is creating sales equal to exp (10.93), which measured in thousands of dollars is equal to approximately US$ 55.826 million. The variable IATA (Intangible assets over total assets), which we use to proxy the technological sophistication is on average 0.056. Each MNE has on average 20.70 foreign subsidiaries with a standard deviation of 72.61. In terms of cash flow, the average firm is possessing cash flow equal to exp (8.61), which measured in thousands of dollars is equal to approximately US$ 5.486 million. Each MNE has on average 1.64 tax haven subsidiaries with a standard deviation of 8.17. Due to missing values, there are some drops in

the number of observations for firm size (Turnover), technological sophistication (IATA) and NACE industry codes, thereby reducing the number of observations after running regressions to 50,710 observations. All monetary values in the dataset are in thousands of dollars. Hence, we use United States GDP Deflator (Trading Economics, 2019) to deflate monetary values.

Table 4.3 Descriptive statistics for sample data chapter 4

Variables	N	Mean	S.D.	Min	Max
Business cluster	50,710	.1541905	.3611348	0	1
Tax havens	50,710	.2616052	.4395131	0	1
Firm age	50,710	37.32907	31.84515	0	653
Firm size (Ln turnover)	50,710	10.93594	2.268114	-8.246447	19.72982
Technological sophistication (IATA)	50,710	.0562612	.1253755	-.4145658	.9616124
No. of foreign subsidiaries	50,710	20.70473	72.61604	1	2045
Ln cashflow	50,710	8.610934	2.209882	-3.260399	17.62002
No. of tax haven subsidiaries	50,710	1.641727	8.171418	0	418
NACE industry code	50,710	47.47521	21.04212	1	96
Year	50,710	2013.052	2.310653	2009	2017

Table 4.4 reports the correlation matrix between all of the variables used in our analysis. The matrix shows that the correlations between our variables are weak, ranging from (0.0202) to 0.5577. Therefore, multicollinearity is not a problem.

Table 4. 4 Correlation Matrix Chapter 4

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Tax haven	1.0000						
(2) Business clusters (BCL)	0.3640	1.0000					
(3) Firm age	0.0499	0.0073	1.0000				
(4) Firm size (Ln Turnover)	0.1759	0.1099	0.2918	1.0000			
(5) Technological sophistication	0.1148	0.0820	-0.0202	0.1708	1.0000		
(6) No. of foreign subsidiaries	0.36270	0.1824	0.1127	0.2108	0.0987	1.0000	
(7) Cash flow	0.3193	0.1718	0.2478	0.5577	0.2231	0.3461	1.000

4.3.3 Empirical models

We estimate Probit models and run a number of specifications that revolve around five unbalanced panel data models.

Hypothesis 1 about the use of tax havens by MNEs located in a business cluster is tested using an equation in the following form:

$$\textbf{(1)}\ Tax\ Haven_{i,t} = \alpha + \beta_0\, Cluster_i + \Sigma \beta_1\, Firm_{i,t} + \Sigma \beta_2\, Sector_{s,i} + time_t + country_c + \varepsilon_{i,t}$$

where the index *i* refers to *Firm*, *s* refers to *Sector*, *t* refers to *Time*, and *c* refers to *Country*. The dependent variable $Tax\ Haven_{i,t}$ is binary proxy variable for the use of tax havens, equals 1 if the company has at least one subsidiary in tax havens and 0 otherwise. The variable $Cluster_i$ in equations is dummy variable, equals 1 if a MNE is a cluster firm, and equals 0 otherwise. β_0 is the coefficient of primary interest as it quantifies the impact of being located in business clusters on a firm's presence in tax havens. The vector $Firm_{i,t}$ captures a number of firm characteristics such as firm age, firm size, technological sophistication, number of foreign subsidiaries, and cash flow. The vector $Sector_{s,i}$ includes sector dummy variables at two-digit NACE industry codes as proposed by Eurostat definition. The sector dummy variable is divided into six categories, including "High technology manufacturing", "High/Medium technology manufacturing", "Medium/Low technology manufacturing", "Low technology manufacturing", "Knowledge intensive services" and "Less knowledge intensive services", in which "Low technology manufacturing" is chosen as the base group. For detailed descriptions of NACE codes for the categorization of the industrial sectors, see **Table 4.1**. The variables $time_t$ and $country_c$ are time and countries dummies, to account for business cycle and countries effects. The time dummy variable covers a research period from the year 2009 to the year 2017. The country dummy variable is classified into five categories, namely "Austria – AT",

"Belgium – BE", "Germany – DE", "France – FR" and "the UK – GB", and ε represents the error term.

Extending the above benchmark specification, the modelling for testing hypotheses 2 on the moderating effect of technological sophistication is as follows:

$$\textbf{(2)}\ Tax\ Haven_{i,t} = \alpha + \beta_0\ Cluster_i + \Sigma\beta_1\ Firm_{i,t} + \Sigma\beta_2\ Sector_{s,t} + \beta_3\ Cluster_i * IATA_{i,t} + time_t + country_c + \varepsilon_{i,t}$$

For hypothesis 3 and hypothesis 4 on the moderating effect of firm size, the following augmented specifications are used:

$$\textbf{(3)}\ Tax\ Haven_{i,t} = \alpha + \beta_0\ Cluster_i + \Sigma\beta_1\ Firm_{i,t} + \Sigma\beta_2\ Sector_{s,i} + \beta_3\ Cluster_i * Age_{i,t} + time_t + country_c + \varepsilon_{i,t}$$

$$\textbf{(4)}\ Tax\ Haven_{i,t} = \alpha + \beta_0\ Cluster_i + \Sigma\beta_1\ Firm_{i,t} + \Sigma\beta_2\ Sector_{s,i} + \beta_3\ Cluster_i * Size_{i,t} + time_t + country_c + \varepsilon_{i,t}$$

We then include three interaction terms (business cluster with technological sophistication, firm age and firm size) into specification (4) to verify the relationship between business clusters and tax havens, and the moderating effects of technological sophistication and firm size. The modelling is as followes:

$$\textbf{(5)}\ Tax\ Haven_{i,t} = \alpha + \beta_0\ Cluster_i + \Sigma\beta_1\ FSA_{i,t} + \Sigma\beta_2\ Sector_{s,i} + \beta_3\ Cluster_i * IATA_{i,t} + \beta_4\ Cluster_i * Age_{i,t} + \beta_5\ Cluster_i * Size_{i,t} + time_t + country_c + \varepsilon_{i,t}$$

4.4 Empirical results

Table 4.5 reports the results for equations (1) to (5). Column (1) corresponds to the benchmark specification; Column (2) exhibits the results of the interaction between business cluster and a firm's technological sophistication; Column (3) shows the results of the interaction between business cluster and firm age; Column (4) shows the results of the interaction between business cluster and firm size; and Column (5) presents the results with all three interaction terms (business cluster with technological sophistication, firm age and firm size). For each variable, three rows of numbers are displayed. The first row presents the coefficient, the following shows the standard error, and the final row shows the p-value related to the variable statistical significance. The results report marginal effects.

Table 4. 5 Probit analysis of dots tax haven results (Marginal effects)

Dependent variable: Tax haven dummy variable	(1)	(2)	(3)	(4)	(5)
Business cluster	0.320***	0.322***	0.339***	0.310***	0.313***
(S.E)	(0.00921)	(0.00968)	(0.00511)	(0.0181)	(0.0176)
(P-value)	0.000	0.000	0.000	0.000	0.000
Firm age	0.000139***	0.000146***	0.000118***	0.000119***	0.000297***
(S.E)	(0.000381)	(0.000384)	(0.000359)	(0.000341)	(0.0000373)
(P-value)	0.000	0.000	0.008	0.000	0.009
Firm size (Ln Turnover)	0.00323***	0.00325***	0.00235***	0.00190***	0.00218***
(S.E)	(0.000756)	(0.000763)	(0.000646)	(0.000700)	(0.000710)
(P-value)	0.000	0.000	0.000	0.000	0.000
Technological sophistication (IATA)	0.0414***	0.0570***	0.0328***	0.0374***	0.0528***
(S.E)	(0.00815)	(0.00964)	(0.00709)	(0.00744)	(0.00864)
(P-value)	0.000	0.000	0.000	0.000	0.000
No. of foreign subsidiaries	0.00206***	0.00207***	0.00182***	0.00192***	0.00191***
(S.E)	(0.000581)	(0.000589)	(0.000743)	(0.000695)	(0.000712)
(P-value)	0.000	0.000	0.000	0.000	0.000

Ln Cashflow	0.00669***	0.00661***	0.00520***	0.00589***	0.00582***
(S.E)	(0.000798)	(0.000801)	(0.000715)	(0.000743)	(0.000743)
(P-value)	0.000	0.000	0.000	0.000	0.000
Business cluster × Technological sophistication (IATA)		0.0619***			0.0563***
(S.E)		(0.0186)			(0.0174)
(P-value)		0.001			0.000
Business cluster × Firm age			0.000594***		0.000557***
(S.E)			(0.0000921)		(0.0000987)
(P-value)			0.000		0.000
Business cluster × Firm size				0.00396***	0.00257**
(S.E)				(0.00121)	(0.00126)
(P-value)				0.010	0.009
High technology manufacturing dummy	0.0191***	0.0199***	0.00900*	0.0117**	0.0111**
(S.E)	(0.00621)	(0.00645)	(0.00533)	(0.00571)	(0.00563)
(P-value)	0.002	0.002	0.004	0.004	0.038
High/ Medium technology manufacturing dummy	0.000435	0.000455	-0.00574	-0.00352	-0.00494
(S.E)	(0.00528)	(0.00516)	(0.00479)	(0.00499)	(0.00500)

(P-value)	0.932	0.930	0.778	0.987	0.779
Medium/ Low technology manufacturing dummy	0.00231	0.00283	-0.00229	-0.00132	-0.00178
(S.E)	(0.00568)	(0.00558)	(0.00507)	(0.00538)	(0.00534)
(P-value)	0.684	0.611	0.655	0.666	0.825
Knowledge intensive service dummy	0.0390***	0.0412***	0.0309***	0.0369***	0.0355***
(S.E)	(0.00473)	(0.00481)	(0.00409)	(0.00445)	(0.00436)
(P-value)	0.000	0.000	0.000	0.000	0.000
Less knowledge intensive service dummy	0.0145***	0.0148***	0.0104***	0.0130***	0.0124***
(S.E)	(0.00451)	(0.00449)	(0.00387)	(0.00419)	(0.00412)
(P-value)	0.001	0.001	0.001	0.001	0.022
Year dummy	Yes	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes	Yes
Observations	50,710	50,710	50,710	50,710	50,710

Notes: Each column reports a separate probit regression. The dependent variable is whether a MNE own a tax haven subsidiary. Year dummies and Country dummies are unreported for brevity. Turnover and cash flow are entered as their natural logarithms. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

In all specifications, the coefficients of the business cluster variable are positive and significant at 1 percent level. The coefficients estimate for the effect of business clusters are in the range of 0.310 to 0.339, implying that being located in business clusters increases the probability of using tax havens to transfer prices by 0.310 to 0.339 (or 31.0 to 33.9 percent). The outcomes show strong support for our contention that business clusters provide cluster firms with knowledge environment via industrial agglomeration to learn from each other and they are inclined to engage in tax haven activity to minimize tax liabilities. Hypothesis 1 is therefore strongly supported.

Turning to firm-specific characteristics, all coefficients for variables firm age, firm size, technological sophistication (IATA), no. of subsidiaries, and cash flow are statistically significant. The coefficients of firm age range from 0.000118 to 0.000297, indicating that mature firms are more likely to engage in tax haven activity than start-up firms. The coefficients of firm size (turnover) range from 0.00190 to 0.00326, meaning that a 10 percent growth in turnover raises the likelihood of tax haven presence by around 0.190 to 0.325 percent. The coefficient of technological sophistication (IATA) is 0.0328 to 0.0570, showing that a 10 percent increase in the IATA ratio leads to increase in tax haven utilization by around 3.28 to 5.70 percent. The coefficients of no. of foreign subsidiaries hover around 0.00182 to 0.00207, showing that MNEs who have a higher number of foreign subsidiaries are more likely to manage larger tax haven networks. The coefficients of cashflow are in the range of 0.00520 to 0.00669, meaning that a 10 percent increase in cash flow raises the likelihood of tax haven presence by around 0.520 to 0.669 percent.

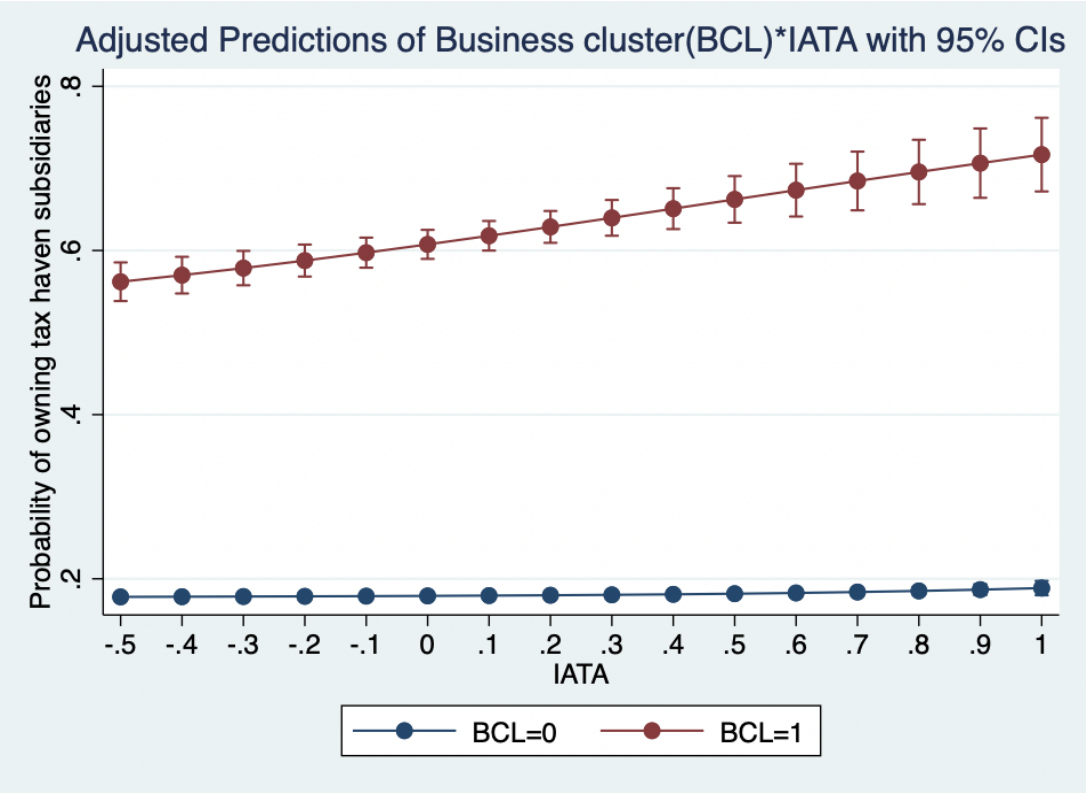
With regard to industrial sectors, the coefficients for high technology manufacturing dummy and knowledge service dummy variables are positive and statistically significant. The

outcomes correspond to the findings suggested by Jones and Temouri (2016) that technologically intensive manufacturing and knowledge MNEs have greater propensity of owning a tax haven subsidiary than less technologically intensive MNEs.

To explore the impact of technological sophistication, the corresponding interaction term is included in the regression. The results are presented in column (2). The coefficients of the interaction term between business clusters and technological sophistication indicate that the effect of technological sophistication is 5.63 to 6.19 percent higher for MNEs, who are part of a business cluster than for MNEs, who are not part of a business cluster. The result justifies the contention that MNEs possessing valuable intangible assets are ideal candidates for profit-shifting, and the role of hierarchical position in a business cluster allows technological firms to be the most suitable players to engage in tax haven utilization. Therefore, hypothesis 2 is strongly supported.

Figure 4.3 visualizes the margins of tax haven utilization by technological sophistication. As level of technological sophistication rises, the effect of level of technological sophistication on cluster MNEs increases steadily. Whereas, the effect on non-cluster firm remains the same in accordance with the increase in level of technological sophistication.

Figure 4. 3 Predictive margins by technological sophistication



To explore the impact of firm age on the relationship between business clusters and the use of tax havens, the corresponding interaction terms are included in the regressions. The coefficient of the interaction term of the business cluster variable with firm age in column (3) is significant at 1 percent level. The coefficients of the interaction term range from 0.000557 to 0.000595, indicating that the effect of firm age on the use of tax havens is 0.0557 to 0.0594 percent higher for MNEs, who are part of a business cluster than for MNEs who are not part of a business cluster. As such, there is a clear support for hypothesis 3.

To explore the impact of firm size on the relationship between business clusters and the use of tax havens, the corresponding interaction terms are included in the regressions. The coefficients of the interaction term of the business cluster variable with firm size in column (4) are

significant at 1 percent level and 5 percent level, respectively. The coefficients of the interaction term range from 0.00257 to 0.00396, indicating that the effect of firm size on the profit-shifting activity via tax havens is 0.257 to 0.396 percent higher for MNEs who are part of a business cluster than for MNEs who are not part of a business cluster. As such, there is a clear support for hypothesis 4.

In addition, we visualize the margins of tax haven utilization by firm age and firm size. **Figure 4.4** and **Figure 4.5** illustrate the marginal effects of firm age and firm size on the relationship between business clusters and the use of tax havens. As firm size and firm age increase, there is a positive effect on MNEs, who are part of a business cluster, while there is little effect on MNEs, who are not part of a business cluster.

Figure 4. 4 Predictive margins by firm age

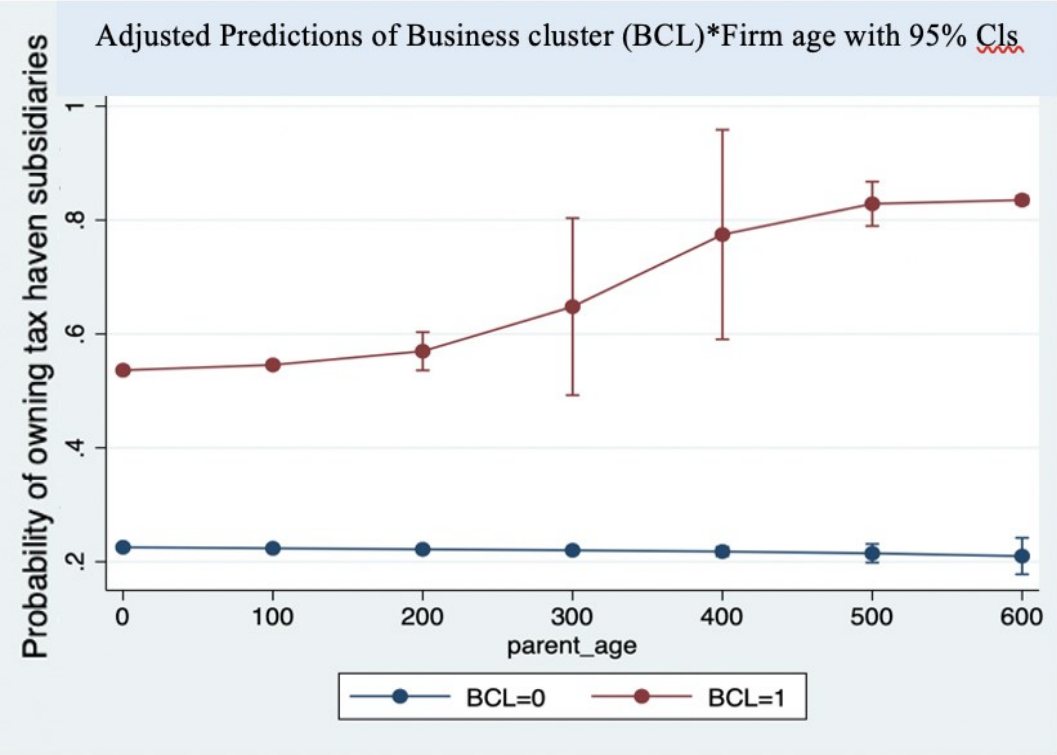
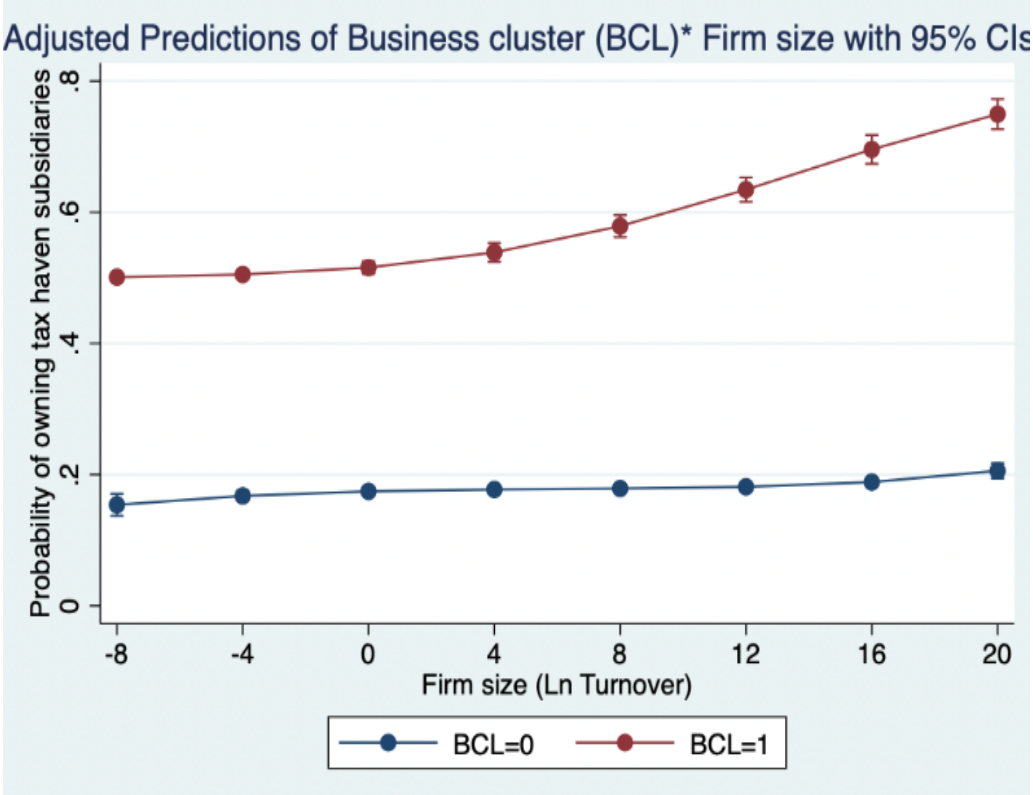


Figure 4. 5 Predictive margins by firm size



To compare the results with the use of different tax haven lists, **Table 4.7 (Appendix A)** provides the results which are replicated with the more conservative definition of tax havens to aid comparability. In all specifications with different definitions of tax havens, the coefficients of the business cluster variable are positive and significant. The coefficients estimate for the effect of business clusters are in the range of 0.18537 to 0.2099 with the use of the tax havens lists proposed by Jones and Temouri 2016 and Hines and Rice Dots, implying that being located in business clusters increases the probability of using tax havens to shift profits by 0.18537 to 0.2099 (or 18.53 percent to 20.99 percent). For these two definitions, the coefficients of the business clusters are significant at 1% level. With the use of FSI 20 and Hines and Rice Big 7 lists, the coefficients are significant at 5% and 10% levels, respectively. The outcomes again strongly confirm the hypothesis related to the relationship between MNEs who, are parts of business clusters and their tax haven use. As such, business clusters provide

cluster firms with knowledge environment via industrial agglomeration to learn from each other and they are inclined to engage in tax haven activity to minimize tax liabilities.

Turning to firm-specific characteristics, coefficients for variables firm age, firm size, technological sophistication (IATA), no. of subsidiaries, and cash flow are statistically significant are not consistent with the coefficients in the main findings at some points. The coefficients of firm age are positive and significant at 1% level and 5% level with the Hines and Rice Big 7's definition and Jones and Temouri 2016's definition respectively, indicating that mature firms are more likely to engage in tax haven activity than start-up firms. Whereas, the coefficients of firms age with the other two definitions are negative.

The coefficients of firm size (turnover) range from 0.004736 to 0.007312, meaning that a 10 percent growth in turnover raises the likelihood of tax haven presence by around 0.4736 to 0.7312 percent. However, there is a negative coefficient of firm size with the definition of FSI 20. When it comes to technological sophistication (IATA), the all coefficients are significant at 1% level and range from 0.01985 to 0.09723, showing that a 10 percent increase in the IATA ratio leads to increase in tax haven utilization by around 1.985 to 9.723 percent. The coefficients of no. of foreign subsidiaries hover around 0.00182 to 0.00207, showing that MNEs who have a higher number of foreign subsidiaries are more likely to manage larger tax haven networks. The coefficients of cashflow are in the range of 0.001414 to 0.003791, meaning that a 10 percent increase in cash flow raises the likelihood of tax haven presence by around 0.1414 to 0.3791 percent.

With regard to industrial sectors, the coefficients for high technology manufacturing dummy and knowledge service dummy variables are positive and statistically significant. The

outcomes correspond to the main findings and are in line with the results by Jones and Temouri 2016 that technologically intensive manufacturing and knowledge MNEs have greater propensity of owning a tax haven subsidiary than less technologically intensive MNEs.

To explore the impact of technological sophistication, the corresponding interaction term is included in the regression. The coefficients of the interaction term between business clusters and technological sophistication are positive and significant with the tax haven definitions by Hines and Rice Dots and FSI 20. The results indicate that the effect of technological sophistication is 2.1564 to 7.3695 percent higher for MNEs, who are part of a business cluster than for MNEs, who are not part of a business cluster. The result justifies the contention that MNEs possessing valuable intangible assets are ideal candidates for profit-shifting, and the role of hierarchical position in a business cluster allows technological firms to be the most suitable players to engage in tax haven utilization. Therefore, hypothesis 2 is supported with the use of the definitions by Hines and Rice Dots and FSI 20.

In terms of the corresponding interaction term of business cluster and technological sophistication, the coefficient is positive and significant at 5% level with the definition of FSI 20 and is positive and significant at 1% with the definition of Hines and Rice Dots. The coefficients of the interaction term between business clusters and technological sophistication indicate that the effect of technological sophistication is 2.156 to 7.369 percent higher for MNEs, who are part of a business cluster than for MNEs, who are not part of a business cluster. The result justifies the hypothesis 2 that cluster MNEs possessing valuable intangible assets are more likely to engage in tax haven utilization compared to their non-cluster counterparts.

In terms of the relationship between business clusters and the use of tax havens, all coefficients of the interaction term between business cluster variable and firm age with different tax haven lists are significant at 1 percent level. The coefficients of the interaction term range from 0.000282 to 0.000909, indicating that the effect of firm age on the use of tax havens is 0.0282 to 0.090 percent higher for MNEs, who are part of a business cluster than for MNEs who are not part of a business cluster. As such, there is a clear support for hypothesis 3.

To explore the impact of firm size on the relationship between business clusters and the use of tax havens, the corresponding interaction terms are included in the regressions. The coefficients of the interaction term of the business cluster variable with firm size are significant at 1 percent level and 5 percent level with the FSI 20 definition and Hines and Rice Big 7 definition, respectively. As such, with the use of the FSI 20 and Hines and Rice Big 7 tax haven lists, there is a support for hypothesis 4 that the effect of firm size on the profit-shifting activity via tax havens is higher for MNEs who are part of a business cluster than for MNEs who are not part of a business cluster.

Robustness Tests

To examine the strength of our findings, we adopt two approaches as robustness checks to our baseline models. First, we repeat specifications (1) to (5) using Poisson models. Accordingly, the dependent variable is no longer measured by tax haven dummy variable. Instead, we utilize a count variable which sums the number of tax haven subsidiaries owned by a parent firm. This count variable is discrete in nature and does not include negative values. Second, we lag our explanatory variables (Turnover, IATA, number of foreign subsidiaries, and cashflow) for one period to further reduce the possibility of simultaneity bias. **Table 4.6** shows the empirical results of Poisson regressions for robustness check.

Table 4. 6 Poisson regression of the number of tax haven subsidiaries

Dependent variable: No. of tax haven subsidiaries	(1)	(2)	(3)	(4)	(5)
Business cluster (BCL)	1.416***	1.456***	1.435***	1.766***	1.715***
(S.E)	(0.0691)	(0.0697)	(0.103)	(0.0972)	(0.121)
(P-value)	0.000	0.000	0.000	0.000	0.000
Firm age	0.0135***	0.0134***	0.0136***	0.0133***	0.0133***
(S.E)	(0.000892)	(0.000892)	(0.000966)	(0.000890)	(0.000965)
(P-value)	0.000	0.000	0.000	0.000	0.000
Firm size (Turnover)$_{t-1}$	0.00563	0.00511	0.00563	0.0155***	0.0132***
(S.E)	(0.00398)	(0.00398)	(0.00398)	(0.00444)	(0.00452)
(P-value)	0.157	0.199	0.157	0.000	0.004
Technological sophistication (IATA)$_{t-1}$	0.0854*	0.290***	0.0855*	0.0939*	0.231***
(S.E)	(0.0487)	(0.0676)	(0.0487)	(0.0487)	(0.0696)
(P-value)	0.079	0.000	0.079	0.054	0.001
Ln cashflow$_{t-1}$	0.0236***	0.0240***	0.0236***	0.0260***	0.0258***
(S.E)	(0.00389)	(0.00389)	(0.00389)	(0.00392)	(0.00392)
(P-value)	0.000	0.000	0.000	0.000	0.000
No. of foreign subsidiaries$_{t-1}$	0.000145***	0.000150***	0.000145***	0.000148***	0.000151***
(S.E)	(0.000296)	(0.000297)	(0.000296)	(0.000296)	(0.000297)
(P-value)	0.000	0.000	0.000	0.000	0.000

Business cluster × Technological sophistication (IATA)$_{t-1}$		0.399***			0.268***
(S.E)		(0.0912)			(0.0974)
(P-value)		0.000			0.006
Business cluster × Firm age			0.000552*		0.000631*
(S.E)			(0.00224)		(0.000210)
(P-value)			0.058		0.057
Business cluster × Firm size$_{t-1}$				0.0289***	0.0230***
(S.E)				(0.00565)	(0.00606)
(P-value)				0.000	0.000
High technology manufacturing dummy	0.0181**	0.0177**	0.0180**	0.0154**	0.0156**
(S.E)	(0.153)	(0.153)	(0.153)	(0.153)	(0.153)
(P-value)	0.036	0.035	0.036	0.040	0.036
High/ Medium technology manufacturing dummy	0.00494**	0.00259**	0.00320**	0.000683**	0.00275**
(S.E)	(0.117)	(0.117)	(0.117)	(0.117)	(0.117)
(P-value)	0.047	0.050	0.050	0.050	0.050
Medium/ Low technology manufacturing dummy	-0.130	-0.114	-0.131	-0.124	-0.114
(S.E)	(0.127)	(0.127)	(0.127)	(0.126)	(0.126)
(P-value)	0.304	0.369	0.301	0.327	0.364
Knowledge intensive service dummy	1.294***	1.309***	1.294***	1.312***	1.319***
(S.E)	(0.0987)	(0.0986)	(0.0987)	(0.0985)	(0.0985)
(P-value)	0.000	0.000	0.000	0.000	0.000

Less knowledge intensive service dummy	0.447***	0.460***	0.448***	0.457***	0.464***
(S.E)	(0.102)	(0.102)	(0.102)	(0.102)	(0.102)
(P-value)	0.001	0.001	0.001	0.001	0.001
Constant	1.828***	1.867***	1.833***	1.987***	1.979***
(S.E)	(0.117)	(0.118)	(0.119)	(0.121)	(0.122)
(P-value)	0.000	0.000	0.000	0.000	0.000
Year dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes
Observations	49,516	49,516	49,516	49,516	49,516

Notes: Each column reports a separate Poisson regression. The dependent variable is a count variable which sums the number of tax haven subsidiaries owned by a parent firm. Year dummies and Country dummies are unreported for brevity. Turnover and cash flow are entered as their natural logarithms. Firm size (Turnover), technological sophistication, no. of foreign subsidiaries and cash flow are lagged for one period. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

By using the different measure for the use of tax haven (Number of tax haven subsidiaries owned by each multinational), we obtain the results of the robustness check for the baseline models. The Poisson coefficients on the business cluster variable suggests that other factors being equal, the number of subsidiaries in tax havens established by MNEs within business clusters is nearly 1.416 to 1.766 times higher than the number of subsidiaries in tax havens established by MNEs outside business clusters. Hence, the conclusion for the main hypothesis drawn from the probit models continues to hold – MNEs in business clusters are more likely to engage in tax haven utilization and establish its foreign subsidiaries in tax havens.

With regard to moderating factors including technological sophistication, firm age and firm size, the coefficients for interaction terms between business clusters and technological sophistication, and between business cluster and firm size are significant at 1 percent level. Specifically, the coefficients for the interaction terms with technological sophistication and firm size are 0.268 to 0.399 and 0.0230 to 0.0289, respectively. The results from Poission models strengthen our argument in hypotheses 2 and 4 about the moderating role of level of technological sophistication and firm size on the relationship between business cluster MNEs and their use of tax havens. The coefficients for interaction terms between business clusters and firm age is statistically significant at 10 percent level. Hence, the results from Profit models for the hypothesis related to the moderating effect of firm age still hold.

In general, the empirical results of the Poisson regression models provide strong robustness check for the main proposed hypotheses related to the link between MNEs in business clusters and their use of tax havens, the moderating effects between business cluster with technological sophistication, firm age and firm size.

4.5 Concluding remarks

This chapter utilizes a dataset collected from ORBIS with 50,710 observations for 21,389 MNEs from five OECD countries (Austria, Belgium, France, Germany and the UK). The outcomes of this chapter highlight that firms within business clusters have higher likelihood to establish subsidiaries in tax havens. Our analysis shows that cluster-located MNEs have 31.0 to 33.9 percent higher likelihood of engaging in tax haven activity compared to their counterparts outside business clusters.

The results suggest that the role of business clusters is far from insignificant in firms' tax haven activity specifically and firms' investment decisions generally. Thanks to knowledge spillovers, firms in business clusters have favourable conditions to maintain and promote frequent interactions, interdependent relations and closer linkages. Co-located firms are very strategic to take advantage of both multiple benefits from business clusters and lower tax bills from profit-shifting via tax havens. The intra-cluster cooperation in business clusters allows cluster entities to promote knowledge spillovers. Whilst, companies outside clusters might find it more challenging to transfer information and create new knowledge compared to MNEs who are part of business clusters. In other words, a truly operating cluster continuously enhances its knowledge base, thereby enabling cluster members to possess higher strategic flexibility and faster response to market changes compared to outsiders. It is suggested that MNEs in business clusters had better follow effective strategies and suitable tax payment to obtain competitive advantages via tax cutting and to reap multiple benefits of agglomeration locations.

In addition, the findings suggest that the effects of business clusters on the use of tax havens can be moderated by some firm specific covariates such as technological sophistication, firm age and firm size. Specifically, the effect of agglomeration on the use of tax havens is stronger

for MNEs who have higher level of technological sophistication. Moreover, the relationship between cluster-located firms and their use of tax havens are stronger for older and larger firms. That reveals specific types of MNEs in business clusters which are more aggressive in shifting profits via tax havens. This chapter therefore is to discuss evidence that will help rationalize closer regulation for cluster firms and the design and implementation of effective policies, especially regulations for multinational enterprises.

APPENDIX A

Table 4.7: Probit analysis of dots tax haven results (Marginal effects) (with different tax haven lists)

For the detailed list, see **Table 3.1**

Dependent variable: Tax haven dummy variable	(Jones & Temouri, 2016)	(Hines & Rice)	(Big 7)	(FSI 20)
Business cluster	0.20999***	0.18537***	0.04553*	0.31127**
(S.E)	*(0.05219)*	*(0.04929)*	*(0.07056)*	*(0.06005)*
(P-value)	*0.000*	*0.000*	*0.094*	*0.030*
Firm age	0.00349*	-0.0004346	0.005085***	-0.001167
(S.E)	*(0.0001989)*	*(0.0001711)*	*(0.0001658)*	*(0.0001817)*
(P-value)	*0.079*	*0.800*	*0.002*	*0.521*
Firm size (Ln Turnover)	0.005020*	0.007312***	0.004736***	-0.00215**
(S.E)	*(0.000335)*	*(0.000241)*	*(0.000369)*	*(0.000962)*
(P-value)	*0.055*	*0.002*	*0.000*	*0.000*
Technological sophistication (IATA)	0.0198576***	0.0972370***	0.0286961***	0.0351582***
(S.E)	*(0.0033491)*	*(0.0032665)*	*(0.0038786)*	*(0.0050986)*
(P-value)	*0.000*	*0.003*	*0.000*	*0.000*

No. of foreign subsidiaries	0.005627***	0.004553***	0.0013986***	0.009433***
(S.E)	*(0.000961)*	*(0.000129)*	*(0.001764)*	*(0.000925)*
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*
Ln Cashflow	0.002140***	0.001414***	0.003267***	0.003791***
(S.E)	*(0.000262)*	*(0.000255)*	*(0.000329)*	*(0.000354)*
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*
Business cluster × Technological sophistication (IATA)	0.086506	0.073695***	-0.0155318	0.021564**
(S.E)	*(0.066094)*	*(0.065694)*	*(0.082678)*	*(0.010149)*
(P-value)	*0.191*	*0.002*	*0.162*	*0.034*
Business cluster × Firm age	0.0002907***	0.000909**	0.000643***	0.000282***
(S.E)	*(0.000044)*	*(0.0000411)*	*(0.0000619)*	*(0.0000513)*
(P-value)	*0.000*	*0.027*	*0.000*	*0.000*
Business cluster × Firm size	-0.00758	-0.00599	0.0013645**	0.0039964***
(S.E)	*(0.004905)*	*(0.004547)*	*(0.006413)*	*(0.00121)*
(P-value)	*0.122*	*0.187*	*0.033*	*0.000*
High technology manufacturing dummy	0.096724**	0.03516***	0.012708***	0.02235***
(S.E)	*(0.004460)*	*(0.003432)*	*(0.002905)*	*(0.003148)*

(P-value)	*0.030*	*0.000*	*0.000*	*0.000*
High/ Medium technology manufacturing dummy	0.001352**	0.00604**	0.003223	0.007538***
(S.E)	*(0.002628)*	*(0.002741)*	*(0.002295)*	*(0.002386)*
(P-value)	*0.030*	*0.028*	*0.160*	*0.002*
Medium/ Low technology manufacturing dummy	0.003230	-0.005212	-0.007855**	-0.0031860
(S.E)	*(0.00568)*	*(0.002473979)*	*(0.002527)*	*(0.002892)*
(P-value)	*0.684*	*0.833*	*0.02*	*0.271*
Knowledge intensive service dummy	0.04413 ***	0.01044***	0.01840***	0.02200***
(S.E)	*(0.002153)*	*(0.00184)*	*(0.001963)*	*(0.00221)*
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*
Less knowledge intensive service dummy	0.04153***	0.08009***	-0.04100***	-0.022195***
(S.E)	*(0.00220)*	*(0.00186)*	*(0.002091)*	*(0.00249)*
(P-value)	*0.000*	*0.000*	*0.005*	*0.003*
Year dummy	Yes	Yes	Yes	Yes
Country dummy	Yes	Yes	Yes	Yes
Observations	50,710	50,710	50,710	50,710

CHAPTER 5: THE IMPACT OF LOCAL BUSINESS TAX RATES ON THE USE OF TAX HAVENS BY MULTINATIONAL ENTERPRISES IN BUSINESS CLUSTERS: EMPIRICAL EVIDENCE FROM GERMANY

5.1 Introduction

The relocation of firms, which affects market structure, has come under increasing scrutiny given the liberalization in world trade (Bárcena-Ruiz & Garzón, 2014). A sizable literature highlights that MNEs with operations in high-tax countries can benefit the most from reallocating taxable income to tax havens (Leslie, 1991; Hines, 1996; Dyreng, Hanlon & Maydew, 2008; Gumpert, Hines & Schnitzer, 2016; Barker, Asare & Brickman, 2017). In recent years, the profit-shifting activities by MNEs has received significant attention due to the global financial crisis. According to OECD (2019), the base erosion and profit-shifting cost countries around US$ 100-240 billion in 2019, which is the equivalent to 4-10 percent of the global corporate income tax revenue.

Limited by the unavailability of data, most of the tax haven literature mainly focuses on the impact of corporate tax rates across countries, instead of exploring tax rates at the local level and how this affects MNEs' profit-shifting activities (Gumpert, Hines & Schnitzer, 2016; Barker, Asare & Brickman, 2017). Moreover, according to a study by the Small Business Administration (cited in Porter & Miranda, 2009), business clusters such as Wisconsin and California in the United States (US) have above-average tax levels compared to their neighbour states. Due to higher tax rates, an increasing number of companies in the clusters relocate their activities to regions where there are more beneficial taxation systems. The study also highlights that if the regions want to encourage the continuing development of the clusters, these supposedly high rates of state taxation should be lowered. In recent years, empirical work reveals that tax rates are higher in agglomerated regions than in less-agglomerated ones

(Brülhart, Jametti & Schmidheiny, 2012; Becker, Egger & Merlo, 2012; Crabbé & Bruyne, 2013; Rohlin, Rosenthal & Ross, 2014). Therefore, it is important to investigate whether, and to what extent, higher local tax rates in business clusters are more likely to force cluster firms to reallocate their investments to tax havens with low or a zero tax rate. Limited work has been done so far to address whether industrial agglomeration drives MNEs offshore, particularly to tax haven locations. Thus, this chapter represents the first study that specifically addresses the impact of higher local tax rates on the use of tax havens.

This empirical chapter contributes to the literature by analysing whether, and to what extent, local tax rates in business clusters impacts tax haven activities of MNEs in Germany. In doing so, we extent the new economic geography theory by linking the use of tax havens with the literature of tax and agglomeration. According to the new economic geography theory (Krugman, 1991; Krugman, 1998; Baldwin & Krugman, 2004), the main feature of regional development is the uneven territorial distribution of economic activity. Therefore, local governments in different regions have varying tax setting behaviours on firms (Crabbé & Bruyne, 2013; Chen, Li & Liu, 2018). In this chapter, we argue that the use of tax havens reduces the ability of local jurisdictions to compete over tax to attract firms. If local authorities set tax rates too high, they lose the tax competition game against their rivals as firms have choices to engage in tax havens abroad. As a result, MNEs in locations with higher tax rates will be more likely to own tax haven subsidiaries. Moreover, firms in localities that have economic clusters are often imposed higher local tax rates (Baldwin & Krugman, 2001; Brülhart, Jametti & Schmidheiny, 2012; Crabbé & Bruyne, 2013; Koh, Riedel & Böhm, 2013). We revisit the topic of the relationship between business clusters and the use of tax havens by focus on the context of local tax rates. Specifically, we, propose that due to knowledge spillovers in agglomeration economies, cluster firms can quickly learn from one another about

the use of tax havens and this mitigates the cost of business clusters in the form of local tax rates. Therefore, MNEs in clusters are much more likely to establish tax haven subsidiaries in host countries to benefit from tax minimization.

We exploit local business tax rates (known as "*Gewerbesteuer*") in Germany as a testing ground, that comprises of two components (statutory tax rate multiplying with municipal multipliers). There is a large nationwide disparity in local business tax rates, ranging from 7 to 20 percent across Germany (Tax Justice Network, 2020). For example, the local business tax rate in the large city of Munich is approximately 17.15 percent, but only 9.1 percent in a small town of Grünwald (about 12 kilometres southwest of Munich). As the statutory rate of 3.5 percent is the same throughout Germany, the variation in local business tax rates comes from the differentiation in municipal multipliers which are freely set at municipality level (Germany Trade & Invest, 2020). In particular, the municipal multiplier for Munich is 490, while the multiplier for Grünwald is only 260.

For the construction of the agglomeration measure, we combine the pre-existing lists of business clusters available from government websites and the cluster literature (Porter, 1990; Audretsch & Feldman, 1996; Porter, 1998; Porter & Miranda, 2009), which considers geographical location and industry to determine whether a firm is part of a business cluster. In terms of the use of tax havens, we measure a firm's likelihood to use tax havens by tracking the entire network of a MNE's subsidiaries around the world on an annual basis, including subsidiaries in tax haven locations.

We compile a large panel dataset on local business tax and other data at the micro-regional (municipality) level, which we source from the Federal Statistical Office of Germany

(DESTATIS). Our dataset covers 12,232 German municipalities between the time period of 2008-2018. We link it with data on locations of MNEs and other firm level characteristics, which are collected from ORBIS. As a number of municipalities in Germany do not have a presence of MNEs, our sample for this empirical chapter includes 10,987 Germany-based MNEs located in 2,652 municipalities. The panel data allows us to estimate a number of econometric specifications using a count-data methodology to investigate the relationship between local tax rates, agglomeration effect and MNEs' tax haven use. Moreover, our estimation approach takes into account the assumption of endogenous business tax rates. We then employ an instrumental variable (IV) approach which relies on micro-regional data of real property tax "B" (*Grundsteuer B*) levied in each municipality as one of the instrumentntal variables for the independent variable local business tax rates (*Gewerbesteuer).*

This empirical chapter makes a number of key contributions to the literature, both theoretically and empirically. In terms of theory, we extend the new economic geography theory to the context of tax havens and explain why local tax rates and the knowledge environment in clusters have a significant impact on MNEs' tax haven activities. Analysing the use of tax havens in the context of local tax rates and agglomeration economies offers an alternative explanation for why jurisdictions in clusters are able to collect taxes at higher rates without fear of losing firms to peripheral regions. In terms of empirical contribution, our analysis is the first to quantify the impact of local business tax rates and clusters on the likelihood of owning tax haven subsidiaries. Hence, we are able to show that higher local business tax is a key characteristic of business clusters and it is associated with MNEs utilising, managing and maintaining a higher network of tax haven subsidiaries.

We identify a significant positive impact of local business tax rates and industrial clusters on the number of tax haven subsidiaries owned by MNEs. Our first result reveals that local business tax acts as a driver for MNEs to set up subsidiaries in tax havens. A one-percent increase of the municipal business tax rates leads to an increase in the number of tax haven subsidiaries of a MNE of 4.97 percent. Furthermore, the average local business tax rate which encourages the likelihood of owning tax haven subsidiaries to increase is 11.27 percent (or the municipal multiplier of 322). Our second result suggests that MNEs who are part of a business cluster have higher likelihood of owning tax haven subsidiaries than MNEs who are not part of a business cluster. With regard to the magnitude of the effects, our results indicate that being located in business clusters increases the number of tax haven subsidiaries of a MNE by 10.83 percent on average. In terms of the interaction between agglomeration effect and local business tax, our third result shows that the agglomeration effect can moderate the relationship between local tax rates and MNEs' tax haven use. In particular, the effect of local business tax on the use of tax haven is enhanced by 7.67 percent when a firm is located in a business cluster.

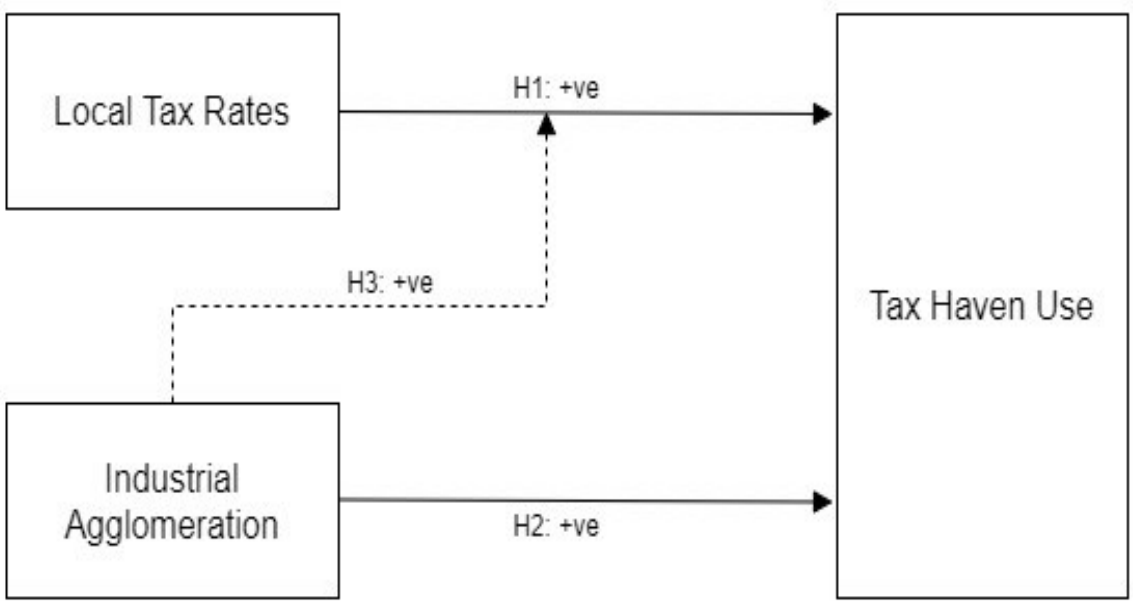
The remainder of this chapter is organized as follows. Section 2 presents our theoretical framework and hypotheses. We describe data, variables and methodology in Section 3. Empirical findings and results for robustness checks are discussed in Section 4. We conclude the chapter with concluding remarks.

5.2 Theoretical framework and hypotheses

According to the new economic geography, a country is divided into endogenous regions with the uneven distribution of economic activity (Maggioni, 2001). Parallel to that, tax policies vary significantly among different local authorities (Baldwin et al., 2005). The theoretical work in economic geography highlights that as firms earn higher rents in clusters, which incentivises

cluster tax authorities to set higher local tax rates on firms compared to authorities in the periphery, i.e. in non-cluster regions (Crabbé & Bruyne, 2013; Koh, Riedel & Böhm, 2013; Fréret & Maguain, 2017; Chen, Li & Liu, 2018). Due to the agglomeration forces and the associated economic rents generated, these locations are natural targets for local governments to attract tax revenue. Besides, the intra-cluster cooperation in economic agglomerations spreads information among cluster members, resulting in learning and demonstration effects (Anderson & Narus, 1990; Jankowska, Götz & Główka, 2017; Du & Vanino, 2020). We, therefore, focus our attention on two important cluster-specific factors, namely higher local tax rates and agglomeration industry. We predict that higher local tax rates, agglomeration forces and free trade tend to magnify the likelihood of owning tax haven subsidiaries by MNEs. The theoretical framework we use is presented in **Figure 5.1.**

Figure 5. 1 Theoretical framework chapter 5



The following sub-sections present our main theoretical contributions, which focus on the cluster-specific factors (higher local business taxes and industry agglomeration) and the moderating factor of industry agglomeration on the relationship between local business taxes and the use of tax havens.

5.2.1 Local tax rates and investment relocation

Recent studies indicate that competition among jurisdictions for local tax rates has become a common phenomenon (Chen, Li & Liu, 2018). While statutory corporate tax rates are uniform throughout a country, local tax rates are not (Crabbé & Bruyne, 2013; Koh, Riedel, & Böhm, 2013; Fréret & Maguain, 2017). This is mostly due to different tax-collecting behaviours of local authorities on firms located in different regions. On the one hand, local authorities have autonomy to grant tax exemption or tax reduction to compete with other regions for mobile factors (Chen, Li & Liu, 2018). However, local authorities can also be incentivised to impose additional local tax rates if they are aware of advantages for local firms in their region (Koh, Riedel & Bohm, 2013).

In Germany, some evidence indicates that local business tax rates in big cities are higher than in smaller and more rural communities, which have lower infrastructure burdens (Becker, Egger & Merlo, 2012). For example, large cities such as Munich, Frankfurt and Berlin which face the local business tax rates of 16.45 percent, 16.10 percent and 16.10 percent, respectively (the municipal multipliers of 470, 460 and 460 for the three cities, respectively and the statutory rate of 3.5 percent). Whereas, a suburban municipality such as Schönefeld in the Dahme-Spreewald district, which is in the federal state of Brandenburg, faces the minimum local business tax rate of 7 percent (the municipal multiplier of 200 and the statutory rate of 3.5 percent). Basically, along with corporate taxation (*Körperschaftsteuer*) and trade tax

(*Gewerbesteuer*), the overall burden on corporate profits earned in Munich would be approximately 33 percent. In Frankfurt, the burden would be 32 percent. In Berlin, it would be 30 percent (PWC, 2021).

Previous studies have struggled to provide empirical evidence that local level tax policies do affect the tendency of entrepreneurs to redirect their investments to international markets. In this chapter, we investigate whether higher local tax rates in home countries lead to reallocation of investments by MNEs to host countries with low tax rates or a zero-tax rate. According to Porter (1998), the higher the costs of using the market, the more international production is likely to take place. The fact that firms who choose to diversify the geographical portfolio of their investments reflects not only its ability to do so, but also its perception of the resulting costs and benefits (Jones & Temouri, 2016). In terms of tax haven use, tax minimization is considered the key driver of tax haven activity (Jones & Temouri, 2016). In Germany, business tax rates represent approximately two thirds of the corporate tax rate on average, thereby significantly contributing to tax burdens on firms (Koh, Riedel & Böhm, 2013). Under these conditions, investing abroad and utilising tax haven subsidiaries allow German MNEs in high-tax regions to escape these higher local business taxes at home. We, therefore, argue that higher local tax rates increase the probability of MNE's investing in tax havens. So, this leads to our first hypothesis of this chapter as follows:

> **Hypothesis 1.** Higher local business tax rates, all things equal, are more likely to drive MNEs offshore to invest in tax haven subsidiaries.

5.2.2 Agglomeration forces and taxable rents

According to the new economic geography theory, local clusters of industries are envisioned with "agglomeration forces" which lead to spatial concentrations of firms and turn mobile factors into quasi-fixed factors (Baldwin et al., 2005, p.380). Normally, it is understood that agglomeration or clustering is tied to a specific geographic location (Bottazzi & Gragnolati, 2015). However, the concentration of economic activity in an area is necessary but not sufficient to constitute a cluster (Tsakalerou, 2018). Instead, the definition of business clusters should coincide with sustainable competitive advantages over other places and regions. According to Sainsbury (2014), business clusters cannot be created by design. Jasiniak and Kozinski (2017) highlight that within clusters, a self-reinforcing mechanism operates to create a pool of multiple-cluster benefits. Whilst, non-clustered regions have less of a chance to access such advantages. As a result, investors often want to take advantages of agglomeration economies, and give considerable decision weight to agglomeration benefits. Recent evidence also shows that clusters of firms often have superior ability to drive economic growth and business development (De Prospris & Driffield, 2006). Put simply, the competitive advantages in business clusters is one of the main distinguishing factors that define cluster localities from localities without clusters.

Most of the literature in this area identify a number of competitive advantages that agglomeration forces create for actors in business clusters (Jankowska, Götz & Główka, 2017; Kelchtermans, Neicu & Teirlinck, 2020; Du & Vanino, 2020). First, the concentration of firm with the same specialization in a single location offers a pooled market for workers with industry-specific skills (Jankowska, Götz & Główka, 2017). That ensures not only a low probability of labour shortage but also a lower probability of unemployment. Second, localized industries can support the production of non-tradable specialized inputs (Kelchtermans, Neicu

& Teirlinck, 2020). Third, information spillovers enable clustered firms to obtain a better production function compared to their isolated producers (Du & Vanino, 2020). Hence, agglomeration forces reduce the sensitivity of firm location decisions as capital (investment) earns rents when it is located in agglomerated areas. More importantly, government in the core where agglomeration forces are strong often take advantage of the situation and levy a positive source-tax on firms.

Recent empirical studies provide evidence for the existence of "taxable location-specific agglomeration rents" by investigating different types of local taxes, which are set autonomously at the local level (Hill, 2008; Fréret & Maguain, 2017; Chen, Li & Liu, 2018). Hill (2008) utilizes data on "total number of establishments in the county" and "total number of jobs in the county" to measure the density of business activity within regions in Tennessee. It is revealed that property tax rates in stronger urbanization counties are roughly 0.06 percentage points higher than that in areas with less business activity. Fréret and Maguain (2017) base on localization index and urbanization index to estimate the degree of business activity in France. Specifically, one percent point increase of the localization economies indicator leads to an increase of the business tax rate by 0.43 percent point. The most recent study on this research area is implemented by Chen, Li and Liu (2018) who use "Labour share" and "Output share" to estimate the regional economic activity. The findings indicate that actual tax rates imposed on firms in areas with high concentration of businesses are 1.12 percent points higher compared to that in non-cluster regions in China.

These empirical studies confirm the idea of the race-to-the-top in tax rates in the new economic geography model, such that the core sets higher tax rates than the periphery since the mobile factor earns agglomerations rent which can be additionally taxed without risking firms'

relocation. Firms seem to accept the "cost of clusters" (higher local tax rates) to take location advantages of agglomeration forces in the regions. However, the current tax-agglomeration literature entirely ignores the use of tax havens. Amdam et al. (2020) find that industrial clusters provide imperatives and shape the motivation of firms to internationalize. That leads us to the argument that firms in clusters are more likely to use tax havens. This leads to our second hypothesis of this chapters as follows:

> **Hypothesis 2.** MNEs who are part of a business cluster are more likely to own tax haven subsidiaries compared with MNEs who are not part of a business cluster.

5.2.3 Peer groups and the knowledge sharing in business clusters

The new economic geography theory postulates that competitive advantages are hardly uniform between regions of a nation (Porter, 1998). In particular, knowledge is considered the most crucial strategic resource to ensure competitive advantages and sustainable differentiation of a cluster (Grant, 1996; Hoskisson et al., 1999; Maskell, 2001; Porter & Miranda, 2009). According to Kelchtermans, Neicu and Teirlinck (2020), there are two critical dimensions of a business cluster, including geographical proximity and industrial specification. Geographical proximity fosters the interaction between cluster entities as short distance favours contacts among members (Nam, Manchanda, & Chintagunta, 2007; Isaksson, Simeth & Seifert, 2016). Bell and Zaheer (2007) highlight the facilitating role of location for knowledge access, comprising both formal and informal knowledge exchange. Furthermore, industrial specification which composes economic activities of the same or related industries implies easier sharing of common knowledge (Delgado et al., 2014). Hence, geographical proximity and the composition of economic activities reinforces geographically bounded nature of knowledge spillovers, mainly through cooperation, competition and personnel relations (Gort

& Konakayama, 1982; Almeida & Kogut, 1999; Debruyne & Reibstein, 2005; Leary & Roberts, 2014; Laursen, Masciarelli & Reichstein, 2016). This creates an important mechanism for cluster firms to learn from each other (Curado, 2006; Isaksson, Simeth & Seifert, 2016; Du & Vanino, 2020).

Furthermore, the process of social interaction from a geographical region leads to imitation behaviour for corporate decisions by cluster firms (Swann & Prevezer, 1996; Debruyne & Reibstein, 2005; Leary & Roberts, 2014). Kelchtermans, Neicu and Teirlinck (2020) reveal that spatially agglomerated firms are likely to rely on the choices of their peers to make their own decisions with regard to R&D tax exemptions. Gielens and Dekimpe (2007) find that firms' adoption of the tax credit scheme can be attributed to decisions of peers, rather than to own firm characteristics. More importantly, Boschma and Frenken (2010) highlight that in situations of high uncertainty and costly optimization, peer effects play a very important role for the process of corporate decision making. Therefore, it is reasonable to argue that firms' decisions to transfer price via tax havens legitimize a certain path of action which rely on other peers' decisions because the internationalization process often take firms high risks and huge costs to participate in (Freixanet & Renart, 2020).

We argue that spatial knowledge spillovers spread knowledge and information among cluster members, and cluster entities can learn quickly about tax haven use specifically and internationalization process generally. The knowledge environment in business clusters allows cluster members to perceive that it is in their best interest to combine spatially transferable intermediate production generated in business clusters with at least some immobile factor endowments in tax havens (low tax rates or a zero tax rate). Whilst, firms outside business cluster often lack information to implement business strategies. Under this circumstance,

agglomeration economies seem to exacerbate the intensity of tax competition when firms opting for some strategic solutions such as expanding their business in tax havens. Hence, it is reasonable to hypothesize the moderating effect of agglomeration on the relationship between local tax rates and the use of tax havens. This leads us to our third hypothesis of this chapter as follows:

> **Hypothesis 3.** Agglomeration effect enhances the relationship between local business tax rates and the use of tax havens by MNEs.

5.3 Data, variables and empirical models

5.3.1 Data

Data used in this chapter is secondary in nature and is drawn from two main sources, including ORBIS and DESTATIS. Data on firm location, financial status, subsidiaries and other firm-level data comes from ORBIS. We downloaded consolidated accounts data for every German incorporated MNE with at least one foreign subsidiary. We use the conventional way of defining a MNE, namely as a firm that owns at least 10 percent of a subsidiary located abroad (UNCTAD, 2013). One of the key advantages of using ORBIS is that the dataset allows us to identify the location of every MNEs' foreign subsidiary, including tax haven locations on an annual basis. As a result, we can track the whole network of tax haven subsidiaries across firms and across time period.

Data on local business tax rates, regional population, regional employment, local economic value added (EVA), property tax B and other region-level data are from the Federal Statistical Office of Germany (Statistisches Bundesamt DESTATIS). With the use of the smallest regional unit (municipality), firms face a much more homogeneous institutional setting across

municipalities within a country than at cross-country level. The details of variables used for Chapter 5 is provided in **Table 5.1** below.

Identifying tax haven networks

The dependent variable is a count variable, summing up the number of tax haven subsidiaries that each MNE owns on an annual basis during the sample period 2008-2018. In our context, this count variable offers a proxy for the overall likelihood of MNEs to conduct tax havens activities. From ORBIS data, we identify the whole history of subsidiary ownership for individual MNEs annually, thereby being able to construct the time variant number of tax haven subsidiaries.

There are a number of different lists available that define which countries as tax havens (Hines & Rice, 1994; Desai, Foley & Hines, 2006; Jones & Temouri, 2016; Tax Justice Network, 2018). To define which subsidiary locations are tax havens, we take a conservative approach, and adopt mainly the island tax havens to include jurisdictions where investments often go there for tax purposes as defined in a broad literature of tax haven. Relevant for our analysis is the early work by Jones and Temouri (2016). Our lists, therefore, includes 28 jurisdictions. For the full list of tax haven locations, see **Table 5.1.**

Measuring local business tax

We collect time variant data on municipal multipliers from the Federal Statistical Offices of the 16 German states (*Länder*). As explained above, local business tax rate comprises two components, the statutory rate (*Gewerbesteuermesszahl*) and the municipal multiplier (*Hebesatz*) (Germany Trade and Invest, 2020). We, therefore, multiply the collected municipal

multipliers data 2008-2018 with the tax base rate of 3.5 percent (the statutory rate throughout Germany) to obtain local business tax rates for each municipality where firms locate.

Official statistics in Germany are decentralized and the responsibility for providing data in a deep regional structure is mainly with the 16 regional statistical offices. We first contacted The Federal Statistical Office (DESTATIS) and then the Federal Statistical Office takes over the procurement of the available information from the 16 Statistical Offices of the German states (*Länder*). Previous studies in this research area have been challenged due to the lack of information about micro-regional data (Becker, Egger & Merlo, 2012; Koh, Riedel & Bohm, 2013). Instead, our time variant sub-national dataset distributed from DESTATIS covers ten consecutive years from 2008 to 2018. In total, we collected the comprehensive set of data on municipal multipliers for about 12,232 municipalities in the time period of 2008-2018. As this chapter examines the use of tax havens by MNEs, the number of municipalities with the presence of at least one German MNE in the analysis is 2,652.

Defining business clusters

Our independent variable "Cluster" is a binary variable, equals 1 if a MNE is located in a recognized business cluster, and 0 otherwise. The identification of clusters and non-cluster firms is based on the pre-existing lists of business clusters published on government websites. In addition, we draw on the cluster literature and consider the definition of industry clusters with two main dimensions, including geographical proximity and industry specialization (Porter, 1990; Audretsch & Feldman, 1996; Porter, 1998; Porter & Miranda, 2009).

Based on an available business cluster map and list from Federal Ministry for Economic Affairs and Energy of Germany (see **Graph B4, Appendix B**), we establish a three-stage procedure to

identify business cluster firms. First, we detect reference municipalities for recognized business clusters in Germany. Second, we match NACE industry codes (industrial activity classification as defined by Eurostat) for industry specialization of each business cluster. Third, we combine reference municipalities and NACE industry codes to obtain a list of cluster firms. After that, we are able to detect non-cluster firms in the dataset. This way is compatible with quantitative econometric analysis developed therein.

Explanatory variables

We use two different groups of explanatory variables, including firm-level variables and regional-level variables. We collected all firm-level explanatory variables from annual accounts data for each MNE in ORBIS. Annual turnover is used to capture firm size of each MNE as suggested by Jones and Temouri (2016). Firm age is calculated by using the date of incorporation. We also collect firm-level data on intangible assets and long-term debt as explanatory variables. We rely on regional data on NUTS3 level from DESTATIS for other explanatory variables, comprising regional population, regional employment, and regional economic value added (EAV). Those variables are discussed in the work by Markusen (2002), Markusen and Maskus (2002); Navaretti and Venables (2004); Becker, Egger and Merlo (2020) as determinants of MNE activity. Financial data from ORBIS are measured in ‘000s of dollars while financial data from DESTATIS are measured in ‘000 000s of euros. We then use the average annual exchange rate from Trading Economics (2020) to convert from euros to dollars. In addition, all monetary values are deflated using United States GDP Deflator to take account of inflation (Trading Economics, 2020).

Table 5. 1 Variables and measures of chapter 5

Variable name	Measures	Source
Tax haven definitions		
Tax havens (Jones & Temouri, 2016)	Andorra, Anguilla, Antigua, Barbados, Bahrain, Bermuda, Bahamas, Belize, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Isle of Man, Jersey, Gibraltar, Grenada, Guernsey, Liechtenstein, Luxembourg, Macao, Malta, Monaco, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Seychelles, Turks and Caicos Islands	ORBIS
Tax havens (Hines & Rice, 1994)	Andorra, Antigua & Barbuda, Bahamas, Aruba, Bahrain, Barbados, Belize, Bermuda, Cayman Islands, Cote d'Ivoire, Cyprus, Dominica, Gibraltar, Grenada, Jordan, Kiribati, Liechtenstein, Luxembourg, Macao, Malta, Mauritania, Nauru, Netherland Antilles, St. Kitts & Nevis, St. Lucia, St. Vincent, Vanuatuan	
Business clusters definitions		
Cluster firms	Dummy variable (equals 1) indicating that an MNE is located in a recognized business cluster.	ORBIS
Non-cluster firms	Dummy variable (equals 0) indicating that an MNE is not located in any recognized business cluster.	ORBIS
Municipal multiplier for local business tax	The multiplier, which is levied on taxable incomes of companies, is set freely by each municipality in Germany.	DESTATIS
Local business tax	The tax is calculated by multiplying 3.5 percent with municipal multiplier	DESTATIS

Municipal multiplier for real property tax "B"	The multiplier which is levied on the value of the real estate, is set freely by each municipality in Germany.	DESTATIS
Firm characteristics		
Log Turnover	The natural log of turnover. Turnover is listed in the Balance Sheet account and defined as Total Operating Revenue (Net sales + Other operating revenue + Stock variations). These figures do not include VAT or excise taxes or similar obligatory payments.	ORBIS
Age	The age of a firm calculated since the year the company was incorporated.	ORBIS
Intangible fixed assets	Intangible assets are listed in the Balance Sheet account. Intangible fixed assets include all intangible assets such as formation expenses, research expenses, goodwill, development expenses, and all other expenses with a long-term effect.	ORBIS
Long-term debt	The natural log of long-term debt. Long term debt is financial variable in the balance sheet account and is defined as loans and financial obligations owed for a period exceeding 12 months. This can include bank loans, mortgage bonds, debentures or other obligations not due for 12 months.	ORBIS
Number of tax havens subsidiaries	The total number of tax haven subsidiaries identified for the parent firm.	ORBIS
Number of non-tax havens subsidiaries	The total number of non-tax haven subsidiaries identified for the parent firm.	ORBIS
Regional characteristics		
Population density	Number of local habitants on NUTS3 level	DESTATIS
Number of employees	Number of local employees on NUTS3 level	DESTATIS

Economic valued added	Local gross economic value added on NUTS3 level	
Industry activity classification		Eurostat
High Technology manufacturing	Nace 2-digit codes: 21, 26.	
Medium/High technology manufacturing	Nace 2-digit codes: 20, 27, 28, 29, 30.	
Medium/Low technology manufacturing	Nace 2-digit codes: 19, 22, 23, 24, 25, 33.	
Low technology manufacturing	Nace 2-digit codes: 10, 11, 12, 13, 14, 15, 16, 17, 18, 31, 32.	
Knowledge Intensive services	Nace 2-digit codes: 50, 51, 58, 59, 60, 61, 62, 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 78, 80, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93.	
Less knowledge intensive services	Nace 2-digit codes: 45, 46, 47, 49, 52, 53, 55, 56, 68, 77, 79, 81, 82, 94, 95, 96, 97, 98, 99.	
Time	Year of sample period: 2008-2018.	ORBIS

5.3.2 Empirical models

We estimate fixed effects Poisson models and run a number of specifications that revolve around four unbalanced panel data models. The econometric model for testing hypotheses 1 about the relationship between local business tax and the use of tax havens is of the following form:

$$\textbf{(1)}\ Tax\ Haven\ Subsidiaries_{i,t} = \alpha + \beta_0\, Localtax_{r,t} + \Sigma\, \beta_1\, Firm_{i,t} + \Sigma\, \beta_2\, Region_{r,t} + \Sigma\, \beta_3\, Sector_{s,t} + time_t + \varepsilon_{i,t}$$

where the index *i* refers to *Firm*, *r* refers to *region*, s refers to *sector*, and *t* refers to *time*. The dependent variable $Tax\ Haven\ Subsidiaries_{i,t}$ is count proxy variable for the use of tax havens. $Localtax_{r,t}$ is local business tax set by local authorities. β_0 quantifies the impact of local business tax rates on firms' tax haven use. The vector $Firm_{i,t}$ captures a number of firm characteristics

such as firm age, firm size, intangible assets and long-term debt. The vector $Region_{r,t}$ captures regional characteristics such as local population, local employment, and local economic value added. The sector dummy variable is divided into six categories, including "High technology manufacturing", "High/Medium technology manufacturing", "Medium/Low technology manufacturing", "Low technology manufacturing", "Knowledge intensive services", and "Less knowledge intensive services". For detailed descriptions of NACE industry codes for the categorizations of the industrial sectors, see **Table 5.1**. The variables $time_t$ is time dummies to account for business cycle. The time dummy variable covers a research period from the year 2008 to the year 2018, and ε represents the error term.

The empirical model for testing Hypothesis 2 about the use of tax havens by MNEs located in a business cluster is of the following form:

$$\textbf{(2)}\ Tax\ Haven\ Subsidiaries_{i,t} = \alpha + \beta_0\ Cluster_i + \Sigma\beta_1\ Firm_{i,t} + \Sigma\beta_2\ Region_{r,t} + \Sigma\beta_3\ Sector_{s,t} + time_t + \varepsilon_{i,t}$$

The empirical model used for testing Hypothesis 3 (i.e. the interaction term between business cluster and local tax) is included to verify the moderating effect of industry agglomeration on the relationship between local tax and the use of tax havens. This is tested via the following model:

$$\textbf{(3)}\ Tax\ Haven\ Subsidiaries_{i,t} = \alpha + \beta_0\ Cluster_i + \beta_1\ Localtax_{r,t} + \beta_2\ Cluster_i * Localtax_{r,t} + \Sigma\beta_3\ Firm_{i,t} + \Sigma\beta_4\ Region_{r,t} + \Sigma\beta_5\ Sector_{s,t} + time_t + \varepsilon_{i,t}$$

In specification (3), an interaction term between business cluster and local tax is included to verify the moderating effect of industry cluster on the relationship between local tax and the use of tax havens.

The variable $Cluster_i$ in equations is dummy variable, equals 1 if an MNE is a cluster firm, and equals 0 otherwise. β_0 quantifies the impact of being located in business clusters on firms' presence in tax havens.

We then include interaction term into specification (4) to verify the relationship between local business tax rates, industrial agglomeration and the use of tax havens, and the moderating effect of business cluster on the relationship between local business tax rates and MNEs' tax haven use. The model is as follows:

(4) $$Tax\ Haven\ Subsidiaries_{\ i,t} = \alpha + \beta_0\ Cluster_i + \beta_1\ Localtax_{r,t} + \beta_2\ Cluster_i * Localtax_{r,t} + \Sigma\beta_3\ Firm_{i,t} + \Sigma\beta_4\ Region_{r,t} + \Sigma\beta_5\ Sector_{s,t} + time_t + \varepsilon_{i,t}$$

Robustness checks

We adopt different approaches as robustness checks to our baseline models, including using a different list of tax havens as discussed in the literation; changing dependent variable from count variable to ratio variable; exploring time lag for one-year period; and using instrumental variables for the independent variable local business tax.

First, we use a different list of tax havens for the dependent variable. The list of tax havens has no longer 28 jurisdictions as described above. Instead, the new list includes 26 dot tax havens, as indicated by Hines and Rice (1994) (See **Table 5.1**). In addition, rather than using a count variable, we calculated the tax haven ratio by dividing the number of tax haven subsidiaries into the number of non-tax haven subsidiaries as a proxy for the likelihood of using tax havens.

This ratio would bring a clearer picture of the use of tax havens by multinationals as it takes both number of tax haven subsidiaries and number of non-tax haven subsidiaries into account. This ratio variable is continuous in nature and does not include negative values.

Second, we explore time lags to further alleviate any possibility of simultaneity bias. We lag Second, we explore time lags to further alleviate any possibility of simultaneity bias. We lag our explanatory variables (Firm age, turnover, intangible assets, long-term debt, and local economic value added) for one-year period.

Third, under the assumption of endogenous business tax rates, we rely on a two stage least squares (2SLS) method. Hence, we adopt an instrumental variables regression. It is important to have an instrument that is correlated with local business tax, but is uncorrelated with the dependent variable, in this case is the use of tax havens. We utilise real property tax "B*"* (*Grundsteuer B)* of each municipality as the instrumental variable for local business taxes. Real property tax "B" is one of the tax forms on corporations for constructible real property, commercially used real property or real property with buildings (German Properties, 2020). In particular, Real property tax "B" is levied by the municipality in which real estate is located, at a rate of 0.35 percent of the tax value of the property, multiplied by a municipal coefficient (German Properties, 2020). Similar to the municipal multiplier for local business tax, the municipal multiplier to real property tax is stipulated by each municipality separately (Deloitte, 2019). Hence, real property tax "B" is likely to be correlated to local business tax (*Gewerbesteuer*). On the other hand, while local business tax is imposed directly on firms' taxable profits, real property tax "B" is based on the value of the property. Therefore, real property tax "B" unlikely drives MNEs to engage in offshore profit-shifting. In addition, we lag real property tax *(Grundsteuer B)* by one period and include it as one of the instruments.

For postestimation, we implement Durbin-Wu-Hausman (DWH) test to determine whether the exogeneity assumption holds (Cameron & Trivedi, 2010, p189). We then employ a Stock-Yogo test (Cameron & Trivedi, 2010, p196) for weak identification to test whether instruments utilized are valid. The results of those tests are presented in **Table 5.5.**

5.3.3 Descriptive statistics

Table 5.2 shows descriptive statistics for the whole panel dataset covering annual data over 2008-2018. In total, we are able to construct a panel of 10,987 MNEs in 12,232 German municipalities. Included are the number of observations, the mean, standard deviation, and the maximum and minimum values for each variable. Due to the unbalanced nature of our sample, our empirical estimates are based on 31,125 observations.

Table 5. 2 Descriptive statistics for sample data chapter 5

Variables	N	Mean	S.D.	Min	Max
Local business tax	31,125	14.02341	1.98267	7	19.25
Business cluster (BCL)	31,125	0.083596	0.276788	0	1
No. of tax haven subsidiaries	31,125	0.280721	3.28830	0	418
No. of non-tax haven subsidiaries	31,125	15.9956	55.7243	0	1,010
Firm age	31,125	41.8261	43.9154	0	653
Firm size (Ln turnover)	31,125	11.5860	2.06066	-.74437	19.0697
Ln Intangible assets	31,125	6.62760	3.64774	-7.6132	18.1746
No. of foreign subsidiaries	31,125	16.27638	56.8516	1	1046
Ln long-term debt	31,125	8.86822	2.56417	-4.52301	18.2742
Number of employees	31,125	300.2364	386.6571	18.90	1955.455
Local population	31,125	500.2444	639.6615	38.277	3594.163
Ln Local economic value added	31,125	9.55529	1.104766	7.07978	11.8836
Municipal multiplier of local tax	31,125	400.669	56.6477	200	550
Municipal multiplier of real property tax “B”	31,125	428.2576	122.0247	80	959
Real property tax “B”	31,125	1.498	0.4270	0.28	3.35
NACE code	31,125	53.33951	20.49229	1	96
Year	31,125	2013.259	3.136894	2008	2018

Local business tax rates range from 7 to 19.25 percent with the average value being 14.02 percent. From the collected dataset, we visualise the average municipal multiplier by business cluster categories. As indicated in **Figure 5.2**, the average value for municipal multipliers levied on MNEs, who are part of a business cluster is 413.149, whereas the value is 380.35 for MNEs, who are not part of a business cluster. This illustrates a substantial gap in local tax rates between cluster firms and non-cluster firms. This also shows evidence for the argument that higher local tax rates is one of business-cluster characteristics, and may drive firms in high-tax jurisdictions to establish foreign subsidiaries in tax havens. In terms of the tax haven dummy, about 8.35 percent of the firm year observations are identified in business clusters. With regard

to the tax havens variable, each MNE has on average 0.28 tax haven subsidiary with a standard deviation of 3.28. The number of tax haven subsidiaries ranges from 0 to 418. As for firm age, the average age of each firm is 41.82 years with a standard deviation of 43.91 years. In terms of firm size, as proxied for by turnover, the average firm is creating sales equal to exp (11.58), which is measured in thousands of dollars, and is equal to approximately US$ 106.93 million. As for the variable intangible assets, a firm is holding intangible assets equal to exp (6.627) on average, which is measured in thousands of dollars, and is equal to approximately US$ 755 thousand. With regard to long-term debt, the average firm is having long-term debt equal to exp (8.15), which is measured in thousands of dollars, and is equal to approximately US$ 5.8 million.

In terms of regional explanatory variables, each municipality has an average of 300 thousand employees with standard deviation of 386 thousand employees. In terms of the local population, each district has an average of 500 thousand inhabitants with the standard deviation of 639 thousand inhabitants. When it comes to local economic value added, a municipality has an average of exp (9.555) of GDP, which measured in millions of dollars is equal to around US$ 14.115 million. Municipal multipliers of real property tax “B” vary significantly, from 80 to 959. That leads to a significant discrepancy in Real property tax “B”, from 0.28 to 3.35 percent.

Figure 5. 2 Municipal multipliers by business cluster categories

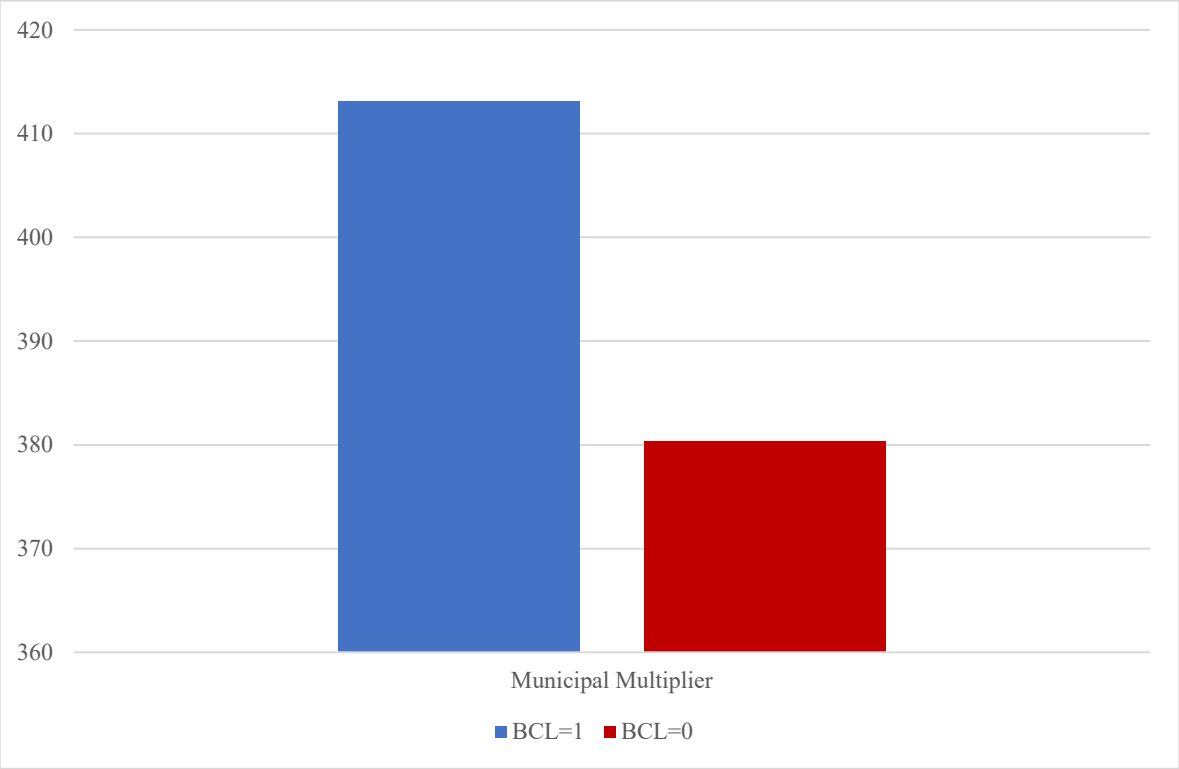


Table 5.3 reports the correlation matrix between all of the variables used in our analysis. The matrix shows that the correlations between our variables are weak, ranging from (0.005) to 0.709. Therefore, multicollinearity is not a problem.

Table 5. 3 Correlation Matrix chapter 5

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No. of tax haven subsidiaries	1.000									
Business clusters (BCL)	0.072	1.000								
Local business tax	0.038	0.031	1.000							
Firm age	0.033	0.085	-0.005	1.000						
Firm size	0.099	0.173	0.044	0.266	1.000					
Intangible assets	0.086	0.161	0.058	0.181	0.709	1.000				
Long-term debt	0.117	0.150	0.023	0.177	0.567	0.546	1.000			
Local employment	0.038	0.066	0.460	-0.097	-0.012	0.020	-0.010	1.000		
Local population	0.025	0.064	0.381	-0.090	-0.016	0.014	-0.017	0.706	1.000	
Local economic value added	0.049	0.060	0.564	-0.091	0.022	0.056	0.021	0.660	0.685	1.000

5.4 Empirical results

We report our results in two parts. In the first part, we present the results of the baseline models using a number of Poisson specifications. In the second part, we present the results of the instrumental variables regression that attempts to control for endogeneity. Overall, the results show conclusive support for each of our hypotheses.

5. 4.1 Baseline models

Table 5.4 reports the results for equations (1) to (4). Column (1) exhibits the results for the relationship between local business tax rates and the tax haven use; Column (2) corresponds to the specification for the relationship between agglomeration effect and the use of tax havens; Column (3) shows the results of the interaction between business cluster and local business tax. For each variable, three rows of numbers are displayed. The first row presents the coefficient, the following shows the standard error, and the final row shows the p-value related to the variable statistical significance.

Table 5. 4 Fixed Effects Poisson regression

Dependent variable: No. of tax haven subsidiaries	(1)	(2)	(3)
Local Business Tax	0.0497***		0.0458***
(S.E)	(0.00768)		(0.00847)
(P-value)	0.008		0.000
Business cluster (BCL)		0.1083***	0.0373**
(S.E)		(0.0314)	(0.217)
(P-value)		0.000	0.049
Business cluster × Local business tax			0.0767***
(S.E)			(0.0144)
(P-value)			0.000
Firm age	0.00343***	0.00392***	0.00381***
(S.E)	(0.000181)	(0.000186)	(0.000184)
(P-value)	0.000	0.000	0.000
Firm size (Ln Turnover)	0.363***	0.354***	0.356***
(S.E)	(0.00934)	(0.00929)	(0.00938)
(P-value)	0.000	0.000	0.000
Intangible assets	0.165***	0.153***	0.154***
(S.E)	(0.00598)	(0.00594)	(0.00599)
(P-value)	0.000	0.000	0.000

Long-term debt	0.1439***	0.1517***	0.1419***
(S.E)	(0.00764)	(0.007613)	(0.00764)
(P-value)	0.000	0.000	0.000
Local employment	0.00239***	0.00281***	0.00232***
(S.E)	(0.000185)	(0.000177)	(0.000131)
(P-value)	0.000	0.000	0.000
Local population	-0.00139***	-0.00158*	-0.00129***
(S.E)	(0.0000949)	(0.0000893)	(0.0000808)
(P-value)	0.000	0.096	0.000
Ln Economic Value Added	0.0297**	0.0225**	0.0132**
(S.E)	(0.0236)	(0.0283)	(0.0228)
(P-value)	0.038	0.047	0.043
Constant	-9.264***	-8.593***	-9.045***
(S.E)	(0.274)	(0.258)	(0.165)
(P-value)	0.000	0.000	0.000
Year dummy	Yes	Yes	Yes
Log likelihood	-16590.664	-17102.942	-16564.87
Wald chi2	14844.37	15423.30	15032.20
Prob > chi2	0.0000	0.0000	0.0000
Prob > chibar2	0.000	0.000	0.000
Observations	31,125	31,125	31,125

Notes: Each column reports a separate Poisson regression. The dependent variable is a count variable, summing up the number of tax haven subsidiaries for each MNE. Sector dummies and Year dummies are unreported for brevity. Turnover, intangible assets, long-term debt, and local gross value added are entered as their natural logarithms. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

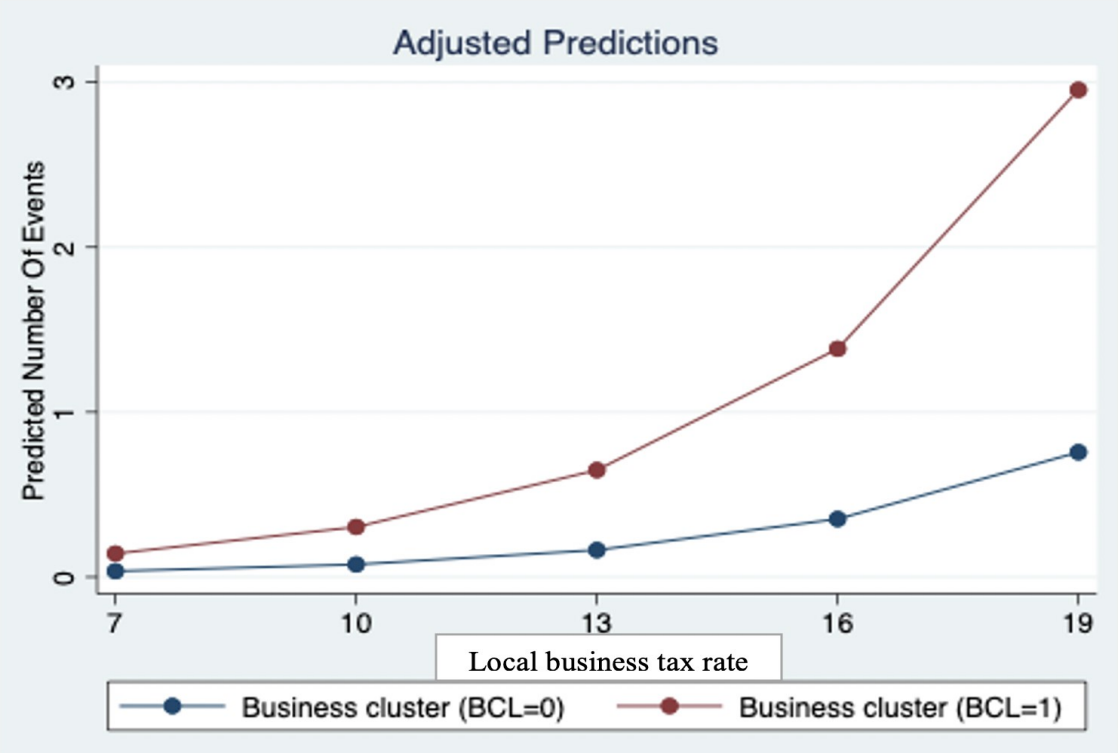
In the first specification, the coefficient of the local tax variable in column (1) is significant at 1 percent level. The coefficients of 0.0497 indicates that 1 percent point increase in local business tax rates leads to approximately 4.97 percent increase in the number of tax haven subsidiaries by MNEs. The finding supports our argument that MNEs in locations with higher tax rates are more likely to go offshore and invest in locations with endowments (low tax rates or a zero-tax rate). As such, hypothesis 1 of this empirical chapter is significantly supported.

The coefficient of the business cluster variable is positive and significant at 1 percent level. The coefficient for the effect of business clusters in specification (2) is 0.1083, implying that being located in business clusters increases the number of tax haven subsidiaries of each MNE by 10.83 percent on average. The outcomes show the strong support for our contention that taxable rents in business clusters are considered costs for member companies. As a result, MNEs who are part of business clusters have more motivation to engage in tax haven activity to minimize tax liabilities compared to MNEs who are not part of business clusters. Therefore, hypothesis 2 is strongly supported.

To investigate the agglomeration-local tax effect on the use of tax havens, an interaction term between the business cluster variable and the local business tax variable is included in the regression. The coefficient of the interaction term presented in column (3) is positive and significant at 1 percent level. Therefore, hypothesis 3 is strongly supported. Furthermore, as indicated in Column (3), the coefficients for the local tax variable and the business cluster variable are both positive and significant at 1 percent level. This strengthens our results, as evidence for Hypothesis 1 and Hypothesis 2 as discussed above.

We depict the agglomeration-tax effect on the tax haven utilization in **Figure 5.4** to illustrate the predictive margins of agglomeration on the relationship between local tax rates and the use of tax havens. As level of local tax rates rises, the effect of local business tax rates on the use of tax havens increases steadily with the agglomeration effect. Whereas, the effect for non-cluster firms slightly increases in accordance with the increase in level of local business tax rates.

Figure 5. 3 Predictive margins of the use of tax havens by agglomeration effect



Turning our discussion now to control variables, the coefficients for firm-specific characteristics (firm age, firm size, intangible assets and long-term debt) are statistically significant at 1 percent level in all specifications. The coefficients of firm age range from 0.00343 to 0.00392, indicating that mature firms are more likely to own subsidiaries in tax havens than start-up firms. The coefficients of firm size (turnover) range from 0.354 to 0.363,

meaning that a 10 percent growth in turnover raises the number of tax haven subsidiaries by around 35.4 to 36.3 percent. The coefficients of intangible assets range from 0.153 to 0.165, showing that a 10 percent increase in the intangible fixed assets leads to an increase in the likelihood of tax haven utilization by around 15.3 to 16.5 percent. The coefficients of long-term debts are in the range of 0.1439 to 0.1517, indicating that a 10 percent increase in long-term debts leads to an increase in the number of tax haven subsidiaries by around 14.39 to 15.17 percent. In terms of control variables at regional level, the coefficients of local employment hover around 0.00232 to 0.00281, showing that MNEs in regions with higher number of employees own the higher number of tax haven subsidiaries by 0.23 to 0.28 percent. The coefficients of regional economic value added are in the range of 0.0132 to 0.0297, meaning that a 10 percent increase in local value added raises the number of tax haven subsidiaries by around 1.32 to 2.97 percent. Interestingly, the coefficients for local population are negative and significant at 1 percent level. The results show that MNEs in populated municipalities are less likely to establish foreign subsidiaries in tax havens. However, when it comes to employment, MNEs in municipalities with higher level of local employment are more likely to engage in tax haven use via tax haven subsidiaries. The results for local population with regard to the use of tax havens by MNEs are interesting and bring a scope to consider for future research.

5.4.2 Instrumental variables model

Table 5.5 reports the results for the instrumental variables model to control for endogeneity. In terms of the impact of the local tax, the coefficient estimate is 0.000354 and is statistically significant at 1 percent level. This suggests that one percent increase in local tax rates leads to an increase in tax haven ratio (number of tax haven subsidiaries/ number of non-tax haven subsidiaries) by 0.0354 percent. This brings evidence for the Hypothesis 1 that higher local business tax rates, all things equal, are more likely to drive MNEs offshore to invest in tax haven subsidiaries. In addition, with regard to the effect of business cluster, the coefficient of the variable *business cluster (BCL)* strongly confirms the significant impact of agglomeration on the use of tax havens by MNEs as proposed in Hypothesis 2. It is indicated that the tax haven ratio for MNEs, who are part of a business cluster is approximately 2.43 percent higher, on average, than that for MNEs who are not part of a business cluster. With regard to the interaction term between local tax rates and business clusters, the empirical result for the robustness check is positive and significant at 10 percent level and it also confirms our third hypothesis that the effect of agglomeration enhances the relationship between local business tax rates and tax haven use by 1.70 percent.

For postestimation, the Durbin-Wu-Hausman test of endogeneity with the p-value of 0.0745 provides a rejection of the null hypothesis that local tax is exogenous, suggesting that instruments are valid. The Stock and Yogo test provides that the F statistic (F-statistic=1852) is significant high and therefore we can reject the hypothesis that the instruments are weak.

Table 5. 5 Instrumental variables regression

Dependent variable: Tax haven ratio	(1)
Instrumental for Local business tax: Real property tax "B"	
Local business Tax_{t-1}	0.000354***
(S.E)	(0.00000896)
(P-value)	0.000
Business cluster (BCL)	0.024288 ***
(S.E)	(0.003075)
(P-value)	0.000
Local business Tax_{t-1*} Business cluster (BCL)	0.0170023*
(S.E)	(0.0093949)
(P-value)	0.070
Firm age	0.000237
(S.E)	(0.000189)
(P-value)	0.211
Firm size $_{t-1}$ (Ln Turnover $_{t-1}$)	0.0010021
(S.E)	(0.0006172)
(P-value)	0.100
Intangible assets $_{t-1}$	0.000995 ***
(S.E)	(.0003347)
(P-value)	0.003
Long-term debt $_{t-1}$	0.0023259***
(S.E)	(0.0003927)
(P-value)	0.000
Local employment	0.000691
(S.E)	(0.000128)
(P-value)	0.090
Regional population	0.000433
(S.E)	(0.0000662)
(P-value)	0.513
Ln Economic value added $_{t-1}$	0.00108
(S.E)	(0.00158)

(P-value)	0.496
Constant	-0.0601
(S.E)	(0.113)
(P-value)	0.596
Year dummy	Yes
Durbin-Wu-Hausman (p-value)	0.0745
Stock & Yogo (F-statistic)	1852
Wald chi2	270.87
Prob > chi2	0.0000
R-squared	0.0131
Observations	28,721

Notes: The table reports instrumental variables regression. The dependent variable is tax haven ratio which is calculated by dividing no. of tax haven subsidiaries by no. of non-tax haven subsidiaries. Sector dummies and Year dummies are unreported for brevity. Turnover, intangible assets, long-term debt, and local gross value added are entered as their natural logarithms. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

5.5 Concluding remarks

This chapter combines firm-level data from ORBIS with region-level data from DESTATIS to investigate the relationship between local business tax rates and the use of tax havens by German firms. We based our analysis on 31,125 observations for 10,987 German MNEs. This chapter show that local business tax and agglomeration have a significant impact on the extent to which MNEs establish tax havens network to avoid tax liability. Specifically, 1 percent point increase in local business tax rates leads to approximately 4.97 percent point increase in the number of tax haven subsidiaries by an MNEs on average.

It also reveals that MNEs who are part of a business cluster have 10.83 percent higher number of tax haven subsidiaries compared to those MNEs who are not part of a business cluster. Besides, the results suggest that agglomeration locations exert a significantly positive impact on MNEs' tax haven use. Moreover, the result shows a very interesting role of business cluster on the relationship between local tax rates and MNEs' tax haven activity. In particular, business clusters moderate the relationship and drive cluster-located firms to engage in the use of tax haven under the effect of local business tax rates.

In the context of municipal tax rates, the use of tax havens allows firms in localities with higher local tax rates in home countries to avoid massive tax expenses by shifting profits via tax haven subsidiaries in host countries. High local tax rates make MNEs more aggressive in shifting profits via tax havens. Thus, tax competition creates an even greater race to the bottom. In other words, the use of tax havens reduces the ability of municipalities to compete over tax to attract MNEs. This chapter therefore prompts a rethink of the aims and objectives of cluster policy and tax avoidance schemes.

CHAPTER 6: INTRA-GERMAN TAX WARS: A RACE TO THE BOTTOM

6.1 Introduction

Profit-shifting of intrafirm trade constitutes an important way for companies to design tax-optimal real investments (Overesch, 2006). A large body of public economic literature mainly analyses international relocation of a firm from one country to others (Pennings & Sleuwaegen, 2000; Sleuwaegen & Pennings, 2006; Forte & Brandão, 2008; Cumming, Fleming & Schwienbacher, 2009; Barbieri et al., 2019). However, little work has been done so far to address the responsiveness of a firm to shifting profit domestically. Recent media coverage concerning tax affairs in Germany is of interest, showing that parishes in structurally weak regions or around big cities have turned themselves into miniature domestic German corporate tax havens by setting their local business tax rates (*Gewerbesteuer*) to zero to attract capital inflows (Tax Justice Network, 2018, 2020). For example, the village of Norderfriedrichskoog became a popular tax haven staple with a zero-tax rate from 1990 to 2003. The commune hosted just a handful of farmsteads and offered companies a place to regularly have so-called "meetings" in makeshift boardrooms built at the back of farms (Tax Justice Network, 2018). Such a place ensures that companies have enough presence to be allowed to qualify for the Norderfriedrichskoog tax rate (Tax Justice Network, 2018). By the year 2003, Norderfriedrichskoog, with the population of only 47, had accommodated over 500 companies, including affiliates of high profile names such as Deutsche Bank, Eli Lilly & Co., Unilever, Lufthansa and E.On (Tax Justice Network, 2018). In Germany, substantial money laundering activities are recorded, with between approximately €29 billion and €100 billion being laundered annually (Trautvetter, 2019). This has increased pressure on policy makers to take action, and calls for academic research to gather evidence, which might justify the development of effective policy to tackle tax aggressiveness.

To explore this, this empirical chapter utilizes the local business tax rates (*Gewerbesteuer*) which are freely set by German local authorities. This chapter examines whether higher local tax rates lead to the establishment of domestic subsidiaries in low-tax jurisdictions. The traditional tax competition view proposes that when firms have choices of location, governments are forced to offer attractive conditions such as low taxes and good public services (e.g. infrastructure and legal systems) (Baldwin & Krugman, 2004). In most of traditional models of tax competition, governments differ only in terms of profit taxes (Bucovetsky, 1991; Wilson, 1999; Baldwin et al., 2005). Other things being equal, producers will move their capital to whichever locations offer low tax rates, triggering a competition for mobile factors among different jurisdictions (Zodrow & Mieszkowski, 1986). This drives tax rates ever lower, leading to a race-to-the-bottom in tax rates among governments.

We compile a large panel dataset on local business tax rates and other data at the micro-region (municipality) level from the Federal Statistical Office of Germany (DESTATIS). Our dataset covers more than 10,000 German municipalities across the time period 2011-2018. We link it with data on firms' financial information, ownership, locations and other data collected at company level from ORBIS. As the panel dataset from ORBIS captures the locations of every parent company and all their affiliates, we are able to locate the whole network of domestic subsidiaries, owned and used by each firm on an annual basis, and then to construct a unique sample of relocating firms in Germany.

Utilising a large dataset of 30,226 observations of German firms during the years 2011-2018, we find that a one percent increase in the local business tax rates at headquarters leads to a 5.21 to 6.31 percent increased likelihood of ownership of domestic subsidiaries in low-tax municipalities. In addition, we show that factors such as intangible assets and pre-tax profits can moderate the relationship between local tax rates and firms' domestic profit-shifting activity. In particular, when level of intangible assets and pre-tax profits rises, the effect of such covariates on firms in high-tax locations increases steadily, whilst the effect for firms in low-tax locations decreases significantly.

The chapter makes a number of key contributions to the literature both theoretically and empirically. First, this chapter extends the traditional tax competition theory to reveal intra-German tax wars in which firms' tax responses are significantly affected by local business tax rates levied at municipal level. It shows the extent to which higher local business tax rates are associated with firms utilising, managing and maintaining their networks of domestic subsidiaries in low-tax municipalities. This finding offers a more accurate understanding of firms' location choices, to reduce policy inefficiencies. Second, this chapter reveals that tax avoidance happens not only in the form of offshore profit-shifting via foreign subsidiaries, but also in the form of domestic profit-shifting via domestic affiliates. Identifying the relative importance of alternative channels of profit-shifting is crucial to understanding their impact on national economies and for the design and implementation of anti-avoidance rules. Third, the disaggregated and novel nature of data records on domestic subsidiary locations, which has for a long time been restricted by data availability, allows us to provide an insight into the domestic tax haven network within Germany.

The remainder of this chapter is set out as follows. In the next section, we will discuss the theory behind and hypotheses for the study. In Section three, information on data, variables, empirical models and descriptive statistics will be described. The empirical results will then be presented in Section four. Finally, we provide concluding remarks to this piece of empirical research, related to domestic profit-shifting and freeports within Germany.

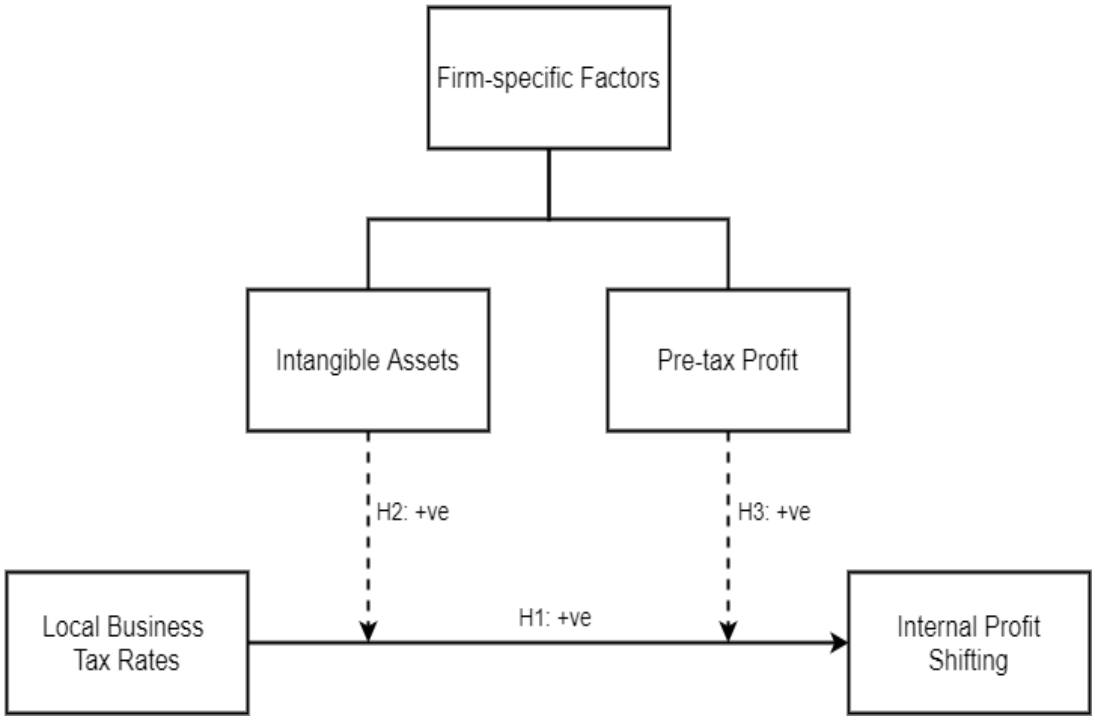
6.2 Theoretical consideration

The analysis of standard tax competition for mobile factors has a long tradition in economics (Wilson, 1991; Krugman, 1998; Tung & Cho, 2001). This strand of the literature predicts a race-to-the-bottom of tax rates when firms are mobile. In practice, governments behave strategically when setting capital tax rates (Andersson & Forslid, 2003). First, local public decision-makers are supposed to be benevolent, in the sense that their objective is to finance public services and maximise the welfare of their citizens (Charlot & Paty, 2010). Tax collection is considered the main revenue source for governments, in which taxes on mobile factors account for a large proportion of public revenue (Andersson & Forslid, 2003). Second, jurisdictions see capital flight as a massive cost as it causes huge tax-revenue losses (Brülhart, Jametti & Schmidheiny, 2012). An outflow of capital resulting from an increase in tax rates in one jurisdiction represents an inflow of capital in another jurisdiction (Hill, 2008). Put another way, the optimization problem for a jurisdiction relates not only to its own tax rates, but also to those of others. As a result, jurisdictions have an incentive to lower their tax rates in order to attract the mobile capital bases. There is a large body of literature that has tried to estimate the responsiveness of the allocation of capital to taxes (Hines, 1996; Buettner, 2001; Devereux & Griffith, 2003; Shafik, Martin & Alfons, 2010; Chen, Li & Liu, 2018). The existing literature on this topic has mostly looked at the effects of corporate taxation (Garretsen & Peeters, 2007, Hebous, Ruf & Weichenrieder, 2010; Lawless et al., 2018); international capital mobility of multinational firms (Brülhart, Jametti & Schmidheiny, 2012; Crabbé & Bruyne, 2013); or FDI inflows into particular countries (Leslie, 1991; De Mooij & Ederveen, 2003; Hansson & Olofsdotter, 2013). However, the predictability of the effects of local tax rates on firms' locations remains fairly limited, given the huge differentials in local tax rates among jurisdictions of a nation. This is especially the case in European countries (Hill, 2008; Koh, Riedel & Böhm, 2013; Fréret & Maguain, 2017).

Moreover, there are significant competition effects between local jurisdictions regarding firms' location choices (Brülhart & Jametti, Schmidheiny, 2012; Crabbé & Bruyne, 2013; Rohlin, Rosenthal & Ross, 2014; Chen, Li & Liu, 2018). However, much less attention has been paid to analysis of the likelihood of establishing domestic subsidiaries by firms due to local tax differentials across jurisdictions (Rohlin, Rosenthal & Ross, 2014; Becker, Egger & Merlo, 2012). This leaves the issue of the impact of local taxes on the domestic portfolio reallocation of firms theoretically and empirically under-researched.

In this regard, by linking tax - setting behaviours of local authorities with firms' domestic profit-shifting activities, it should be possible to analyse the wider economic impact of local tax rates on business investment decision-making. Rohlin, Rosenthal and Ross (2014) highlight that entrepreneurs are inclined to seek to avoid taxation by locating new establishments in low-tax rate locations. Taxes do affect business activity, and new businesses are drawn to locations in which they are relatively more sheltered from higher taxes (Becker, Egger & Merlo, 2012). We therefore propose that tax competition among municipal entities is a game of a few and that domestic profit-shifting is one of the crucial channels of tax avoidance. The theoretical framework for the three hypotheses proposed in this chapter is illustrated in the **Figure 6.1** below:

Figure 6. 1 Theoretical framework chapter 6



6.2.1 Local business tax

Local business tax is considered the main source of revenues for local authorities, and impose a considerable burden on businesses (Rohlin, Rosenthal & Ross, 2014; Becker, Egger & Merlo, 2012; Hill, 2008; Koh, Riedel & Böhm, 2013; Fréret & Maguain, 2017). In Germany, business profits are subject to two taxes, namely corporation tax (*Körperschaftsteuer)* and trade tax (*Gewerbesteuer*) (PwC, 2021). Local business tax rates significantly contribute to the high tax rates on business profits (Delloite, 2021). It is estimated that effective corporate tax rates in Germany range between 30 percent and 33 percent (PwC, 2021). These are among the highest rates in Europe (European Commision, 2015). In the case of Germany, utilising domestic subsidiaries on the low-tax side of a border can allow firms on the high-tax side of the border to escape adverse tax effects through their choice of municipal locations (Frank & Stefan, 2007). It is well documented that the effect of local taxes is sufficiently large in magnitude to

be important in influencing entrepreneurs' location decisions (Brülhart, Jametti & Schmidheiny, 2012; Golem, 2013; Rohlin, Rosenthal & Ross, 2014).

However, previous studies have struggled to provide empirical evidence that local tax setting policies affect the tendency of entrepreneurs to redirect their investments across different jurisdictions within national borders. According to Jones and Temouri (2016), firms that choose to diversify the geographical portfolio of their investments reflects not only their ability to do so but also their perception of the resulting costs and benefits. By setting the minimum local business tax rate of 7 percent, municipalities such as Norderfriedrichskoog or Schönefeld turn themselves into miniature domestic German corporate tax havens (Tax Justice Networks, 2018, 2019) and enable firms to create "financial specific advantages" to save a huge amount on taxation (Oxelheim, Randøy & Stonehill, 2001, p.660). In this chapter, we argue that domestic profit-shifting constitutes a considerable share of aggressive tax planning by firms in Germany. So, this leads us to the main hypothesis of this chapter:

> **Hypothesis 1.** Higher local business tax rates, all things being equal, are more likely to drive firms to engage in domestic profit-shifting via domestic affiliates in low-tax municipalities.

6.2.2 Factors moderating the effect of local business tax rates

Intangible assets

Firms with high levels of intangible assets are highly likely to engage in profit-shifting activity (Dischinger & Riedel, 2011; Jones & Temouri, 2016). We propose that intangible assets act as a moderator in the relationship between local business tax rates and the likelihood to establish domestic subsidiaries in low-tax municipalities. This is for the following reasons:

First, firms with high level of intangible assets are the highest-potential candidates to engage in profit-shifting activity, as it is easy to relocate intangible assets (Dyreng, Hanlon & Maydew, 2008; Bárcena-Ruiz & Begoña Garzón, 2009). In particular, intangible assets consist of items such as formation expenses, R&D expenses, advertising expenditures, training of employees, and intellectual property such as patents, trademarks, copyrights, licences and sub-licenses, and goodwill (Contractor, Yang & Gaur, 2016). As such assets are non-physical in nature (Filatotchev & Piesse, 2009), firms find it attractive to locate intangible property in low-tax affiliates. In addition, intangible assets often contribute a significant proportion of the corporate return, while trade prices for intangible assets are very small when they are shifted to locations with low or a zero tax rate (Bartelsman & Beetsma, 2003). That leads to very low accruing rents because the actual rents for firms are taxed at low rates. The existing literature also shows consistent evidence that the size of a firm's intangible assets is the key driver for obtaining tax benefits via profit-shifting aggressiveness (Dyreng, Hanlon & Maydew, 2008; Dischinger & Riedel, 2011; Taylor, Richardson & Taplin, 2015).

Second, financial consultancies are inclined to advocate company tax planning strategies that imply the relocation of intangible property holdings to low-tax jurisdictions (Bartelsman & Beetsma, 2003). In practice, an increasing number of companies are using the specialist services of financial consultancy firms (Beale, 2004). These firms provide not only accounting services but also have a strong presence in tax consultancy (Hanlon & Shevlin, 2002; Bartelsman & Beetsma, 2003; Jones, Temouri & Cobham, 2018). Maydew and Shackelford (2005) argue that financial consultancy firms have enormous advantages over law firms due to their ability to crunch the numbers. In fact, the financial reporting perspectives of accountants have helped shape corporate tax planning. More specifically, one of the main roles of accountancy firms is enabling companies to avoid corporate tax across their subsidiary network

(Hogan & Noga, 2015). Jones, Temouri and Cobham (2018) reveal that MNEs which use auditing services offered by the Big 4 accountancy firms are more likely to build, manage and maintain larger tax haven subsidiary networks in comparison with MNEs that do not use the Big 4 to audit their accounts. Parallel to that, financial consultancies are inclined to utilize intangible assets as a major channel to transfer cost and benefit from tax minimization (Bartelsman & Beetsma, 2003; Taylor, Richardson & Lanis, 2015). Therefore, there is the high possibility that geographical proximity facilitates the distance between financial accountancy firms and cluster MNEs. Hence, financial accountancy firms are likely to advise companies to transfer incomes and profits across jurisdictions through intangible assets.

Third, arm's length prices for firm-specific intangibles are difficult to determine (Bartelsman & Beetsma, 2003). Intangible assets constitute a major source of profit-shifting opportunities due to a highly non-transparent profit-shifting process. Specifically, intangibles can be geographically separated from other production units in the group at low costs (Dischinger & Riedel, 2011). Companies are inclined to shift profits earned at production affiliates in high-tax jurisdictions to intangibles-holding low-tax affiliates in locations where tax rates is very low or zero (Bartelsman & Beetsma, 2003). The low-tax entities then sell patents and licenses to high-tax production affiliates and receive corresponding royalty payments as earnings. The royalty flows between all of these subsidiaries ensure that corporate tax is avoided across multiple locations (Bartelsman & Beetsma, 2003; Chen, Dhaliwal & Trombley, 2012). In addition, firm often utilize schemes with layers of complexity that make the tracking of royalty payments by the tax authorities almost impossible (Mutti & Grubert, 2007). This process is complicated and is just the tip of the iceberg. Sikka and Hampton (2005) highlight that companies are also freely able to choose tax-optimized transfer prices for firm-specific intangibles. Accordingly, the true transfer price for royalties and licenses are normally

overstated (Billiot & Glandon, 2005). In other words, the true value of intangible assets is hardly observable for national tax authorities. This is one of the reasons why parent companies' intangible investments have become a weak predictor of royalty payments from subsidiaries to the parent firms, but simultaneously enhance the earnings of group affiliates located in low tax regions.

In sum, we propose that intangible assets impact on the magnitude of the relationship between local tax rates and the likelihood to establish domestic subsidiaries in low tax rate municipalities. This leads us to the second hypothesis:

> **Hypothesis 2.** The effect of local business tax rates on firms' domestic profit-shifting activity is stronger for firms, who have higher level of intangible assets compared to firms, who possess lower levels of intangible assets.

Pre-tax profit

The ultimate goal of every business is to achieve the highest profits (Martini, 2015). Therefore, firms will choose a location which maximises locational net benefits (Overesch, 2006). We propose that pre-tax profit can act as a moderator in the relationship between local business tax rates and the tendency to establish affiliates in low-tax jurisdictions. This is for following reasons:

First, firms with high level of pre-tax profits in high-tax locations always aim at shielding their profits from higher local tax rates to obtain the highest post-tax returns (Graham & Tucker, 2006; Dyreng, Hanlon & Maydew, 2008). Bartelsman and Beetsma (2003) highlight the sensitivity of total earnings of corporations to tax rates as firms decide to settle in a particular region on the basis of the expected profitability of being located there. This profitability

depends on net locational benefits - expressed as the difference between gross locational benefits and costs (Baldenius, Melumad & Reichelstein, 2003; Choe & Hyde, 2004). Capital mobility has increased opportunities for tax avoidance through profit-shifting to low-tax jurisdictions. The activity leads to differences between reported income and the actual income generated by real economic activity (Baldenius, Melumad & Reichelstein, 2003). The optimal transfer price decision is to maximize firm-wide profits after taxes (Martini, 2015). In practice, entrepreneurs choose to locate new establishments in more tax - advantaged locations to not only minimize taxes, but also maximize the firm's pre-tax profit (Buettner, 2001; De Mooij & Ederveen, 2003; Martini, 2015). Firms who relocate their capital form high-tax jurisdictions to low-tax jurisdictions can strategically reduce tax burdens and maximize their pre-tax profit simultaneously (De Mooij & Ederveen, 2003). Therefore, it is reasonable to argue that firms with high level of pre-tax profits are more likely to shift their profits to low tax jurisdictions to obtain their fundamental goal of maximizing after-tax profits.

Second, due to the existence of a territorial tax system for corporations (Santandertrade, 2019), Germany is an interesting case to exemplify a clear rationale for the moderating effect of pre-tax profit on the relationship between local business tax rates and profit-shifting activity. Local taxes are naturally based on immobile components to ensure that the local beneficiaries are responsible for their local taxes. In Germany, local business tax rates (Gewerbesteuer) are directly levied on taxable incomes of all commercial business operations, irrespective of their legal forms (Germany Trade & Invest, 2020). As a result, companies' pre-tax profits are directly affected by the level of local business tax rates which are imposed freely at municipality level. Evidence has shown that business tax rates range from 14 to 17 percent on average (Deloitte, 2021). This makes up a huge proportion of effective corporate tax rates on businesses in Germany. This is highly likely to prompt strong resistance from the business

community and its constituent organisations which fear a higher tax burden on their profits. This leads us to the third hypothesis:

> **Hypothesis 3.** The effect of local business tax rates on firms' domestic profit-shifting activity is stronger for firms, who have higher levels of pre-tax profits compared to firms, who have lower level of pre-tax profits.

6.3 Data, variables, and empirical model

6.3.1 Data

All data in this empirical chapter is secondary in nature and is collected from two main sources, including ORBIS and DESTATIS. In particular, ORBIS provides rich and varied data such as financial information, and information on locations and subsidiaries at the company level. This allows us to identify the locations of parent MNEs. In addition, ORBIS data captures the information on the location of every subsidiary, thereby enabling us to identify the whole network of domestic subsidiaries of German firms. Data on local business tax rates, regional populations, regional employment rates, local GDP, property tax B and other micro-regional level data are drawn from federal statistical offices of the 16 German states *(Länder*) included in the database Regionaldatenbank Deutschland. This database is distributed by Federal Statistical Office of Germany (Statistisches Bundesamt DESTATIS). Thanks to its inclusion of the smallest regional unit (municipality), the database offers a holistic picture of institutional settings across municipalities within a country compared to databases at cross-country level.

Dependent variable: identifying the tendency to establish domestic subsidiaries in low-tax locations

Our dependent variable is a binary variable, it equals 1 if a firm has at least one subsidiary located in a municipality with a lower local tax rate than that of its parent firm, and 0 if a firm

does not have any subsidiary in low-tax municipalities. We collected time variant data on municipal multipliers from the federal statistical offices of the 16 German states (*Länder*). As explained above, local business tax comprises two components, the statutory rate (*Gewerbesteuermesszahl*) and the municipal multiplier (*Hebesatz*) (Germany Trade and Invest, 2020). We, therefore, multiplied the collected municipal multipliers data 2011-2018 with the tax base rate of 3.5 percent (the statutory rate throughout Germany) to calculate local business tax rates for each municipality where firms are located. The dataset allows us to identify data on the location of municipalities of every parent company and of every domestic subsidiary. As a result, we are able to compare local business tax rates of parent companies with those of their affiliates. Hence, we can assess the tendency for establishing domestic subsidiaries in low-tax locations.

Independent variable: Measuring local business tax rates imposed on parent companies

We measured the local business tax rates of municipalities where parent companies operated. This variable is continuous in nature and does not include negative values. Previous studies in this research strand have been challenged due to the lack of information about such micro-regional data (Becker, Egger & Merlo, 2012; Koh, Riedel & Bohm, 2013). In contrast, our time variant sub-national dataset distributed from DESTATIS covers eight consecutive years from 2011 to 2018. In total, we collected the comprehensive set of data on local business tax rates for 9,224 municipalities where parent firms are located and for 10,746 municipalities where domestic affiliates are located in the time period 2011-2018.

Explanatory var*iables*

The explanatory variables in our analysis are obtained from annual accounts data in ORBIS for each German parent firm to capture the firm's age, size (measured by turnover as proposed by

Graham & Tucker, 2006), intangible assets and long-term debts. Those variables are discussed in work by Jones and Temouri (2016) as determinants of tax avoidance schemes. Furthermore, we base on the NACE two-digit industry codes which are defined by Eurostat to identify the industrial sectors in which each multinational company operates. For region-level variables, we collected data on regional population, regional employment, and regional gross domestic product at NUT3 level from DESTATIS. Those variables are discussed in the work by Markusen (2002); Markusen & Maskus (2002); Navaretti & Venables (2004); Becker, Egger & Merlo (2020) as determinants of firms' investment activity within particular regions. Financial data from ORBIS are measured in '000s of dollars while financial data from DESTATIS are measured in '000 000s of euros. We then use the average annual exchange rate from Trading Economics (2020) to convert from euros to dollars. In addition, all monetary values are deflated using United States GDP Deflator to take account of inflation (Trading Economics, 2020). The details of variables for this empirical chapter are presented in **Table 6.1** below:

Table 6. 1 Variables and measures of chapter 6

Variable name	Measures	Source
Local tax binary (Relocating firm)	Dummy variable (equals 1) indicating that a firm has at least one domestic subsidiary in low-tax municipality.	ORBIS
	Dummy variable (equals 0) indicating that a firm does not have any domestic subsidiaries in a low-tax municipality.	ORBIS
Municipal multiplier for local business tax	The multiplier, which is levied on taxable incomes of companies, is set freely by each municipality in Germany.	DESTATIS
Local business tax	The tax is calculated by multiplying 3.5 percent with municipal multiplier	DESTATIS
Municipal multiplier for real property tax "B"	The multiplier which is levied on the value of real estate, is set freely by each municipality in Germany.	DESTATIS
Firm characteristics		
Log Turnover	The natural log of turnover. Turnover is listed in the Balance Sheet account and defined as Total Operating Revenue (Net sales + Other operating revenue + Stock variations). These figures do not include VAT or excise taxes or similar obligatory payments.	ORBIS
Age	The age of a firm calculated since the year the company was incorporated.	ORBIS
Intangible fixed assets	Intangible assets are listed in the Balance Sheet account. Intangible fixed assets include all intangible assets such as formation expenses, research expenses, goodwill, development expenses, and all other expenses with a long-term effect.	ORBIS

Pre-tax profits	Operating profits + Financial profits	ORBIS
Long-term debt	The natural log of long-term debt. Long term debt is financial variable in the balance sheet account and is defined as loans and financial obligations owed for a period exceeding 12 months. This can include bank loans, mortgage bonds, debentures or other obligations not due for 12 months.	ORBIS
Regional characteristics		
Population density	Number of local habitants on NUTS3 level	DESTATIS
Number of employees	Number of local employees on NUTS3 level	DESTATIS
Gross domestic product	Local gross domestic product on NUTS3 level	
Industry activity classification		Eurostat
High Technology manufacturing	Nace 2-digit codes: 21, 26.	
Medium/High technology manufacturing	Nace 2-digit codes: 20, 27, 28, 29, 30.	
Medium/Low technology manufacturing	Nace 2-digit codes: 19, 22, 23, 24, 25, 33.	
Low technology manufacturing	Nace 2-digit codes: 10, 11, 12, 13, 14, 15, 16, 17, 18, 31, 32.	
Knowledge Intensive services	Nace 2-digit codes: 50, 51, 58, 59, 60, 61, 62, 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 78, 80, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93.	
Less knowledge intensive services	Nace 2-digit codes: 45, 46, 47, 49, 52, 53, 55, 56, 68, 77, 79, 81, 82, 94, 95, 96, 97, 98, 99.	
Time	Year of sample period: 2011-2018.	ORBIS

6.3.2 Empirical models

The empirical analysis draws on a mix of data sources at the firm, micro-regional (municipality) and NUTS3 levels. We adopt a multilevel mixed effect model in order to consider the hierarchical nature of the data. The method can include variables in the model at different levels and relax the stringent assumption that observations within subunits are uncorrelated (Gelman & Hill, 2007; Srholec, 2010).

Hypothesis 1 about the effect of local business tax rates on firms' domestic profit-shifting is tested using an equation in the following form:

$$\textbf{(1)}\quad Relocate_{i,t} = \alpha + \beta_0\, Localtax_{m,t} + \Sigma\, \beta_1\, Firm_{i,t} + \Sigma\, \beta_2\, Region_{r,t} + \Sigma\, \beta_3\, Sector_{s,t} + time_t + \varepsilon_{i,t}$$

where the index "i" refers to "Firm", "m" refers to "Municipality", "r" refers to "Regions", "s" refers to "Sector", and "t" refers to "Time". The dependent variable $Relocate_{i,t}$ is a binary variable for the expansion of firms from higher-tax locations to low-tax locations, it equals 1 if a company has at least one subsidiary in low-tax municipality and 0 otherwise. $Localtax_{m,t}$ is local business tax rates set by local authorities. β_0 is the coefficient of primary interest as it quantifies the impact of local business tax rates on a firm' presence in low-tax municipalities. The vector $Firm_{i,t}$ captures a number of firm characteristics such as firm age, firm size, intangible assets and long-term debt. The vector $Region_{r,t}$ captures regional characteristics such as local population, local employment and local gross value added. The sector dummy variable is divided into six categories: "High technology manufacturing", "High/Medium technology manufacturing", "Medium/Low technology manufacturing", "Low technology manufacturing", "Knowledge intensive services", and "Less knowledge intensive services".

The variables $time_t$ refer to time dummies to account for the business cycle. The time dummy variable covers a research period from the year 2011 to the year 2018, and ε represents the error term.

Extending the above benchmark specification, the modelling for testing hypotheses 2 on the moderating effect of intangible assets is as follows:

$$\textbf{(2)}\ Relocate_{i,t} = \alpha + \beta_0\, Localtax_{m,t} + \Sigma\beta_1\, Firm_{i,t} + \Sigma\beta_2\, Region_{r,t} + \beta_3\, Localtax_{m,t} \times Intangibleassets_{i,t} + \Sigma\beta_4\, Sector_{s,t} + time_t + \varepsilon_{i,t}$$

For hypothesis 3 on the moderating effect of pre-tax profits, the following augmented specification is used:

$$\textbf{(3)}\ Relocate_{i,t} = \alpha + \beta_0\, Localtax_{m,t} + \Sigma\beta_1\, Firm_{i,t} + \Sigma\beta_2\, Region_{r,t} + \beta_3\, Localtax_{m,t} \times Profit_{i,t} + \Sigma\beta_4\, Sector_{s,t} + time_t + \varepsilon_{i,t}$$

We then include two interaction terms (local tax with intangible assets and pre-tax profit) in specification (4) to verify the relationship between local tax rates and firms' domestic profit-shifting activity, and the moderating effects of intangible assets and pre-tax profit. The modelling is as follows:

$$\textbf{(4)}\ Relocate_{i,t} = \alpha + \beta_0\, Localtax_{m,t} + \Sigma\beta_1\, Firm_{i,t} + \Sigma\beta_2\, Region_{r,t} + \beta_3\, Localtax_{r,t} \times Intangibleassets_{i,t} + \beta_4\, Localtax_{r,t} \times Intangibleassets_{i,t} + \Sigma\beta_5\, Sector_{s,t} + time_t + \varepsilon_{i,t}$$

6.3.3 Descriptive statistics

Table 6.2 shows descriptive statistics for the whole panel dataset covering annual data over the period 2011-2018. In total we constructed an unbalanced panel of 29,530 German incorporated firms. Included are a number of observations, the mean, standard deviation, and the maximum and minimum values for each variable.

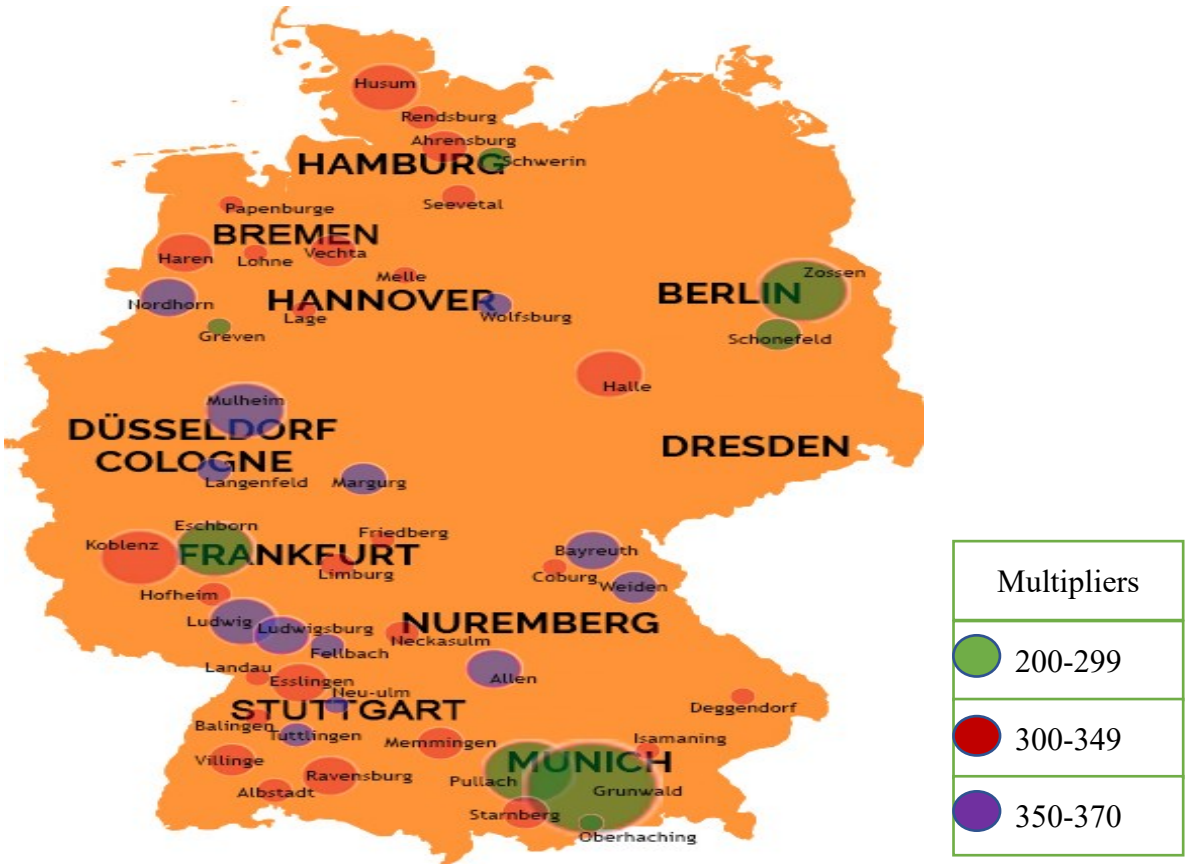
Table 6. 2 Descriptive statistics for sample data chapter 6

Variables	(1) N	(2) mean	(3) sd	(4) min	(5) max
Local tax binary	30,226	0.9035	0.2951	0	1
Local business tax (parent firms)	30,226	13.92	2.012	7	20.30
Local business tax (subsidiary firms)	30,226	13.73	1.899	7	20.30
Municipal multiplier (parent firms)	30,226	397.7	57.49	200	580
Municipal multiplier (subsidiary firms)	30,226	392.4	56.55	200	580
Municipal multiplier for Property tax B (parent firms)	30,226	451.18	141.0826	0	960
Municipal multiplier for Property tax B (subsidiary firms)	30,226	449.10	138.827	0	960
Property tax B (parent firms)	30,226	1.5791	0.4937	0	3.36
Property tax B (subsidiary firms)	30,226	1.5718	0.4858	0	3.36
Firm age	30,226	15.93	17.72	0	790
Ln Turnover	30,226	7.215	3.349	-0.106	18.48
Ln Intangible assets	30,226	3.228	2.202	-0.106	16.58
Ln Profit before tax	30,226	6.438	2.537	-0.106	16.71
Ln Long-term debt	30,226	5.730	2.938	-0.106	18.21
Ln Local GDP	30,226	9.527	1.135	7.078	11.99
Local employment	30,226	308.4	450.0	19.51	1,955
Local population	30,226	534.4	783.2	34.05	3,594
NACE codes	30,226	65.36	14.87	1	99
Year	30,226	2015	2.276	2011	2018

Local business tax rates range from 7 to 20.3 percent with the average value being 13.92 percent for parent firms, and with the average value being 13.73 percent for domestic subsidiary firms. The values for municipal multipliers range from 200 to 580, with the mean for parent firms being 397.7, and with the mean for domestic subsidiary firms being 392.4. In addition, based on our data sample, we establish a domestic subsidiary network in **Figure 6.2**. The figure shows 48 small municipalities with a density of domestic subsidiaries (numbers of subsidiaries range from 388 to 644) and low rates of municipal multiplier (rates range from 200 to 370). Interestingly, such municipalities are quite close to big cities such as Berlin, Frankfurt and Munich.

Figure 6. 2 German domestic subsidiary network

(Note: The map includes 48 small municipalities with a density of domestic subsidiaries and lowest rate of municipal multiplier)



Like local business tax rates, real property tax B consists of two components (statutory rate and municipal coefficient) (German Properties, 2020). The statistical descriptive shows a significant difference in real property tax B throughout the country. Specifically, municipal multiplier ranges from 0 to 960, leading to a huge variation in this type of tax form from 0 to 3.36 percent with an average rate of 1.5791 percent for parent firms and with an average of 1.5718 percent for subsidiary firms. As for firm age, the average age of each firm is 15.93 years with a standard deviation of 17.72 years. In terms of firm size, as proxied for by turnover, the average firm is creating sales equal to exp (7.215), which measured in thousands of dollars is equal to approximately US$ 1.35 million. As for the variable intangible assets, a firm is holding intangible assets equal to exp (3.228) on average, which measured in thousands of dollars is equal to approximately US$ 25.23 thousand. In terms of profit before tax, the average firm is obtaining pre-tax profit equal to exp (6.438), which measured in thousands of dollars is equal to around US$ 625 thousand. With regard to long-term debt, the average firm is having long-term debt equal to exp (5.73), which measured in thousands of dollars is equal to approximately US$ 307.97 thousand. With regard to region-level variables, each district has an average of exp (9.527) of GDP, which measured in millions of dollars is equal to around US$ 13,725 million. In terms of local population and local employment, each district has an average of 534.4 thousand inhabitants and 308 thousand employees.

Robustness Tests

To examine the strength of our findings, we adopt two approaches as robustness checks to our baseline models in this chapter: (1) using instrumental variables for the independent variable "local business tax" and (2) lagging explanatory variables for a one-year period.

First, under the assumption of endogenous business tax rates, we use instrumental variables for the independent variable "local business tax rate". We based on a two stage least squares (2SLS) method, and hence adopted instrumental variable regressions. In order to operationalise this methodology, it is important to have an instrument that is correlated with the independent variable *local business tax*, but is uncorrelated with the dependent variable, which in this case is *domestic profit-shifting from higher-tax municipality to low-tax municipality*. The real property tax "B" (*Grundsteuer B*) of each municipality is utilized as the instrumental variable for the dependent variable *local business taxes*. Real property tax "B" is one of the tax forms levied on corporations for constructible real estate, commercially used real property or real property with buildings (German Properties, 2020). Real property tax "B" is levied by the municipality in which real estate is located, at a rate of 0.35 percent of the tax value of the property, multiplied by a municipal coefficient. In Germany, land tax is also under the discretion of local governments (European Commission, 2021). Similarly to the municipal multiplier for local business tax, the municipal multiplier to real property tax is stipulated separately by each municipality (Deloitte, 2019). Hence, real property tax "B" is likely to be correlated to local business tax (*Gewerbesteuer*). On the other hand, while local business tax is imposed directly on firms' taxable profits, real property tax "B" is based on the value of the property. In addition, unlike local business tax which is the main contribution to local tax revenue, taxes that are levied on land, electricity or energy consumption, business properties, floor space, or number of employees usually do not raise considerable revenues (European Commision, 2015). Therefore, real property tax "B" is unlikely to drive firms to engage in the establishment of subsidiaries in low-tax jurisdictions. In addition, we time-lagged real property tax *(Grundsteuer B)* by a one-year period and include it as one of the instruments. For post-estimation, we implemented Durbin-Wu-Hausman (DWH) test to determine whether the exogeneity assumption holds (Cameron & Trivedi, 2010, p189). We then employed a

Stock-Yogo test (Cameron & Trivedi, 2010, p196) for weak identification to test whether instruments utilized were valid. The results of those tests are presented in **Table 6.3**.

Second, we explored time lags to further alleviate any possibility of simultaneity bias. We time-lagged our explanatory variables (turnover, profit before tax, intangible assets, long-term debts, and regional GDP) for one-year period. Due to time-lagging explanatory variables, the number of observations decreases from 30, 226 in **Table 6.3** to 28, 632 observations in **Table 6.4**

6.4 Empirical results

6.4.1 Baseline models

Table 6.3 reports the results for equations (1) to (4). Column (1) corresponds to the benchmark specification; Column (2) exhibits the results of the interaction between local business tax rates and a firm's intangible assets; Column (3) shows the results of the interaction between local business tax rates and a firm's pre-tax profits. Column (4) shows the results with all variables in specification (1) to (3) and both interactions between local business tax rates and intangible assets, and pre-tax profit. For each variable, three rows of numbers are displayed. The first row presents the coefficient, the following row shows the standard error, and the final row shows the p-value related to the variable statistical significance.

In all specifications, the coefficients of the local business tax variable are positive and significant at 1 percent level. The coefficients estimate for the effect of local business tax rates are in the range of 0.0521-0.0631, implying that a one percent increase in local business tax rates increases the likelihood of establishing domestic firms in low-tax municipalities by 5.21 to 6.31 percent. The outcomes show robust support for our contention that higher local business

tax rates are more likely to drive firms to engage in domestic profit-shifting via domestic affiliates in low tax locations. Hypothesis 1 is therefore strongly supported.

To explore the impact of intangible assets on the relationship between local business tax rates and domestic profit-shifting activity, the corresponding interaction terms are included in the regression. The results are presented in Column (2). The coefficients of the interaction term of the local tax variable with intangible assets are significant at 5 percent level. The coefficients of the interaction term indicate that intangible assets can moderate the relationship between local tax rates and a firm's tendency to relocate in tax-advantaged regions. As such, there is a clear support for hypothesis 2.

We visualize the margins of the tendency of establishing new investments in low-tax locations by intangible assets. **Figure 6.3** illustrates the marginal effects of intangible assets on the relationship between local tax rates and a profit-shifting tendency. As intangible assets increase, there is a positive effect on firms, who are in higher-tax locations, while there is negative effect on firms, who are in low tax locations.

To explore the moderating impact of pre-tax profit, the corresponding interaction term is included in the regression. The results are presented in Column (3). The significant coefficient of the interaction term at 5 percent level indicates that hypothesis 2 is supported. The coefficients of the interaction term show that the effect of pre-tax profit is higher for firms located in higher-tax locations than for firms, who are located in low-tax locations. The result justifies the contention that pre-tax profits can act as a moderator in the relationship between local business tax rates and firms' profit-shifting activity. Therefore, our hypothesis 3 is significantly supported.

Figure 6.4 visualizes the margins of the tendency of investing in low-tax jurisdictions by pre-tax profit. As level of pre-tax profits rises, the effect of pre-tax profits on firms in high-tax locations increases steadily. Whereas, the effect on firms in low-tax locations decrease significantly in accordance with the increase in level of pre-tax profits.

Figure 6. 3 Predictive margins of the tendency of establishing domestic subsidiaries in low-tax jurisdictions by intangible assets

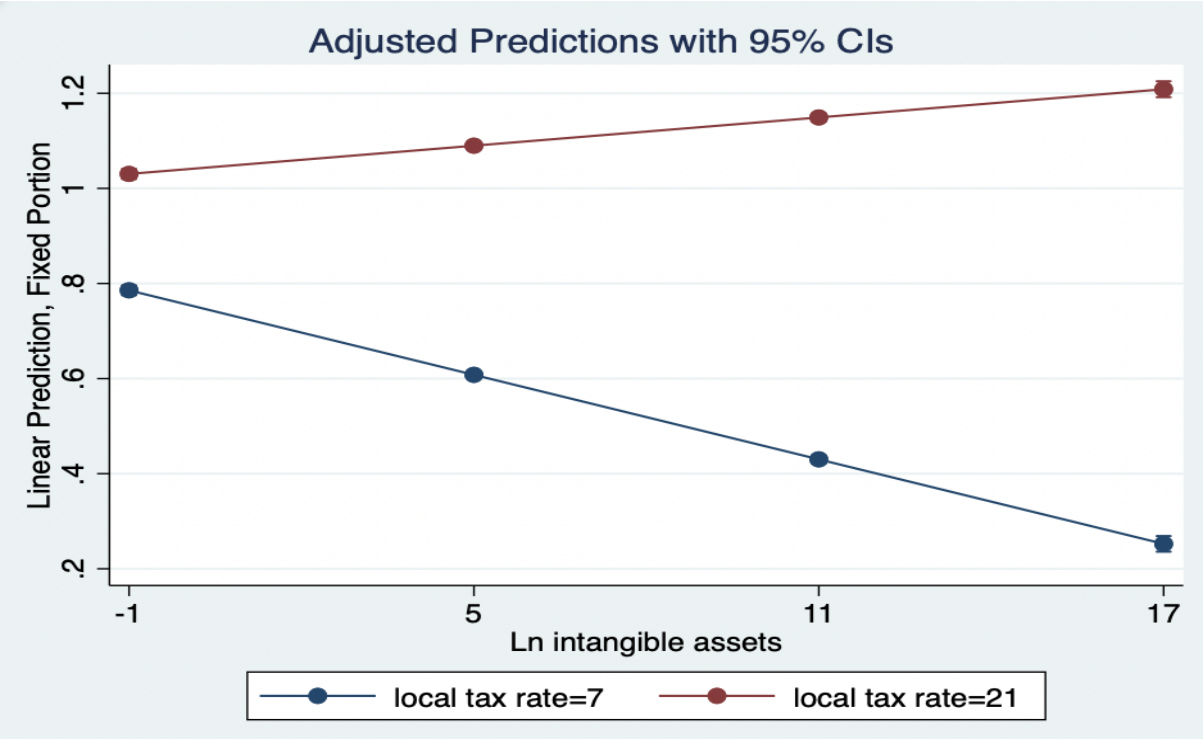
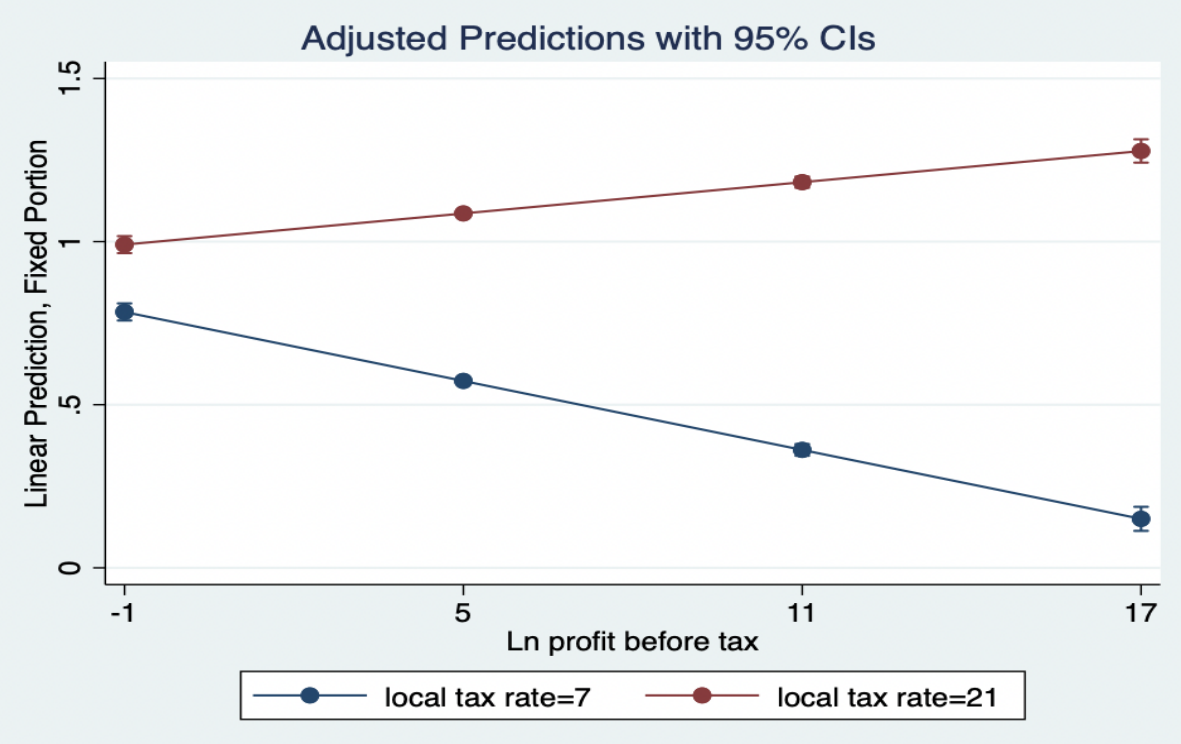


Figure 6. 4 Predictive margins of the tendency of establishing domestic subsidiaries in low-tax jurisdictions by pre-tax profits



Turning to firm-specific characteristics, coefficients for the variables firm age and firm size are negative and statistically significant. The coefficients of firm age are negative, ranging from (-0.000154) to (-0.000143) (**Table 6.3**). The result indicates that younger firms are more likely to engage in the establishment of domestic subsidiaries in low-tax municipalities. This finding is corroborated with the findings discussed in Chapter 5 (**Table 5.4**) that older German-incorporated multinational enterprises are more likely to invest in overseas tax havens instead. **Table 5.4** reveals that coefficients of the variable firm age are all positive and significant at 1 percent level, ranging from 0.00278-0.00392. The coefficients of firm size (turnover) are negative, ranging from (0.0111) to (0.0110), meaning that a 10 percent growth in turnover decreases the likelihood of presence in low-tax municipality by around 1.10 percent-1.12 percent. This is an intriguing finding and certainly warrants further investigation in future

research. For intangible assets, the coefficients range from 0.00361 to 0.0071 and are significant at 1 percent and 5 percent levels, respectively, revealing that higher levels of intangible assets lead to higher tendency to engage in profit-shifting from higher-tax jurisdictions to low-tax jurisdictions domestically. This finding is in line with the empirical results reported by Jones and Temouri (2016). The coefficients of long-term debts are significant at the 1 percent level, ranging from 0.00587 to 0.0384. The result shows that the level of long-term debts positively correlates to the domestic profit-shifting propensity.

In terms of control variables at regional level, the coefficients of local GDP hover around 4.034 to 4.142, showing that firms in regions with higher local GDP have a greater likelihood of establishing domestic subsidiaries in low-tax locations. As for local employment, the coefficients are positive and significant at the 10 percent level, showing that firms in regions with higher level of local employment are more likely to relocate to low-tax municipalities than firms in regions with lower levels of local employment. The coefficients for local population are not significant and negative, showing that local population seems not to have impact on domestic profit-shifting tendency.

Table 6. 3 Multilevel mixed-effects regression

Dependent variable: The tendency to establish domestic subsidiaries in low tax jurisdictions	(1)	(2)	(3)	(4)
Local tax	0.0521***	0.0563***	0.0543***	0.0631***
(S.E)	(0.00354)	(0.00397)	(0.00513)	(0.00551)
(P-value)	0.000	0.000	0.000	0.000
Firm age	-0.000151**	-0.000154**	-0.000150**	-0.000143*
(S.E)	(0.0000731)	(0.0000731)	(0.0000731)	(0.0000732)
(P-value)	0.061	0.035	0.040	0.051
Ln Turnover	-0.0112***	-0.0110***	-0.0112***	-0.0111***
(S.E)	(0.00180)	(0.00180)	(0.00180)	(0.00180)
(P-value)	0.000	0.000	0.000	0.000
Ln Intangible assets	0.00361***	0.0171***	0.00361***	0.0153**
(S.E)	(0.00100)	(0.00577)	(0.00100)	(0.00688)
(P-value)	0.000	0.003	0.000	0.026
Ln profit before tax	0.00465***	0.00467***	0.00907**	-0.0180*
(S.E)	(0.00145)	(0.00145)	(0.00762)	(0.00957)
(P-value)	0.001	0.001	0.050	0.060
Ln long-term debt	0.00587***	0.00591***	0.00589***	0.0394***

(S.E)	(0.000964)	(0.000964)	(0.000964)	(0.00725)
(P-value)	0.000	0.000	0.000	0.000
Local tax * Intangible assets		-0.000942**		-0.000817*
(S.E)		(0.000398)		(0.000476)
(P-value)				0.086
Local tax * Profit before tax			-0.000305**	0.00158**
(S.E)			(0.000517)	(0.000655)
(P-value)			0.086	0.016
Ln Local GDP	4.142**	4.034**	4.110**	4.087**
(S.E)	(1.783)	(1.783)	(1.784)	(1.783)
(P-value)	0.024	0.024	0.021	0.022
Local employment	0.000298*	0.000292*	0.000296*	0.000300*
(S.E)	(0.000204)	(0.000204)	(0.000204)	(0.000204)
(P-value)	0.100	0.097	0.090	0.094
Local population	-0.000141	-0.000137	-0.000140	-0.000144
(S.E)	(0.000137)	(0.000137)	(0.000137)	(0.000137)
(P-value)	0.150	0.153	0.148	0.142
Constant	-0.184	-0.231	-0.211	-0.338*
(S.E)	(0.195)	(0.196)	(0.200)	(0.203)
(P-value)	0.190	0.122	0.180	0.035
Year dummy	YES	YES	YES	YES

Sector dummy	YES	YES	YES	YES
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Prob > chibar2	0.000	0.000	0.000	0.000
Observations	30,226	30,226	30,226	30,226

Notes: Each column reports a separate multilevel mixed-effect regression. The dependent variable is whether a firm has at least one domestic subsidiary in a low-tax municipality. Turnover, intangible assets, long-term debts and local GDP are entered as their natural logarithms. Sector and year dummies are unreported for brevity. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

6.4.2 Instrumental variables model

Table 6.4 reports the results for the instrumental variables model to control for endogeneity. In terms of the impact of the local tax, the coefficients range from 0.0444 to 0.0692 and are statistically significant at 1 percent level. This suggests that a one percent increase in local tax rates leads to an increase in the likelihood of establishing domestic subsidiaries in low-tax jurisdictions by 4.44 to 6.92 percent. This magnitude confirms a strong positive relationship between local tax rates and firms' domestic profit-shifting activity. In addition, with regard to the moderating effect of intangible assets and pre-tax profits, the coefficients are statistically significant. This strongly confirms the impact of such covariates on the relationship between local business tax rates and firms' likelihood to establish domestic firms in low-tax municipalities.

For post-estimation, the Durbin-Wu-Hausman test of endogeneity with the p-values of 0.0122 to 0.0155 provide a rejection of the null hypothesis that local tax is exogenous. The p-values suggest that the instruments are valid. The Stock and Yogo test is used to test whether the instruments are weak or not. The critical value for the F statistic ranges from 2,115 to 2,668. The F value is significantly high and therefore we can reject the hypothesis that the instruments are weak.

Table 6. 4 Instrumental variables regression

Dependent variable: Tendency of establishing domestic subsidiaries in low-tax municipalities	(1)	(2)	(3)	(4)
Instrumental for Local business tax: Real property tax "B"				
Local tax	0.0444***	0.0567***	0.0643***	0.0692***
(S.E)	(0.00170)	(0.00464)	(0.0120)	(0.0152)
(P-value)	0.000	0.000	0.000	0.000
Firm age	-0.000142*	-0.000134*	-0.000129	-0.000152*
(S.E)	(0.0000791)	(0.0000794)	(0.0000791)	(0.0000789)
(P-value)	0.073	0.092	0.103	0.090
Ln Turnover	-0.0125***	-0.0123***	-0.0126***	-0.0120***
(S.E)	(0.00202)	(0.00202)	(0.00202)	(0.00202)
(P-value)	0.000	0.000	0.000	0.000
Ln Intangible assets	0.00705***	0.0407***	0.00690***	0.0241***
(S.E)	(0.00112)	(0.0101)	(0.00113)	(0.00815)
(P-value)	0.000	0.000	0.000	0.000
Ln Profit before tax	0.00424***	0.00393**	0.0419**	0.00372*
(S.E)	(0.00165)	(0.00165)	(0.0208)	(0.0184)
(P-value)	0.010	0.017	0.043	0.056
Ln Long-term debt	0.00684***	0.00690***	0.00701***	0.0418***

(S.E)	(0.00110)	(0.00110)	(0.00110)	(0.0137)
(P-value)	0.000	0.000	0.000	0.000
Local tax * Ln Intangible assets		-0.00241***		-0.00122**
(S.E)		(0.000718)		(0.000573)
(P-value)		0.001		0.042
Local tax * Ln Profit before tax			-0.00267*	0.000486*
(S.E)			(0.00146)	(0.00129)
(P-value)			0.068	0.069
Ln Local GDP	5.977***	9.750***	7.290***	-0.0175***
(S.E)	(1.793)	(2.303)	(1.988)	(0.00455)
(P-value)	0.001	0.000	0.000	0.000
Local employment	0.000186***	0.000201***	0.000203***	0.000184***
(S.E)	(0.000394)	(0.000395)	(0.000396)	(0.000393)
(P-value)	0.000	0.000	0.000	0.000
Local population	-0.000702***	-0.000766***	-0.000775***	-0.000702***
(S.E)	(0.000197)	(0.000197)	(0.000197)	(0.000197)
(P-value)	0.000	0.000	0.000	0.000
Constant	-0.250	-0.799***	-0.655**	0.00651
(S.E)	(0.188)	(0.250)	(0.270)	(0.205)
(P-value)	0.001	0.001	0.015	0.102

Year dummy	YES	YES	YES	YES
Sector dummy	YES	YES	YES	YES
Durbin-Wu-Hausman (p-value)	0.0155	0.0151	0.0122	0.0136
Stock & Yogo (F-statistic)	2,341	2,668	2,115	2120
Observations	28,632	28,632	28,632	28,632

Notes: The table reports instrumental variables regressions. The dependent variable is whether a firm has at least one domestic subsidiary in low-tax municipality. Sector dummies and Year dummies are unreported for brevity. Turnover, intangible assets, long-term debt, and local GDP are entered as their natural logarithms and lagged for one-year period. Standard errors are provided in parentheses. The p-values are presented in italic form. *, **, and *** indicate whether the results are statistically different from zero at the 10%, 5%, and 1% significance levels, respectively.

6.5 Concluding remarks

This chapter combines firm-level data from ORBIS with region-level data from DESTATIS to investigate the likelihood of domestic profit-shifting activity by German firms from high-tax jurisdictions to low-tax jurisdictions. We base the findings on 30,226 observations from 29,530 German MNEs. The dataset allows us to track the whole domestic network of individual parent firms on an annual basis. Therefore, we are able to detect local business tax rates for every parent company and for its entire domestic subsidiary network. Another advantage of this dataset is that institutional characteristics and the taxation of other factors are much more homogeneous across municipalities within a country than in cross-country studies. So, the impact of local-level tax policies on the location of firms is identified much more precisely than is possible in an international context.

Overall, we find that domestic profit-shifting represents an important channel of company tax planning in Germany. In particular, higher business tax rates drive firms to relocate in low-tax municipalities. This impact is found after controlling for other important determinants of a firm's location decision-making. The results suggest that domestic profit-shifting is a significant channel for firms to avoid high local taxes. Furthermore, the outcomes of this chapter confirm that the effects of local business tax rates on the propensity of establishing domestic subsidiaries in low-tax locations by firms can be moderated by some firm specific covariates such as intangible assets and pre-tax profits. This reveals specific types of firms which are more aggressive in shifting profits domestically.

Moreover, this chapter highlights that tax rates are subject to intra-German competition at the parish level. In this chapter, we provide a map of the domestic subsidiary network in Germany, in which municipalities with a density of subsidiaries and low business tax rates are indicated. We equate such tiny municipalities to freeports which act as tax haven staple inside Germany. This chapter provides empirical evidence for the enhancement of policy measures for tax avoidance activities

CHAPTER 7: CONCLUSION

This thesis was developed to examine the impact of business clusters on firms' profit-shifting, internationally and domestically. It reports on the conduct of several novel empirical tests concerning the proposed theoretical models in the context of the significant rise in tax avoidance activities and the dominance of business clusters in the world economy. This chapter summarises the main findings of the thesis; reviews implications for managers and policy makers; and addresses limitations of the empirical studies.

7.1 Summary of key findings

This thesis contributes to the understanding of profit-shifting activities in the context of industry agglomeration. It examines five research questions: (1) Does being located in a business cluster impact upon tax haven use? (2) Whether, and to what extent, do local tax rates in business cluster impacts upon tax haven activities of MNEs? (3) What are the cluster-specific determinants that drive firms to engage in the use of tax havens? (4) What are the firm-specific factors that moderate the relationship between business clusters and the use of tax havens by firms? (5) Does profit-shifting take place internally via a domestic tax havens network?

Empirical evidence shows that the effects of business clusters are very significant on firms' tax haven usage. We extended the knowledge-based theory and find evidence that MNEs who are part of a business cluster have a higher likelihood of engaging in tax haven activity compared to MNEs who are not part of a business cluster. In particular, we find that cluster MNEs have a 31.0 to 33.9 percent higher likelihood of engaging in tax haven activity compared to their non-cluster counterparts. This association continues to hold whilst controlling for other important factors that drive tax haven FDI. The interesting point is

that the effects of industry cluster are not homogeneous on all firms but vary according to firm-specific factors such as firm age, firm size, technological sophistication, level of intangible assets and pre-tax profits. The findings also show the variation in the effects of industry agglomeration on the use of tax havens by different sectors.

This thesis also utilizes traditional tax competition and new economic geography theories as theoretical lens, providing conflicting predictions for tax setting and the resulting reactions of firms. We find evidence that local business tax and industry cluster have a significant impact on the use of tax havens by MNEs. A one-percent increase in local business tax rates leads to an approximately 4.97 percent point increase in the number of tax haven subsidiaries owned by MNEs. The agglomeration effect leads to an increase in the number of a MNE's tax haven subsidiaries by an average of 10.83 percent. Furthermore, industrial agglomeration acts as a moderator to enhance the relationship between local tax rates and the use of tax havens by 7.67 percent.

Moreover, domestic profit-shifting activity does take place between German parent firms based in big cities and their corporate domestic subsidiaries in miniature domestic corporate tax havens inside the country. In terms of domestic profit-shifting, the analysis shows robust evidence of a positive relationship between local business tax rates and firms' domestic profit-shifting activity. A one percent increase in local business tax rates increases the likelihood of establishing domestic subsidiearies in low-tax municipalities by 5.21 to 6.31 percent. The empirical results also show that intangible assets and pre-tax profits can moderate the magnitude of the relationship between local business tax rates and firms' investment in low-tax jurisdictions. Hence, the findings of this thesis demonstrate that the knowledge environment, higher local tax rates and industrial clusters

are among cluster-specific factors that drive firms to engage in tax haven activities, internationally and domestically.

7.2 Managerial and policy implications

The findings in this thesis shed more light on the use of tax havens among firms in business clusters and generate important implications for managers and policy makers.

Implications for managers

The findings imply that the adoption of external tax havens and internal location decisions can be substitute strategies for a firm. Co-located firms are sufficiently physically close to maintain frequent interactions, interdependent relations and closer linkages. As a result, clusters normally by their very nature offer an environment which facilitates knowledge transfers (Leonard & Sensiper, 1998). Firms in the same industry or closely related industries trigger processes that create dynamism, flexibility, as well as enhancing learning and innovation. Spatial proximity facilitates knowledge spillover and thus knowledge transfer (Bathelt, Malmberg & Maskell, 2004). More importantly, it is possible to convert tacit knowledge into explicit knowledge for members in business clusters, thanks to the social embeddedness. In addition, the cooperation with law and tax firms in the network are highly likely to enable cluster firms learn the tacit knowledge related to the use of tax havens.

Besides, the use of tax havens can reduce the responsiveness of firms to higher local tax rates in home countries. The use of tax havens is highly likely to provide MNEs with transactions gains from the common governance of activities in different locations (Sharmiladevi, 2017). The thesis also brings evidence that domestic profit-shifting

represents an important channel of company tax planning. The domestic profit-shifting can be seen as one of the best ways for German companies to avoid high local tax rates, especially for start-up firms as the internationalization process often brings firms high risks and huge costs of participation (Amdam et al., 2020).

Evidence has shown that Germany charges some of the highest overall corporate tax rates among EU countries, with combined charges of between 30 percent and 33 percent (PwC, 2021). Compared to Germnay, the figures are 19 percent for Austria, 25 percent for Belgium, and 11.9 to 21.6 percent for Switzerland. The findings of this thesis imply that domestic profit-shifting from high-tax municipalities to low-tax municipalities can help businesses in Germany offset against their corporate tax bills generally and municipal trade tax specifically. For example, firms in high-tax municipalities such as Munich will be charged the total corporate tax rates of approximately 32.98 percent (15.825 percent of corporate tax on average and 17.15 percent of local business tax). Whereas, firms in low tax municipalities such as Oberhaching will be levied total corporate tax rates of around 24.57 percent only (15.825 percent of corporate tax on average and 8.75 percent of local business tax). If firms from Munich are able to diversify their businesses effectively to municipalities such as Oberhaching, they will significantly benefit from huge savings from tax bills.

Firms are always keen to cut costs to a minimum and tax-cutting is one of the most common types of cost-cutting for firms (Baldwin & Krugman, 2001; Oquero, 2019). It has been highlighted that a lower tax bill made possible by the use of tax havens gives MNEs a competitive advantage (Jones & Temouri, 2016). Many multinationals may find it attractive to perform certain activities within a tax haven to achieve a more favourable tax

position (Desai, and Dharmapala, 2006). In reality, tax havens can be used legally in tax planning where profits are properly attributable to the tax haven and sufficient economic accountability is maintained. However, an aggressive tax haven use might force companies to consider the reputational consequences of their actions. Choy et al. (2017) examined the effect of a report disclosing firms that have a tax haven subsidiaries network and found that such actions had a negative impact on governmental scrutiny, reputation and investor sentiment. Goldman Sachs and Cargill were charged £79 million (€89 million) by the UK's HM Revenue and Customs when the US giants were found guilty of tax avoidance.[6] This type of case, which is just one example of many, may reduce a firm's competitive advantage and detract from its core activities. If policy makers consider tax haven use by MNEs a revenue risk, and if they consider the cluster role in the relationship between local tax rates and tax haven use to be firmly established, they will be likely to take a more cautious approach to companies in location with higher local tax rates and in more-agglomerated regions. At that point, MNEs will suffer huge burden due to strict measures from authorities. MNEs therefore need to have effective strategies and suitable tax payment arrangements to reap multiple benefits not only from business clusters, from tax havens but also from local tax rates.

Implications for policy makers

Clusters have become a key mode of economic co-ordination and focus of government policies across the world. A large portion of global trade takes place in the form of intra-firm trade, typically between subsidiaries of a parent firm (Graham & Tucker, 2006; Wilson, 2009; Hanlon & Slemrod, 2009). It is highlighted that outsiders are unable to

[6] EuropeanCEO. 2018. Goldman Sachs and Cargill fined 89 million euros in UK tax avoidance case. https://www.europeanceo.com/finance/goldman-sachs-and-cargill-fined-e89m-in-uk-tax-avoidance-case/

observe tax shelter activities of companies (Lisowsky, 2013). This inherently creates a loophole in the international business tax regime. Policy makers are often in very difficult position in dealing with tax avoidance issues (Chen & Chu, 2005). Analysis of the OECD's flagship safeguarding policy against countries enabling harmful tax practices, reveal that the policy failed to detect almost all corporate tax abuse risks documented by the index (Mansour, 2021). One of the policies set by the OECD, which was launched in 2015, is one of the four key pillars of the set of global rules to tackle tax abuse by multinational corporations, known as the BEPS (Base Erosion and Profit Shifting) Action Plan (OECD, 2019). However, the Corporate Tax Haven Index revealed that countries graded by the OECD as "not harmful" are responsible for 98 percent of the world's corporate tax abuse risks. In comparison, countries graded "harmful" by the OECD account for just one percent (Mansour, 2021).

It does appear that policy makers increasingly take a cautious approach to tax avoidance schemes by companies. For instance, policy makers routinely impose higher corporate tax rates or ungenerous allowances on companies to deter tax avoidance (Kim & Jang, 2018). This can become a huge burden on a majority of companies' shoulders, thereby deterring investment and even worsening global economies. However, if policy makers do not put pressure on MNEs, the world has to suffer huge losses to tax avoidance activities. Therefore, relevant policies should be put in place in order to improve the general anti-avoidance provisions, and to provide strong incentives for firms to pay the full statutory tax rates on profits. The outcomes of the thesis highlighted that firms within business clusters have a higher propensity to engage in tax haven activity. Therefore, policy makers could consider specific transparency requirements or closer regulation for cluster firms.

In addition, the outcomes of the thesis confirm that specific types of MNEs in business clusters which are more aggressive in shifting profits via tax havens.

Policy makers need to implement requirements to tackle tax haven abuse by paying attention to the local presence of firms in tax havens and firms' effective operation within the jurisdiction. For instance, effective policies should ensure that companies seeking to operate within a tax haven should, in essence, be managed and controlled from that jurisdiction and have sufficient operations that can justify their tax residency. In addition, information exchange through country-by-country reporting should be enhanced (Deloitte, 2021). Only when companies are willing to operate transparently with sufficient economic substance and are prepared to put the appropriate structures in place, will tax havens be used legally by MNEs.

The thesis also reveals important policy ramifications that state-level tax policies do affect the likelihood of firms to establish foreign subsidaries in tax havens if tax rates at headquarters are high. Higher local taxes in home countries lead to establishment of foreign subsidiaries in host countries with low or a zero-tax rate. The use of tax havens reduces the ability of municipalities to compete over tax to attract MNEs. Put it another way, if the domestic tax rate is set too high, firms are likely to go offshore. Thus, tax competition creates an even faster race to the bottom. Tax avoidance by MNEs has been on top of the international tax policy agenda since the global financial crisis and it is one of the most pressing concerns of European governments (Forsgren, 2017). Regulators are aware of tax avoidance techniques and they have created a series of regulations to stop tax avoidance activities. However, a different type of tax avoidance scheme known as jurisdictional arbitrage make it difficult for them to obtain the desired effect. It is

estimated that tax avoidance costs European countries an equivalent of approximately twenty percent of the region's corporate taxes (Tax Research UK, 2019). In Germany, tax avoidance activity is significantly on the rise. Due partly to its proximity to the traditional tax havens such as Luxemburg, Germany has a relatively high share of its wealth held offshore (Tax Justice Network, 2018). Zucman et al. (2017, cited in Tax Justice Network, 2020) estimate the wealth held offshore for Germany to be at 16 percent compared to a world average of 9.8 percent. Policy makers need to put greater emphasis on imposing effective local taxes on firms to bring about more appropriate tax planning.

Moreover, this thesis highlights that tax rates are subject to intra-German competition at the parish level. The thesis makes a clear and novel contribution by examining tax patterns at the regional level, highlighting domestic profit-shifting with the effect of local business tax rates. The finding implies that curbs on the use of tax havens (externally) might make profit-shifting domestically more pervasive. German policy makers should not only try to eradicate profit-shifting abroad, they must also mitigate tax competition at home. The decentralized system has repeatedly served as an excuse to engage in ruinous intra-German tax wars through lax enforcement (Tax Justice Network, 2020). This thesis then bring a number of evidence related to business clusters, local tax rates and tax haven use for promoting international tax regimes for better anti-tax avoidance practice.

7.3 Limitation of our study and future avenues of research

To the best of our knowledge, this is the first cross-country, firm-level study to elaborate the tax haven activity of MNEs, who are part of a business cluster. However, our research does have some limitations that future researchers may be able to address. First, we base our work on recognized business cluster maps and lists from government websites. We

also base it on two criteria of business clusters, including reference cities and NACE codes to identify cluster and non-cluster firms. This might not capture the entire presence of firms within and outside business clusters. Future research may shed light on this, by looking at smaller samples or by taking advantage of other data sources to more specifically identify cluster firms and non-cluster firms in the sample. However, the use of recognized business cluster maps and lists is still capable of making a major contribution to ensuring that the coverage of firms within and outside clusters is quite precise and accurate.

Second, we have used data for a set of OECD countries. Our analysis may therefore only reflect the phenomenon in the developed world. Future research in this area could extend the analysis beyond OECD countries to reveal broader trends in developing countries. In addition, knowledge spill overs via industrial agglomeration and higher local tax rates are among the cluster-specific factors that drive firms to engage in the use of tax havens. Future research might focus more in this topic and uncover other cluster factors that may relate to tax havens usage by cluster actors.

Third, we use real property tax "B*"* (*Grundsteuer B)* of each municipality as the instrumental variable for local business taxes. It is very important to find instrumental variables, which are likely to be correlated to local business tax (*Gewerbesteuer*), but are unlikely to drive MNEs to engage in offshore profit-shifting. Future research could add other instrumental variables to bring more robustness to the empirical results.

Fourth, although ORBIS and DESTATIS databases allow us to access comprehensive information which is very useful for our research, future research can delve deeper into the research area by utilizing different research methods and then to explore possible

alternative explanations of the findings in this chapter. It would be useful if future research includes some wider discussion of other potential regional factors, which might affect domestic profit-shifting activities by MNEs.

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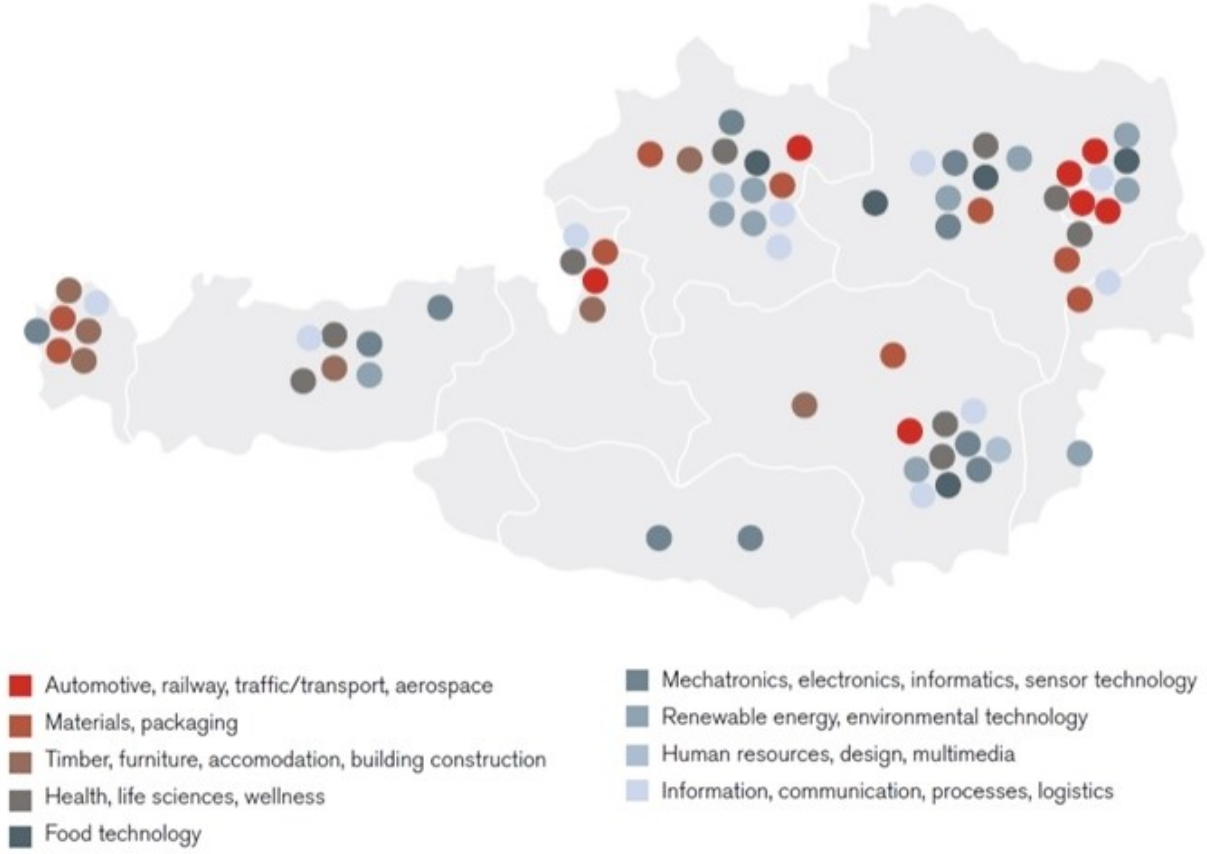
APPENDIX B

Business clusters maps and lists references.

Country	Map/ Lists	References	Websites
Austria	Map	Federal Ministry Republic of Austria (2019)	https://investinaustria.at/en/research-development/clusters.php
Belgium	List	European Cluster Collaboration Platform (2019)	https://www.clustercollaboration.eu/cluster-list
France	Map	France Clusters – Mapster (2018)	https://www.clustercollaboration.eu/news/france-clusters-publishes-its-mapster-2018
Germany	Map	Clusterexzellenz in Deutchland (2019)	https://www.clusterplattform.de/CLUSTER/Navigation/Karte/SiteGlobals/Forms/Formulare/EN/karte-formular.html
The UK	Map	BRES ONS data, IHS Global Insight, World Industry Service (2014)	https://www.mckinsey.com/~/media/mckinsey%20offices/united%20kingdom/pdfs/web_industrial_revolutions_final.ashx

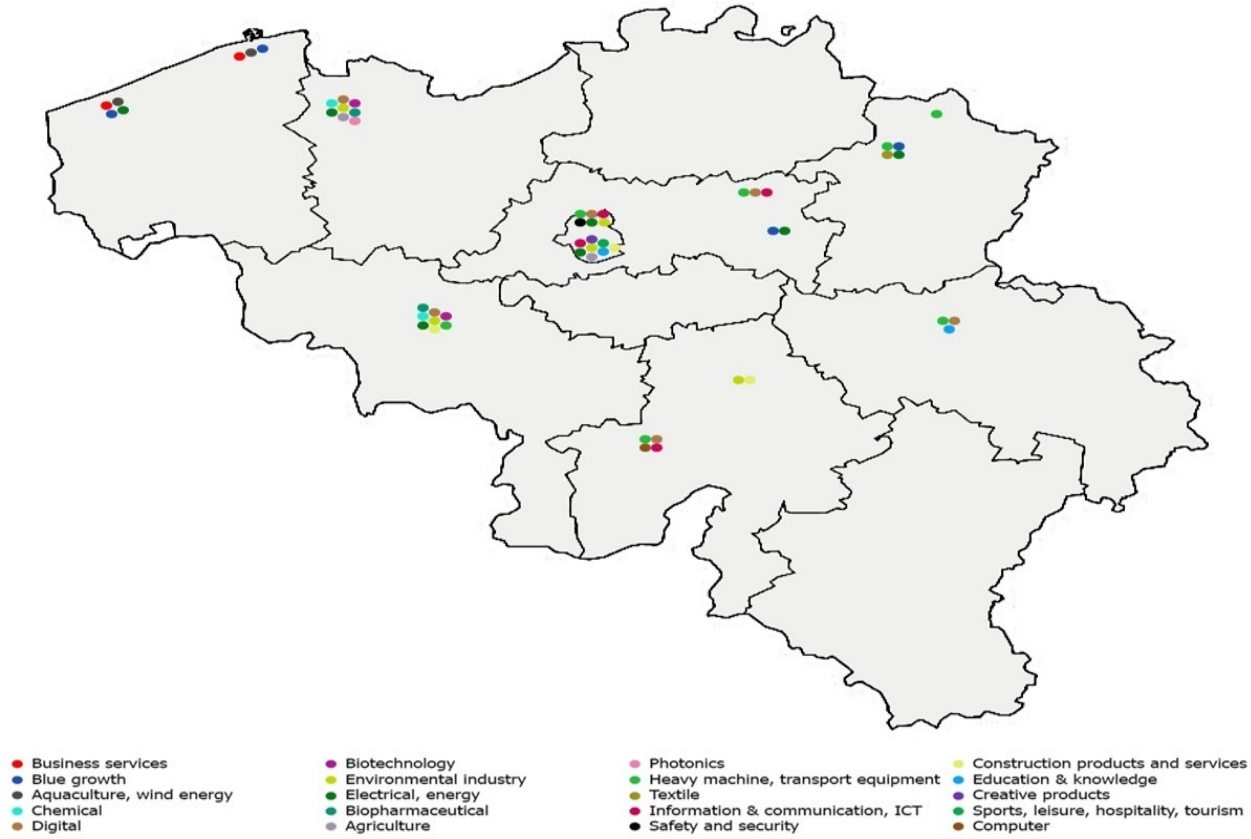
APPENDIX C

Graph B1 Austrian business clusters map



Source: Federal Ministry Republic of Austria (2019)

Graph B2 Belgium business clusters map

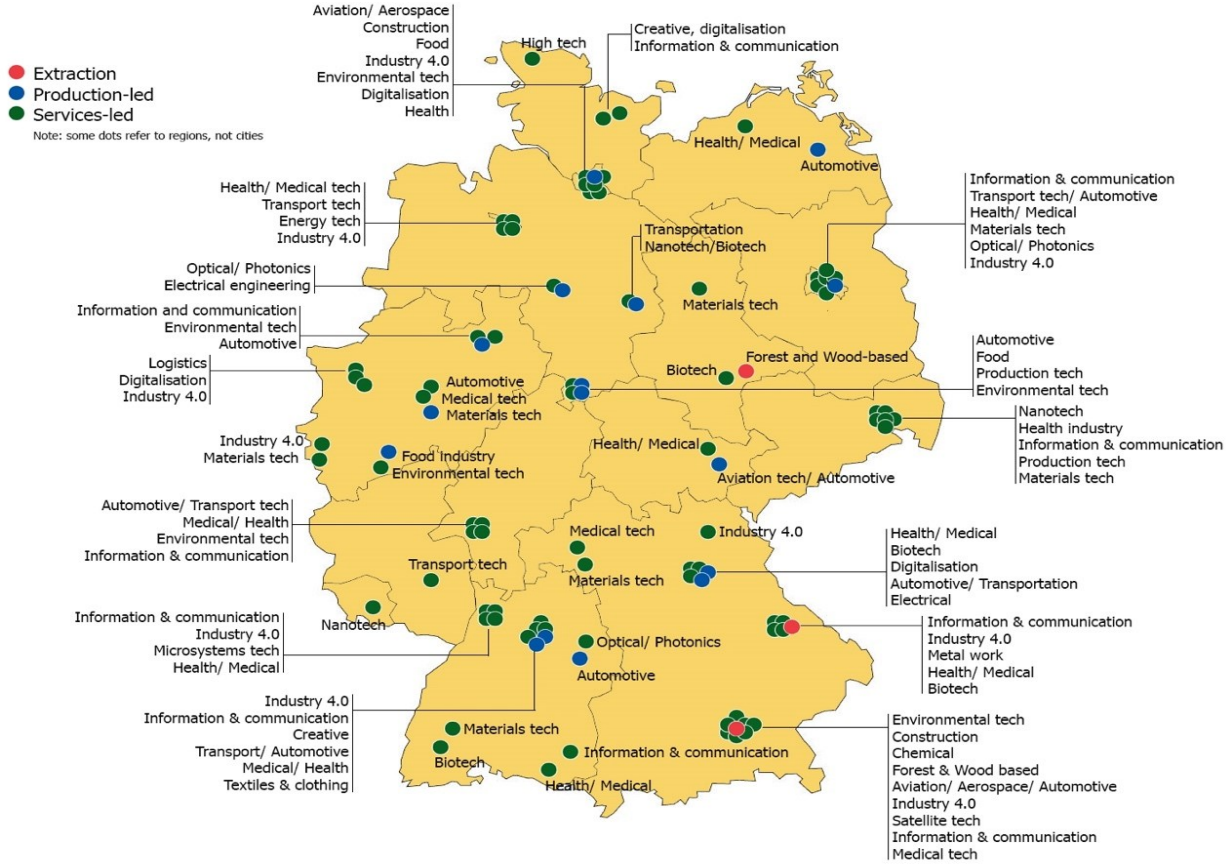


Source: European Cluster Collaboration Platform (2019)

Graph B3 French business clusters map

Source: France Clusters – Mapster (2018)

Graph B4 German business clusters map

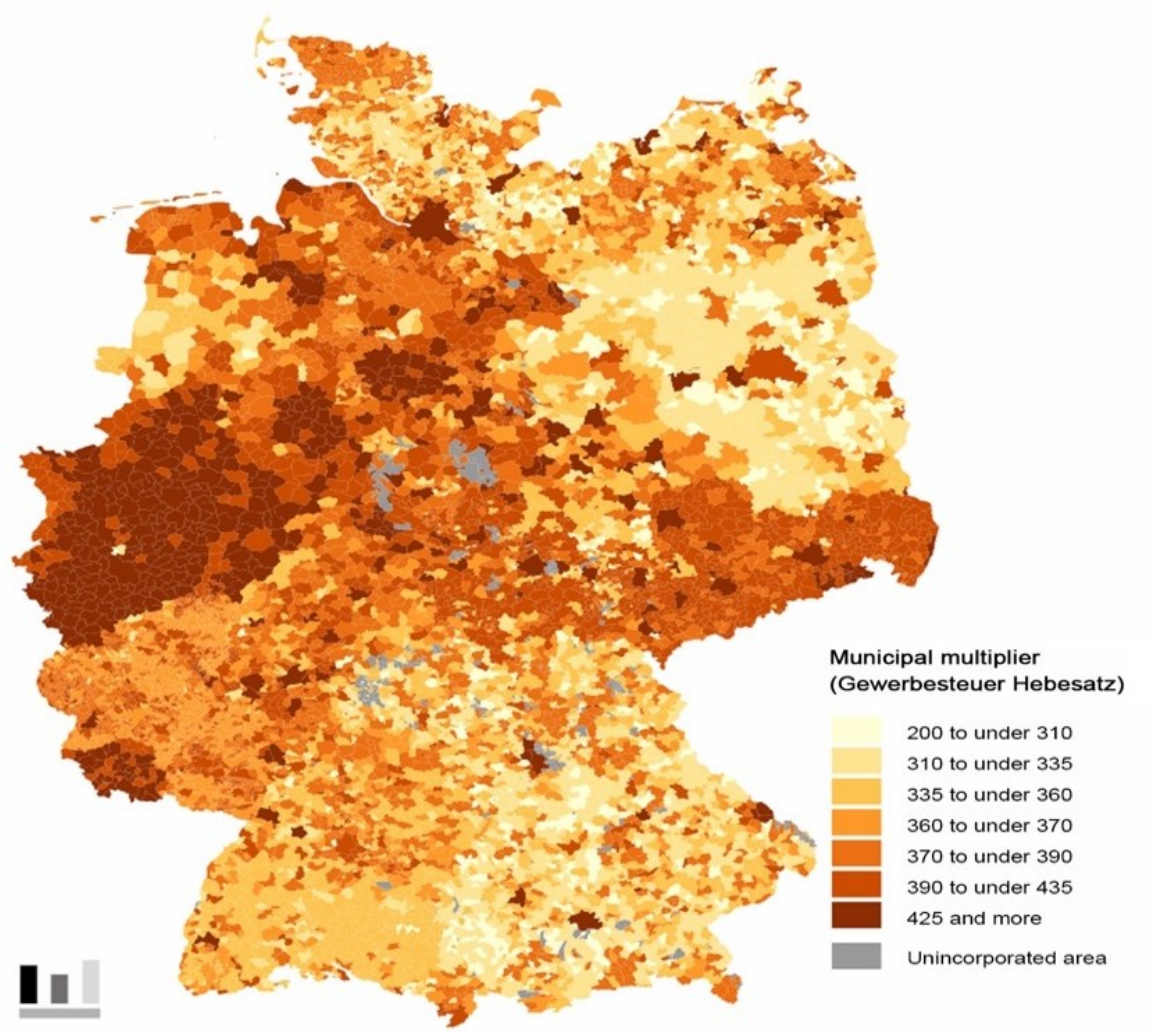


Source: Clusterexzellenz in Deutchland (2019)

Graph B5 UK business clusters map

Source: BRES ONS data, IHS Global Insight, World Industry Service (2014)

Graph B6 Municipal multipliers in Germany in 2019



Source: Federal Statistical Office of Germany, 2019.